

POLITECNICO DI MILANO
School of Industrial and Information Engineering
Department of Mechanical Engineering



How do EPC suppliers in Oil&Gas markets configure their supply chains?

Supervisor: Prof. Guido Jacopo Luca Micheli

Co-supervisor: Prof. Enrico Cagno

Thesis Dissertation of:

Andrea Monticone

ID: 836377

ACADEMIC YEAR 2016-2017

ACKNOWLEDGMENTS

I would like to start by thanking my supervisor Prof. Guido Jacopo Luca Micheli and co-supervisor Prof. Enrico Cagno for giving me the possibility of doing this thesis with them, providing me with suggestions every time I needed one.

I thank my closest friends Emanuele, Marco, Andrea Co., Andrea Cr., Gianluca, Alessandra, Camilla, Chiara, Ludovica and Marialuisa for passing with me these last six years and for sharing the best moments.

Thanks to my friends that I met here with whom I spent my daily life at Politecnico.

Thanks to ANIE for the help that they provided during this research.

I want to deeply thank colleagues F.Manzi and G.Padovani because, since my thesis have roots in their researches, I could not have done it without theirs.

And last, but not least, a special thanks to my parents Marcello and Paola, my brothers Davide e Alessandro for all the support that you give me every single day and to the rest of my family, my aunts, my uncles, my cousins and my grandparents for staying close to me during this long journey.

Andrea

Table of contents

ACKNOWLEDGMENTS	3
LIST OF TABLES AND FIGURES	8
ABSTRACT	19
ABSTRACT (italian version)	20
Executive Summary	21
1. Area of investigation.....	57
Introduction.....	57
1.1. Introduction to EPC (Engineering, Procurement and Construction)	59
1.1.1. LEP (Large Engineering Project).....	60
1.1.2. Project Stages	60
1.2 Products under investigation	62
1.2.1 Special Valves	62
1.2.1.1 Special Valves classification.....	62
1.2.1.2 Special Valves description	63
1.2.1.2.1 Ball valve.....	63
1.2.1.2.2 Butterfly valve	63
1.2.1.2.3 Gate valve.....	64
1.2.1.2.4 Globe valve	65
1.2.1.2.5 Check valve	66
1.2.1.2.6 Plug valve.....	66
1.2.2 Static Equipment	67
1.2.2.1 Static Equipment classification.....	67
1.2.2.2 Static Equipment products description	68
1.2.2.2.1 Pressure Vessels	68
1.2.2.2.2 Columns and Drums	68
1.2.2.2.3 Shell and Tube Heat Exchanger	69
1.2.2.2.4 Trays and internals	70
1.2.2.2.5 Air coolers.....	71
1.2.2.2.6 Packages	72
1.2.2.2.7 Steam generators and industrial boilers	72
1.2.3 Switchgears.....	72
1.2.3.1 Switchgears classification	72
1.2.3.2 Switchgears description.....	73
1.2.3.2.1 Low Voltage Power Center	75

1.2.3.2.2 Low Voltage Secondary Distribution Switchgear	75
1.2.3.2.3 Motor Control Center	75
1.2.3.2.4 Low Voltage Automation and Control Switchgear	76
1.2.3.2.5 Low Voltage Explosion-Proof Switchgear	76
1.2.3.2.6 Synoptic Switchboard	76
1.2.3.2.7 Medium Voltage Metalclad Switchgear (LSC2B)	76
1.2.3.2.8 Medium Voltage Metal Enclosed Switchgear (LSC2A)	76
2. Literature review	77
2.1 Framework overview	77
2.1.1 Performance items	78
2.1.2 Capabilities	80
2.1.3 Practices.....	85
2.2 Contingent resource-based theory.....	88
2.3 The link between framework and contingent RBT	91
2.4 ETO sector.....	93
3. Research Objectives and Methodology.....	93
3.1 Data collection.....	93
3.1.1 Interviews to EPC Contractors.....	94
3.1.2 Interviews to Best Performers.....	94
3.2 Data Analysis	95
3.2.1 Single Case analysis	95
3.2.2 Multi-Case analysis.....	96
3.2.3 Outliers' analysis.....	96
3.2.4 Analysis of sectors and ETO	96
3.3 Research questions.....	97
4. Best Performers description.....	97
4.1 Companies overview – SVS.....	97
4.1.1. Single cases - SVS.....	99
4.1.1.1 SVS – 1	99
4.1.1.2 SVS – 2	101
4.1.1.3 SVS – 3	104
4.1.1.4 SVS – 4	107
4.1.1.5 SVS – 5	111
4.1.1.6 SVS – 6	114
4.1.1.7 SVS – 7	117
4.1.1.8 SVS – 8	120

4.1.1.9 SVS – 9	124
4.1.1.10 SVS – 10	126
4.1.1.11 SVS – 11	130
4.1.1.12 SVS – 12	133
4.1.1.13 SVS – 13	137
4.1.1.14 SVS – 14	141
4.1.1.15 SVS – 15	145
4.1.1.16 SVS – 16	148
4.1.1.17 SVS – 17	152
4.1.1.18 SVS – 18	155
4.2 Companies overview – SES	158
4.2.1 Single cases – SES	159
4.2.1.1 SES – 1	160
4.2.1.2 SES – 2	165
4.2.1.3 SES – 3	170
4.2.1.4 SES – 4	173
4.2.1.5 SES – 5	177
4.2.1.6 SES – 6	183
4.2.1.7 SES – 7	187
4.2.1.8 SES – 8	191
4.2.1.9 SES – 9	197
4.2.1.10 SES – 10	202
4.2.1.11 SES – 11	206
4.2.1.12 SES – 12	209
4.3 Companies Overview – SWS	212
4.3.1 Single cases - SWS	212
4.3.1.1 SWS – 1	213
4.3.2 SWS – 2	216
4.3.2.3 SWS – 3	219
4.3.2.4 SWS – 4	223
4.3.2.5 SWS – 5	227
4.3.2.6 SWS – 6	230
4.3.2.7 SWS – 7	234
4.3.2.8 SWS – 8	238
4.3.2.9 SWS – 9	241
5. Intra-sector Supply Chain Configurations Analysis	245

5.1 Considerations about the framework	245
5.2 Introduction to supply chain configuration	245
5.3 Multi-case study	246
5.3.1 Special Valves sector	246
5.3.1.1 Performance – SVS	246
5.3.1.2 Performance – Capabilities – SVS.....	250
5.3.1.3 Capability – Practices – SVS	264
5.3.1.4 Actions overview – SVS.....	282
5.3.1.5 Summary of the results – SVS.....	291
5.3.2 Static Equipment sector	294
5.3.2.1 Performance – SES.....	295
5.3.2.2 Performance-Capabilities – SES.....	298
5.3.2.3 Capability-Practices – SES	308
5.3.2.4 Actions overview – SES.....	322
5.3.2.5 Summary of the results - SES.....	330
5.3.3 Switchgears sector.....	335
5.3.3.1 Performance – SWS	335
5.3.3.2 Performance-Capabilities – SWS	338
5.3.3.3 Capability-Practices – SWS	350
5.3.3.4 Actions overview – SWS	363
5.3.3.5 Summary of the results – SWS	371
6.1 Introduction to outliers’ analysis.....	377
6.1.1 Average supply chain configuration	378
6.1.2 Similarity Index	379
6.2 Intra-sector outliers’ identification	381
6.3 ETO outliers’ identification	386
6.4 Outliers’ analysis.....	390
6.4.1 SVS – 12B	390
6.4.2 SWS – 8	391
6.4.3 SVS – 1	392
6.4.4 SVS – 5	393
6.4.5 SES – 6.....	393
6.4.6 SES – 11.....	394
6.4.7 SVS – 13, SVS – 15, SWS – 5, SWS – 9	395
6.5 Comparative analysis of single sectors with ETO	395
6.6 Discussion of the results.....	397

7. Conclusions and future research.....	400
REFERENCES.....	404
ANNEX-A	408
ANNEX B	418
ANNEX C.....	418

LIST OF TABLES AND FIGURES

Figure 2.1 Contingent resource-based theory (Brush and Artz, 1999)	25
Table 8.2 Comparison among average supply chain of the theory.....	38
Figure 1.1 Stakeholders' scheme.....	59
Figure 1.2 Sequence of operative phases of a project	60
Figure 1.3 Impact of the different phases on costs and on the result	61
Table 1.1 Classes designation.....	62
Figure 1.4 Detail ball valve.....	63
Figure 1.5 Detail of a butterfly valve	64
Figure 1.6 Detail of a gate valve	65
Figure 1.7 Detail of a globe valve	66
Figure 1.8 Detail of a check valve	66
Figure 1.9 Detail of a plug valve	67
Table 1.2 Investigated products within the static equipment sector	68
Figure 1.10 Detail of a pressure vessel.....	68
Figure 1.11 Detail of a column (packed on the left, trays on the right)	69
Figure 1.12 Detail of a shell and tube HE	70
Figure 1.13 Sieve Tray, Valve Tray, Bubble-cap Tray.....	70
Figure 1.14 Detail of an Air cooler.....	71
Figure 1.15 A generic skid package	72
Table 1.3 Investigated products within the switchgears sector.....	73
Figure 1.16 The interior of a switchgear	73
Figure 1.17 Detail of an Air Circuit Breaker (ACB)	74
Figure 1.18 Detail of a SF6 Circuit Breaker	75
Table 2.1 Dickson's vendor selection criteria.....	79
Table 2.2 Performance related to the framework	80
Figure 2.1 Zhao's framework.....	82
Table 2.3 Capabilities related to the framework.....	85
Table 2.4 Practices and actions related to the framework	88
Figure 2.2 Resource based-theory model (Barney, 1991).....	89
Figure 2.3 Integrated model of RBT and Dynamic Capability theory (Teece,1997, Sirmon et al.,2007).....	90
Figure 2.4 Contingent resource-based theory (Brush and Artz, 1999)	91
Table 4.1 Product/market scenario's trend.....	97
Table 4.2 Best Performers data – SVS	98
Table 4.3 Best Performers' groups data – SVS	99
Table SVS1.1 – Vital statistics	99
Table SVS1.2 – Market/product scenario.....	99
Table SVS1.3 – Prospective markets.....	99
Table SVS1.4 – Production stages.....	100

Table SVS1.5 – Supply chain configuration	101
Table SVS2.1 – Vital statistics	101
Table SVS2.2 – Market/product scenario	102
Table SVS2.3 – Prospective markets.....	102
Table SVS2.4 – Production stages.....	102
Table SVS2.5 – Supply chain configuration	104
Table SVS3.1 – Vital statistics	104
Table SVS3.2 – Market/product scenario	104
Table SVS3.3 – Prospective markets.....	104
Table SVS3.4 – Production stages.....	105
Table SVS3.5 – Supply chain configuration	107
Table SVS4.1 – Vital statistics	107
Table SVS4.2 – Market/product scenario	108
Table SVS4.3 – Prospective markets.....	108
Table SVS4.4 – Production stages.....	109
Table SVS4.5 – Supply chain configuration – Ball valves	110
Table SVS4.6 – Supply chain configuration – Check ball valves	111
Table SVS5.1 – Vital statistics	111
Table SVS5.2 – Market/product scenario	111
Table SVS5.3 – Prospective markets.....	111
Table SVS5.4 – Production stages.....	112
Table SVS5.5 – Supply chain configuration	114
Table SVS6.1 – Vital statistics	114
Table SVS6.2 – Market/product scenario	114
Table SVS6.3 – Prospective markets.....	115
Table SVS6.4 – Production stages.....	115
Table SVS6.5 – Supply chain configuration	116
Table SVS7.1 – Vital statistics	117
Table SVS7.2 – Market/product scenario	117
Table SVS7.3 – Prospective markets.....	117
Table SVS7.4 – Production stages.....	118
Table SVS7.5 – Supply chain configuration	119
Table SVS8.1 – Vital statistics	120
Table SVS8.2 – Market/product scenario	120
Table SVS8.3 – Prospective market	120
Table SVS8.4 – Production stages.....	121
Table SVS8.6 – Supply chain configuration – North America	122
Table SVS8.7 – Supply chain configuration – Far East/Australia	123
Table SVS9.1 – Vital statistics	124
Table SVS9.2 – Market/product scenario	124
Table SVS9.3 – Prospective market	124
Table SVS9.4 – Production stages.....	124
Table SVS9.5 – Supply chain configuration	126
Table SVS10.1 – Vital statistics	126
Table SVS10.2 – Market/product scenario	126
Table SVS10.3 – Prospective market	126
Table SVS10.4 – Production stages	127
Table SVS10.5 – Supply chain configuration	129

Table SVS11.1 – Vital statistics	130
Table SVS11.2 – Market/product scenario	130
Table SVS11.3 – Prospective markets.....	130
Table SVS11.4 – Production stages	131
Table SVS11.5 – Supply chain configuration	133
Table SVS12.1 – Vital statistics	133
Table SVS12.2 – Market/product scenario	133
Table SVS12.3 – Prospective markets.....	134
Table SVS12.4 – Production stages	134
Table SVS12.5 – Supply chain configuration – Middle East.....	135
Table SVS12.6 – Supply chain configuration – Far East.....	136
Table SVS12.7 – Supply chain configuration – Northern Europe	137
Table SVS13.1 – Vital statistics	137
Table SVS13.2 – Market/product scenario	137
Table SVS13.3 – Prospective markets.....	137
Table SVS13.4 – Production stages	138
Table SVS13.5 – Supply chain configuration	140
Table SVS14.1 – Vital statistics	141
Table SVS14.2 – Market/product scenario	141
Table SVS14.3 – Prospective markets.....	141
Table SVS14.4 – Production stages	142
Table SVS14.5 – Supply chain configuration – Northern Europe/Central Asia	143
Table SVS14.6 – Supply chain configuration – Other markets	144
Table SVS15.1 – Vital statistics	145
Table SVS15.2 – Market/product scenario.....	145
Table SVS15.3 – Prospective markets.....	145
Table SVS15.4 – Production stages	146
Table SVS15.5 – Supply chain configuration	147
Table SVS16.1 – Vital statistics	148
Table SVS16.2 – Market/product scenario.....	148
Table SVS16.3 – Prospective markets.....	148
Table SVS16.4 – Production stages	149
Table SVS16.5 – Supply chain configuration	151
Table SVS17.1 – Vital statistics	152
Table SVS17.2 – Market/product scenario.....	152
Table SVS17.3 – Prospective markets.....	152
Table SVS17.4 – Production stages	153
Table SVS17.5 – Supply chain configuration	155
Table SVS18.1 – Vital statistics	155
Table SVS18.2 – Market/product scenario.....	156
Table SVS18.3 – Prospective markets.....	156
Table SVS18.4 – Production stages	157
Table SVS18.5 – Supply chain configuration	158
Table 4.4 Best Performers data – SES.....	159
Table 4.5 Best Performers’ group data – SES	159
Table SES1.1 – Vital statistics	160
Table SES1.2 – Market/product scenario	160
Table SES1.3 – Prospective markets.....	160

Table SES1.4 – Production stages.....	161
Table SES1.5 – Supply chain configuration.....	165
Table SES2.1 – Vital statistics	165
Table SES2.2 – Market/product scenario	166
Table SES2.3 – Prospective markets.....	166
Table SES2.4 – Production stages.....	167
Table SES2.5 – Supply chain configuration.....	169
Table SES3.1 – Vital statistics	170
Table SES3.2 – Market/product scenario	170
Table SES3.3 – Prospective markets.....	170
Table SES3.4 – Production stages.....	171
Table SES3.5 – Supply chain configuration.....	172
Table SES4.1 – Vital statistics	173
Table SES4.2 – Market/product scenario	173
Table SES4.3 – Prospective markets.....	173
Table SES4.4 – Production stages.....	174
Table SES4.5 – Supply chain configuration.....	177
Table SES5.1 – Vital statistics	177
Table SES5.2 – Market/product scenario	177
Table SES5.3 – Prospective markets.....	178
Table SES5.4 – Production stages.....	179
Table SES5.5 – Supply chain configuration.....	182
Table SES6.1 – Vital statistics	183
Table SES6.2 – Market/product scenario	183
Table SES6.3 – Prospective markets.....	183
Table SES6.4 – Production stages.....	184
Table SES6.5 – Supply chain configuration.....	187
Table SES7.1 – Vital statistics	187
Table SES7.2 – Market/product scenario	187
Table SES7.3 – Prospective markets.....	188
Table SES7.4 – Production stages.....	189
Table SES7.5 – Supply chain configuration.....	191
Table SES8.1 – Vital statistics	191
Table SES8.2 – Market/product scenario	191
Table SES8.3 – Prospective markets.....	192
Table SES8.4 – Production stages.....	193
Table SES8.5 – Supply chain configuration – Pressure Vessels/Columns and Drums	195
Table SES8.6 – Supply chain configuration – Heat Exchangers	197
Table SES9.1 – Vital statistics	197
Table SES9.2 – Market/product scenario	197
Table SES9.3 – Prospective markets.....	198
Table SES9.4 – Production stages.....	199
Table SES9.5 – Supply chain configuration.....	201
Table SES10.1 – Vital statistics	202
Table SES10.2 – Market/product scenario	202
Table SES10.3 – Prospective markets.....	202
Table SES10.4 – Production stages.....	203
Table SES10.5 – Supply chain configuration.....	205

Table SES11.1 – Vital Statistics	206
Table SES11.2 – Market/product scenario	206
Table SES11.3 – Prospective markets	206
Table SES11.4 – Production stages	207
Table SES11.5 – Supply chain configuration	209
Table SES12.1 – Vital statistics	209
Table SES12.2 – Market/product scenario	210
Table SES12.3 – Prospective markets	210
Table SES12.4 – Production stages	210
Table SES12.5 – Supply chain configuration	211
Table 4.6 Best Performers data – SWS	212
Table 4.7 Best Performers groups data – SWS	212
Table 4.8 Products abbreviations	213
Table SWS1.1 – Vital statistics	213
Table SWS1.2 – Market scenario	213
Table SWS1.3 – Prospective markets	213
Table SWS1.4 – Production stages	214
Table SWS1.5 – Supply chain configuration	215
Table SWS2.1 – Vital statistics	216
Table SWS2.2 – Market scenario	216
Table SWS2.3 – Prospective markets	216
Table SWS2.4 – Production stages	217
Table SWS2.5 – Supply chain configuration	219
Table SWS3.1 – Vital statistics	219
Table SWS3.2 – Market scenario	220
Table SWS3.3 – Prospective markets	220
Table SWS3.4 – Production stages	220
Table SWS3.5 – Supply chain configuration	222
Table SWS4.1 – Vital statistics	223
Table SWS4.2 – Market scenario	223
Table SWS4.3 – Prospective markets	223
Table SWS4.4 – Production stages	224
Table SWS4.5 – Supply chain configuration	226
Table SWS5.1 – Vital statistics	227
Table SWS5.2 – Market scenario	227
Table SWS5.3 – Prospective markets	227
Table SWS5.4 – Production stages	228
Table SWS5.5 – Supply chain configuration	230
Table SWS6.1 – Vital statistics	230
Table SWS6.2 – Market scenario	230
Table SWS6.3 – Prospective markets	231
Table SWS6.4 – Production stages	231
Table SWS6.5 – Supply chain configuration	233
Table SWS7.1 – Vital statistics	234
Table SWS7.2 – Market scenario	234
Table SWS7.3 – Prospective markets	234
Table SWS7.4 – Production stages	235
Table SWS7.5 – Supply chain configuration	237

Table SWS8.1 – Vital statistics	238
Table SWS8.2 – Market scenario	238
Table SWS8.3 – Prospective market	238
Table SWS8.4 – Production stages	239
Table SWS8.5 – Supply chain configuration	240
Table SWS9.1 – Vital statistics	241
Table SWS9.2 – Market scenario	241
Table SWS9.3 – Prospective markets	241
Table SWS9.4 – Production stages	242
Table SWS9.5 – Supply chain configuration	243
Table 5.1 New actions added during the interviews	245
Table 5.2 Performance – SVS	247
Figure 5.1: Performance overview - SVS	248
Table 5.3 Recommended performance – SVS	250
Table 5.4 Quality – SVS	251
Figure 5.2 Quality overview – SVS	252
Table 5.5 Recommended Quality enabling capabilities – SVS	252
Table 5.6 On-time Delivery – SVS	254
Figure 5.3 On-time Delivery overview – SVS	254
Table 5.7 Recommended On-time Delivery enabling capabilities – SVS	255
Table 5.8 Engineering – SVS	255
Figure 5.4 Engineering overview – SVS	256
Table 5.9 Recommended Engineering enabling capabilities – SVS	256
Table 5.10 Price – SVS	257
Table 5.11 Recommended Price enabling capabilities – SVS – 1	258
Table 5.12 Recommended Price enabling capabilities – SVS – 2	259
Table 5.13 Flexibility (SC) – SVS	259
Table 5.14 Service – SVS	260
Table 5.15 Innovation – SVS	261
Table 5.16 Differentiation – SVS	262
Table 5.17 Financial – SVS	262
Table 5.18 Communication – SVS	263
Table 5.19 Knowledge – SVS	263
Table 5.20 Recommended capabilities – SVS	264
Table 5.21 Explanation of chromatic indicators	264
Table 5.22 Supply Chain Management Inbound – SVS	266
Table 5.23 Recommended practices for SCM Inbound – SVS	266
Table 5.24 Supply Chain Management Outbound – SVS	267
Table 5.25 Recommended practices for SCM Outbound – SVS	268
Table 5.26 Knowledge Management Capability – SVS	269
Table 5.27 Recommended practices for Knowledge Management Capability - SVS	269
Table 5.28 Product/Process Development Capability – SVS	271
Table 5.29 Recommended practices for Product/Process Development Capability – SVS	271
Table 5.30 Capacity and Flexibility – SVS	272
Table 5.31 Recommended practices for Capacity and Flexibility – SVS	273
Table 5.32 Customer Service– SVS	275
Table 5.33 Recommended practices for Customer Service – SVS	275
Table 5.34 Relationship Capability – SVS	276

Table 5.35 Market Development Capability – SVS	277
Table 5.36 Financial Capability – SVS	278
Table 5.37 Internal Integration – SVS	279
Table 5.38 External Integration – SVS	280
Table 5.39 Project Management Capability – SVS	281
Table 5.40 Recommended practices for Project Management Capability – SVS	282
Table 5.41 Configuration actions overview – SVS	283
Figure 5.5 Relative frequency of selection of actions respect to the practices	284
Figure 5.6 Actions related to Information Technology	284
Table 5.42 Primary and secondary actions for Information Technology – SVS	284
Figure 5.7 Actions related to Information Sharing – SVS	285
Table 5.43 Primary and secondary actions for Information Sharing – SVS	285
Figure 5.8 Actions related to IS Customer to Firm – SVS	285
Table 5.44 Primary and secondary actions for IS Customer to Firm – SVS	285
Figure 5.9 Actions related to IS Customer to Firm - SVS	286
Table 5.45 Primary and secondary actions for IS Firm to Customer – SVS	286
Figure 5.10 Actions related to Long-term Relationships with Suppliers – SVS	286
Table 5.46 Primary and secondary actions for Long-term Relationships with Suppliers– SVS	287
Figure 5.11 Actions related to Long-term Relationships with Customers – SVS	287
Table 5.47 Primary and secondary actions for Long-term Relationships with Customers – SVS	287
Figure 5.12 Actions related to Human Resource Management Practices – SVS	288
Table 5.48 Primary and secondary actions for Human Resource Management Practices – SVS	288
Figure 5.13 Actions related to Project Management Practices – SVS	288
Table 5.49 Primary and secondary actions for Project Management Practices – SVS	289
Figure 5.14 Actions related to Production System Practices – SVS	289
Table 5.50 Primary and secondary actions for Production System Practices – SVS	289
Figure 5.15 Actions related to Network - SVS	290
Table 5.51 Primary and secondary actions for Network – SVS	290
Figure 5.16 Actions related to Strategic Behavior – SVS	290
Table 5.52 Primary and secondary actions for Strategic Behavior – SVS	291
Figure 5.17 Actions related to Financial Practices – SVS	291
Table 5.53 Primary and secondary actions for Financial Practices – SVS	291
Table 5.54 Quality suggested configuration – 1 – SVS	292
Table 5.55 On-time Delivery Set suggested configuration – 1 – SVS	293
Table 5.56 Engineering suggested configuration – 1 – SVS	293
Table 5.57 Price Set suggested configuration – 1 – SVS	294
Table 5.58 Price suggested configuration – 2 – SVS	294
Table 5.59 Static Equipment classification and coding	295
Table 5.60 Performance – SES	296
Figure 5.18 Performance overview – SES	297
Table 5.61 Recommended performance – SES	298
Table 5.62 Price – SES	299
Figure 5.19 Price overview – SES	300
Table 5.63 Recommended Price enabling capabilities – 1 – SES	300
Table 5.64 Recommended Price enabling capabilities – 2 – SES	300
Table 5.65 Quality – SES	302
Figure 5.20 Quality overview – SES	302
Table 5.66 Recommended Quality enabling capabilities – 1 – SES	302

Table 5.67 Recommended Quality enabling capabilities – 2 – SES	302
Table 5.68 On-time Delivery – SES	303
Figure 5.21 On-time Delivery overview – SES	304
Table 5.69 Recommended On-time Delivery enabling capabilities – 1 – SES	304
Table 5.70 Recommended On-time Delivery enabling capabilities – 2 – SES	304
Table 5.71 Recommended On-time Delivery enabling capabilities – 3 – SES	304
Table 5.72 Engineering – SES.....	305
Table 5.73 Innovation – SES	306
Table 5.74 Differentiation – SES	306
Table 5.75 Flexibility (SC) – SES	307
Table 5.76 Recommended capabilities – SES	308
Table 5.77 Explanation of usage of chromatic indicators	308
Table 5.78 Supply Chain Management Inbound – SES.....	309
Table 5.79 Recommended practices for Supply Chain Management Inbound – SES	310
Table 5.80 Supply Chain Management Outbound – SES.....	311
Table 5.81 Recommended practices for Supply Chain Management Outbound – SES	311
Table 5.82 Knowledge Management Capability – SES	312
Table 5.83 Product/Process Development Capability – SES.....	313
Table 5.84 Recommended practices for Product/Process Development Capability – SES.....	314
Table 5.85 Capacity and Flexibility – SES.....	315
Table 5.86 Recommended practices for Capacity and Flexibility – SES	315
Table 5.87 Customer Service – SES.....	316
Table 5.88 Relationship Capability – SES.....	317
Table 5.89 Market Development Capability – SES	318
Table 5.90 Financial Capability – SES.....	319
Table 5.91 Internal Integration – SES	320
Table 5.92 External Integration – SES.....	320
Table 5.93 Project Management Capability – SES.....	322
Table 5.94 Recommended practices for Project Management Capability – SES	322
Table 5.95 Configuration actions overview – SES	324
Figure 5.22 Relative frequency of selection of actions respect to the practices	324
Figure 5.23 Actions related to Information Technology – SES.....	324
Table 5.96 Primary and secondary actions for Information Technology – SES.....	325
Figure 5.24 Actions related to Information Sharing – SES.....	325
Table 5.97 Primary and secondary actions for Information Sharing – SES	325
Figure 5.25 Actions related to IS – Customer to Firm – SES	325
Table 5.98 Primary and secondary actions for IS – Customer to Firm – SES.....	326
Figure 5.26 Actions related to IS – Firm to Customer – SES	326
Table 5.99 Primary and secondary actions for IS – Firm to Customer – SES.....	326
Figure 5.27 Actions related to Long-term Relationships with Suppliers – SES.....	326
Table 5.100 Primary and secondary actions for Long-term Relationships with Suppliers – SES	327
Figure 5.28 Actions related to Long-term Relationships with Customers – SES	327
Table 5.101 Primary and secondary actions for Long-term Relationships with Customers – SES.....	327
Figure 5.29 Actions related to Human Resource Management Practices – SES	327
Table 5.102 Primary and secondary actions for Human Resource Management Practices – SES.....	327
Figure 5.30 Actions related to Project Management Practices – SES	328
Table 5.103 Primary and secondary actions for Project Management Practices– SES	328
Figure 5.31 Actions related to Production System Practices – SES	328

Table 5.104 Primary and secondary actions for Production System Practices – SES.....	329
Figure 5.32 Actions related to Network – SES.....	329
Table 5.105 Primary and secondary actions for Network – SES.....	329
Figure 5.33 Actions related to Strategic Behavior – SES	329
Table 5.106 Primary and secondary actions for Strategic Behavior – SES	329
Figure 5.34 Actions related to Financial Practices – SES	330
Table 5.107 Primary and secondary actions for Financial Practices– SES.....	330
Table 5.108 Price suggested configuration – 1 – SES	331
Table 5.109 Price suggested configuration – 2 – SES	331
Table 5.110 Quality suggested configuration – 1 – SES.....	332
Table 5.111 Quality suggested configuration – 2 – SES.....	333
Table 5.112 On-time Delivery suggested configuration – 1 – SES.....	333
Table 5.113 On-time Delivery suggested configuration – 2 – SES.....	334
Table 5.114 On-time Delivery suggested configuration – 3 – SES.....	335
Table 5.115 Performance – SWS	335
Figure 5.35 Performance – SWS	336
Table 5.116 Recommended performance – SWS.....	338
Table 5.117 Quality – SWS.....	339
Figure 5.36 Quality overview – SWS.....	339
Table 5.118 Recommended Quality enabling capabilities – SWS	340
Table 5.119 Engineering – SWS	341
Figure 5.37 Engineering overview – SWS	341
Table 5.120 Recommended Engineering enabling capabilities – SWS.....	341
Table 5.121 On-time Delivery – SWS.....	342
Figure 5.38 On-time Delivery overview – SWS.....	343
Table 5.122 Recommended On-time Delivery enabling capabilities – SWS – 1.....	343
Table 5.123 Recommended On-time Delivery enabling capabilities – SWS – 2.....	343
Table 5.124 Flexibility (SC) – SWS.....	344
Figure 5.39 Flexibility (SC) overview – SWS.....	345
Table 5.125 Recommended Flexibility (SC) enabling capabilities – SWS	345
Table 5.126 Price – SWS	346
Figure 5.40 Price overview – SWS	346
Table 5.127 Recommended Price enabling capabilities – SWS – 1	347
Table 5.128 Recommended Price enabling capabilities – SWS – 2	347
Table 5.129 Recommended Price enabling capabilities – SWS – 3	347
Table 5.130 Lead-time – SWS	348
Table 5.131 Commercial Impact – SWS.....	348
Table 5.132 Service – SWS.....	349
Table 5.133 Recommended capabilities – SWS.....	350
Table 5.134 Number of actions selected for practice	350
Table 5.135 Supply Chain Management Inbound – SWS	351
Table 5.136 Recommended practices for Supply Chain Management Inbound – SWS.....	352
Table 5.137 Supply Chain Management Outbound – SWS	352
Table 5.138 Recommended practices for Supply Chain Management Outbound – SWS.....	353
Table 5.139 Knowledge Management Capability – SWS.....	354
Table 5.140 Recommended practices for Knowledge Management Capability – SWS	354
Table 5.141 Production/Process Development Capability – SWS.....	355
Table 5.142 Recommended practices for Production/Process Development Capability – SWS	356

Table 5.143 Capacity and Flexibility – SWS	357
Table 5.144 Recommended practices for Capacity and Flexibility – SWS.....	357
Table 5.145 Relationship Capability – SWS	358
Table 5.146 Recommended practices for Relationship Capability – SWS.....	359
Table 5.147 Customer Service – SWS	360
Table 5.148 Recommended practices for Customer Service – SWS	360
Table 5.149 Project Management Capability – SWS	361
Table 5.150 Recommended practices for Project Management Capability – SWS.....	361
Table 5.151 Market Development Capability – SWS.....	362
Table 5.152 External Integration – SWS	363
Table 5.153 Configuration actions overview – SWS	364
Figure 5.41 Relative frequency of selection of actions respect to the practices – SWS	364
Figure 5.42 Actions related to Information Technology – SWS	365
Table 5.154 Primary and secondary actions for Information Sharing – SWS.....	365
Figure 5.43 Actions related to Information Sharing – SWS	366
Table 5.155 Primary and secondary actions for Information Sharing – SWS.....	366
Figure 5.44 Actions related to IS – Customer to Firm – SWS	366
Table 5.156 Primary and secondary actions for IS – Customer to Firm – SWS	366
Table 5.157 Primary and secondary actions for IS – Firm to Customer – SWS	366
Figure 5.45 Actions related to Long-term Relationships with Suppliers – SWS	367
Table 5.158 Primary and secondary actions for Long-term Relationships with Suppliers – SWS.....	367
Figure 5.46 Actions related to Long-term Relationships with Customers – SWS.....	367
Table 5.159 Primary and secondary actions for Long-term Relationships with Customers – SWS	368
Figure 5.47 Actions related to Human Resource Management Practices– SWS.....	368
Table 5.160 Primary and secondary actions for Human Resource Management Practices– SWS	368
Figure 5.48 Actions related to Project Management Practices – SWS.....	369
Table 5.161 Primary and secondary actions for Project Management Practices – SWS	369
Figure 5.49 Actions related to Production System Practices – SWS	369
Table 5.162 Primary and secondary actions for Production System Practices – SWS	370
Figure 5.50 Actions related to Network – SWS	370
Table 5.163 Primary and secondary actions for Network – SWS	370
Figure 5.51 Actions related to Strategic Behavior – SWS.....	371
Table 5.164 Primary and secondary actions for Strategic Behavior – SWS.....	371
Table 5.165 Primary and secondary actions for Financial Practices – SWS	371
Table 5.166 Quality suggested configuration – 1 – SWS.....	372
Table 5.167 Engineering suggested configuration – 1 – SWS	373
Table 5.168 On-time Delivery suggested configuration – 1 – SWS	373
Table 5.169 On-time Delivery suggested configuration – 2 – SWS	374
Table 5.170 Flexibility (SC) suggested configuration – 1 – SWS.....	375
Table 5.171 Price suggested configuration – 1 – SWS.....	375
Table 5.172 Price suggested configuration – 2 – SWS.....	376
Table 5.173 Price suggested configuration – 3 – SWS.....	377
Figure 6.1 Model of average SCC for one of the three most selected performance	379
Figure 6.2 Match performance-capability-practice.....	380
Figure 6.3 Match performance-capability	380
Figure 6.4 Match capability-practice	380
Figure 6.5 Match performance.....	381
Table 6.1 Average supply chain configuration – SVS.....	383

Table 6.2 Average supply chain configuration – SES.....	384
Table 6.3 Average supply chain configuration – SWS	385
Table 6.4 – Similarity Index – SVS.....	385
Table 6.5 – Similarity Index - SES.....	385
Table 6.6 – Similarity Index - SWS	385
Table 6.7 Cut-off values for each sector.....	386
Table 6.8 Outliers of each sector.....	386
Figure 6.6 Similarity index vs Firm’s dimension – SVS.....	387
Figure 6.7 Similarity index vs Firm’s dimension – SES.....	387
Table 6.9 Average supply chain configuration – ETO	389
Table 6.10 Similarity Index - ETO	389
Table 6.11 Outliers of ETO	389
Table 6.12 Outliers’ classification.....	390
Table 6.13 List of similarity indexes – Single sector/ETO	397
Table 6.14 Average similarity index variation for each sector	397
Table .1 Reference answers for R.Q.1 and R.Q.2	401
Table 8.2 Comparison among average supply chain of the theory.....	402

ABSTRACT

In a period of instability of the Oil&Gas market and with the increase of competitiveness of foreign competitors, that can reduce the strategic position of Italian EPC, the purpose of this study is to define guidelines to provide to the suppliers of Special Valves, Static Equipment and Switchgears, in order to improve their competitive position on the market.

The information required are collected by means of interview to excellent companies belonging to one of each sector, that are called Best Performers. The status of Best Performer has been defined by the EPC clients.

This research focuses on the analysis of the supply chain configuration of each company, trying to highlight which are the main elements that could be useful and replicable.

These companies are interviewed about their supply chain configuration, whose information are gathered thanks to a theoretical framework, which has been defined with the literature, and further improved during the interviews.

Through the research-based theory, it is possible to provide a theoretical lens that allow to identify the structure and the configuration of these suppliers, thus providing an insight in each of these sectors. It is important to describe the theoretical framework, that is basically composed by three blocks of elements:

- Performance: contractor's evaluation of suppliers;
- Capabilities: firms' abilities and skills that generate performance;
- Practices: packages containing configuration actions that are bundled to obtain capabilities.

The sample of firms is composed of 18 special valves, 12 static equipment and 9 switchgears suppliers. The interviews help understanding which are the practices, capabilities, performance and their combinations that allow those companies to obtain competitive advantage to prevail over their competitors. The identification of these elements is made through the multi-case approach.

In order to understand if the resource-based theory is adequate to describe the configurations through which those companies compete on market, an index is introduced, called "Similarity Index", who provides how far each company is to the average behavior of its sector. This procedure allows the identification of outliers, that are the companies that behave in the most different way, respect to their sector.

The suppliers are then grouped under the contextual factor of the ETO (Engineer-to-Order), that helps providing a different point of view for the analysis of these companies.

The universality of the proposed research model, and the relative resource-based view theory, could allow future researches in different fields.

Keywords: Oil&Gas market, EPC suppliers, resource-based theory, performance, capability, practice, supply chain configuration, engineer-to-order

ABSTRACT (italian version)

In un periodo di instabilità del mercato dell'Oil&Gas e con l'aumento della competitività dei concorrenti esteri, che possono ridurre la posizione strategica degli EPC italiani, lo scopo dello studio è la definizione di linee guida da presentare ai fornitori di valvole ingegnerizzate, caldareria e quadri elettrici, al fine di migliorare la loro competitività sul mercato.

Le informazioni necessarie sono state ottenute mediante interviste di fornitori eccellenti appartenenti a questi settori, che sono stati definiti Best Performer. Lo stato di Best Performer è stato definito dagli EPC Contractor.

La ricerca si concentra sull'analisi della configurazione di filiera di ciascuna di quelle aziende, nel tentativo di evidenziare quali possano essere gli elementi principali che possano essere utili e replicabili.

Questi fornitori sono quindi stati intervistati sulla propria azienda e sulla configurazione di filiera, le cui informazioni sono stati raccolti e analizzati mediante un modello di ricerca (i.e. *framework*), il quale è stato definito a partire dalla letteratura, e parzialmente migliorato nel corso delle interviste.

Attraverso la *resource-based theory*, è possibile ottenere una lente teorica del framework che consenta di identificare la struttura di questi fornitori, aiutando a dare una descrizione più completa dei settori in analisi. Il modello di ricerca è costituito da tre diversi blocchi di elementi, che vengono, in seguito, presentati:

- *Performance*: valutazione del fornitore da parte del cliente;
- *Capability*: capacità e conoscenze che consentono l'ottenimento delle *performance*;
- *Practice*: pacchetti di azioni (*actions*) legati alla configurazione di filiera che, se uniti, abilitano le *capability*.

Il campione di aziende in analisi è composto da 18 fornitori di valvole "speciali", 12 di caldareria e 9 di quadri elettrici. Le interviste consentono di ottenere quali siano le pratiche e le rispettive combinazioni che consentano a questi fornitori di ottenere un vantaggio competitivo rispetto ai concorrenti. Il *multi-case approach* è la tecnica utilizzata per la valutazione dei suddetti elementi.

Diventa inoltre necessario valutare se la *resource-based theory*, applicata assieme al framework, consenta di descrivere adeguatamente le configurazioni e i metodi con cui queste aziende riescono a competere sul mercato e, per fare ciò, è stato introdotto un coefficiente, chiamato *Similarity Index*, che consente di capire quanto una certa azienda sia distante, in termini di configurazione di filiera, rispetto al comportamento medio del settore di appartenenza. Questa procedura consente di identificare gli "*outlier*", che sono le aziende che più si comportano nella maniera più diversa rispetto al settore, la cui analisi ha consentito il range di applicabilità della *resource-based theory* allo studio in questione.

I fornitori sono, infine, stati riuniti sotto un unico fattore di contesto, quello dell'ETO (*Engineer-to-Order*), che ha consentito di studiare queste aziende secondo un diverso punto di vista, estendendo i risultati ottenuti in precedenza.

Keywords: mercato dell'Oil&Gas, fornitori EPC, resource-based theory, performance, capability, practice, configurazione di filiera, engineer-to-order

Executive Summary

1. Introduction

The Oil&Gas market has passed a long period of instability, mainly due to the entrance of South Asian competitors and the contemporaneous decrease of the oil price. Italian suppliers have always been at the competitive edge in this sector, thus this research wants to provide an insight of these companies, in order to identify possible guidelines that describe their competitiveness.

When talking about Oil&Gas, it is important to understand what are the Large Engineering Project, since the construction of an extraction site is one of them. These megaprojects are very large projects, in which an extremely long and complex sequence of activities is performed by companies that are called EPC contractors, which has to manage and execute these activities, respecting the will and need of their customer, the end users.

In this panorama, it becomes extremely important the selection of the suppliers, since the procurement activity covers almost the 50% of the overall costs (Weber et al. 1991; Smith, 2002). The selection criteria have evolved in time, since at the beginning the buyers only focused on price, thus obtaining low quality products and service, under the trade-off selection concept (Weber&Current, 1993).

The suppliers, that are the focus of this research, provide to the EPC contractors the *key items*, that in our case are going to be Special (Engineered) Valves, Static Equipment and Switchgears, that are selected following different multi criteria selection.

The contextual environment under which a project is developed is always different, making almost impossible, for these suppliers, to provide standard items, needing to relate frequently with customers to identify the most proper kind of item for the specific project.

A megaproject is defined as a “temporary endeavor undertaken to create a unique product, service or result”. While the unicity has already been tackled, it is important to notice that the other fundamental characteristics of a project is its temporary nature, meaning that usually start and end dates are planned ahead the beginning. Thus, the on-time delivery of these key items becomes of paramount importance, since the delay in the delivery can create a waterfall sequence of delays over the overall project.

The companies that are going to be analyzed in this study are suppliers for megaproject in the Oil&Gas sector and they provide critical item such as special valves, static equipment and switchgears.

In order to be considered “Special” or “engineered”, a valve must satisfy at least one of these criteria; Rating > 600, Size $\geq 16''$, being cryogenic or able to work in hostile environments, or being made of high alloy steel or not standard material. The study considers Ball, Gate, Globe, Check, Plug and Butterfly valves that respects one of these criteria.

The static equipment under consideration are: Pressure Vessels, Columns and Drums, Shell and Tube Heat Exchangers, Trays and Internals, Steam Generators and Industrial Boilers, Air Coolers and Packages. These products can be furthermore classified in base of their size, material and, if it is relevant, also the operating pressure.

The classification of switchgears follows three criteria; Voltage class, that can be low (1kV in AC) or medium voltage (from 1kV to 75kV in AC); insulation medium, Air-Insulated, Gas-Insulated or Hybrid configuration; type of use in the plant.

The scope of the research is the identification of the supply chain configuration of these companies, that is described thanks to a framework that will be later described in the literature review chapter that is supported

by the resource-based theory, which states that firms achieve competitive advantage thanks to their resources and how do they combine them.

The analysis of the supply chain configuration allows the identification of which are the most important elements of the supply chain configuration of these companies, in order to provide an insight on each sector.

Furthermore, the study points at identifying possible outliers in the three sectors, so that, through their analysis, it will be possible to verify if the resource-based theory can be used to describe accurately this phenomenon.

The companies are also gathered altogether under the contextual factor of ETO (engineer-to-order), that is a manufacturing mode used by the firm to create certain types of products. EPC companies usually belong to this classification; thus, it becomes interesting to test if the resource-based theory, applied to the framework, is able to describe the behavior of these suppliers also under the ETO sector.

2. Literature review

2.1 The research framework and the resource-based theory

The scope of this study is to provide the description of the supply chain configuration of these suppliers, since during literature review, it has been noticed that EPC companies are rarely investigated under this aspect.

In order to do that a research framework, grounded in the resource-based theory, has been created. This framework is composed by three blocks of elements, that are:

- Performance: set of activities that allows the company to meet customers' requirements and to obtain competitive advantage over competitors;
- Capabilities: firms' abilities or skills that help the company to achieve the proper performance levels;
- Practices: bundles of configuration actions or strategic decisions that enable the capabilities.

The analysis of the literature showed that there are no studies that present a framework that articulated, since usually these elements are considered, even if they are the strategic source of competitive advantage for the company, without holistic view. The resource-based theory will be addressed later.

Several studies considered the relationships between practices and capabilities (Tan *et al.* (1999, 2002), Zhou (2007) and Li *et al.* (2006)), or focused on only one single block of element, such as performance (Beamon, 1999, Weber, 1991) or capabilities (Tracey *et al.*, 2005, Tseng, 2014, Morgan *et al.*, 2009, Zhao *et al.*, 2001), but no holistic view among the contemporaneous view of the three blocks have been provided, thus these studies have been researched to provide a more complete framework, able to described the supply chain configuration in its entirety.

It is important to notice that even if this study focuses only on the EPC industry, the framework has been developed under the general considerations, thus it should be applicable to any context, without any restrictions.

In the following sections, the guidelines for the identification of the elements of the framework is presented.

2.1.1 Performance

Performance measurement has always been a topic that has always driven the attention of the researchers, being the contact point between the output of a certain firm and the requirements of the customers, that

have to be aligned in order for the supplier to win a certain order or to gain competitive position on the market.

At the beginning of the 1980s, companies were mainly focused in the development of the products internally, while with the arrival of the globalization, they started outsourcing different production activities. While initially companies were almost exclusively focused on cost reduction, the complication of the environmental conditions and the evolution of markets led the companies to understand how the only cost reduction was not enough anymore.

Thus, since the impact of the suppliers on the firm's performance has constantly grown, it became extremely important to indicate which were the most important indicators and methods for suppliers selection and qualification (Luzzini et al., 2014).

In his seminal work, Dickson (1966) listed and ranked 23 vendors' selection criteria in function of their importance for the buyer. This research has been further analyzed and improved, assessing the consistency of the criteria identified by him.

The review of the literature on performance measurement led to the identification of 14 performance items with the respective performance measurements that are: *Price, Quality, On-time Delivery, Engineering, Innovation, Differentiation, Variety, Lead-time, Flexibility of Supply Chain, Commercial Impact, Financial, Service, Communication and Knowledge*.

2.1.2 Capabilities

The concept of capability has always been confused in literature, resulting ambiguous to the most. A univocal definition has been attributed by Day (1990), who stated that capabilities are bundles of skills and accumulated knowledge that enable firm to coordinate activities and make use of their assets. This combination of resources or practices has to lead the company to improve its competitive position, being it a cost advantage, lower costs to the competitors, or a differentiation advantage, achieved through the effectiveness of the product/service delivered (Kaleka, 2002).

Researchers have always studied at different types of capabilities, also relating their enablement to the impact on performance, (Song et al, 2007, Morgan et al., 2009), without evaluating at the same time which combination of assets, resources or practices have been used to obtain the capability.

Day (1994) classified the capabilities in three different categories; outside-in capabilities, that are used to connect the company with the external environment; inside-out capabilities, focused on physical distribution; spanning capabilities, whose role is the provision of advantage to the company through internal coordination.

Tseng (2014), instead, focused on two other very important capabilities, that are dynamic and knowledge management capabilities. While the first one refers to the ability of a company to provide continuous improvement to its production system, the other focuses on the analysis and comprehension of internal and external factors. The two capabilities were demonstrated to be correlated, with knowledge management being a support for the dynamic capability, while the latter was demonstrated being positively impacting of organizational capabilities.

The analysis of previous literature helped to identify other important capabilities, other than the ones that have been previously presented, obtaining an overall set of 14 capabilities: *Supply Chain Management Inbound, Supply Chain Management Outbound, Knowledge Management Capability, Product/Process Development Capability, Capacity and Flexibility, Customer Service, Relationship Capability, Market*

Development Capability, Financial Capability, Internal Integration, External Integration, Project Management Capability.

2.1.3 Practices

The last block of elements is related to the practices. While in the 1950s and 1960s, companies were mainly focused on cost reduction through the utilization of mass production, with the changing of markets and the advent of new technologies, that challenges that a company has to face are now completely changed.

With the arrival of the outsourcing, relationships with supplier became more and more important, as studied by Chen et al. (2004). Having skilled personnel in the firm, able to provide different mansion, as to manage new technologies turned out to be strategic, thus raising the interest in human resource management, whose practices have been studied by Wright.

Instead of mass production, companies started targeting other production system practices, such as total quality management, just in time or lean practices.

Prajogo (2012), Tan (1999) and Zhou (2007) focused on the practices that could be useful to coordinate the company both internally and externally, in its relationships with the entities in its supply chain. Also network practices acquired an important role, since the globalization increased the amount of supply chain network design possibilities. The literature review on practices allowed the identification of 11 practices, with the relative configuration actions that are required to be implemented to achieve them: *Information Technology, Information Sharing, IS Customer to Firm, IS Firm to Customer, Long-term Relationships with Suppliers, Long-term Relationships with Customers, Human Resource Management Practices, Project Management Practices, Production Systems Practices, Network, Strategic Behavior.*

All the elements of the framework, with the respective literature review, are presented in ANNEX A.

2.1.4 Contingent Resource-based view

The resource-based theory (RBT) states how companies can create and maintain competitive advantage through the possession of rare, inimitable and non-substitutable resources, under the original definition of Barney (1991).

This theory has grown around the concept of *resource* that can be defined as “something a firm possess or has access to, not what a firm is able to do”, considering those more as assets than skills. While the theory grew in importance, it also started to attract different critics, because of its static nature and inability to related to different external conditions.

Barney (1991) tried to fix the static problem by stating how sustained competitive advantage could be provided if the resources of the firm were also imperfectly imitable and substitutable. Several researchers still believed that this could not provide a satisfactory solution to the problem. It was then introduced the concept of *capability*, which is the capacity of a firm to develop competitive advantage over time through the bundling of the firm’s resources (Amit and Schoemaker, 1993).

The RBT started being coupled with the *dynamic capability theory*, initially introduced by Teece (1997), that states how companies are able to maintain their competitive advantage over time thanks to the enablement of capabilities (Hitt, 2016).

Sirmon et al. (2007) describe the resource management as the comprehensive process of structuring and managing the resources’ portfolio. They introduced the concept of bundling, that is used to combine different resources to enable capabilities, that they distinguished from leveraging, which is a set of process in which

the capabilities are used to access competitive advantage, through the development of value for the customers.

Even with this implementation, the resource-based view was still suffering of “context insensitivity”, meaning that it was not able to provide an explanation for which capabilities and practices use in a certain environment.

Thus, Brush and Artz (1999) combined the RBT with the contingency theory, which argues that internal and external conditions can influence how a company organizes its own assets and coined the term contingent resource-based view.

Coupled with resource-based view, the contingency theory explains that each company has to adapt its own resource deployment as a function of the environmental conditions.

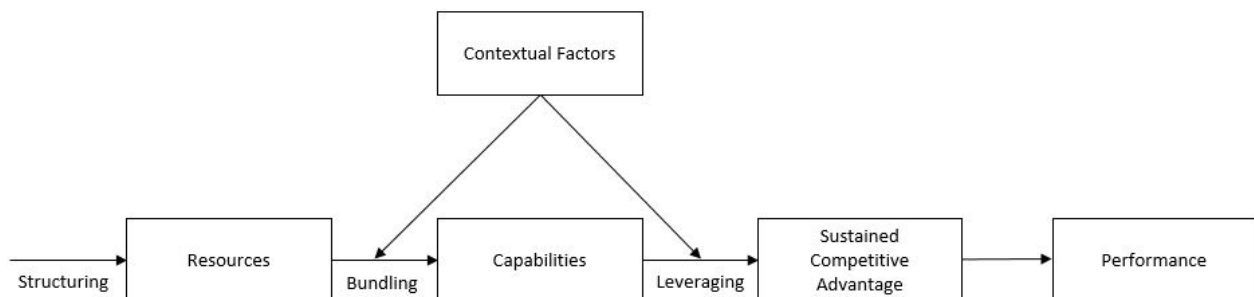


Figure 2.1 Contingent resource-based theory (Brush and Artz, 1999)

Through the introduction of dynamic capability and contingency theory, the role of the manager in the RBT grew in importance, since he became the figure that has to identify the external conditions and adapt to them the resource and capabilities of the company.

2.1.5 Adaptation of the contingent resource-based theory to the framework

While the contingent resource-based theory is mainly used to confirm relationships between resources/capabilities and the contextual factors, in this case it will be applied, in addition to the framework, to provide a description, through case study approach, of how the different EPC suppliers organize their resource under different contextual factors in order to achieve certain performance.

In order to do that, it is necessary to clarify certain discrepancies between the theory and the research framework.

The first significant difference is given by the fact the, while the resource-based view considers the resources of the firms, the framework is oriented on describing the capabilities as bundles of practices. In supply chain management, the practices are defined as set of activities undertaken by companies to effectively manage the supply chain (Li et al. 2006).

Considering the definition of resource that has been previously given, there are two differences: the first is related to the nature of the two elements, the practice is an activity, while the resource is an asset that the company possess; the second is given by the fact that the resource is defined as something internal to the company, while the practice refers to the overall supply chain, considering external companies.

In order to solve the first problem, it is possible to say that according to the definition of practice, it can also be seen as an investment that the company makes to achieve or generate a certain resource, that can be

external or internal. This is the assumption made of this paper, in order to provide the cohesion between practice and resource, that allows to consider the resource as the output of a certain practice.

The second mismatch is solved through an analysis of the literature. It has already been noticed that one limit of RBT was that it related only to internal resource, thus neglecting possible benefits coming from external resources. In order to solve this problem, it was proposed the extended resource-based view, in which inter-firm relationships can provide strategic resources that are kept beyond the boundaries on the single company, which can contribute in increasing its competitive advantage (Lewis *et al.*, 2010).

Lavie (2006) reviews and extends Barney's RBT framework, adding those resources that can be added from outside the boundaries of the company, that are called network resources.

Assuming in this research this adaptation of the RBT, it is possible to integrate the framework to the resource-based view. The integration of external resource is of paramount importance, especially for a sector such as the EPC, where suppliers, EPC companies and end users have usually very tight relationships.

3. Objective and methodology

The collection of the information necessary for the study has been done through interviews, under the supervision and help of ANIE-ANIMA-ANIMP, with both EPC contractors and the Italian suppliers of special valves, static equipment and switchgears, called Best Performers because of their excellence in their own field. The status of excellence has been provided by the EPC contractors.

The interviews with the EPC contractors were necessary to contextualize the Oil&Gas market, defining the actual market of interest, possible future rising markets, to define the classification of them under investigation and, finally, to identify the Best Performer for each of the three sectors, with an evaluation of the most important performance for each of them. Thanks to the EPC contractors, it has been possible to obtain a list of excellent suppliers which has been compared with the one provided by ANIMA-ANIE-ANIMP, reaching a convergence of 33 special valves, 43 static equipment and 10 switchgears suppliers.

After having contacted these companies, also thanks to the intermediation of the associations, it was possible to interview 18 special valves suppliers, 12 static equipment and 9 switchgears suppliers.

These interviews covered a lot of different arguments, being of course centered on the definition of their supply chain configuration, provided thanks to the framework. During the interviews, it has been important to identify other aspects that could help contextualizing their decision, under different aspects, such as firm dimension, membership to a group, product portfolio and reference markets.

These data were very important because they allow to fully exploit the contingent resource-based theory, providing the supply chain configuration of the firms embedded in their contextual environment and allowing to grasp which are the most important elements behind the configuration decisions of these firms. Other information about production process stages and recent strategies in the Oil&Gas were obtained.

Being a critical part of their strategy, these companies were also asked to describe their relationships with EPC contractors and end users. The end of the interview was centered on the definition of the supply chain configuration, asking them to identify the 3 most important performance and connecting them with, more or less, 3 capabilities for each performance and 3 practices for each capability.

The study of the data, as it has been previously introduced, hinges on four different analysis: single case approach, multi-case study, outliers' identification and examination and, finally, comparison between each sector and ETO, based on the similarity index, that will be later described.

The results of the four analysis consented to identify the answers to the four research questions related to the research.

Case studies have been used because they are particularly suitable for exploratory and descriptive researches, because they answer the questions “how” and “why” (Yin, 1994).

In the single case study, each company is described by the data that are extracted from the questionnaire, whose first part is necessary for the contextualization of the company, while in the second one the supply chain configuration is provided. The information used to contextualize the firm are described below:

- Main geo-political reference scenarios;
- Product portfolio and eventual core products;
- Peculiarities about supply chain and eventual recent strategies.

The model used for the description of the single case is defined as follows: tables containing vital statistics, market/product scenario and future market of interest, with motivations and possible actions; a brief description of the company and its environmental context; table presenting the production process stage; definition of the choice behind eventual outsourcing and relationships with suppliers; framework with supply chain configuration; description of the most important part of the supply chain configuration; relationships with end users and EPC contractors.

After the single case study of the companies, all the data about supply chain configuration are aggregated and studied through the multi-case study. This technique is useful because it helps understanding which are analogies and differences between diverse supply chain configurations.

The reliability of this analysis is given by the fact that these companies are referred as Best Performers by both the associations (ANIMA-ANIMP-ANIE) and the clients, the main contractors.

This examination consented to identify, for each sector, which are the most selected, and so important, elements for each block, dividing them by different sectors. Furthermore, it has been possible to evaluate the links between the most important performance and capabilities, and capabilities with the practice. Uniting then these relationships, it has been possible to provide suggested sets of capabilities and practices for each main performance in each sector.

The next analysis concerns the outlier identification and examination. The outlier is defined as a company which has a behavior, described by the supply chain configuration, that is much different than the average of the sector. In order to evaluate the average supply chain configuration for each sector, the data from multi-case analysis have been taken, in order to identify a structure made of the 3 most selected performance, the 3 most selected capabilities respect to each performance and the 3 most important practices respect to each capability. In case of equal frequency of selection between two elements, considering only the selection occurrence related to the element above, the one with the highest *absolute* frequency of selection should be taken.

Once the average configuration has been obtained for each sector, the closeness of a company to it has been measured introducing the similarity index. This value has does not come from the literature because of the newness of the framework, it was impossible to identify a similar indicator.

The logic behind the similarity index is to measure how much the configuration of a company can be superimposed respect to the configuration of the sector. A score is attributed to each branch (performance-capability-practice) of the firm's configuration depending on how similar it is respect to the most fitting branch on the configuration of the sector.

Points are attributed as follows: 1 if there is perfect matching performance-capability-practice; 0,6 overlapping performance-capability; 0,4 overlapping capability-practice; 0,2 overlapping of the only performance.

In the picture, there is a graphical example of overlapping performance-capability.

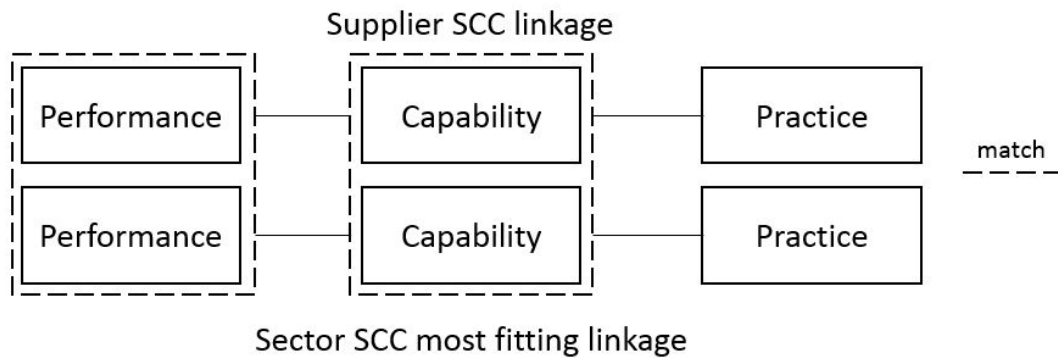


Figure 3.1 Example of overlapping Performance and Capability

The score has been assessed in that way because performance overlapping was considered the most important, since performance are what the suppliers desire to achieve, thus giving 0,2, while overlapping of only practice or capabilities do not provide any score.

Calculating this score for each branch of the configuration of the firm, it is possible then, with the mean of these values, to evaluate the similarity index for each company.

Considering the distribution of similarity indexes inside each sector, the outliers are defined as those companies which have a value of similarity index that is lower than the tenth percentile.

At this stage, the ETO sector has been introduced and the outliers related to that sector has been calculated.

The ETO has been considered because it could offer, through the definition of its outliers, a possible alternative view, that could increase the detail of the analysis, thus providing better results, as it will be shown later.

Each outlier has been deeply analyzed, in order to understand if its different configuration respect to the competitors can still be explained through the resource-based view, using the ETO outliers as alternative variables to provide more information. The result of this analysis will be provided and discussed in the Discussion section.

After the outliers' identification and examination, the successive analysis concerned the three overall sectors, as related to the ETO, since the target has been to see whether the resource-based view, applied through the framework, could explain the relationships of each company with the ETO.

In order to do that, the percentage variation of the similarity index of each company from the sector to the ETO has been calculated. Proceeding to estimate the mean among the percentage variations of all the firms in each sector, it could be possible to estimate which is the sector with the highest average difference.

The outcomes of this examination have been compared with the outliers' analysis results and debated.

4. Discussion of the results

In this section, the results of the multi-case study, the outliers' analysis and the comparison sectors-ETO will be provided, starting from the most important performance, capabilities and practices identified by the multi-case study.

First of all, it is important to notice that EPC contractors have defined as the main performance requested, Quality, Price and On-time Delivery and this will be required to verify the effective alignment with Best Performers.

Analyzing the supply chain configuration of the suppliers, distinguished among different sectors, it is possible to identify which are the most selected performance, capabilities and practices.

In the next table, the list of most selected performance and capabilities required to its development is presented for each sector (SVS stands for special valves suppliers, SES static equipment and SWS switchgears).

Performance – SVS	Performance – SES	Performance – SWS
Quality	Quality	Quality
On-time Delivery	On-time Delivery	Engineering
Engineering	Price	On-time Delivery
Price		Flexibility (SC)
		Price

Table 4.1 Most selected performance

Capabilities – SVS	Capabilities – SES	Capabilities - SWS
Supply Chain Management Inbound	Supply Chain Management Inbound	Production/Process Development Capability
Supply Chain Management Outbound	Product/Process Development Capability	Knowledge Management Capability
Knowledge Management Capability	Supply Chain Management Outbound	Capacity and Flexibility
Product/Process Development Capability	Capacity and Flexibility	Relationship Capability
Customer Service	Project Management Capability	Supply Chain Management Inbound
Project Management Capability		Customer Service
Capacity and Flexibility		Supply Chain Management Outbound
		Project Management Capability

Table 4.2 Capabilities required to enable the most selected performance

The main performance selected by the special valves suppliers are Quality, Price, On-time Delivery and Engineering. For static equipment sector, it is possible to obtain Quality, Price and On-time Delivery, since the Engineering is not considering that important having products more standardized. On the other hand, switchgears suppliers have defined Quality, Engineering, On-time Delivery, Flexibility (SC) and Price and it can

be noted that this is the sector that is less aligned, since companies tend to focus on a higher number of performance, respect to the other two.

Anyway, it is possible to verify the alignment among Best Performers and the EPC Contractors.

After the comparison among the performance, it is necessary to compare which capabilities have been selected, in order to enable the performance above selected.

It is possible to see that, since there is no Engineering is static equipment, there is also the absence of the knowledge management capability, that is instead used by the two other sectors. In general, it is possible to notice that static equipment is focused on a smaller number of capabilities, and the majority of the suggested configuration for its performance are obtained through SCM Inbound and Product/Process Development Capability. A big difference is given by the fact that switchgears sector does not use as much the capability of SCM Inbound, because the sector, on average, is vertical integrated and, in fact, the Product/Process Development Capability is the one most selected capability, since the suppliers invest more on the internal development of the processes.

Also the static equipment sector has reached outstanding level of Product/Process Development, that is used by almost all the companies, since they present too high vertical integration. Even if Project Management Capability is used among the three sectors, in the static equipment one it has a higher importance, since it is very important, especially for big orders, being able to provide the proper documentation. Project Management Capability, anyway, is increasing its importance also in the other two sectors, even if, at the moment, it appears more at practice level, especially on those companies which are more involved in Oil&Gas sector.

Relationship Capability has only been extensively used by switchgears sector and this is explained because those companies outsource major electrical components from multinationals, that are at the same time competitors and suppliers, with which they often start partnership for the combined development of products, thus in the switchgears sector it is of paramount importance being able to relate not only with customers and suppliers, but also with these competitors.

Customer service is also important in switchgears and special valves sector, even if for different reasons; for valves suppliers being able to provide after-sales services is very important since it is part of the package usually required by customers, since valves failures are extremely frequent in Oil&Gas big plants; in switchgear instead, since these suppliers are small-medium companies, they have more difficulty in interacting directly with end users and so, after-sales service are a possibility to remain close to the final customer and to enhance the relationships.

The Production System Practices are the most selected for the three sectors, because they cover a spread set of extremely important actions that take into account both for the production lines and the warehouse, possibly automated, whose proper management helps improving supply chain downstream, thus On-time Delivery and Supply Chain Management Outbound.

It is possible to confirm that high vertical integration reduces the need for Long-term Relationships with suppliers, since static equipment is the sector with its lowest relative percentage of selection while, even if switchgears suppliers are quite vertically integrated, they need to partner up with electrical component suppliers, thus having a high frequency of selection.

The relative selection of Project Management Practices confirms what said about Project Management Capability, since it is lowly selected in both switchgears and special valves, while it is important in static equipment. Information Technology is really important for static equipment, because it helps a proper scheduling of the operations, being the bulk of production process realized internally. It is possible to notice that network is really important for switchgears, since a lot of these companies have a local safety network

of suppliers that is used to cover possible peaks of demand, while the low needs of suppliers from static equipment firms allow them to keep that frequency low.

These are the result of the static multi-case study that have been made on the three sectors and that allowed to identify possible differences. Anyway, differences among these sectors were expected, since they present different features, even if they operate in the same sector of EPC industry, and ETO secondarily.

After the discussion of multi-case results, there is the need to focus on outliers' examination and, later, the comparison between each sector and the overall ETO.

The outliers' identification process allowed to distinguish those suppliers that have the most different supply chain configuration among their competitors, that are listed in the following table:

Special Valves	SVS – 1	0,337	SVS – 5	0,294	SVS – 12B	0,238
Static Equipment	SES – 6		0,369	SES – 11		0,311
Switchgears	SWS – 8			0,311		

Table 4.3 Outliers' respect to each sector

It is of our interest also to identify which are the outliers inside the ETO sector, that is obtained accruing the companies from the three sectors. The process of identification of the outliers' is the same, it only changes the average supply chain configuration, that of course is going to be referred to the ETO in this case. This average configuration has been obtained weighting the relative frequencies of selection of each performance, capability and practice for each sector.

It is necessary to notice that it has been used the relative frequency, because the three sectors have different dimension, meaning that the consideration of the absolute frequency of selection would have biased the average towards the special valves average configuration since is the largest sector, in terms of number of firms, among the three.

The size, expressed as turnover in Millions of euro, among companies is very different in each sector, since it possible to find firms with turnover lower than 20 Million of euro along with other whose turnover is higher than 200. Thus, before accruing all the companies altogether, it has been verified that, especially for static equipment and special valves, the size of the companies would not influence too much the similarity index.

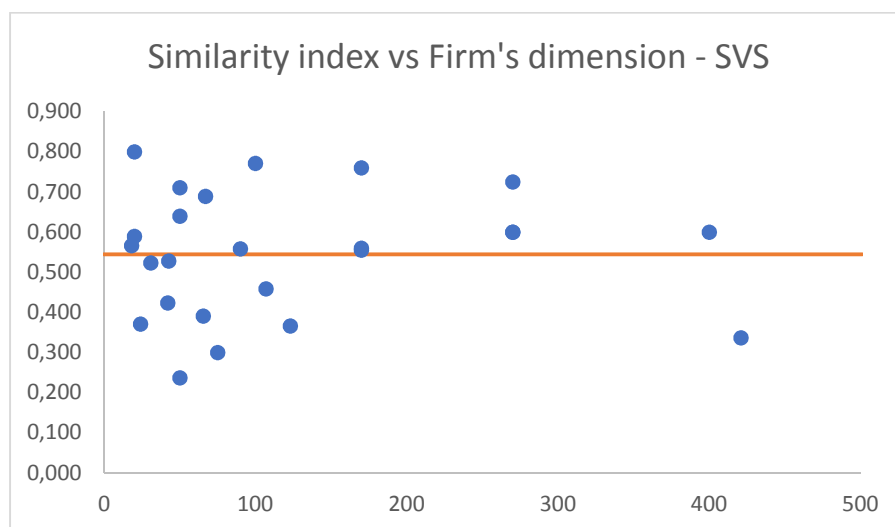


Figure 4.1 Similarity index vs Firm's dimension - SVS

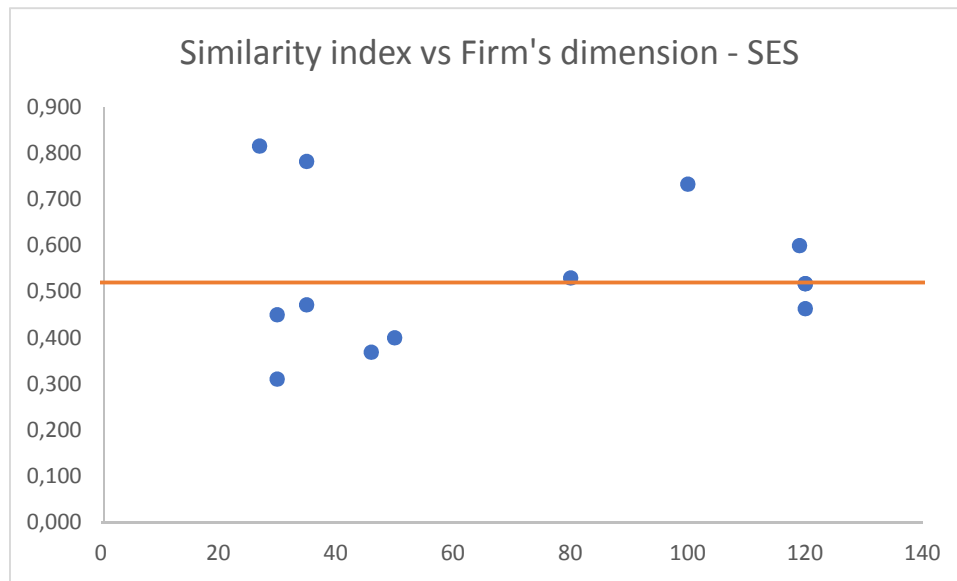


Figure 4.2 Similarity index vs Firm's dimension - SES

The results are shown in the images and it is possible to see that the distribution of companies is almost symmetric respect to the average, meaning that there is not a strong influence between size and similarity index.

Given these conclusions, it is possible to unite all the companies under the ETO contextual factor and to analyze them altogether, comparing the results with those occurred studying the single sectors.

Given the average supply chain configuration of ETO, it has been possible to calculate the similarity indexes and the outliers, always taking into account the tenth percentile as a cut off value.

The outliers for the ETO are the ones which follow:

Special Valves	SVS – 12B	0,238	SVS – 13	0,185	SVS – 15	0,271
Switchgears	SWS – 5	0,244	SWS – 8	0,000	SWS – 9	0,275

Table 4.4 Outliers of ETO

Now that it is possible to identify outliers in both ETO and sectors, companies could be classified according to those being or not an outlier in those two cases and the following classification is obtained:

ETO\Own sector	Outlier – YES	Outlier – NO
Outlier – YES	SVS – 12B, SWS – 8	SVS – 13, SVS – 15, SWS – 5, SWS – 9
Outlier – NO	SVS – 1, SVS – 5, SES – 6, SES – 11	–

Table 4.5 Outliers' classification

The companies which are not outlier in neither the cases are not interesting. The supply chain configurations of the outliers that will be now discussed are inserted in ANNEX B.

The outliers for the ETO that are not outliers in their sector will be discussed later altogether, since this analysis want to cope with the application of RBT to describe outliers inside their own sector.

SVS – 12B

This outlier is related to a configuration of SVS – 12 on far east market. The main difference with the average is given by the selection of the Service, rarely chosen other times, and Price, that does not appear in average supply chain configuration of valves. This difference of supply chain configuration can be explained with contingent resource-based view: a different market, such as Far East, can lead the company to identify and enable performance factors that are strongly diverse than the ones required for other markets. Furthermore, other companies that specifically selected a diverse supply chain configuration for Far East are much bigger and they can allow not to choose the Price on those market, preferring On-time Delivery, Engineering and Quality. The specificity of the market pushes that company to configure very differently on this market, in both special valve sector and ETO.

SVS – 8

This company is an outlier in both the cases and it is the only outliers for switchgears sector. The company has strongly invested in customer satisfaction, meaning that is almost entirely oriented towards effectiveness, through the acquisition or creation of international branches, that are required to increase the closeness with end users and to strengthen their after-sales services. This is reflected by the performance selected, which are completely different respect to the ones of the average, both ETO and switchgear. Also the capabilities reflect this difference. This firm does not neglect other performance, considered fundamental by other suppliers, such as Price and Quality, but the firm just considers them as cutting performance, it is just important to be able to compete on market level, without having the necessity of improving them. This company is one of the two suppliers of switchgears, that works almost entirely in Oil&Gas market. While the other belongs to an international group that allows it to be known internationally, this company has to provide the connection by itself.

While this almost pure effectiveness-oriented strategy seems to be more difficult on the other sectors, because the products are maybe less standard, it feels as a possible future strategy for the Italian switchgears industry, relying on market standard on Price and trying to compete on winning order through closeness and customer satisfaction. This outlier can still be described by the extended resource-based theory. A firm identifies resources, that are mostly outside the boundary of its firm, to anticipate its competitors and obtain a competitive advantage that will last over time.

SVS – 1

This is the first, out of four, supplier that behaves as an outlier if compared with its sector, while it is not for ETO. The main difference is given by the selection of the performance of Flexibility (SC) and Differentiation. This supplier is the only that, in special valves sector, focuses in the provision of all the categories of valves and which has as main business the wide portfolio. The strategy above mentioned is favored by the dimension of the firm, since that is one of the two biggest companies of the whole sample, that allows it the selection of the Differentiation performance. Financial capability is required to support this performance.

Thus, firm's dimension can be, for sure, considered as a contextual factor that allows the supplier to build a wide portfolio of high engineered valve, but at the same time, it is also related to a choice of strategy of the company, that favors this uncommon business strategy.

The Flexibility (SC) is another extremely important characteristic, since it allows the company, in spite of its dimension, to be able to adapt to clients' requirements and modifications, while maintaining this complete products portfolio.

Size and product portfolio are contingent factors that explain the difference of configuration respect to competitors, thus it falls in explanation domain of RBT. The risk is that the supplier, being an outlier in his sector, could be too aligned with ETO, thus meaning that the company would act as an ETO company without, yet, possessing the required specialization to operate and compete long-term on special valves market; this

seems quite difficult since, thanks to its huge dimension and investment in maintaining the proper level of Quality and Flexibility (SC), the company should be able to maintain long-term advantage.

The fact that that company is aligned with ETO could mean that RBT cannot describe these companies inside the ETO. This result will be used later.

SVS – 5

This is the only supplier that has selected Financial. It is in fact a small company, which provides a wide portfolio and to win order in a sector with big competitors, that performance is mandatory. The company prefers competing on price rather than quality of the products.

The particular configuration of this company is probably the result of a sequence of factors: the wide portfolio and being a relatively small company that does not belong to a group, these factors push the company to configure their supply chain rather diversely.

Yet, its position on the market seems quite precarious in the long-term, being surrounded by much bigger or more specialized companies; the firm has a configuration that is a hybrid respect to bigger suppliers that provide a wide portfolio and more specialized companies. In case of variation on the market this company could risk the survival.

SES – 6

This firm is fairly aligned in terms of practices and capabilities, yet those are combined to enable performance that are not much used in its sector, such as Flexibility (SC) and Engineering.

This supplier is completely focused on the production of Trays & Internals, that are products rarely produced by the companies in this sample; this difference leads the company to mainly sell its products to licensors, instead of EPC companies. Since this is a very niche market, the company is able to have a worldwide leadership.

Other than licensors, this firm works with suppliers of columns, which is a market with very low competitiveness, thus making them have high margin.

Its alignment in the ETO could result in an unstable position on future market, because the company is not aligned with its sector, it has a hybrid configuration that could not be enough in a foreseeable future, because, being a vertical integrated sector, big companies in static equipment could start producing Trays&Internals, endangering the position of this supplier.

SES – 11

Unlike the other competitors, this company is not part of an international and big group, but it is the headquarter of a national one, which prefers to acquire companies.

Its relative small dimension did not allow the firm to achieve the production capacity required to decrease costs, through economy of scale, during crisis, thus the Engineering became extremely important because the firm was no more able to compete on markets ruled mainly by low-cost criteria, so it had to search niche markets on which it could get competitive advantage providing highly technological equipment. In the meanwhile, the company invested a lot for the enhancement of its Price performance, in order to compete with Italian and European competitors.

Another difference with market is given by the fact that it does not use Project Management, and this can be explained by the fact that the company does not operate a lot in Oil&Gas and it has a relatively small dimension, meaning that Project Management is not really required. Even in this case it seems that the

company could be endangered in the future, being an ETO firm, but outlier in its sector. If the market shrinks, they would not have immediate Project Management skills to increase its orders, thus hindering a potential growth.

These results are quite good, because they show that the RBT is able to describe in detail how do firms inside their sector, configure their supply chain, even when they are subject to contextual factors that strongly differ from the ones of their competitors.

The richness of this part of the study is that, not only it confirms the goodness of the RBT applied to this context, but it also allows to analyze which are the most significant contextual factors. Furthermore, other than a few exceptions, it can be noticed that in order for a company to structure differently its own supply chain, usually it is necessary, for the supplier, to be subjected to a different combination of contextual factors, that act as external forcing.

Except SWS – 8 and SES – 6, whose single contextual factors are strong enough to alter the structure of the company by themselves, all the other suppliers are different because of a combination of two or three different factors, that can be taken among size of the firm, product portfolio, partnership to a group and reference market.

Another interesting result relates with future of some of these companies that are outliers in their sector and are aligned with ETO. SVS – 5, SES – 6 and SES – 11 all have configurations that seem to be fine at the moment, but that, in reality, are fragile, since they are hybrid between extreme configurations of other companies in their sector and, in future, if the market should change, this configuration, if not adapted quickly, could endanger their competitive position.

These conditions have already been discussed in their own sections.

Another result relates to SV – 1, which present a configuration aligned with ETO, that is an outlier in the sector but that, as opposed to the previous three firms, it seems to be stable in the future, meaning not being perceived as an outlier in ETO is due to a lack of the RBT applied to the description of the relationships between valves and ETO.

After the analysis of the outliers, it is possible to say that the RBT seems quite appropriate in the description of companies inside their sector. Additional results are related to the next analysis thus they will be presented later.

ETO has been introduced along with three sectors to provide a different view. Thanks to the framework it has been possible to define an average supply chain configuration also for ETO, allowing the identification of outliers. The contextual factor of the ETO enable the aggregation of all these suppliers, under one single theoretical lens to provide a different view and to see if, through the RBT, it is possible to say something about ETO.

It is interesting to understand how close each sector is respect to this common lens, to see if the RBT can describe the ETO sector or if there is a gap in the theory that could be later addressed. In order to do that, similarity indexes of each company for both its sector and ETO are compared; from this comparison, it is possible to calculate the percentage variation that the similarity index of a firm has when the average reference supply chain configuration passes from the sector to ETO. Once this is done, it is possible to calculate the average one each sector, thus having an indicator of how well each sector is approximated by ETO, using the contingent resource-based view.

The percentage variation for each sector is then listed:

	Average variation
Special Valves	-20,48%
Static Equipment	-11,38%
Switchgears	-32,41%

Table 4.6 Average similarity index variation for each sector

From this analysis, it is possible to see that the sectors whose companies are more heterogeneous respect to the ETO, are special valves and switchgears. This reduction could be normal, because the three sectors, that have been united, present different features and the union could increase the variance of the data, thus reducing the average degree of fit with the ETO sector.

Anyway, this result could show that, instead, companies belonging to switchgears and special valves are not described well by the RBT, when they are studied under the ETO, because the theory is not able to fully describe the relationships between these sectors.

Furthermore, there are four outliers of the ETO, that are aligned inside their own sector. From a logical point of view, this would mean that their membership sectors are borderline respect to ETO, thus these outliers are companies that do not have ETO characteristics, but that work in an ETO environment, such as the EPC industry. While this could be an interesting reading of the results, there is another alternative; the four companies belong to special valves and switchgears sectors. No outlier of that type comes from static equipment.

This could validate the previous consideration which states that the resource-based theory applied on the framework is not accurate or complete enough to be used to properly describe companies supplying switchgears and special valves as they were ETO suppliers. Then, those four companies could be outliers in ETO because the framework is warping their supply chain, showing data that are not true.

The last element that seems to confirm this incapacity of the RBT to describe the relationships among switchgears, valves and ETO is given by company SVS – 1. According to the results obtained to the other three companies that were present in its same cluster, SVS – 1 should have an unstable position in the future, endangering its survival. This is the result coming from the analysis on the other three companies; yet, the supply chain of this company seems robust, thus meaning that being an outlier in the ETO could be an error due to, once again, the fact that the framework does not describe well special valve suppliers respect to ETO.

It is likely that switchgear and special valves have some feature that is not properly described by the RBT and that when relates to ETO, it leads to false results.

For the special valve, this characteristic seems quite hidden and the situation seems more complicated, since it is not so easy to perceive this feature. It could a topic for future analysis.

The switchgear sector has present a more easily traceable feature, since it is a sector whose companies do not produce electrical components, relying a lot on purchasing it from competitors. This leads these suppliers to the necessity of developing strong relationships for product development and other positive effects, such as better after-sales services.

Even if the RBT has been extended to external resources, it is probably not enough to describe a core characteristic such this one, that is not shared by the other sectors, meaning that, applying the framework on switchgears companies under ETO sector, tend to warp the suppliers' supply chain configurations, resulting in these differences.

The literature identifies how RBT has been used in the fields of operation and supply chain management and which are the most associated theories. Among these, there are some that have already been considered in

this paper, that allowed the connection with the framework, while others can be used for the analysis of strategic outsourcing: transactional cost economics (TCE) and knowledge-based view (KBV).

In Transaction Cost Economics approach, the properties of the transaction determine what constitute the most efficient governance structure, that can be market, hierarchy or alliance (Williamson, 1975). There is a growing body of literature that is starting to view these theories altogether in order to understand which approaches lie behind outsourcing decisions, leveraging on the fact that, alone, they cannot explain properly this phenomenon, as it seems to happen in this study.

Knowledge-based view is very similar to resource-based view, identifying the knowledge as the most important resource of a company. The primary role of a company is the identification, acquirement, storing and application of knowledge, through different mechanism. Knowledge management among buyer-supplier can be a strategic resource for the company and a source of competitive advantage. Starting from this concept, Bustinza et al. (2010) analyzed the outsourcing under a knowledge-based perspective, assessing how the nature of the knowledge outsourced affects the success of outsourcing.

One of these theories can provide a deeper insight on how do these companies generate competitive advantage while outsourcing the manufacturing of high-value components from suppliers that are, at the same time, their competitors, and how do these companies succeed in creating win-win partnerships, that allow them to survive on the markets.

Since the manufacturing of own set of electrical components is also often opposed by the end users, which prefer the more reliable technology coming from international groups, another analysis on this side of the supply chain could be useful.

5. Conclusions and future research

The study wanted to unit a framework which could describe accurately the supply chain configuration, with the resource-based theory, that states how companies arrange their resources to gain competitive advantage over competitors. The integration happened by mean of resource-based theory and other complementary theories.

Through this framework it has been possible to interview 39 suppliers from the Oil&Gas market, describing us their supply chain configuration, embedded in their environmental factors.

Through a multi-case study, it has been possible to verify that these sectors are aligned with EPC contractors in terms of the main performance (Table 4.1). It has also been possible to identify, for each sector the capabilities that could enable those performance (Table 4.2) and their relative practice, whose differences and commonalities have been previously described.

The second part of the research dealt with the trial to assess whether the RBT was able or not to appropriately describe companies inside their sectors and through the analysis of the outliers, it has been possible to prove this.

The problem starts when the companies from the three sectors are put in common and analyzed under the contextual factors of engineer-to-order. It has been previously demonstrated that this theory, along with the framework, is not enough to describe appropriately the configurations of these firms in relationships to the ETO.

So, the interest is to see if it is possible to understand something more.

Combining different companies mean that there are companies that are well described by a theory, that when are united, are no more describable by this theory, in particular this seems applicable to two sectors out of three.

It is likely that switchgear cannot be properly described because it presents a fundamental feature that is not present in the other sectors, that impede the good result of the analysis. This could also imply the decrease of the special valves sector.

This could also imply the higher decrease of the special valves sector. If special valves sector is closer to switchgears than it is with static equipment, during the evaluation of the average supply chain configuration of the ETO, the data coming from switchgears could affect it negatively, thus warping also the final result for the special valves sector, showing it much farer from the ETO than the real value.

This proximity can be roughly proved, using the similarity index calculated between the averages supply chain configurations of the three sectors.

Compare to\Reference	Special Valves	Static Equipment	Switchgears
Special Valves	-	0,43	0,533
Static Equipment	0,504	-	0,4
Switchgears	0,519	0,348	-

Table 8.2 Comparison among average supply chain of the theory

Given these averages configurations, it is possible to see that special valves and switchgear are close, meaning that the resource-based theory can influence also the other data, thus showing that static equipment and special valves could still be aligned under the ETO.

One possible future research is to try the same outliers' analysis and the same comparison with ETO sector just considering the Special Valves and Static Equipment in order to understand if the reduction of the Special Valves is really due to it being different than ETO, or that the previous result was biased by the switchgear.

Future researches can be related to the identification of which is the most appropriate theory that can be used to relate the switchgears into the ETO context, taking from KBV and TCE, that seem to be the most likely to be able to accurately describe the effect of the outsourcing of that sector.

Finally, it could be useful to uses this framework in a research in a field different than the Oil&Gas.

REFERENCES

- Amit R, Schoemaker PJH. 1993. Strategic assets and organizational rent. *Strategic Management Journal* 14(1): 33–46
- Barney, Jay. "Firm resources and sustained competitive advantage." *Journal of management* 17.1 (1991): 99-120.
- Beamon, Benita M. "Measuring supply chain performance." *International journal of operations & production management* 19.3 (1999): 275-292.
- Brush, Thomas H., and Kendall W. Artz. "Toward a contingent resource-based theory: The impact of information asymmetry on the value of capabilities in veterinary medicine." *Strategic Management Journal* (1999): 223-250.
- Chen, Injazz J., and Antony Paulraj. "Towards a theory of supply chain management: the constructs and measurements." *Journal of operations management* 22.2 (2004): 119-150
- Day, George S. "Market Driven Strategy." (1990).
- Day, George S. "The capabilities of market-driven organizations." *the Journal of Marketing* (1994): 37-52.
- Dickson, G.W. (1966). An analysis of vendor selection systems and decisions. *Journal of Purchasing*, 2(1), 5-17.
- Hitt, Michael A., Kai Xu, and Christina Matz Carnes. "Resource based theory in operations management research." *Journal of Operations Management* 41 (2016): 77-94.
- Lavie, D. (2006), "The competitive advantage of interconnected firms: an extension of the resource-based view", *Academy of Management Review*, Vol. 31 No. 3, pp. 638-58.
- Li, Suhong, et al. "The impact of supply chain management practices on competitive advantage and organizational performance." *Omega* 34.2 (2006): 107-124.
- Luzzini, Davide, Federico Caniato, and Gianluca Spina. "Designing vendor evaluation systems: An empirical analysis." *Journal of Purchasing and Supply Management* 20.2 (2014): 113-129.
- Morgan, Neil A., Douglas W. Vorhies, and Charlotte H. Mason. "Market orientation, marketing capabilities, and firm performance." *Strategic Management Journal* 30.8 (2009): 909-920.
- Prajogo, Daniel, and Jan Olhager. "Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration." *International Journal of Production Economics* 135.1 (2012): 514-522
- Sirmon, David G., Michael A. Hitt, and R. Duane Ireland. "Managing firm resources in dynamic environments to create value: Looking inside the black box." *Academy of management review* 32.1 (2007): 273-292
- Smith, N.J. (2002). *Engineering project management*. Blackwell
- Song, Michael, C. Anthony Di Benedetto, and Robert W. Nason. "Capabilities and financial performance: The moderating effect of strategic type." *Journal of the Academy of Marketing Science* 35.1 (2007): 18-34.
- Tan, K.C., Kannan, V.R., Handfield, R.B., Ghosh, S. (1999). Supply Chain Management: an empirical study of its impact on performance. *International Journal of Operations & Production Management*, 19(10), 1034-1052.
- Tan, K.C. (2002). Supply Chain Management: practices, concerns, and performance Issues. *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, (2002), 42-53.

Tracey, Michael, Jeen-Su Lim, and Mark A. Vonderembse. "The impact of supply-chain management capabilities on business performance." *Supply Chain Management: An International Journal* 10.3 (2005): 179-191.

Tseng, Shu-Mei, and Pei-Shan Lee. "The effect of knowledge management capability and dynamic capability on organizational performance." *Journal of Enterprise Information Management* 27.2 (2014): 158-179.

Weber, C., A., Current, J., R., 1993. A multi-objective approach to vendor selection. *EJ Op Res.* 68:173-184.

Weber, Charles A., John R. Current, and W. C. Benton. "Vendor selection criteria and methods." *European journal of operational research* 50.1 (1991): 2-18.

Zhao, Meng, Cornelia Dröge, and Theodore P. Stank. "The effects of logistics capabilities on firm performance: customer-focused versus information-focused capabilities." *Journal of Business Logistics* 22.2 (2001): 91-107.

Yin, Robert. "Case study research: Design and methods . Beverly Hills." (1994).

Zhou, Honggeng, and W. C. Benton. "Supply chain practice and information sharing." *Journal of Operations management* 25.6 (2007): 1348-1365.

ANNEX A

PERFORMANCE ITEMS	Performance measurement	Author
Price	Product pricing	Li (2006)
	Total cost of acquisition	Kumar Kar (2014)
	Production capability	Gunasekaran (2004)
	Maintenance cost	-
	Dismissal cost	-
Quality	Product quality	Monczka (1988), Weber (1991)
	Safety adherence	Weber (1991), Kumar Kar (2014)
	Quality in field	Chen (2004)
	Defect-free deliveries level	Kumar Kar (2014)
On-Time Delivery	Delivery reliability	Kumar Kar (2014)
	Delivery frequency	-
	Average lateness of orders	Beamon (1999), Li (2006)
	Shipping errors	Beamon (1999)
Engineering	Design capabilities	-
	Technical capability	Timmerman (1986), Weber (1991)
	Product development cycle time	Li (2006)
Innovation	Use of new technology	Kumar Kar (2014)
	Innovation investment	Kumar Kar (2014)
	Research & Development	Kumar Kar (2014)
Differentiation	Product uniqueness perception	-
Variety	Supply variety	Fynes (2005)
	Product line diversity	Kumar Kar (2014)
Lead-Time	Lead-time/response time	Beamon (1999)
	Manufacturing lead-time	Beamon (1999)
	Delivery lead-time	Beamon (1999), So (2003), Fynes (2005)
	Customer response time	Beamon (1999)

Flexibility (Supply Chain)	Procedural compliance	Weber (1991), Kumar Kar (2014)
	Availability of parts	Kumar Kar (2014)
	Response flexibility	Beamon (1999)
	Order flexibility	Beamon (1999)
	Frozen time	-
	Production flexibility	Beamon (1999), Chen (2004)
	Volume flexibility	Chen (2004), Fynes (2005)
	Capacity flexibility	Narasimhan (1983)
	Delivery systems flexibility	Moore (1973), Gunasekaran (2004)
Commercial Impact	Supplier's reputation	-
	Performance history	Timmerman (1986), Weber (1991)
	Trade restrictions	Kumar Kar (2014)
	Brand value	Wagner (1989)
Financial	Financial position	Payne (1970)
	Warranties	Weber (1991)
Service	Service quality experience	Sheth (1973), Weber (1991), Kumar Kar (2014)
	Service quality credence	Sheth (1973), Weber (1991), Kumar Kar (2014)
	Custom duties	Li (2006), Kumar Kar (2014)
	Domain experience	Kumar Kar (2014)
	Packaging capability	Ansari (1988), Weber (1991)
	Billing accuracy	Kumar Kar (2014)
	Installation assistance	-
	Maintenance assistance	-
Communication	Close relationships development	Kumar Kar (2014)
	Electronic data interchange	Kumar Kar (2014)
	Communication barriers	Kumar Kar (2014)
	Reciprocal arrangements	Weber (1991)
	Cultural fitment	Kumar Kar (2014)
	Information accuracy	Mason-Jones (1999), Kumar Kar (2014)
	Information availability	Mason-Jones (1999), Kumar Kar (2014)
	Information timeliness	Mason-Jones (1999), Kumar Kar (2014)
	Self-audits	Kumar Kar (2014)
	e-transaction capabilities	Kumar Kar (2014)
	Staff skill level	Kumar Kar (2014)
Knowledge	Intellectual property rights	Kumar Kar (2014)
	Patents and certifications	Kumar Kar (2014)
	Conflict resolution systems	Kumar Kar (2014)
	Forecasting techniques accuracy	So (2003), Kumar Kar (2014)

CAPABILITIES	Ability of	Authors
Supply Chain Management Inbound	Developing and maintaining an effective purchasing function (procurement)	Tracey (2005)
	Contracting with suppliers and correctly estimate supply value (pricing)	Song (2007), Murray (2011)
	Regulating and optimizing raw materials procurement (commercial agreements for supply)	Wook Kim (2006)
	Managing effectively raw materials transport (from supplier to warehouse)	Tracey (2005)
	Adopting effective quality control on raw materials	Tracey (2005)
	Managing effectively raw materials warehousing	Tracey (2005)
	Monitoring effectively and regularly raw materials inventory (availability and quantity)	Tracey (2005)
	Managing effectively raw materials picking up from warehouse and their inclusion in production cycle	Tracey (2005)
Supply Chain Management Outbound	Adopting effective quality control on finished products	Tracey (2005)
	Managing effectively finished product packaging and labelling procedures	Tracey (2005)
	Managing effectively finished products warehousing	Tracey (2005)
	Monitoring effectively and regularly finished products inventory (availability and quantity)	Tracey (2005)
	Managing effectively finished products delivery (to middle distribution centres or to final customer)	Tracey (2005)
Knowledge Management Capability	Acquiring external knowhow to create, apply and protect new knowledge	Tseng (2014)
	Developing current internal knowhow to create, apply and protect new knowledge	Tseng (2014)
	Managing effectively organizational structures, technologies e company culture for knowhow developing	Tseng (2014)
Product/Process Development Capability	Developing customized products for specific clients	Wook Kim (2006)
	Re-designing and improving existing products	Kaleka (2002), Tseng (2014)
	Developing products that are innovative for the market	Kaleka (2002), Wook Kim (2006), Murray (2011), Tseng (2014)
	Reducing production costs and total costs for clients	Wook Kim (2006)
	Installing and managing production lines that are excellent and reliable	Tseng (2014)
	Developing new production lines and improving/optimizing production processes	Kaleka (2002), Murray (2011), Tseng (2014)
Capacity and Flexibility	Benefiting from economies of scale	Kaleka (2002)
	Extending production capacity	Blome (2013)
	Satisfying large demands in short times (big production lots)	Blome (2013)
	Responding quickly to changes in requested product volumes (order size)	Wook Kim (2006), Swafford (2008)

	Responding quickly to changes in requested product types (portfolio size)	Blome (2013)
	Responding quickly to changes in requested product mixes	Swafford (2008)
Customer Service	Monitoring effectively order processing state	Tracey (2005)
	Processing orders quickly (fast delivery)	Wook Kim (2006)
	Respecting regularly order delivery time (on-time delivery)	Wook Kim (2006)
	Responding effectively to urgent requests or order / delivery time changes	Swafford (2008)
	Selling products of conformed quality	Wook Kim (2006)
	Selling products of superior quality, compared to market standards	Wook Kim (2006)
	Assuring competitive prices, compared to competitors	Wook Kim (2006)
	Supporting clients in decisional and projecting stages	Kaleka (2002)
	Supporting clients during the entire product life cycle	Kaleka (2002), Wook Kim (2006)
Relationship Capability	Creating and managing external collaborations (also with competitors)	Song (2007)
	Creating and managing an excellent and reliable suppliers network	Song (2007)
	Engaging and bargaining with customers	Song (2007), Murray (2011)
	Managing effectively and quickly information acquisition and communication	Tracey (2005)
Market Development Capability	Controlling effectively product selling and delivery network	Wook Kim (2006)
	Delivering effectively products in overseas markets	Wook Kim (2006)
	Managing effectively marketing and communication functions (in product advertisement and promoting)	Wook Kim (2006), Song (2007), Murray (2011)
	Developing and improving firm brand	Wook Kim (2006)
	Identifying new potential clients (sensing)	Kaleka (2002), Song (2007)
	Identifying new potential competitive products	Kaleka (2002), Song (2007)
	Obtaining strategic information about market trend, in order to consider possible developments and opportunities	Kaleka (2002)
	Monitoring developments and opportunities about overseas markets, through external relationships	Kaleka (2002)
Financial Capability	Enabling convenient funding agreements	Kaleka (2002)
	Maintaining constant contribution margins	Kaleka (2002)
Internal Integration	Integrating and coordinating all managing functions, for shared development of firm strategies	Tracey (2005)
	Coordinating all internal logistics activities	Prajogo (2012)
	Integrating internally all firm functions	Wook Kim (2006)
External Integration	Integrating with suppliers	Wook Kim (2006)
	Integrating with customers	Wook Kim (2006)
Project Management Capability	Perceiving and correctly assessing risks	Smith (2002)
	Reducing risk turning out probability or limiting their impact	Smith (2002)
	Planning all different production phases and respecting production timetable	Smith (2002)

Practices	Configuration actions	Authors	COD
IT (Information Technology)	Inter-organizational coordination through electronic links	Prajogo (2012)	A1
	Information Technology-enabled transaction processing	Prajogo (2012)	A2
	Direct computer-to-computer links with key suppliers	Prajogo (2012)	A3
	Electronic mailing (with key suppliers)	Prajogo (2012)	A4
	Electronic Fund Transfer (EFT)	Prajogo (2012)	A5
	Electronic transfer of purchase orders, invoices, etc.	Prajogo (2012)	A6
	Advanced planning and scheduling software	Zhou (2007)	A7
	E-procurement systems	Zhou (2007)	A8
	Bar coding/automatic identification systems	Zhou (2007)	A9
	Scheduling and planning software (use and/or development)	Zhou (2007)	A10
	Production planning	Zhou (2007)	A11
	Electronic Data Interchange (EDI)	Zhou (2007)	A12
	Enterprise Resource Planning Systems (ERP)	Zhou (2007)	A13
	Warehouse Management Software (WMS)	Zhou (2007)	A14
	Monitoring order processing status, Manufacturing Execution Systems (MES)	Zhou (2007)	A15
	Constant delivery tracking, Radio Frequency Identification (RFID)	Bayraktar (2009), Prajogo (2012)	A16
IS (Information Sharing)	Knowledge sharing about Core Business Processes	Li (2006)	B1
	Quality data availability	Tan (1999)	B2
	Frequent, informal, timely information exchange	Prajogo (2012)	B3
	Giving information about events or changes that may affect the other part	Prajogo (2012)	B4
	Frequent face-to-face planning/communication with suppliers/clients	Prajogo (2012)	B5

	Information exchange for improving supplier/client performance	Prajogo (2012)	B6
	Formal Information Sharing agreements	Tan (2002)	B7
	Mutual feedback	Chen (2004)	B8
	Group coordination activities		B9
	Benchmarking	Bhatnagar (2005), Hallgreen (2009)	B10
IS – Customer to Firm	Information exchange about planned orders or order changes	Zhou (2007)	C1
	Information exchange about inventory level	Zhou (2007)	C2
	Product design specifications (from clients)	Zhou (2007)	C3
	Expected performance specifications (from clients)	Zhou (2007)	C4
	Production planning specifications (from clients)	Zhou (2007)	C5
	Information about market opportunities and demand forecasting (from clients)	Zhou (2007)	C6
IS – Firm to Customer	Information about available production capacity	Zhou (2007)	D1
	Information about order status and expected lead-time	Zhou (2007)	D2
	Information about delivery schedule and/or possible changes in delivery schedule	Zhou (2007)	D3
Long-term Relationships with	Close partnerships with strategic suppliers, commercial agreements	Koh (2007)	E1
	Helping suppliers to improve their product quality (Top Management Support)	Li (2006)	E2
	Involving suppliers in new product design	Li (2006)	E3
	Involving suppliers in new process design	Li (2006)	E4
	Mutual performance measurement (Collaborative Performance Systems)	Prajogo (2012)	E5
	Solid and durable relationships with key suppliers (considered as a part of the firm)	Prajogo (2012)	E6
	Expediting (visiting suppliers' plants)	Tan (1999)	E7
	Enhancement of each other's business (common growth)	Power (2001)	E8

	Quality control and guarantee programs	Tan (1999)	E9
	Use of suppliers' technical support and test machines	Tan (1999)	E10
	Annual price negotiations for key items purchase	Tan (1999)	E11
	Use of hedging contracts in suppliers selection	Tan (1999)	E12
Long-term Relationships with Customers	Close partnerships with customers	Koh (2007)	F1
	Resources investment to keep a well-performing supply chain (Commitment)	Li (2006)	F2
	Sharing market interests, firm policies and business goals	Li (2006)	F3
	Collaboration in new product development	Li (2006)	F4
	Sharing marketing strategic decisions	Li (2006)	F5
	Investments for evaluating customer's future needs	Li (2006)	F6
Human Resource Management Practices	Advanced methods for employee selection	Harel (1999)	G1
	Multi-skilled human resource selection	Hallgren (2009)	G2
	Staff training	Harel (1999), Laursen (2003)	G3
	Job enrichment and job enlargement	Harel (1999), Laursen (2003)	G4
	Performance-related payments (Reward Alignment)	Harel (1999), Laursen (2003), Pandey (2012)	G5
	Participation in decisional stages (delegation of responsibilities, team work)	Harel (1999), Laursen (2003)	G6
	Internal Labor Market	Harel (1999)	G7
	Interdisciplinary workgroups	Chen (2004)	G8
Project Management Practices	Risk and opportunities analyzing methods	Smith (2002)	H1
	Advanced methods for supplier selection	Smith (2002)	H2
	Cost Breakdown Structure (CBS)	Smith (2002)	H3
	Work Breakdown Structure (WBS)	Smith (2002)	H4

Production System Practices	Investments in R&D and Engineering functions	-	J1
	International certifications (ISO 9001)	Bhatnagar (2005)	J2
	Plants and machines upgrade/replacement	Hallgren (2009)	J3
	External knowhow/technology acquisition	Jones (2001)	J4
	Product/process standardization (Postponement)	Li (2006)	J5
	Product modularization	Hallgren (2009)	J6
	Statistical process control	Bhatnagar (2005), Hallgren (2009)	J7
	Slack capacity	Hallgren (2009)	J8
	Setup time reduction	Hallgren (2009)	J9
	Cycle time reduction	Zhou (2007)	J10
	Bottleneck controlling	Hallgren (2009)	J11
	Use of manufacturing cells	Bhatnagar (2005)	J12
	Just In Time practices (JIT)	Bhatnagar (2005)	J13
	Total Quality Management practices (TQM)	Bhatnagar (2005)	J14
	Agile manufacturing strategies	Zhou (2007)	J15
	Pull/push procurement systems	Zhou (2007)	J16
	Use of top quality material	Chen (2004)	J17
	Predictive maintenance	Bhatnagar (2005), Hallgren (2009)	J18
	Preventive maintenance	Bhatnagar (2005)	J19
	Stocking area for urgent orders	Bayraktar (2009)	J20
Network	Sections-network development (for commercialization, contracting and assistance)	-	K1
	Sections-network development (for production)	-	K2

	Preference of local suppliers	Tan (2002)	K3
	Limited number of suppliers	Bayraktar (2009)	K4
	Close-to-customer (reference markets) locations	Tan (2002)	K5
	On-time delivery directly to customer's points of use	Tan (2002)	K6
	On-time reception directly to firm's points of use	Tan (2002)	K7
Strategic Behaviour	Sharing sensitive information (about finance, production, design, research, competing scenarios, etc.)	Prajogo (2012)	L1
	Joint Decision Making	Spekman (2002)	L2
	Designation of a supply chain planning team	Zhou (2007)	L3
	Involving both marketing and manufacturing functions in supply chain planning process	Zhou (2007)	L4
	Communication of firm's strategies	Tan (2002)	L5
	Communication of client's strategies to suppliers	Tan (2002)	L6
	Emphasis on health and environmental safety issues	Tan (2002)	L7
	Industrial group participation	Nava (2014)	L8

ANNEX B

SUPPLY CHAIN CONFIGURATION – SVS12B

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Internal Integration	IT (Information Technology)	Production planning
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software
			Warehouse Management Software (WMS)
		Production System Practices	Product/process standardization (Postponement)
	Relationship Capability	IS (Information Sharing)	Information exchange for improving supplier / client performance

		Long-term Relationships with Customers	Collaboration in new product development
		Network	Close-to-customer (reference markets) locations
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Dynamic Capability (Product/Process Development)	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
	Knowledge Management Capability	IS – Customer to Firm	Information about market opportunities and demand forecasting (from clients)
		Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Interdisciplinary workgroups
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Service	Customer Service	Human Resource Management Practices	Multi-skilled human resource selection
		IT (Information Technology)	Electronic mailing
		IS (Information Sharing)	Quality data availability
	Project Management Capability	Production System Practices	Just In Time practices (JIT)
			Stocking area for urgent orders
			Cycle time reduction
	External Integration	Long-term Relationships with Customers	Close partnerships with customers
			Investments for evaluating customer's future needs
		IS – Firm to Customer	Information about available production capacity

SUPPLY CHAIN CONFIGURATION – SVS5

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			International certifications (ISO 9001)
			Plants and machines upgrade/replacement
	Project Management Capability	Long-term Relationships with Customers	Collaboration in new product development
		Production System Practices	Advanced software for product development
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Financial	Supply Chain Management Inbound	IT (Information Technology)	Bar coding/automatic identification systems
		Production System Practices	Automatic warehouse
		Network	Limited number of suppliers

	Capacity and Flexibility	Production System Practices	External slack capacity
		Network	Limited number of suppliers
			Multiple, nearby divisions /plants
	External Integration	Network	Sections-network development (for commercialization, contracting and assistance)
			EPC contractor training teams
		Long-term Relationships with Customers	Close partnerships with customers
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Bar coding/automatic identification systems
		Production System Practices	Automatic warehouse
		Network	Limited number of suppliers
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			International certifications (ISO 9001)
			Plants and machines upgrade/replacement
	External Integration	Network	Sections-network development (for commercialization, contracting and assistance)
			EPC contractor training teams
		Long-term Relationships with Customers	Close partnerships with customers

SUPPLY CHAIN CONFIGURATION – SVS1

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Production System Practices	Product/process standardization (Postponement)
		Network	Limited number of suppliers
	Capacity and Flexibility	Network	Multiple, nearby divisions/plants
			Preference of local suppliers
	Knowledge Management Capability	Production System Practices	Slack capacity
		Human Resource Management Practices	Multi-skilled human resource selection
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Differentiation	Customer Service	IS (Information Sharing)	Information Sharing
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development

	Product/Process Development Capability	Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
			Collaboration in new product development
	Financial Capability	Production System Practices	Plants and machines upgrade/replacement
		Financial Practices	Strong relationships with banks and financiers
		Network	Maintaining large dimensions Acquisitions
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Flexibility	Capacity and Flexibility	Network	Multiple, nearby divisions/plants Preference of local suppliers
		Production System Practices	Slack capacity
	Customer Service	IS (Information Sharing)	Information Sharing
		Long-term Relationships with Customers	Close partnerships with customers Collaboration in new product development
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Production System Practices	Product/process standardization (Postponement)
		Network	Limited number of suppliers

SUPPLY CHAIN CONFIGURATION – SES6

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	IS – Customer to Firm	Product design specifications (from clients)
			Expected performance specifications (from clients)
			Production planning specifications (from clients)
		Long-term Relationships with Suppliers	Quality control and guarantee programs
			Use of suppliers' technical support and test machines
	Knowledge Management Capability	IT (Information Technology)	Scheduling and planning software (use and/or development)
			Production planning
			Enterprise Resource Planning Systems (ERP)
			Bar coding/automatic identification systems
			Warehouse Management Software (WMS)
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Human Resource Management Practices	Staff training
			Performance-related payments (Reward Alignment)
			Internal Labor Market

		Project Management Capability	IT (Information Technology)	Scheduling and planning software (use and/or development)
				Production planning
			IS (Information Sharing)	Frequent, informal, timely information exchange
			Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Project Management Practices	Advanced methods for supplier selection
				Cost Breakdown Structure (CBS)
				Work Breakdown Structure (WBS)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions	
Engineering	Knowledge Management Capability	IT (Information Technology)	Scheduling and planning software (use and/or development)	
			Production planning	
			Enterprise Resource Planning Systems (ERP)	
			Bar coding/automatic identification systems	
			Warehouse Management Software (WMS)	
			Monitoring order processing status, Manufacturing Execution Systems (MES)	
		Human Resource Management Practices	Staff training	
			Performance-related payments (Reward Alignment)	
			Internal Labor Market	
	Product/Process Development Capability	IS (Information Sharing)	Information exchange for improving supplier/client performance	
			Formal Information Sharing agreements	
			Mutual feedback	
			Group coordination activities	
			Benchmarking	
		Long-term Relationships with Customers	Close partnerships with customers	
			Collaboration in new product development	
			Investments for evaluating customer's future needs	
		Human Resource Management Practices	Interdisciplinary workgroups	
	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software (use and/or development)	
			Production planning	
			Warehouse Management Software (WMS)	
		IS (Information Sharing)	Frequent, informal, timely information exchange	

			Benchmarking
		IS – Firm to Customer	Information about available production capacity
		Production System Practices	Agile manufacturing strategies
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (SC)	Supply Chain Management Inbound	IS – Customer to Firm	Product design specifications (from clients)
			Expected performance specifications (from clients)
			Production planning specifications (from clients)
		Long-term Relationships with Suppliers	Quality control and guarantee programs
			Use of suppliers' technical support and test machines
	Product/Process Development Capability	IS (Information Sharing)	Information exchange for improving supplier/client performance
			Formal Information Sharing agreements
			Mutual feedback
			Group coordination activities
			Benchmarking
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Human Resource Management Practice	Interdisciplinary workgroups
	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software (use and/or development)
			Production planning
			Warehouse Management Software (WMS)
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Benchmarking
		IS – Firm to Customer	Information about available production capacity
		Production System Practices	Agile manufacturing strategies

SUPPLY CHAIN CONFIGURATION – SES6

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
On-time Delivery	Supply Chain Management Inbound	Network	Section-network development (for commercialization, contracting and assistance)
			Close-to-customers (reference markets) locations

		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Frequent, Informal, timely information exchange
	Customer Service	IT (Information Technology)	Production Planning
		Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
		Human Resource Management Practices	Multi-skilled human resource selection
	Relationship Capability	IS (Information Sharing)	Frequent, informal, timely information exchange
		Human Resource Management Practices	Staff training
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Network	Section-network development (for commercialization, contracting and assistance)
			Close-to-customers (reference markets) locations
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Frequent, Informal, timely information exchange
	Customer Service	IT (Information Technology)	Production Planning
		Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
		Human Resource Management Practices	Multi-skilled human resource selection
	Relationship Capability	IS (Information Sharing)	Frequent, informal, timely information exchange
		Human Resource Management Practices	Staff training
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Supply Chain Management Inbound	Network	Section-network development (for commercialization, contracting and assistance)
			Close-to-customers (reference markets) locations
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements

		IS (Information Sharing)	Frequent, Informal, timely information exchange
	Customer Service	IT (Information Technology)	Production Planning
		Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
		Human Resource Management Practices	Multi-skilled human resource selection
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
		Network	Sections-network development (for commercialization, contracting and assistance)
			M&A
		Production System Practices	External knowhow/technology acquisition

SUPPLY CHAIN CONFIGURATION – SWS8

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	External Integration	Long-term Relationships with Suppliers	Close partnerships with suppliers
			Involving suppliers in new product design
			Solid and durable relationships with key suppliers (considered as a part of the firm)
	Customer Service	IS (Information Sharing)	Giving information about events or changes that may affect the other part
			Frequent face-to-face planning/communication with suppliers/clients
	Product/Process Development Capability	IS – Customer to Firm	Information exchange about planned orders or order changes
			Product design specifications
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Commercial Impact	Customer Service	Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
			Investments for evaluating customer's future needs
	Knowledge Management Capability	Network	Close-to-customer (reference markets) locations
			On-time delivery directly to customer's points of use
	Market Capability	Strategic Behavior	Communication of firm's strategies
			Emphasis on health and environmental safety issues
Performance 3	Enabling capabilities	Implemented practices	Implemented actions

Service	Customer Service	Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
			On-time delivery directly to customer's points of use
	Supply Chain Management Outbound	Production System Practices	Product/process standardization (Postponement)
			Product modularization
			Use of top quality materials
	External Integration	Long-term Relationships with Suppliers	Close partnerships with suppliers
			Solid and durable relationships with key suppliers (considered as a part of the firm)
			Enhancement of each other's business (common growth)

1. Area of investigation

Introduction

Italy has always been at the top, both in Europe and in the World, in industrial manufacturing sector. After a period of crisis and contraction of the overall demand, manufacturing industry has grown in 2015 and in 2017, respectively for +1.8% and +1.6% of the turnover, and these values are expected to steadily raise for the next three years.

Companies are increasing and stabilizing their structure in terms of assets and patrimony, thus preparing to sustain larger investments in the future. The renewal of their production processes will be a key element for their future success and this will be helped by incentives related to Industry 4.0.

Another fundamental trend, that has also strongly and positively affected the Oil&Gas sector, has been a much more rooted presence on international markets.

Both mechanical and electrotechnical sectors are going to benefit from these tendencies, thanks also to the capability of their companies to produce highly technological products, that help defending against lower cost-lower quality competitors (Prometeia, 2015; Prometeia, 2017).

Even if the forecasts for the manufacturing industry seem to be positive, the situation in the Oil&Gas market is much more complex and uncertain. From 2014 to 2016 a drop of oil price led to a postponement or cancellation of many projects, with a reduction of almost 38% of the CAPEX, leading a lot of companies to retool their strategies to face this scenario. (Franchini, 2017)

However, in 2016 the world demand for oil increased by 2%, one of the biggest boost among the previous years, mostly thanks to the reduction of oil price. (ENI, 2016)

After these three years of reduction, it seems that in 2017, due to a rebalancing between demand and supply, partly accelerated by OPEC's strategy of cutting the production, the oil price could start to grow again, even if with a very slow pace. The expectations behind this upcoming trend are positive, with an expected increase of expenditures in Oil&Gas of 7% in 2017. (Biscardini, 2017)

In this scenario, the Italian manufacturing industry could play a very important role, since companies from both mechanic and electrotechnical industries are strongly engaged in the Oil&Gas market, that is a focal for suppliers of highly engineered products, such as special valves, static equipment and switchgears.

The Italian valve sector is composed by almost 150 companies and its main business is the production of special valves for the Oil&Gas market and it generates almost 3.5 billion of Euro, the 45% of the overall turnover. Its importance in the overall market is testified by the fact the 1 valve out of 4 is produced by Italian companies. (Brancaleoni, 2014)

The static equipment sector employs around 25000 workers, with an overall turnover of 3.1 billion of Euro. (Ufficio studi ANIMA, 2015)

The Italian industry of switchgear covered, in 2015, around the 5.7% of the overall European turnover (close to 14.5 billion of Euro). The 11.8% of the sales of low voltage switchgears is directed toward the Oil&Gas, while for medium voltage the percentage grows up to 33% (Servizio Centrale Studi Economici di ANIE, 2015).

In 2015 the industry related to the EPC had a turnover of 20.97 billion of Euro, with the Oil&Gas producing the highest percentage among the different sectors, with 76.5% on the overall (Tripodo, 2016).

In these three sectors, there are lots of Italian companies that succeeded in configuring themselves so that they would be able to provide to the EPC products that are strategic for the correct completion of large engineering projects. Then, it becomes very interesting to study how these companies structured

themselves, in this period of contraction of oil price, in order to win the competition against lower price-lower quality competitors from foreign countries, such as India and China.

While this is extremely useful, because it allows the definition of guidelines for each sector that can be used to increase the overall competitiveness of the Italian industry, a more structured analysis could help shedding the light on how excellent suppliers organize their resources inside the field of large engineering projects and how different structured companies achieve the highest level of competitiveness.

1.1. Introduction to EPC (Engineering, Procurement and Construction)

The construction of a site for the extraction of petroleum or an offshore drilling plant is called Large Engineering Project, that is a project concerning the realization of very complex works. These megaprojects usually require the collaboration of a very high number of players that are called stakeholders, that are companies, privates or other type of association that have political, economic or environmental interest in the realization of the project. The companies whose scope is the successful completion of the project are called Engineering & Contracting company, also known as main contractor. The network of stakeholders related to a project is very large and handling their satisfaction is one of the most important objective of main contractor.

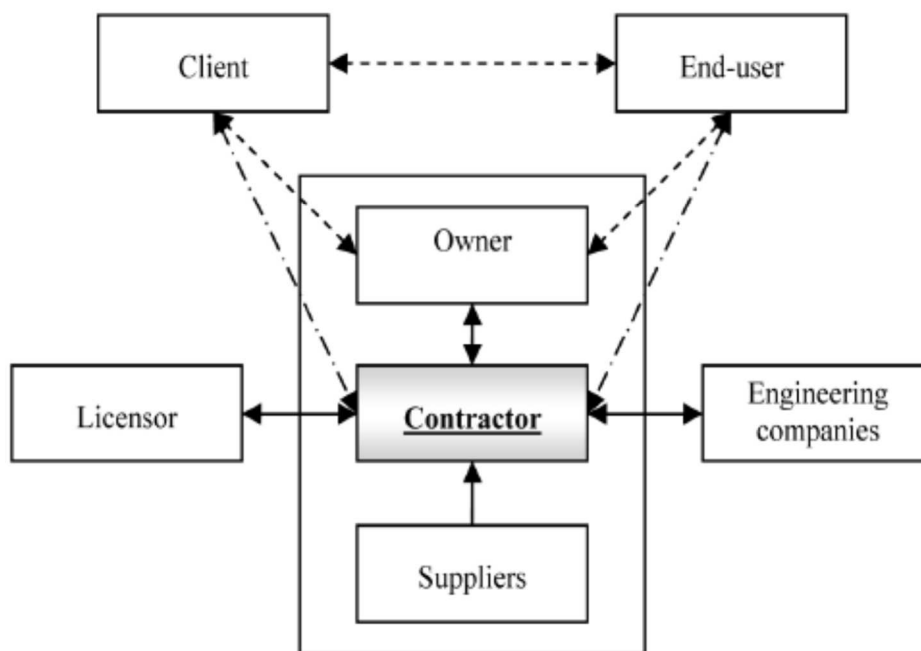


Figure 1.1 Stakeholders' scheme

In particular, the selection of the suppliers is of paramount importance, since an underestimation of the procurement phase can lead to the necessity to re-provide the items, causing delays and payment of penalty clauses to the end user. Procurement is one of the most critical activity of the project, since it can cover up to 50% of the overall costs (Weber et al., 1991; Smith, 2002). The real problem is that often companies end up dealing with poorly performing suppliers and that's part of the trade-off selection concept: suppliers with a smaller cost will provide worse delivery options (Weber & Current, 1993).

Since the end user, especially from the ones of the Oil&Gas, are constantly increasing their requirements in term of quality, the phase of purchasing is becoming more and more strategic, thus leading the suppliers to identify and improve the most important performance to win the bid for the project. This is particularly true for the deliverables called *items*, that are objects that have to fulfill a specific task, such as valves or switchgears, while for *bulk materials* the driving criteria is usually the lowest price (Smith, 2002).

Other important stakeholders are involved in the project. The *end user* is the person or company that is going to use the output of the project. The *owner* has to identify which are the needs of the end user and, once he receives the requirements of the project, he has to perform a feasibility study in order to assess whether the project is doable or not. In case of positive answer, the feasibility study is used to define an initial baseline of the project.

Sometimes it is possible that the most fitting technology required for the project is not property of the owner nor the main contractor. In that case they have to contact the *licensor*, that is the person or entity that owns the patent for that technology in order to reach the permission for its utilization.

1.1.1. LEP (Large Engineering Project)

The Project Management Institute provided, in time, different definitions of a megaproject, defining it in 2004 as “a temporary endeavor undertaken to create a unique product, service or result”. These definitions have two elements in common, unicity and provisional nature, that are the most defining characteristics of a project.

The contextual environment of a project is always different, thus making impossible for the main contractor to standardize its construction processes. Furthermore, the engineering assumes a critical role in the successful realization of a project, since it has to convert the initial requirements in the right sequence of activities, that cannot be replicated from previous projects. The temporariness of a project is given by the fact that its initial and final dates are known before the beginning of the construction, meaning that every activity must be scheduled according to those constraints. Thus, the procurement becomes extremely critical because the lateness in the delivery of the materials, since it is the base from which the construction activities begin, can lead to an overall delay of the project, which usually lead to the payment of penalties in the contract to the end user, reducing the overall margin of the project.

There are other features of a project, that can be extracted from previous definitions:

- Progressive development means that the plan for the project is continuously modified and improved, since new sets of information become available to the project management team. This characteristic is mostly focused in the engineering phase, where technical documentation is elaborated with an iterative process;
- Multidisciplinary integration refers to the complexity of a project, where there is a convergence of different domains, such as technology and industry ones, that have to be properly handled in order to guarantee the correct conclusion;
- Limited availability of resources is related to the fact that during the signing of the contract, the main contractor agrees on developing the project in a certain amount of time and with a fixed budget.
- The non-repetitive nature of a project leads to a high degree of uncertainty, both related to the duration of each activity and to the partially lack of information, especially during the initiation.

1.1.2. Project Stages

In the Engineering & Contracting field, a project is defined as a standard sequence of operative phases that cover all its lifecycle. Along with these activities there are also managerial processes of control and planning executed by the Project Management team, that overlap with operative ones.

The stages are *base engineering*, *detailed engineering*, *procurement*, *execution* and *commissioning* and we will see how these have different impact on costs and result of the project.



Figure 1.2 Sequence of operative phases of a project

The main feature of the *base engineering* is its systemic view. In fact, its scope is the analysis of requirements and the definition of the general configuration of the plant, that takes into account the layout, the sequence of technological processes and the ancillary systems. The output of this phase is given by the technical

documentation that describes the performance and the functional aspects of the components of the plant, that are later used as a base for the detailed engineering to produce more specific documents.

Once the main functionalities of the plant have been identified, the *detailed engineering* has to lead to the overall technical specification of the functional components. During the engineering, there is a low consumption of resources, but it is the phase that has the highest influence on the result and if it is managed properly, it can generate an outstanding reduction of final cost. Otherwise, a poor performance during engineering can create a lot of mismatches and need for corrections during next phases, where costs for corrective actions are extremely high.

Other than the specific behavior of the components inside plant, the detailed engineering must also provide the guidelines for the selection of suppliers and to define and monitor the correct installation the parts on the yard.

Given the high level of uncertainty of information, especially at the beginning, the base engineering works for successive approximations, implying modifications at the technical documentation that could affect the detailed engineering.

Sometimes the opposite happens and one of the specialist team realizes a technical solution that is incompatible with what has been defined at previous stage: an adaptation is then asked. The coordination between these base and detailed engineering is very important, since they are extremely interconnected. That is the role of the Project Engineering.

This continuous going back and forth of the information between detailed and base engineering makes the overall engineering process an iterative one.

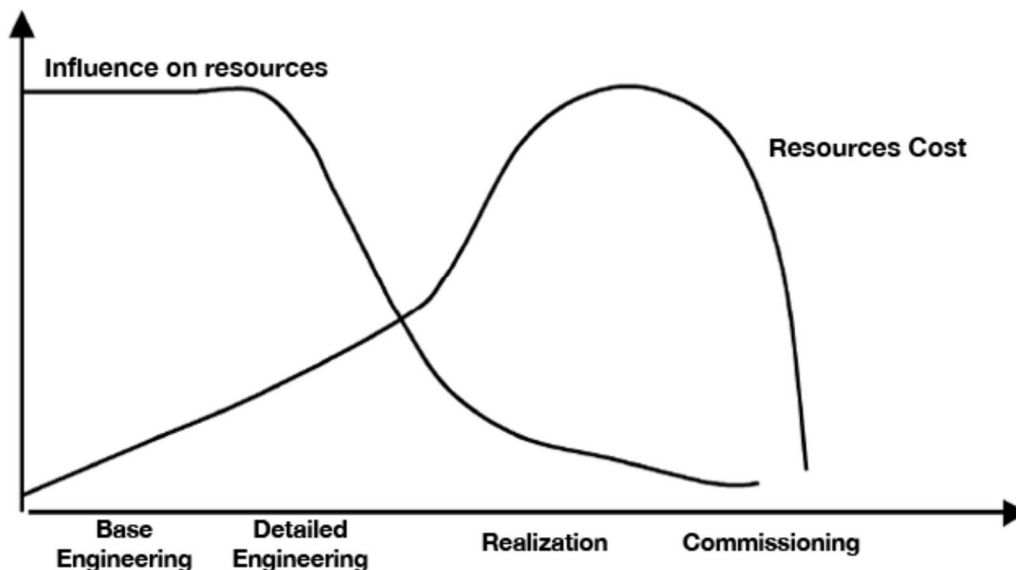


Figure 1.3 Impact of the different phases on costs and on the result

The *procurement* is the phase with the highest percentage of expenditures, that in Engineering & Contracting can reach up to 50% of the overall cost. In this phase, following the guidelines from the engineering, there is the definition of the requirements and the Inquiry for Bid, in which the suppliers present in vendor list are contacted, asking for an economical and technical proposal. In EPC field, especially for the items, the technical contribution of the suppliers can be of extreme importance, since they can collaborate with the engineering department to create the best solution for the project.

Construction requires the most displacement of both technological and human resources. Being the conclusive phase of the project, it is very critical since all the mistakes made in the previous activities emerge, for example, misevaluation of the quantity of resources required or delays in the delivery.

During the construction, there are different specialist works that need to operate in parallel, thus requiring companies, or subcontractors, to operate on the yard at the same time. It is very important for the different activities to strictly follow the beginning and ending dates, thus, the selection of subcontractors plays a fundamental role in the correct succeeding of the project.

The last activity is the *commissioning*, in which there are the final control on the components of the plant, assessing that everything respects the requirements posed by the owner. Its main objective is the *handover* of the unit from the contractor to the owner, guaranteeing its operability.

This study focuses on the analysis of critical items supplied by high performing companies, whose importance is extremely high: it often happens that these objects are highly customized and tailored for the specific project, yet, they have to be delivered in time and respecting strict standard of quality, thus requiring to the suppliers the highest performance.

1.2 Products under investigation

Purchasing is an extremely important aspect in Large Engineering Project because, as we said, the majority of the costs are sustained during this process, thus creating huge damages in case of delays or problems with products supplied. This research focuses on the analysis of three categories of products that are extremely critical inside Oil&Gas plants and whose procurement acquires paramount importance: those products are special, or engineered valves, static equipment and switchgears.

In the following sections, the classification of the products will be provided, along with the description of each class of them, starting from special valves.

1.2.1 Special Valves

1.2.1.1 Special Valves classification

The study takes into consideration only Ball, Gate, Globe, Check, Plug and Butterfly valves having, at least, one of the following properties:

- Rating ≥ 600 ;
- Size $\geq 16''$;
- Cryogenic or able to work in hostile environment;
- Made of high alloy steel or not standard material.

Indeed, a valve with at least one of these characteristics is considered a "Special" valve.

Pressure-temperature ratings are maximum allowable working gage pressures, at given temperatures, for each applicable material and class designation. For intermediate temperatures, linear interpolation is permitted, while interpolation between class designations is not allowed.

Class, followed by a dimensionless number, is the designation for pressure-temperature ratings (Table 1.1).

Class	150	300	400	600	900	1500	2500

Table 1.1 Classes designation

Below, a detailed description of each type of valve is presented.

1.2.1.2 Special Valves description

1.2.1.2.1 Ball valve

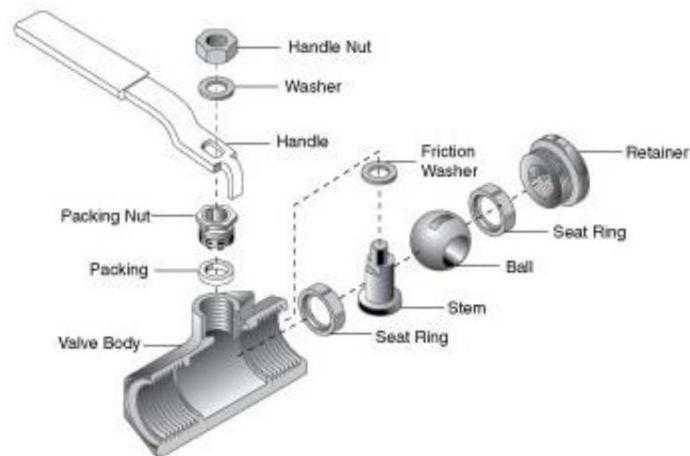


Figure 1.4 Detail ball valve

Ball valves are present in every chemical and petrochemical plants, in refineries plants and, in general, in almost all power plants. This item is mainly created in order to deflect or intercept the flow but, recently is also used to control the flow itself. Indeed, in general, ball valves, due to their high pressure drops, can't compete with globe valves in controlling tasks but, above a certain dimension (more than 20" dimension) ball valves are considered competitive in term of performance and costs.

A ball valve (Figure 1.5) is a quarter-turn valve which controls flow through a hollow, perforated and pivoting ball (called "floating ball"). It is open when the ball's hole is aligned with the flow and closed when it is pivoted 90°.

Its ease of operation, repair, and versatility lend it to extensive industrial use, supporting pressures up to 1000 bar and temperatures up to 500°C, depending on design and materials used. Floating balls are often chrome plated for durability.

There are five general body styles of ball valve: single-body, two or three-piece body, split-body, top-entry and welded. The difference is based on how the valve components — especially the casing that containing the ball — are manufactured and assembled.

In addition, there are different types related to the bore of the ball mechanism itself.

Ball valves in sizes up to 5 [cm] generally come in single, two or three-piece designs. Single-piece ball valves are usually reduced-bore, are relatively inexpensive and generally are throwaway. Two-piece ball valves are generally slightly reduced (or standard) bore; they can be either throwaway or repairable. The three-piece design includes, for the central part of the valve containing the ball, stem and seats to be easily removed from the pipeline: the design concept of a three-piece valve is for it to be repairable.

1.2.1.2.2 Butterfly valve

The butterfly valve is undoubtedly the shut-off and regulating item that, in the last years, has been most optimized. A butterfly valve (Figure 1.6) is a quarter-turn valve that uses a metal disc in the closing mechanism. The valve is fully open or closed when the disc is rotated a quarter turn: the operation is very close to the one of a ball valve (90° pivoting), enabling quick fastening. Butterfly valves are generally used for application not requesting particular technological skills: they are less expensive and lighter in weight, being

suitable for moderate flows. The lower cost is due to the simplicity of the product and the reduced maintenance need.

The disc is positioned in the center of the pipe; a rod passes through the disc to connect to the actuator, outside of the valve. Actuator rotation turns the disc either parallel or perpendicular to the flow.

Unlike a ball valve, the disc is always present within the flow; therefore, a pressure drop is always induced in the flow, regardless of valve position. For this reason, this item is mainly used with shut-off tasks, but, above a certain size, this valve is highly competitive as a control item.

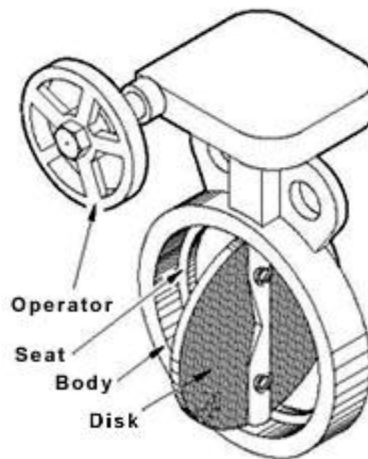


Figure 1.5 Detail of a butterfly valve

1.2.1.2.3 Gate valve

A gate valve (Figure 1.7) opens lifting a round or rectangular gate/wedge out of the fluid path. The peculiarity of a gate valve is the planar sealing surfaces between the gate and seats: for this reason, gate valves are often used when a straight-line flow and minimum restriction are desired.

The gate faces can form a wedge shape or they can be parallel. Gate valves are primarily used to permit or prevent liquids flow, but typical gate valves should not be used for regulating flow, unless they are specifically designed for that purpose. Because of their ability to cut through liquids, gate valves are often used in the Petroleum industry. During gate valve opening, the flow path is enlarged in a non-linear manner, depending on the opening percent: this means that flow rate does not change evenly with stem travel. Most of the flow changes occur near shutoff with a relatively high fluid velocity, causing disk and seat wear and eventual leakage, if used to regulate flow. Typical gate valves are designed to be fully opened or closed; when fully opened, they have no obstruction in the flow path, guaranteeing very low friction losses.

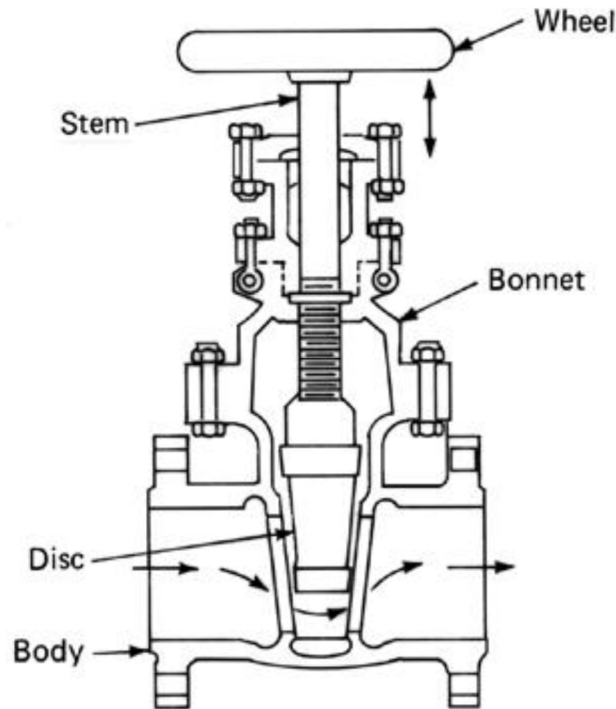


Figure 1.6 Detail of a gate valve

1.2.1.2.4 Globe valve

This is the control valves for excellence. Indeed, the demand of the control flow market is for the 80% composed by this kind of valves. These valves, built from cast or forged components, are usually used as control items up to a nominal pressure of PN760 or up to a size of DN400. Indeed, beyond the indicated size, ball or butterfly valves start to be cost competitive choices both for control and shut-off usage. Globe valves, considering their design, can be classified in four different types of products: "L", "T", "Y", "Z".

A globe valve (Figure 1.8) consists of a movable disk-type element and a stationary ring seat in a generally spherical body, with the two halves of the body separated by an internal baffle. This has an opening forming a seat, onto which a movable plug can be screwed in to close (or shut) the valve. In globe valves, the plug is connected to a stem, which is slid or screwed up or down to throttle the flow; in manual valves, the stem is moved by screw action using a hand wheel. The main uses are for corrosive or highly viscous fluids, which solidify at ambient temperature.

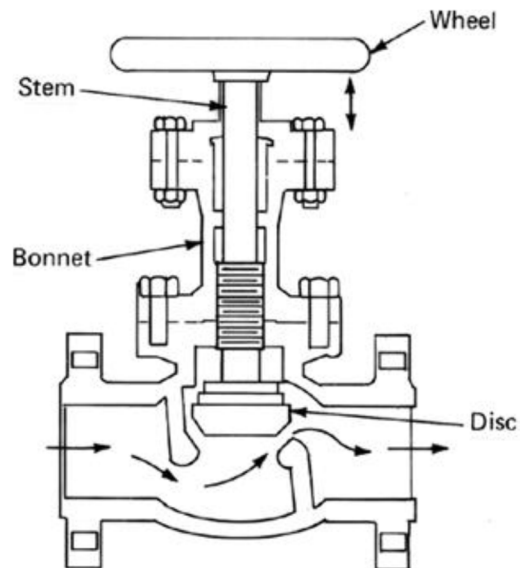


Figure 1.7 Detail of a globe valve

1.2.1.2.5 Check valve

A check valve (or clack valve, non-return valve, one-way valve) is a valve that normally enables fluid (liquid or gas) to flow through it in only one direction.

Check valves are two-port valves, meaning they have two openings in the body, one for fluid entry and the other for fluid exit. There are various check valves types for a wide variety of applications.

They usually work automatically and are not controlled by a person or any external control; because of this, most do not have any valve handle or stem. An important check valves parameter is the cracking pressure, which is the minimum upstream pressure at which the valve can work. Normally, check valves are designed for a specific cracking pressure.

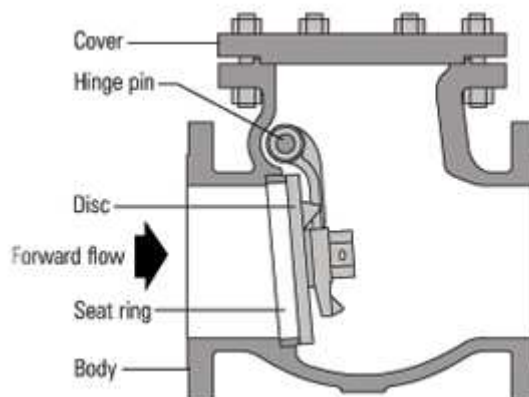


Figure 1.8 Detail of a check valve

1.2.1.2.6 Plug valve

Plug valves are valves with cylindrical or conically tapered "plugs", which can be rotated inside the valve body to control flow through the valve. The plugs in plug valves have one or more hollow passageways going sideways through the plug, so that fluid can flow through the plug when the valve is open.

When the plug is conically tapered, the stem/handle is typically attached to the larger diameter end of the plug. Plug valves usually do not have bonnets, but often have the end of the plug with the handle exposed or mostly exposed to the outside. In such cases, there is usually not much of a stem. The stem and handle often come in one piece, often a simple, approximately L-shaped handle attached to the end of the plug. The other end of the plug is often exposed to the outside of the valve too, but with a mechanism that retains the plug in the body.

Slightly conically tapered metal (often brass) plug valves are often used as simple shut-off valves in household natural gas lines.

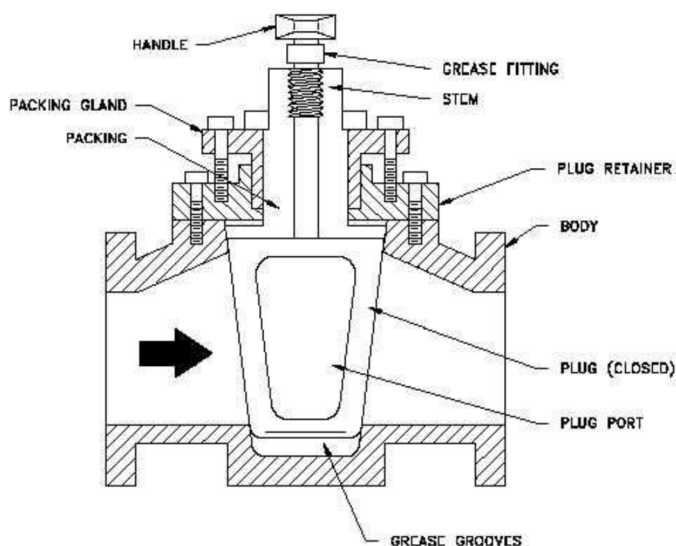


Figure 1.9 Detail of a plug valve

1.2.2 Static Equipment

1.2.2.1 Static Equipment classification

The investigated static equipment items are: Pressure Vessels, Columns and Drums, Shell and Tube Heat Exchangers, Trays and Internals, Steam Generators and Industrial Boilers, Air Coolers and Packages.

Static equipment products of interest are listed, taking into consideration their size, material and if relevant their operating pressure. In the following table, the classification of these items is reported.

Static Equipment investigated products
Pressure Vessels, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter < 5 m
Pressure Vessels, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter < 5 m
Pressure Vessels, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter > 5 m
Pressure Vessels, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter > 5 m
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness < 50 mm diameter < 5 m
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness > 50 mm diameter < 5 m
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness < 50 mm, diameter > 5 m
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness > 50 mm, diameter > 5 m
Other static equipment
Columns and Drums, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter < 5 m
Columns and Drums, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter < 5 m
Columns and Drums, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter > 5 m

Columns and Drums, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter > 5 m
Columns and Drums, Low Alloy Steel Cr-Mo, cladded, thickness < 50 mm, diameter < 5 m
Columns and Drums, Low Alloy Steel Cr-Mo, cladded, thickness > 50 mm, diameter < 5 m
Columns and Drums, Low Alloy Steel Cr-Mo, cladded, thickness < 50 mm, diameter > 5 m
Columns and Drums, Low Alloy Steel Cr-Mo, cladded, thickness > 50 mm, diameter > 5 m
Shell and Tube HEX, low pressure (< 50 bar)
Shell and Tube HEX, high pressure (> 50 bar)
Other Heat Exchanger, low pressure (< 50 bar)
Other Heat Exchanger, high pressure (> 50 bar)
Air Coolers
Packages
Trays and Internals
Steam Generators and Industrial Boilers

Table 1.2 Investigated products within the static equipment sector

1.2.2.2 Static Equipment products description

1.2.2.2.1 Pressure Vessels

Pressure vessels are containers that hold pressurized gases and liquids. Because of the dangerous operative conditions, this item's design and production are regulated by legislation, meaning that every country has its own regulation about, for example, safety factor to be conformed to. Rules also involve non-destructive testing.

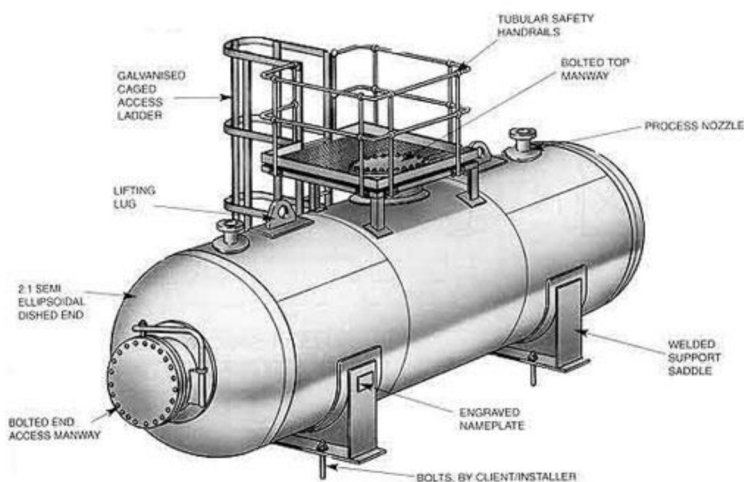


Figure 1.10 Detail of a pressure vessel

1.2.2.2.2 Columns and Drums

Columns are basically the place where the distillation takes place. There are two different type of columns: packed tower and tray type tower.

Packed tower is a vertical column which contains 'Beds' of packing material which are used to bring the rising vapors into contact with liquid falling within the tower.

This type of distillation column usually allows to obtain only a top and bottom product. The quality of the products depends on the height of the tower and the number of contacting devices, as well as the control of temperature, pressure and velocity of the rising vapors.

Tray type tower: it is larger and with higher liquid loads than the packed one. They first appeared in the 1820s and are mainly used for the separation of petroleum fractions at different stages of oil refining. Trays aim is the same of the packages: allow intimate contact between rising vapor and falling liquid. It is much more efficient in the separation process than packed towers but are costlier. There are various types of tray in use and the type selected depends upon the degree of product purity required, the type of fluids, fluid velocity and other process parameters of the system.

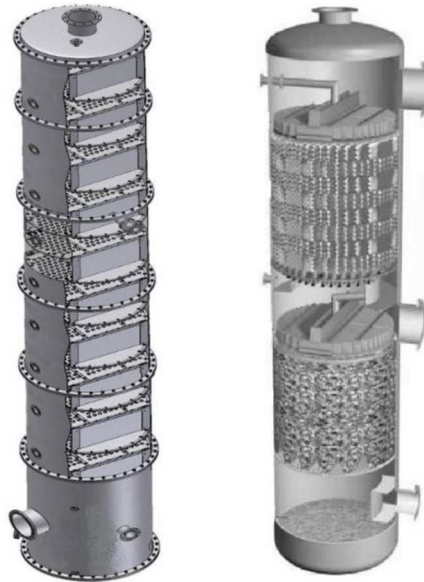


Figure 1.11 Detail of a column (packed on the left, trays on the right)

Drums are vapor-liquid separators. They may also be referred to as flash drum, knock-out drum.

Knock-out pot, compressor suction drum or compressor inlet drum. Several industries used this device to separate a vapor-liquid mixture.

For the common use, gravity is used to cause the liquid to settle at the bottom of the vessel, where it is withdrawn. The gas outlet may be surrounded by a spinning mesh screen or grating to accelerate any liquid that does approach the outlet, throwing them away.

1.2.2.2.3 Shell and Tube Heat Exchanger

Shell and Tube is a class of heat exchanger (HE) designs. It is the most common type of exchanger in oil refineries and other large chemical processes, and is suited for higher-pressure applications. This type of heat exchanger is basically composed of a shell (a large pressure vessel) that encases a bundle of tubes.

One fluid runs through the tubes and another fluid flows over the tubes through the shell to transfer heat between the two fluids. Many type of tubes can be used: plain, longitudinally finned, etc.

Thermal conductivity is the main quality material shell and tube are made of must have.

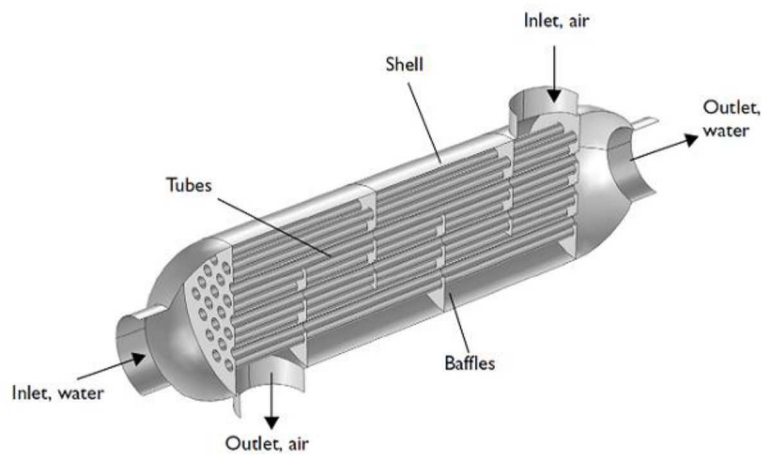


Figure 1.12 Detail of a shell and tube HE

1.2.2.2.4 Trays and internals

Trays are mainly used in high pressure distillation operations (even if there are few atmospheric, moderate pressure and vacuum operations where tray type towers are used). In the column, trays allow vapor to pass through, increasing contact time between the vapor and the liquids in the column and helping to collect liquids that form at various heights in the column. They are equipped with a Weir that maintains the liquid level on the tray forcing gas to bubble through the liquid.

There are three main type of trays: Sieve Tray, Valve Tray and Bubble-cap Tray.

Sieve Tray is a metal plate containing drilled holes. These holes allow rising vapor to pass into the liquid flowing across the tray.

Valve Tray is used when the vapor velocity is not constant. It is similar to the sieve type but each hole is equipped with a flapper valve that prevent liquid from dumping through the holes at times of low gas velocity

Bubble-cap Tray is the most efficient and costly separator. It is composed of a number of Chimneys or Risers (short pipes) through which the vapor can pass. On the top of the riser there is a cap that forces the rising vapor to turn around and through the liquid

12

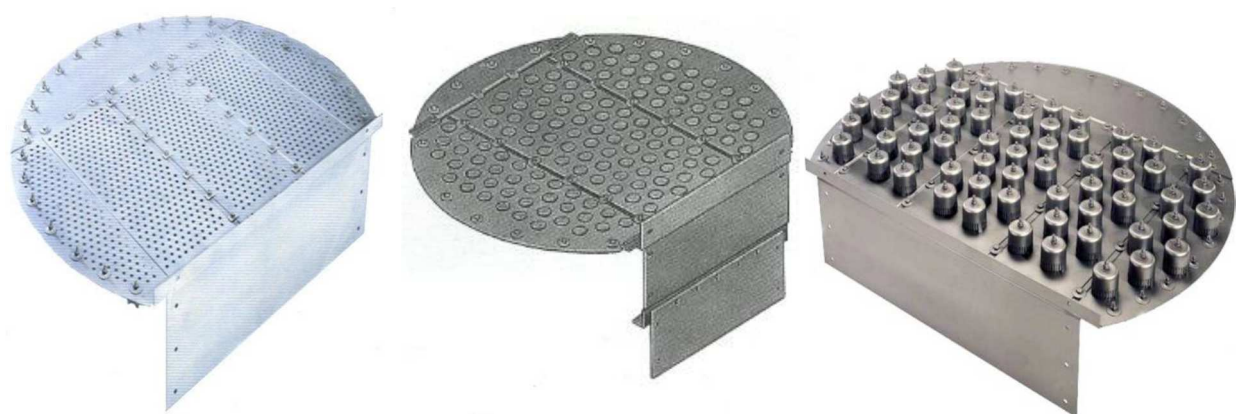


Figure 1.13 Sieve Tray, Valve Tray, Bubble-cap Tray

Internals include a wide range of products, such as: gas and liquid distributors, feed devices, collecting devices, support plates and hold-down plates. They are really important in order to guarantee the optimal performance through a high mass-transfer efficiency with minimal energy requirement.

Gas and liquid distributors must be designed carefully and mounted with high accuracy. They are important in order to maintain an even mass transfer distribution through all the section of the column to guarantee the right mass transfer.

Feed devices are needed to complement with the type of distributor used to give the requested performance. They are essential to maintain the right quantity of liquid to enter the column and boil.

Collecting devices must be carefully designed in order to save column height and reduce pressure head in the collecting section.

Support plates are mainly used to bear the packed bed. They must guarantee a high degree of permeability for both gas and liquids, low weight, corrosion and strength resistance and easy installation. They can be made with many different shapes and material (sometimes, also plastic materials)

Hold-down plates are particular type of plates that prevents packings from being swept away by the flow of gas or vapor.

1.2.2.2.5 Air coolers

Air coolers are widely used in substitution to water when this is not available or dedicated water circuits, pumps, water cooling systems and water conditioning would be complex to place, install and maintain.

Air cooled heat exchangers are employed throughout the entire oil and gas industry (upstream production, refineries, petrochemical) and can be used for high pressure and temperature, as well as corrosive environment (usual conditions for Oil&Gas production process).

The functional principle is the same of a general Heat Exchanger, but there is the inconvenient of the reduced heat exchanging capability of air.

There are specifically designed fins, that are attached to the outer surface (where air flows to cool the fluid down) in order to enlarge the cooling contact surface and increase the thermal exchange efficiency.

The heat transfer rate is a function of the fins' surface area and the velocity of the air flow.

Material and fabrication technology, as well as advanced welding capabilities are the key factor to obtain long service life and quality. Another important parameter is the dimensional stability and weld integrity, in order to assure the required performances and reliability.

In the end, the quality of air coolers depends on advanced design techniques, fabrication assets and extensive experience in the production of this particular heat exchangers.

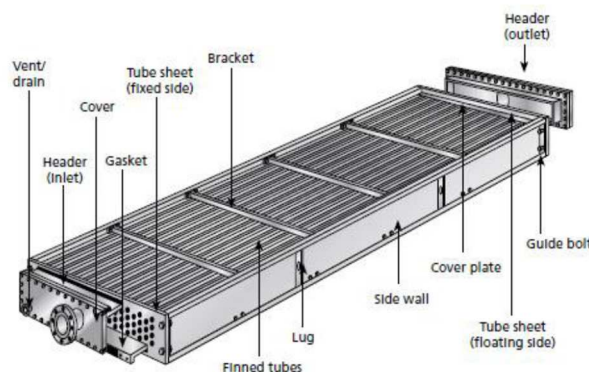


Figure 1.14 Detail of an Air cooler

1.2.2.2.6 Packages

Packages are complex process-oriented items that are defined by their functionality.

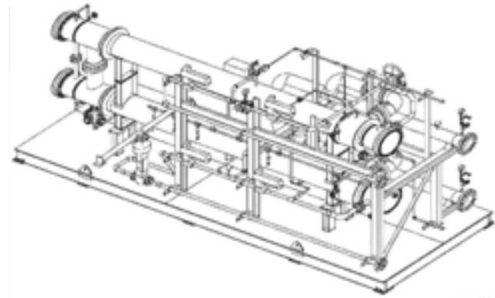


Figure 1.15 A generic skid package

These items are designed to contain a complete process system, a complete unit of operations or to organize a manufacturing process into logical units. These products are made of different and numerous parts and are mainly built with a specific functionality for a specific plant. Then, due to the high customizability of this product, it is difficult to categorize these products basing on their functionality.

Skid packages represent one of the most manufactured categories of packages.

Since these products are self-contained and built within frames, they are characterized by a portable design. Moreover, skid's frames allow equipment layering and piping, vessels, tanks and necessary process equipment can be easily mounted on the skid layer, allowing accessibility to operators.

Finally, in increasing order of complexity, other categories of packages are: complex packages, topside modules and the subsea packages.

1.2.2.2.7 Steam generators and industrial boilers

A boiler or steam generator is a device used to create steam by applying heat energy to water. A boiler or steam generator is used wherever a source of steam is required. A typical steam generator consists of a convection section and a radiant section. The convection section is designed to preheat the softened feed water, and the radiant section further heats the steam pipe for generating steam. A steam generator produces 60 to 80% quality steam, depending on the reservoir requirements. Higher-quality steam can be generated if good-quality water and fuel gas are used. When the required steam quality reaches 90%, the control becomes difficult and the chance of getting an overheating in the pipe increases because of the relatively low liquid phase near the pipe effluent.

The steam injection pressure varies from field to field, depending on: reservoir requirement, steam-injection rate and tightness of the formation. A steam generator can be operated at a pressure of approximately 180 bars and can be designed especially for higher operating pressure if required.

1.2.3 Switchgears

1.2.3.1 Switchgears classification

Switchgears investigated products	
Low Voltage	Power Center (primary distribution)
	Secondary distribution Switchgears
	Motor Control Center
	Automation and Control Switchgears
	Explosion-Proof Switchgears

Medium Voltage	Synoptic Switchboards
	Metalclad Air-Insulated Switchgears
	Metalclad Gas-Insulated Switchgears
	Metal enclosed Air-Insulated Switchgears
	Metal enclosed Hybrid Switchgears
	Metal enclosed Gas-Insulated Switchgears

Table 1.3 Investigated products within the switchgears sector

1.2.3.2 Switchgears description

The switchgear can be defined as a combination of different electrical devices, such as switches and fuses circuit breakers, that is used to control, protect and isolate electrical equipment. The realization of a switchgear is usually ruled by the certifications, that in Oil&Gas market, are related to different end users that usually control also the types of tests under which the product has to be subjected, that are extremely important, since it is usually crossed by high electrical powers and currents.

A switchgear can be roughly divided in three different categories of components, that are:

- Mechanical parts: they usually refer to the bin, which has the function of support and protection of all the different parts contained inside;
- Electrical equipment: it is made by internal components, required to control, protect or move the relative connections and input and output electrical terminals;
- Segregations: these are the different possible internal divisions that are usually made by isolating barriers. Their scope is to allow the maintenance and inspections activities while preserving the security of the operator.



Figure 1.16 The interior of a switchgear

There are several different classifications that can be made for switchgears. In the research, the different switchgears have been divided according to three parameters, that have been then combined altogether to obtain the final classification. Switchgears have been divided considering:

- 1 Voltage class:
 - 1.1 Low voltage, lower than 1kV for alternated current;

- 1.2 Medium voltage, from 1kV to approximately 75 kV for alternated current;
- 2 Insulating medium:
 - 2.1 Air;
 - 2.2 Gas (usually it is SF₆);
 - 2.3 Hybrid insulation;
- 3 Type of use inside the plant.

Considering these different factors, it is possible to obtain the classification of switchgears in Oil&Gas presented in Table 1.3

The insulation refers the element that is used inside the circuit breaker, which is the component of the switchgear in charge of interrupting possible fault currents. The creation of the internal arc, that happens whenever there is a problem inside the switchgear, activates this device which opens the circuit, avoiding more severe damages.

The most traditional insulation medium is the air, which is extremely used for application with a voltage below 15 kV. This kind of circuit breaker encapsulates compressed air that, in case of arc creation, elongates it, eventually exhausting it.

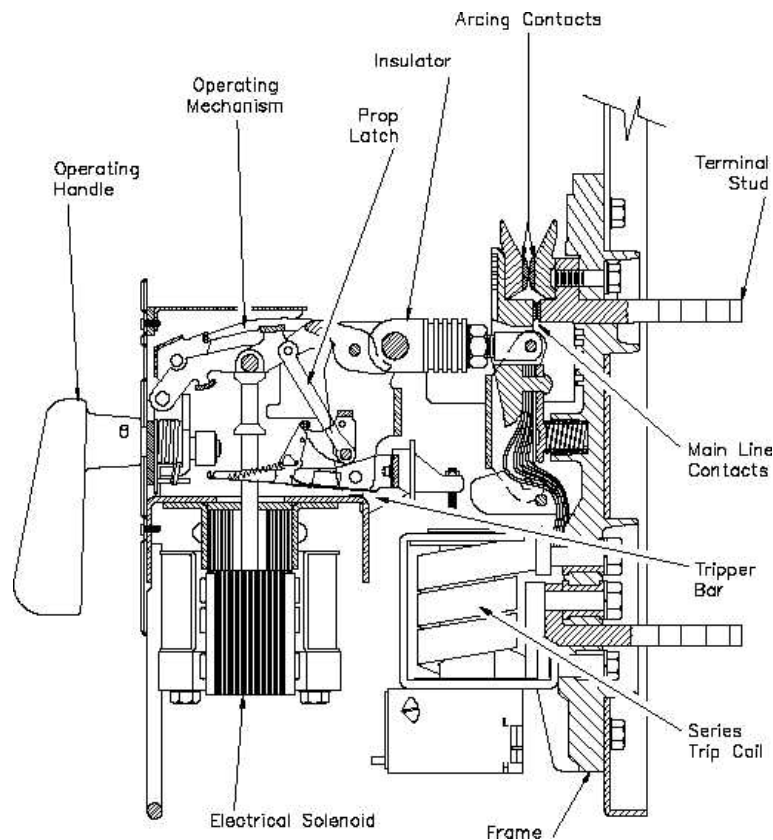


Figure 1.17 Detail of an Air Circuit Breaker (ACB)

An alternative, which is increasing its importance over time, is the sulfur hexafluoride circuit breaker (or SF₆). The gas present in the device has the electronegativity propriety, meaning that it can absorb free electrons, thus acting as a great insulating to quench possible internal arcs. While at the beginning, this type of insulating was not used because of higher costs, now, with the improvement of technology, the circuit breaker became cheaper and more desirable on the market, since it is able to greatly reduce the dimension of the switchgear.

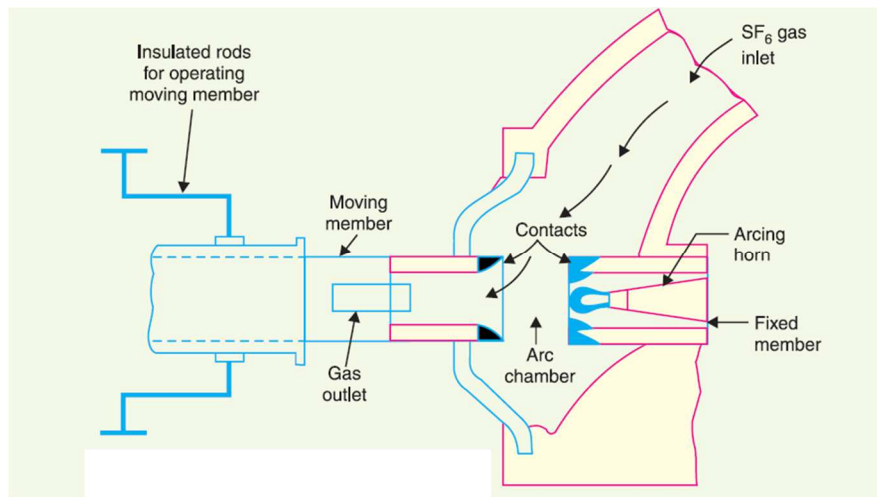


Figure 1.18 Detail of a SF6 Circuit Breaker

Hybrid switchgear is a type which combines properties of both AIS and GIS and it is used for particular application.

While the low voltage switchgears in the classification are almost completely air-insulated, medium voltage ones can be required on both the typologies (three if hybrid insulation is included).

The description of each type of switchgear will be provided below.

1.2.3.2.1 Low Voltage Power Center

This switchgear is mainly used for the primary distribution, so it is installed close to the MV/LV transformer cabinet. In order to provide the possibility of easily operating the maintenance activities, this kind of switchgear is usually divided in functional cells and equipped with extractible drawers containing for electrical switches, in case their substitution was necessitated. The current circulates internally thanks to a system of copper busbars. This product is produced with a strong metallic structure that is fixed on the ground, since it has to guarantee a high resistance to electro-mechanical vibrations, without damaging the internal circuits.

1.2.3.2.2 Low Voltage Secondary Distribution Switchgear

The secondary distribution switchgears represent the second level of electrical energy distribution, thus being interested by less intense electrical current. Because of that, these products can be made of both plastic or metallic material, depending on the application, and they are composed of different modular elements. They are usually installed closely to the utilities that they feed.

Depending on their use, electrical power and current rating, they usually have one input and more output lines and they can be fixed on the ground or on the wall.

1.2.3.2.3 Motor Control Center

This is one of the main class of switchgear for the Oil&Gas market and they can be equipped with various types of switches, circuit breakers, PLC and measurement devices. Their target is the control and monitoring of different electric motors inside the plant.

These products are made of one or more robust metallic cabinets and they are internally divided in modular compartments and drawers, that contain all the different devices required for the control of one motor, in opposition to the Power Center, whose drawers contain a single switch. These drawers are required to verify or replace with ease the different components.

The utilization parameters, such as interrupting and current ratings, are lower than the ones required in primary distribution, yet these switchgears are extremely important for the distribution network.

1.2.3.2.4 Low Voltage Automation and Control Switchgear

These switchgears are realized in metallic cabinet and they contain all the devices required for the monitoring, controlling and protection of the different components and industrial processes inside the plant, and they require a continuous presence of skilled operators.

1.2.3.2.5 Low Voltage Explosion-Proof Switchgear

It is possible to identify different protection classes for the switchgears and the explosion-proof refers to the specific class “ex-d”, which refers to panelboards that have to be particularly robust and able not to plastically yield following explosions, whose pressure that vary between 5 and 12 bar. Rather than a specific type of switchgear, this class refers to a particular way of building the case of the switchgear. The electrical components, that are possible sources of sparks, are confined in a robust container, in contact with the explosive environment, but, in case of trigger, the switchgear is designed to keep the explosion confined internally.

1.2.3.2.6 Synoptic Switchboard

This kind of switchboards is used to provide a general view of the system that has to be monitored. Synoptic switchboards offer the advantage of providing an immediate view of all the processes that have to be monitored, the temperature of the systems, providing and real-time update of all the variables connected to them. Furthermore, all the commands are arranged logically and they are clearly visible to qualified technicians.

1.2.3.2.7 Medium Voltage Metalclad Switchgear (LSC2B)

This product is an assembly of units that are characterized by a main interrupting and interrupting device, that can be easily accessed and removed. The metallic case of this switchgear has to be extremely robust and all the internal parts are enclosed with grounded metal barriers, in order to favor the division between the different internal sections and the insulation. Furthermore, the internal compartments, separated by metal barriers, must have no intentional openings. This type of switchgear, for the Oil&Gas, is mainly used for primary distribution and It can be a AIS (Air Insulation) or GIS (Gas Insulation).

With the norm IEC 62271-200, these switchgears are classified respect to the Loss of Service Continuity, that classifies the functional units depending on which components remain live during maintenance operations. Medium Voltage Metalclad switchgears are now classified as LSC2B, whose functional units keep busbar, switches and cables live during those operations.

1.2.3.2.8 Medium Voltage Metal Enclosed Switchgear (LSC2A)

This type of electrical switchgear is completely enclosed on all sides and on top by a metal sheet, that contains primary power circuit switching and interrupting devices with buses, connections and auxiliary devices, if required. The difference with Metalclad switchgears is given by the fact that the interrupters of metal enclosed do not have to be drawout. Furthermore, the design of the metal enclosed is lighter than a metalclad. This switchgear can be AIS (Air Insulated), GIS (Gas Insulated) and Hybrid. Following the norm IEC 62271-200, these switchgears are now classified as LSC2A, that is a functional unit that during maintenance operations disables switches and cables, while the busbar remain live.

2. Literature review

2.1 Framework overview

In this section, we present the framework that has been used for the description of Best Performers' supply chain configurations. During literature review, it has been noted that EPC project supply chain configurations are rarely treated, thus requiring a special framework that could provide the necessary information. Furthermore, as it will be shown later, other frameworks related to supplier selection or supply chain configurations were not considered articulated enough to provide the amount of information and the sufficient level of details required for the study, thus the decision of starting from scraps and identifying a research framework made of elements that could be identified through the literature.

The final model has been built on three blocks of elements, namely:

- Performance: set of activities that allows the company to meet customers' requirements and to obtain competitive advantage over competitors;
- Capabilities: firms' abilities or skills that help the company to achieve the proper performance levels;
- Practices: bundles of configuration actions or strategic decisions that enable the capabilities.

These three elements are extensively discussed in SCM literature, since they are the strategic bases onto which the companies base their survival. Despite their importance, there is scarcity of frameworks or researches that maintain a holistic view over the three sets of elements, while it is easier to read papers concerning the analysis of just one or two of these blocks, without exploiting the overall supply chain configuration.

Many authors define important capabilities and investigate their relationships among themselves and how do they affect different performance, without considering how practices or resources have been employed in the definition of those capabilities (Tracey *et al.*, 2005, Tseng, 2014, Morgan *et al.*, 2009, Zhao *et al.*, 2001).

In other cases, researchers only put their attention on the performance and the related papers can be roughly distinguished in two types: the first kind is related to supplier selection criteria and these researches usually investigate which are the most critical criteria that have to be considered during the procurement, depending on external factors (Kumar Kar, 2014); on the other side, the problem is related to the definition of a proper metrics to be used for the measurement of the internal company performance (Beamon, 1999, Weber, 1991).

Tan *et al.* (1999, 2002), Zhou (2007) and Li *et al.* (2006), instead, focus their job directly on the bonds between practices and performance. In a dynamic environment such as the supply chain, the usage of capabilities appears to be very important, since they can leverage on different combinations of practices to maintain competitive advantage over time.

There are also studies in which the three blocks of elements are considered altogether, yet typically in those analysis the holistic view misses. In his research on supply chain integration, Wook Kim (2006) tests whether SCM practices affect firm performance and competitive capabilities, and whether the latter influence, too, firm performance, just focusing on dual relationships practices-performance, practices-capabilities and capabilities-performance, without considering the overall interconnectedness of those elements.

Ravichandran *et al.* (2005) identified a research model that is very close to the framework above defined, in which he interrelated four constructs: IS resources, IS capabilities, IT support for core competencies and firm performance, which have been divided in operating and market-based. Yet, even if the overall model is very similar, it is possible to notice that he only focused on analyzing the firm decisions in term of information sharing and information technology.

The elements of the framework that has been previously proposed are not bound to a particular field, but they should be used to model the supply chain configuration in its entirety and in any context.

However, the model is subjected to limitations, since it hypothesizes the absence of direct causal relations between elements composing the same block, but, since the model is presented as axiomatic, it can be considered coherent and complete until further researches do not improve or modify it.

In the following sections, the literature related to the elements of the model will be described.

2.1.1 Performance items

Performance measurement is a topic that has always driven the attention of many researchers. It can be defined as the quantification of the actions required to satisfy the customers with the greatest efficiency and effectiveness (Neely et al. 1995). The latter are the two fundamental dimensions of performance, where the efficiency is the measure of how well did the company employed resources to meet customers' needs, while the effectiveness refers to the degree of satisfaction of customers' requirements.

This subject has become more and more important in the dyadic relationship between buyer and supplier. While, before the 1980s, companies were focused on internally producing components, with the arrival of global competition they started becoming outsourcing-oriented in order to reduce costs. The reduction of products life-cycle also required companies to create strategic alliances with their suppliers, so that they could foster their ability to react to external outputs from the market.

Indeed, since the impact of suppliers on firm's performance has become critical, many researches have been conducted to assess which are the most important indicators and methods suitable for suppliers selection and qualification (Luzzini et al., 2014).

Among the researchers, there is a uniform persuasion that it is not anymore possible to evaluate the performance of company relying exclusively on economical or financial measures, but there is the necessity to include also operational indicators (Flynn et al., 2010).

Literature in the late 1970s and early 1980s was mainly focused on cost. In earlier 1990s, cycle time and customer responsiveness were added, while in late 1990s the importance of flexibility grew. Recently, great emphasis has been given to green supply chain, in which environmental and safety performance have become a key issue. Furthermore, after the 1990s, qualitative criteria started being used in place of quantitative ones.

In his seminal work, Dickson (1966) developed a supplier performance metrics, including 23 vendors selection criteria which have been ranked in function of the importance. His job has been the basis for future researches in purchasing fields and has been revisited by Weber (1991), who confirmed the consistency of the criteria that Dickson has identified.

Rank	Criteria	Degree of importance
1	Quality	Extreme
2	Delivery	
3	Performance history	
4	Warranties and claim policies	
5	Production facility and capacity	Considerable
6	Price	
7	Technical capability	

8	Financial position	
9	Procedural compliance	
10	Communication system	
11	Reputation and position in industry	
12	Desire for business	
13	Management and organization	
14	Operating controls	
15	Repair service	Average
16	Attitude	
17	Impression	
18	Packaging ability	
19	Labor relations records	
20	Geographical location	
21	Amount of past business	
22	Training aids	
23	Reciprocal arrangements	Slight

Table 2.1 Dickson's vendor selection criteria

Kumar Kar (2014), reviewing the literature of Weber (1991) and Ho (2010), identified up to 60 different criteria, used in different contexts, and focused on the identification of a new summary of suitable criteria for performance evaluation.

Beamon (1999) indicated that metrics should satisfy four characteristics, inclusiveness (measurement of all pertinent aspects), universality (comparison under various operating conditions), measurability (measurable data) and consistency (consistent with organization goal).

The review of literature provided the identification of the performance items that has to be included in the framework, along with the metrics required for its measurement. These elements are listed in Table 2.2.

Performance items	Performance measurement	
Price	Product pricing	Maintenance cost
	Total cost of acquisition	Dismissal cost
	Production capability	
Quality	Product quality	Safety adherence
	Quality in field	Defect-free deliveries level
On-Time Delivery	Delivery reliability	Average lateness of orders
	Delivery frequency	Shipping errors
Engineering	Design capabilities	Product development cycle time
	Technical capability	
Innovation	Use of new technology	Research & Development
	Innovation Investment	

Differentiation	Uniqueness of product perception	
Variety	Supply variety	Product line diversity
Lead-Time	Lead-time/response time	Delivery lead-time
	Manufacturing lead-time	Customer response time
Flexibility (Supply Chain)	Procedural compliance	Production flexibility
	Availability of parts	Volume flexibility
	Response flexibility	Capacity flexibility
	Order flexibility	Delivery systems flexibility
	Frozen time	
Commercial Impact	Supplier's reputation	Trade restrictions
	Performance history	Brand value
Financial	Financial position	Warranties
Service	Service quality experience	Packaging capability
	Service quality credence	Billing accuracy
	Custom duties	Installation assistance
	Domain experience	Maintenance assistance
Communication	Close relationships development	Information availability
	Electronic data interchange	Information timeliness
	Communication barriers	Self-audits
	Reciprocal arrangements	e-transaction capabilities
	Cultural fitment	Staff skills level
	Information accuracy	
Knowledge	Intellectual property rights	Patents and certifications
	Forecasting techniques accuracy	Conflict resolution systems

Table 2.2 Performance related to the framework

2.1.2 Capabilities

In the literature, the concept of capability is very ambiguous, since it is often confused with other terms, for example practice or resource, or used improperly. A clear and univocal definition is given by Day (1990), who states that capabilities are bundles of skills and accumulated knowledge that enable firm to coordinate

activities and make use of their assets. It is possible to add that, in order to be useful to the firm, the capability must allow the company to reach competitive advantage. The latter, in literature, can be divided in cost advantage, in which the firm is able to provide a product or service at a lower cost than their competitors, or differentiation advantage, achieved when the customer is able to identify in the product/service one or more important features that positively distinguish it from competitors' ones (Kaleka, 2002).

Thus, the capability can be seen as the ability of a company to implement practices, deploy resources and manage skills and assets so that it will be able to increase its efficiency or meet in some more proper way clients' requirements. In addition, it is important to notice that capabilities are usually peculiar of the single firm, becoming very difficult to be imitated.

It is critical to distinguish the capabilities from the practices, since they are often confused in literature, with capabilities treated as practices and vice versa. There are many studies concerning the usage of capabilities in different environments, often firms are studied in their ability of combining the different practices or in how they handle capabilities to achieve different performance and yet, there are no comprehensive views, in which the three elements are studied altogether.

For example, Song *et al.* (2007) distinguish companies following the Miles-Snow strategic typology, based on how a company aligns with its business environment, and test the relationships between capabilities and financial performance, considering the moderating role of the firms' strategic nature. In this study capabilities are divided as follow:

- Technology capability: it concerns the manufacturing processes, forecasting capacity, new product development and production facilities and they are usually activated on the market by competitors;
- IT capability: it facilitates the management of internal communication and the coordination of cross-functional teams;
- Market-linking capability: it allows organizations to identify shifting in the market, anticipate possible change of the environment or strengthen bonds with customers;
- Marketing capability: it comprehends knowledge on market requirement, competition and customers, as well as advertising and pricing.

Morgan *et al.* (2009) identify different dimensions of marketing capability and they asses how this capability impacts subjective and objective performance, considering the interaction with market orientation, which is defined as the engagement of a company in generating and disseminating responses from market intelligence pertaining customer needs.

In their study, Zhao *et al.* (2001) study the connection between logistics capabilities, distinguished in customer-oriented and information-oriented capabilities, and their impact on firm performance, which is evaluated under both effective and efficient measures. Their findings are quite interesting, since they show that the pure utilization of information-oriented capabilities do not provide benefits to the company, while they are extremely effective as a support for customer-focused capabilities, that enable the firm to build the distinctiveness required to win customers' choice.

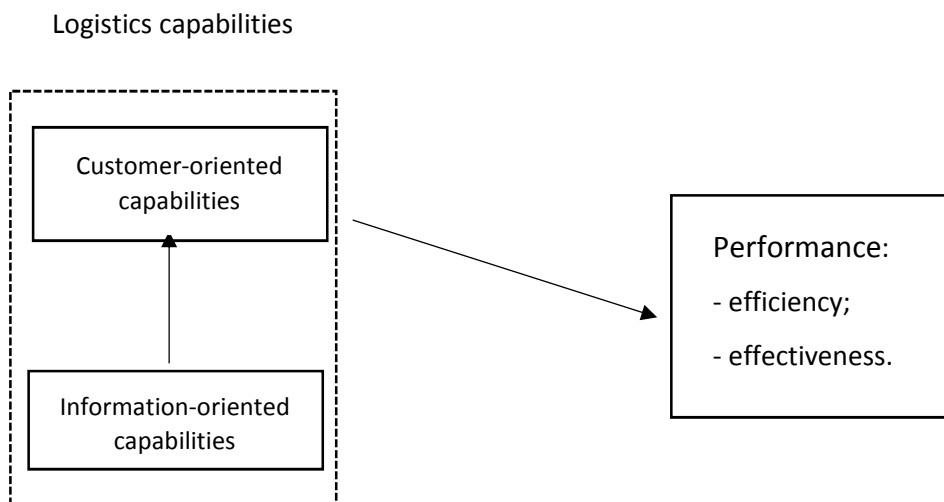


Figure 2.1 Zhao's framework

Day (1994) classified the distinctive capabilities required by a market-driven organization into three constructs:

- Outside-in capabilities: their purpose is the connection between the company and its surrounding environment. They are required to anticipate and adapt to changes in customers' needs, adjusting inbound material flows, production schedules and distribution planning;
- Inside-out capabilities: their focus is on the physical distribution of finished goods, packaging, warehousing, inventory control and outbound transportation.
- Spanning capabilities: their role is the provision of superior value to customers, maintaining horizontal coordination to ensure the availability of internal resources.

Tracey (2005) focused on the demonstration that SCM capabilities could enhance competitive advantage of a firm, impacting on both efficiency (market and financial performance) and effectiveness (product value and customer loyalty). After a thorough literature review, he identified 12 SCM/logistics processes and, using Day's framework, he allocated four of them under each construct. Subsequently, the results of his research validated the hypothesis that SCM capabilities can support a company's business performance, with inside-out and spanning capabilities impacting them directly and outside-in capability affecting it indirectly, having, though, positive effects on inside-out capability.

Wook Kim (2006) resumes and reworks the classification of competitive capabilities, initially provided by Innis and LaLonde (1994) and Koufteros (1995), and he distinguishes them in cost leadership, customer service, innovative marketing technology and differentiation. He further analyzes how these capabilities relate to SCM practices and firm performance, under the role of SC integration, defined as the efficient linkage between the different activities in a supply chain.

Knowledge management and dynamic capabilities are the focal points of Tseng (2014) study, in which he sought to identify the correlation between these two firm's abilities and operational performance. The dynamic capability refers to the capacity of a firm to continuously improve their own manufacturing process and to create new product/service, adapting to change in market scenario. Knowledge management is the ability of an organization to leverage its existing knowledge to improve the expertise and comprehension of internal and external environmental factors. The research proves that these two capabilities are strictly related and, in particular, a firm owning strong KM capability it is more likely to generate continuous

improvement both on its production processes, leading to better products/services. Dynamic capability, in turns, allows quicker responses to external variation, increasing organizational performance.

A thorough analysis of previous literature enabled the identification of 12 distinct capabilities that are afterwards listed in Table 2.3. On the right side, different abilities have been listed to describe how each capability should be unlocked and used.

Other than the capabilities identified with the literature presented above, *Project Management Capability* (Smith, 2002) has been added at the bottom of the list, because of its relevance in the specific context of EPC projects.

Capabilities	Ability of:
Supply Chain Management Inbound	Developing and maintaining an effective purchasing function (procurement)
	Contracting with suppliers and correctly estimate supply value (pricing)
	Regulating and optimizing raw materials procurement (commercial agreements for supply)
	Regulating and optimizing raw materials procurement (commercial agreements for supply)
	Managing effectively raw materials transport (from supplier to warehouse)
	Adopting effective quality control on raw materials
	Managing effectively raw materials warehousing
	Monitoring effectively and regularly raw materials inventory (availability and quantity)
	Managing effectively raw materials picking up from warehouse and their inclusion in production cycle
Supply Chain Management Outbound	Adopting effective quality control on finished products
	Managing effectively finished product packaging and labelling procedures
	Managing effectively finished products warehousing
	Monitoring effectively and regularly finished products inventory (availability and quantity)
	Managing effectively finished products delivery (to middle distribution centers or to final customer)
Knowledge Management Capability	Acquiring external knowhow to create, apply and protect new knowledge
	Developing current internal knowhow to create, apply and protect new knowledge
	Managing effectively organizational structures, technologies e company culture for knowhow developing
Product/Process Development Capability	Developing customized products for specific clients
	Re-designing and improving existing products
	Developing products that are innovative for the market
	Reducing production costs and total costs for clients

	Installing and managing production lines that are excellent and reliable
	Developing new production lines and improving/optimizing production processes
Capacity and Flexibility	Benefiting from economies of scale
	Extending production capacity
	Satisfying large demands in short times (big production lots)
	Responding quickly to changes in requested product volumes (order size)
	Responding quickly to changes in requested product types (portfolio size)
	Responding quickly to changes in requested product mixes
Customer Service	Monitoring effectively order processing state
	Processing orders quickly (fast delivery)
	Respecting regularly order delivery time (on-time delivery)
	Responding effectively to urgent requests or order/delivery time changes
	Supporting clients in decisional and projecting stages
	Selling products of conformed quality
	Selling products of superior quality, compared to market standards
	Assuring competitive prices, compared to competitors
	Supporting clients during the entire product life cycle
Relationship Capability	Creating and managing external collaborations (also with competitors)
	Creating and managing an excellent and reliable suppliers network
	Engaging and bargaining with customers
	Managing effectively and quickly information acquisition and communication
Market Development Capability	Developing and improving firm brand
	Delivering effectively products in overseas markets
	Managing effectively marketing and communication functions (in product advertisement and promoting)
	Controlling effectively product selling and delivery network
	Identifying new potential clients (sensing)
	Identifying new potential competitive products
	Obtaining strategic information about market trend, in order to consider possible developments and opportunities

	Monitoring developments and opportunities about overseas markets, through external relationships
Financial Capability	Enabling convenient funding agreements
	Maintaining constant contribution margins
Internal Integration	Integrating and coordinating all managing functions, for shared development of firm strategies
	Coordinating all internal logistics activities
	Integrating internally all firm functions
External Integration	Integrating with suppliers
	Integrating with customers
Project Management Capability	Perceiving and correctly assessing risks
	Planning all different production phases and respecting production timetable
	Reducing risk turning out probability or limiting their impact

Table 2.3 Capabilities related to the framework

It is noticeable that the majority of the capabilities have retained the name that the respective author has used in his paper, but, in some case, abilities from other researches have been added. The literature and relative researcher of each capability and ability can be found in APPENDIX A.

2.1.3 Practices

While in 1950s and 1960 the only strategy pursued by company was the cost reduction, which was usually achieved through the usage of mass production that was possible thanks to the slow production development cycle. Now the competition has completely changed along with the different challenges that companies have to face. This increasing complexity of the products led companies to involve their suppliers in the definition of the production process, thus transforming, what once were adversarial relationships, in collaborations (Monczka et al., 1998).

SCM has grown in importance and it has changed, from a passive cost control, to a proactive role in shaping the way companies can get competitive advantage over their competitors (Holcomb, 1994). In conjunction with the Global Supply Chain Forum, Lambert et al. (1998) defined SCM as follows: "Supply Chain Management is the integration of key business processes from end user through original suppliers that provides products, services, and information that add value for customers and other stakeholders". The correct utilization of SCM practices have become of paramount importance since they can be used to manage, in a more proper way, all the value-adding activities. Because of that, lots of studies have tried to identify which are the most important, with the related literature usually concerned with the identification of a proper measurement system or with validation of links between these practices and respective capabilities/performance.

Tan *et al.* (2002) identified a framework in which the practices were grouped in three different domains, total quality management, supply base management and customer relations practices.

Chen *et al.* (2004) studied the dyadic connection between supplier and buyer considering supplier base reduction, long-term relationship, communication, cross-functional teams and supplier involvement.

The decrease of more traditional sources of competitive success has raised the importance of human resource management practices, which became the focus of different studies (Lado & Wilson, 1994). Harel (1999) identified six HRM practices, recruitment, selection, compensation, employee participation, internal labor market and training, and tried to demonstrate how their correct utilization could lead to better market and organizational performance. Wright (2005) reviewed the literature about HRM practices and tried to assess their degree of impact on the performance of the firm.

Particular focus has been directed towards cross-functional teams, which should be used by organizations in order to remove boundaries within the firm and to gain stronger control on processes, improving supply chain effectiveness. Such teams helped in the creation of modern supply chains by providing greater integration both internally and externally, with suppliers and customers (Gunasekaran et al. 2004).

The increase in complexity of supply chain strategies led also to a necessity of identifying the correct internal production practices, that could replace the old mass production. Several studies focused on JIT, postponement, TQM, benchmarking and other manufacturing practices (Gordon, 2001, Bhatnagar, 2005, Hallgreen, 2009, Tan, 1999, Zhou, 2007).

It also became important, other than material flows, the correct management of the flow of information required to maintain the proper level of integration among the entities inside a supply chain, thus raising the interest and the research in those practices that could improve the coordination, such as information sharing and information technology (Prajogo, 2012, Zhou, 2007, Frohlich, 2001).

Among these previous studies, practices related to strategic behavior and network issues have been highlighted and distinguished. Since supply chains are usually made of independent and self-interested companies, they usually work on their own demand information, increasing the overall uncertainty. Strategic behavior between these actors can be used to foster their relations, share information and reduce the financial disparities.

Following the phenomenon of globalization, companies have now to consider a much wider and more complex set of decisions concerning supply chain network design, which involve both upstream and downstream sides. Furthermore, those decisions are extremely relevant, since they usually involve high amounts of money and they can impact the configuration of the company for a very long time such as, for example, the degree of globalization, the distribution logistic and others.

Project management (PM) practices have been then considered because of the environment in which this research is done, which is EPC manufacturing sector. Because of their particularity, these practices are usually studied in specific papers (Smith, 2002).

The logic behind the construction of the set of practices required for the framework is similar to the one formulated by Gunasekaran and Li. After a thorough literature review, the different configuration actions have been divided in 11 groups, and they are following listed in Table 2.4:

Practices	Configuration actions	
IT (Information Technology)	Inter-organizational coordination through electronic links	Bar coding/automatic identification systems
	Information Technology-enabled transaction processing	Scheduling and planning software (use and/or development)
	Direct computer-to-computer links with key suppliers	Production planning

	Electronic mailing (with key suppliers)	Electronic Data Interchange (EDI)
	Electronic Fund Transfer (EFT)	Enterprise Resource Planning Systems (ERP)
	Electronic transfer of purchase orders, invoices, etc.	Warehouse Management Software (WMS)
	Advanced planning and scheduling software	Monitoring order processing status, Manufacturing Execution Systems (MES)
	E-procurement systems	Constant delivery tracking, Radio Frequency Identification (RFID)
IS (Information Sharing)	Knowledge sharing about Core Business Processes	Information exchange for improving supplier/client performance
	Quality data availability	Formal Information Sharing agreements
	Frequent, informal, timely information exchange	Mutual feedback
	Giving information about events or changes that may affect the other part	Group coordination activities
	Frequent face-to-face planning/communication with suppliers/clients	Benchmarking
IS – Customer to Firm	Information exchange about planned orders or order changes	Expected performance specifications (from clients)
	Information exchange about inventory level	Production planning specifications (from clients)
	Product design specifications (from clients)	Information about market opportunities and demand forecasting (from clients)
IS – Firm to Customer	Information about available production capacity	Information about delivery schedule and/or possible changes in delivery schedule
	Information about order status and expected lead-time	
Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements	Expediting (visiting suppliers' plants)
	Helping suppliers to improve their product quality (Top Management Support)	Enhancement of each other's business (common growth)
	Involving suppliers in new product design	Quality control and guarantee programs
	Involving suppliers in new process design	Use of suppliers' technical support and test machines
	Mutual performance measurement (Collaborative Performance Systems)	Annual price negotiations for key items purchase
	Solid and durable relationships with key suppliers (considered as a part of the firm)	Use of hedging contracts in suppliers selection
Long-term Relationships with Customers	Close partnerships with customers	Collaboration in new product development
	Resources investment to keep a well-performing supply chain (Commitment)	Sharing marketing strategic decisions
	Sharing market interests, firm policies and business goals	Investments for evaluating customer's future needs
Human Resource Management Practices	Advanced methods for employee selection	Performance-related payments (Reward Alignment)
	Multi-skilled human resource selection	Participation in decisional stages (delegation of responsibilities, team work)

	Staff training	Internal Labor Market
	Job enrichment and job enlargement	Interdisciplinary workgroups
Project Management Practices	Risk and opportunities analyzing methods	Cost Breakdown Structure (CBS)
	Advanced methods for supplier selection	Work Breakdown Structure (WBS)
Production System Practices	Investments in R&D and Engineering functions	Bottleneck controlling
	International certifications (ISO 9001)	Use of manufacturing cells
	Plants and machines upgrade/replacement	Just In Time practices (JIT)
	External knowhow/technology acquisition	Total Quality Management practices (TQM)
	Product/process standardization (Postponement)	Agile manufacturing strategies
	Product modularization	Pull/push procurement systems
	Statistical process control	Use of top quality material
	Slack capacity	Predictive maintenance
	Setup time reduction	Preventive maintenance
	Cycle time reduction	Stocking area for urgent orders
Network	Sections-network development (for commercialization, contracting and assistance)	Close-to-customer (reference markets) locations
	Sections-network development (for production)	On-time delivery directly to customer's points of use
	Preference of local suppliers	On-time reception directly to firm's points of use
	Limited number of suppliers	
Strategic Behaviour	Sharing sensitive information (about finance, production, design, research, competing scenarios, etc.)	Communication of firm's strategies
	Joint Decision Making	Communication of client's strategies to suppliers
	Designation of a supply chain planning team	Emphasis on health and environmental safety issues
	Involving both marketing and manufacturing functions in supply chain planning process	Industrial group participation

Table 2.4 Practices and actions related to the framework

2.2 Contingent resource-based theory

Resource based theory (RBT) suggests that companies can create and maintain competitive advantages through the collection of rare, inimitable and non-substitutable *resources* (Barney, 1991). This definition refers to one of the previous trial to explain how companies could compete on market using an internal point of view.

But, before starting to dig in the development of the theory, it is important to identify accurately what is a resource. There are plenty of definitions, the same Barney (1991) gave his own, stating that a resource can be “. . . all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc., controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness”. This statement gives an idea of how a resource can be considered inside a firm, but it can also create some skepticism since, later, it will be shown that there is a strong difference between resource and capability, thus requiring a more different definition. Another explanation of the term resource is “something a firm possess or has access to, not what a firm is able to do”.

The RBT defined by Barney grew in popularity in different fields, included supply chain management, but it also created confusion and started to attract several critics, especially referred to its static nature and its inability to relate to external environment.

According to RBT, the resources of the company must be:

- Scarce (or rare): unequal access to the resource increases a heterogeneous distribution among competing firms;
- Imperfectly imitable: competitors should not be able to duplicate the asset perfectly. Knowledge-based resources are much more unlikely to be copied, since they are peculiar to the firm they reside;
- Imperfectly substitutable: competitors should not be able to replace the resource with an alternative.

Barney (1991) stated that the attributes listed above allow the firm to preserve the competitive advantage over time.



Figure 2.2 Resource based-theory model (Barney, 1991)

This solution was not considered enough to explain how the only possess of resources, even if rare, hardly replicable and imitable, could lead to maintain competitive advantage, especially in a dynamic environment such as a supply chain context. Furthermore, Priem and Butler (2001) suggested the redundancy of the attribute of rarity, since a resource, that is hardly imitable and substitutable, is rare by definition.

The direction for the solution to this critic is hinted in Dierickx and Cool work (1989), who argued that the capacity of a company of maintaining its competitiveness is given by its ability of reconfiguring its assets in function of market’s needs.

While value and rarity are all characteristics that link resources to competitive advantage, empirical results showed that what a firm does with its resources is at least as important as which resources are possessed (Hansen *et al.*, 2004). The concept of *capability* was then introduced as the capacity of a firm to deploy its resources using organizational processes, which are firm-specific, and developed over time through complex interactions among the firm’s resources (Amit and Schoemaker, 1993). While the resources are something that can be acquired by any company (ex: the patent of a microprocessor), the capability is firm-specific and it cannot be transferred easily (ex: the ability of designing a new generation of microprocessor) (Makadok,

2001). The RBT was then complemented with the *dynamic capability theory*, initially introduced by Teece (1997), that states how capabilities can contribute over the maintenance of competitive advantage over time (Hitt, 2016).

It is more appropriate to say that the competitive advantage is better described as shorter sequences of temporary advantages, that can be lost because of uncertain and changing environment or once competitors take possession of the same resources, thus requiring companies to identify which capabilities can protect the lead on the market. This solution also takes into account managers' ability of acquiring and recombining accurately the assets of a firm, meaning that the only possession of resources is not enough to survive on the market.

Sirmon *et al.* (2007) describe the resource management as the comprehensive process of structuring and managing the firm's resource portfolio. They define *bundling* as the procedure used to combine resources to create unique capabilities and they distinguish it from the *leveraging*, that involves a set of processes required to exploit the existing capabilities to create value for the firm and the customers. While each of these processes, and relative sub processes, is extremely valuable, empirical research shows that the creation of value is especially related to their synchronization (Sirmon, Gove & Hitt, 2008).

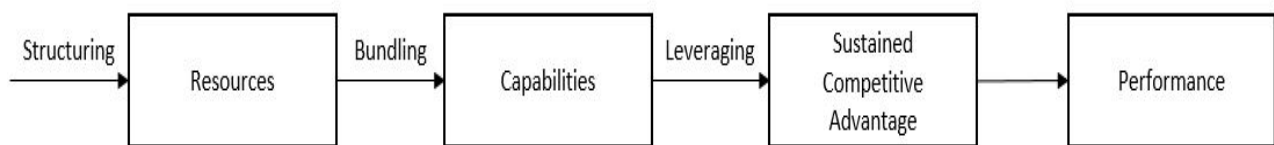


Figure 2.3 Integrated model of RBT and Dynamic Capability theory (Teece,1997, Sirmon *et al.*,2007)

Even introducing the capabilities, the RBT has been criticized because of its “context insensitivity”, meaning that it is unable to explain in which environment certain resources and capabilities perform at the best (Ling-ye, 2007).

Hence, the RBT has been coupled with the contingency theory, which argues that internal and external conditions will influence the management of an organization, thus affecting the success or failure or the deployment of certain resources or capabilities (Grotsch *et al.* 2013).

Researchers of RBT have started to investigate the variables related to the business environment under observation, in order to assess eventual connections between those, in the specific industry context. For example, Brush and Artz (1999), who coined the term *contingent resource-based theory*, explored the veterinary industry to verify the type of service requires the implementation of different sets of practices. Without this perspective, it would have been difficult to understand why there are practices that are more performant for some services and less for others.

The contingency theory highlights how companies have to adapt their strategy to the surrounding environmental conditions (Donaldson, 2001) and, coupled with RBT, it helps explaining why two firms with different configurations can compete on the same market, but also why two organizations, with similar investments over the same period of time, can obtain different long-term effects (Hitt, 2016).

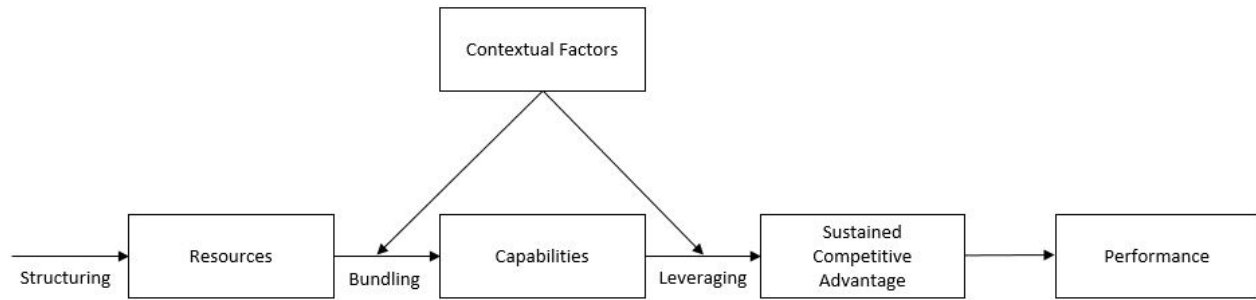


Figure 2.4 Contingent resource-based theory (Brush and Artz, 1999)

Flynn *et al.* (2010) state that there is no optimal way of designing a SC, because the environment, surrounding the organization, shapes its structures and processes. It becomes extremely important to exercise the contingency study, that involves the identification of three different variables (Sousa and Voss, 2008):

- Contextual (or contingency) variables: situational characteristics, also called “high inertia variables”, hardly controllable by managers;
- Response variables: actions undertaken by companies in response to anticipated contingencies;
- Performance variables: aspects of effectiveness or efficiency that are used to evaluate the state of fit.

They further identified different contextual factors from the literature, such as national context and culture, firm size, strategic context, and other organizational variables. The achievement of competitive advantage is not only related to the possession resources and capabilities, but it becomes extremely important their fit with contextual environment.

Through this theory managers’ skills become even more important, because they have to be able to identify whether a certain environmental issue can be a threat or an opportunity and they must implement a strategy to enhance possible benefits or to reduce the risks.

In this research, the suppliers under study belong to different industries and they are subjected to different contextual factors, thus the contingency theory is necessary because it can help explaining the difference or similarities in terms of supply chain configurations among those companies.

2.3 The link between framework and contingent RBT

The contingent resource-based view can be used as a theoretical lens to support the framework previously defined. While the majority of the literature utilizes the contingent RBT to confirm the existence of relationships between resources/capabilities and contextual factors, this study aims at describing by mean of case study methodology and through the cohesion of RBT and the framework, how suppliers, that are the best in their own sector, gather and combine resources to enable different performance.

Before starting the analysis, it is necessary to evaluate whether the framework matches entirely the theoretical construct of the contingent RBT.

A significant difference is given by the building blocks that are used for the development of the capabilities, since the RBT considers resources, while the framework utilizes practices, thus it is necessary to understand whether the two concepts are reconcilable.

The practices, in supply chain management, are defined as the set of activities that are undertaken by companies to effectively manage the supply chain, both the upstream and downstream sides (Li *et al.*, 2006),

while the resource usually includes assets, firm attributes, organizational processes and knowledge controlled by the firm that enable the implementation of strategies that improve its efficiency or effectiveness (Barney, 1991).

From the definitions, it is possible to identify the two main differences, that will be later addressed: the first one is the nature of these two elements, since the practice is an activity, while the resource is something that a company possesses; the second one is related to their context, because the resource, as defined by traditional RBT, is internal to the firm, it is an endogenous factor, while the practice is related to the overall supply chain, both the focal company and the suppliers/customers.

The practice, as defined in this framework, can also be seen as an effort or an investment of the company, in a certain field, that will generate a certain resource, that can be internal, if, for example, the investment is directed to improving the production system or information technology, and external, long-term relationships with customers or suppliers. This is the assumption that has been made in this paper, that considers the resource as the output of a practice, thus allowing the application of the resource-based theory.

The second problem has been already addressed in literature, since it has been considered one of the main flaws of the RBT. In the assumption that only endogenous resources drive competitive advantage, the RBT ignored the possible impact of network resources (Lavie, 2006). In their definition of resource, Barney (1991), Amit and Schoemaker (1993) and Wernerfelt (1984) remark the proprietary assumption, that is the core idea that the firm, since it is the proprietress of the resource, is able to protect it from imitation and substitution, thus shielding the competitive position achieved with it.

Following this hypothesis, firms should only be able to access to advantages through the contribution of internal resources and yet, the literature proves that the attainment of external resources can generate an improvement of financial performance. The fundamental assumption that requires the company to possess the resources is too strict and it leads to incorrect results. A weaker condition of resource accessibility, which establishes the right to utilize and employ resources or enjoy their associated benefits, is enough (Lavie, 2006).

The *extended resource-based view* proposes a model in which inter-firm relationships can provide strategic resources that are kept beyond the boundaries on the single company, which can contribute in increasing its competitive advantage (Lewis *et al.*, 2010). The literature related to this theory investigated different degrees of synergy between supply actors with references to the evolution of relationships between buyer-seller, strategic returns from collaboration and economic value of market power (Croom *et al.*, 2000).

Lavie (2006) reviews and extends Barney's (1991) RBT framework, including those resources and capabilities that can be acquired thanks to external collaborations, that are called network resources. Once the conditions of scarcity, imperfect imitability and substitutability have been reassessed, Lavie concludes that often the competitive advantage of a firm is more influenced by external resources rather than internal ones.

When an alliance between two companies occurs, it is possible to get two different results, depending on how the companies decide to share their own subset of resources with the other firm: in the first case, the two companies pool the resources, or part of them, in order to access a more successful competitive position; in the other case, there is a complementary alliance, in which firms decide to create a synergy employing two not overlapping sets of resources.

Assuming the application, in this paper, of the RBT to the framework previously identified, the integration of external resources allows a much more complete description of the suppliers' supply chain configuration, especially in the EPC industry, where suppliers and EPC companies, because of the nature of Large Engineering Projects, have usually very tight relationships. The absence of network resources would lead to erroneous conclusions.

2.4 ETO sector

EPC companies can be considered as a subset of companies that operate in the ETO sector, where ETO refers to a manufacturing mode used by firms to create certain types of products. ETO stands for Engineer-to-Order and companies that operate in this environment are usually characterized by a “decoupling point” is located at the design stage, meaning that the customer can affect the design of the product.

These products are usually characterized by low volume production, strong customization and high degree of interaction between customer and supplier. Given the high complexity and dynamism of this sector, the literature about it is starting to increase, leading researchers to try to identify how different supply chain strategies can be applied in this environment, for example, Azadegan et al. (2013) found out that application of lean practices can significantly influence the performance of this sector.

Hicks et al. (2000) studied the business approach of several ETO companies, identifying four trends, outsourcing of non-competitive operations, focusing on operations, reduction of suppliers' base and establishment of long-term collaborative relationships with suppliers.

A strong source of complexity in ETO is also given by continuous product development processes, that requires a complex mix of activities of activities, relationships, organizations, knowledge and skills that come altogether during project realization (Rahman et al. 2003, Gosling, 2015).

In this paper, since the suppliers under consideration can all be considered as ETO companies, this is going to be considered as a contextual factor and used to provide a different view of the result. The consideration of the ETO will help the understanding of the differences among the three other sectors and it will be used as a control variable, to see if the resource-based theory, that has been coupled with the theoretical framework, is sufficient to describe the behavior of these firms, by assessing the differences between the configuration of the firm under their sector and under ETO.

3. Research Objectives and Methodology

3.1 Data collection

In order to collect the data required, interviews have been taken with both EPC contractors and Best Performer suppliers, under the supervision and help of ANIMA-ANIMP-ANIE. At the beginning, the interviews with EPC contractors were held, since it was necessary to contextualize the research, identifying the main characteristics and the classification of the products (that have been previously listed), understanding which were the most important countries for the Oil&Gas markets and possible future rising markets.

Then, after these contextualization questions, the main contractors were asked to identify the excellent suppliers for each sector, assessing also which were the most important performance that were asked to them and that they were able to show. The list of Best Performers was later compared to the one identified by ANIMA-ANIMP-ANIE, reaching to a convergence on 33 special valves, 43 static equipment and 10 switchgears suppliers.

While the first step included the interviews with EPC contractors, in the second steps the excellent suppliers were contacted, asking them if they were available to be interviewed about their supply chain configuration and their contextual environment, with the interviews being based on the previously described framework.

At the end, the sample was composed by 18 special valves, 12 static equipment and 9 switchgears suppliers.

After the interviews to Best Performers, the acquired data have been analyzed using in two different ways, single case and multi-case studies, describing the companies in a detailed way and, later, identifying which were the most selected performance, capabilities and practices.

Knowing the most important performance of each sector allowed the verification of the alignment between Best Performers and EPC companies, using the performance items that clients sought in their suppliers.

The following step relied on the identification of the average supply chain configuration for each sector, using the data previously collected, that were then used for the identification of the companies, called outliers, that had the most diverse configurations respect to competitors in the same sector. This analysis was performed to assess the applicability to the research of the resource-based theory.

The last step concerned the union of the three samples of companies under the contextual factor of the ETO sector, leading to a study similar to the previous one, in which the outliers in this sector were identified, and compared to the ones identified before.

3.1.1 Interviews to EPC Contractors

The beginning of this study was related to the initial interviews with the most important Italian Main Contractors in Oil&Gas market. These interviews, whose questions can be seen in ANNEX B, were extremely important, because they allowed to contextualize the research, providing the following data:

- The most critical technical characteristics required by the key-items under investigation. After that, it was possible, uniting the different data, obtain a common classification of the products for each sector, that was the base for the interview to the suppliers;
- A general definition of the most strategic markets, intended as geo-political areas, for the Oil&Gas, identifying also possible worldwide trends for future markets of interest, relating this situation to the position of the Italian suppliers;
- Defining possible differences in terms of assets or performance between Italian and foreign suppliers;
- Identifying lacks and areas of future improvements for Italian suppliers;
- Assessing the most important performance/capability/asset required to each supplier and, in case it was possible, clarifying possible differences related to different product/market combinations;
- A list of best performers for each sector, with an evaluation of their performance.

3.1.2 Interviews to Best Performers

The interviews with Main Contractor were also important because they allowed to identify interesting fields of research that could be exploited while talking to Best Performers. Being the foundational base of this research, these interviews were more in-depth than the ones with Contractors: producers have been interviewed face-to-face or through phone calls, considering between one hour and one hour and a half for each interview.

While, during the interview, the definition of the company supply chain configuration, done using the framework as foundation, was the most important part, these suppliers were also interviewed on other aspects related to their company, that has been used, later, to contextualize their decisions.

In fact, since the framework is coupled with contingent resource-based theory, it has been necessary to provide vital statistics, such as turnover, membership to a group, characteristics of those groups. Furthermore, in order to provide a full context of the company, it was asked in which market it does sell and which products, if there are any differences, and possible future markets of interest.

Even if in the literature of fifteen to twenty years ago, the membership to a group was not considered as a major factor of influence, now, especially in ETO and EPC sector, it has become extremely important, especially for large dimension orders, that require a financial capability that often is not achievable by companies operating independently. Thus, companies being part of a group, other than its features, was asked which strategy lied behind the acquisition/union, major advantages and disadvantages.

Other questions about company strategies are usually asked to further contextualize its business environment, especially strategies that could impact its work in the Oil&Gas market, describing whether production process stages were internal performed or outsourced and defining their relationships with eventual suppliers

Since the interaction with customers, being those EPC Contractors or end users, one of the major element of this sector, suppliers were asked to describe their relationships with them, highlighting difficulties and strategies for improvement.

At the end, respondents were asked to structure their supply chain, using the theoretical framework, identifying, if possible, the 3 most important performance, 3 capabilities used for enabling each performance and 3 practices for each capability, specifying also the actions associated.

Further details about the questionnaire used during the interviews can be found in ANNEX C.

3.2 Data Analysis

Once the data were collected, the phase of analysis started. It is possible to define three different phases: single case, multi-case approach and outliers' identification and comparison.

The first two methods were selected because they are indicated in the literature as fitting for the analysis of complex environment, rich in information as the one under investigation.

The single case analysis is required to provide the description of the supply chain configuration and the business environment in which the company operates, considering also contextual factors.

The multi-case study enables to perform the comparison among the different sectors and to identify the most important elements present in those configurations. The outputs of these data have also been used for the last analysis.

Finally, the research concludes with the analysis of the outliers and comparison of companies with both their sector and ETO. The identification and comparison of the outliers have been selected because it is extremely interesting to identify which are the companies that, in term of supply chain configuration, behave in the most different manner respect to their sector and to try to explain the reasons.

Furthermore, the introduction of the ETO sector can be useful to add information to the previous analysis, but also to understand if the resource-based theory, that act as the theoretical support of the framework, is able to describe in its entirety the competitive advantage that these suppliers are able to achieve.

Single case and multi-case approaches will be described below, while the identification and comparison of the outliers will be described and undertaken in chapter 5, along with the ETO analysis.

3.2.1 Single Case analysis

Case studies are suitable for exploratory, descriptive and explanatory research because they answer the "how" and the "why" questions, and are useful for the analysis of contemporary events over which the investigator has little or no control (Yin, 1994). Moreover, they are suggested also when the focus is on contemporary phenomenon within some real-life context (Yin, 1994).

For every case study, it is necessary to assemble data extracting the most relevant information from the questionnaire but keeping the richness of the information gathered. A part of them is necessary to contextualize the firms, and understand:

- Their main geo-political reference scenarios;
- The most relevant (core) products they supply;

- Peculiarities about supply chains and internal configurations.

Through a research-framework-based analysis, it is possible to understand which capabilities are perceived as relevant by the focal firm, and what influential actions, through their implementation, may enable relevant capabilities and, consequently, an improvement of different performance items.

The single-case analysis aims not just to well-structure the data collected and present them but also focus the peculiar characteristics of each company and justify the choice made by the company to compete in the interesting product-market scenario.

3.2.2 Multi-Case analysis

After single cases analysis and description, it is interesting to analyze analogies and differences between different supply chains and configurations, sourcing for pattern and company characteristics that create clusters and relevant supply chain model. These analyses have been made within each sector. The recurrence of certain capabilities and enabling configurations practices, needed to be competitive in different geographical areas or for different products are investigated in order to justify the models.

It is to remember that the reliability of the cases is assured by the fact that all the firms are indicated as best performer both by main contractors and main suppliers' association (ANIMP – ANIMA - ANIE).

Moreover, the performance indicated by the suppliers are checked with the ones indicated by the suppliers' clients, i.e. main contractors.

The analysis is based on the three main blocks defined in the research framework, starting from the necessary performance levels (for each performance item) to be competitive, till the indication of actions to implement for achieving such performance level, passing through relevant and key capabilities.

During the multi-case study, links between blocks are analyzed and packages of the most implemented practices are generated.

3.2.3 Outliers' analysis

This analysis points at identifying, through a coefficient that is going to be called *similarity index* and that will be better described in Chapter 6, which are the *outliers* of each sector, where the outlier is a company whose supply chain configuration significantly differs from the average behavior of the its sector.

The concept of ETO sector is going to be introduced as a contextual factor, that can gather the whole sample, or part of it, of companies belonging to three sectors related to the EPC. Outliers will also be calculated respect to the average behavior of ETO, and they will be compared to the outliers of each sector.

This analysis can be useful to understand if the resource-based view is able also to clarify how companies that are significantly different respect to others, succeed in preserving their competitive position on the market. This study is required to verify the range of applicability of the RBT inside each sector, using also information coming from ETO outliers.

3.2.4 Analysis of sectors and ETO

After having introduced the ETO and once the RBT has been tested into each sector, the scope of the analysis becomes to assess if it is possible to use the framework, supported by the RBT, to describe these suppliers under the contextual factors of ETO. This study will help understanding if the resource-based theory is able, not only to study companies inside their dominion, but also as a part of a more complex sector and, in case it is not able, which are, if they exist, possible theories that can be used to compensate to RBT lacks.

3.3 Research questions

It is possible to classify the results of this research under four research questions:

R.Q.1 Which are the most important performance, capabilities and practices for each sector?

R.Q.2 Which are the suggested configurations for each principal performance of the three sectors?

R.Q.3 Can the resource-based theory, as presented in the literature review, describe appropriately how the companies, in their respective sectors, are able to achieve competitive advantage?

R.Q.4 Is the resource-based theory, as presented in the literature review, able to relate, through the framework, the three sectors under study with the ETO?

4. Best Performers description

In this section, the Best Performers are described and all their data are listed, along with their supply chain configurations.

In order to respect the confidentiality agreements defined with them, each company is defined using an abbreviation that refers to its sector (SVS for special valves suppliers, SES for static equipment suppliers and SWS for switchgears suppliers) and a numerical value, since the real name cannot be used.

Finally, to describe the trend of every actual market/product scenarios where the generic firm works, the symbols illustrated in Table 4.1 are used.

Trend's symbols	Meaning
	Increase
	Slight increase
	Stable
	Slight decrease
	Decrease

Table 4.1 Product/market scenario's trend

4.1 Companies overview – SVS

Valves best performers belong to different contexts. Indeed, their turnover values vary between less than 30 and over 400 million € and their number of employees from less than 100 to over 1,000 (Table 4.2). In addition, some companies are part of an international group, which could offer financial and technical boost

for their growth. For this reason, it is very important to introduce general, basic data of every company, to understand the composition of the research sample.

Interviewed companies globally have a total turnover of more than 2000 Million of Euro and mainly produce special valves for the Oil&Gas sector. Indeed, they globally achieve a turnover between 1000 and 1300 Million of Euro supplying special valves for the Oil&Gas sector. In order to provide a global overview of the sector, it is important to know that the Italian industry is composed of about 150 companies, leaders in the production of special valves that achieve a global turnover of 3000 million of 38 Euro supplying special valves for the Oil&Gas sector. Finally, considering the list of excellent companies provided by main contractors, we can reasonably say that interviewed Best Performers of the sample produce the 35% of special valves for the Oil&Gas sector.

Errore. L'origine riferimento non è stata trovata.	Turnover [Mln €]	% of turnover related to Oil&Gas	Production plants	Production plants in Italy	Number of employees	Belonging to a group
1	>200	>75%	>10	6-10	>1000	NO
2	>200	>75%	6-10	2-5	100-1000	YES
3	20-50	>75%	1	1	<100	YES
4	20-50	<25%	1	1	<100	YES
5	50-200	25%-50%	2-5	2-5	100-1000	NO
6	50-200	>75%	1	1	100-1000	YES
7	50-200	50%-75%	2-5	2-5	100-1000	YES
8	50-200	>75%	2-5	2-5	100-1000	NO
9	50-200	50%-75%	2-5	2-5	100-1000	NO
10	20-50	50%-75%	2-5	1	<100	YES
11	20-50	50%-75%	2-5	1	<100	NO
12	50-200	25%-50%	2-5	2-5	100-1000	NO
13	20-50	50%-75%	2-5	1	100-1000	NO
14	>200	>75%	2-5	1	100-1000	YES
15	20-50	50%-75%	2-5	1	100-1000	YES
16	50-200	>75%	1	1	100-1000	YES
17	50-200	<25%	1	1	100-1000	YES
18	50-200	>75%	1	1	100-1000	YES

Table 4.2 Best Performers data – SVS

Company	Group turnover in million € [2014]	Group profit in million € [2014]	Group employees
2	>10000	<1000	>20000
3	>25000	>1000	>100000
4	<200	>20	<1000
5	<2000	<1000	<10000
6	>2000	<1000	>10000
7	-	-	-
10	<1000	-	<10000
14	-	-	-
15	-	-	<1000

16	>2000	-	>10000
17	>2000	-	>10000
18	<1000	-	<10000

Table 4.3 Best Performers' groups data – SVS

4.1.1. Single cases - SVS

4.1.1.1 SVS – 1

Turnover [Mln €]	> 200
% of Special valves-Related turnover from the O&G sector	> 75%
Group Belonging	No
Supplied valves	Ball Plug Gate Globe Butterfly Check
Main Business	Wide portfolio

Table SVS1.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America/Ball, Gate	Not saturated	
Middle East/Ball, Gate	Not saturated	
Central Asia/Gate	Not saturated	

Table SVS1.2 – Market/product scenario

Market	Motivations	Actions to undertake
Africa	Poorly explored, New energy sources	Local content
Southern America	Poorly explored, New energy sources	Local content, quick market approach

Table SVS1.3 – Prospective markets

Special (engineered) valves represent almost 95% of the company's total product portfolio. Power and Oil&Gas sectors generate 90% of the turnover: 70% comes from offshore and onshore Oil&Gas projects, 20% is from Power productions. Navy, military (in England) and water applications cover the remaining 10%. Respect to others, Northern American market is based on a different concept, because American clients usually request standardized products: reasonably, such valves can be considered as “bulk” objects (mainly used for standard gas transmission applications). American valve distributors usually buy products in large volumes and keep them in stock for clients.

Many producers are seeking for a way to successfully enter African and Southern American markets. (Table SVS1.3). At present, the firm does not feel very competitive on them since they represent almost new areas of interest for every producer. Nigeria, Congo, Angola and Algeria are expected to start many projects and create many business opportunities in the next years. Projects to develop in these areas will request especially offshore products, but also onshore applications will surely be relevant (e.g. for refineries). In Southern America, Brazil can be identified as a potential, strategic area, in spite of political restrictions and greater competition: for these reasons, investing and gaining competitive advantage as soon as possible is very important.

One of restrictions all mentioned countries of interest present, including other countries of the Caspian area (e.g. Kazakhstan) is local content legislation: acquisitions, joint ventures or local plants are all valid strategic

solutions. However, engineered valves production needs technologically advanced processes and plants, as well as trained and specialized employees: local labor and infrastructures would not be sufficient to afford special products manufacturing, but they would be qualified only for standard valve production.

Procurement	IN	OUT	-
Forging	IN	OUT	4-5 forged components suppliers
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Labeling	IN	OUT	-

Table SVS1.4 – Production stages

The firm can rely on high quality, specialized suppliers for materials and components: the company selected 4-5 reliable Italian forgers and some mechanical manufacturers, for welding operations etc. This enables major flexibility, since the firm can always be confident on the availability of suppliers' material. Moreover, the company does not face the particular restrictions it would have in case it produced components internally, with consequent capacity and production planning issues: collaborations with reliable, external suppliers let the firm organize and modify production plans in an agile way, always satisfying the demand in a short time.

In addition, a great emphasis on flexibility is given by many other firm strategic aspects, like portfolio completeness and customizability.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Production System Practices	Product/process standardization (Postponement)
		Network	Limited number of suppliers
	Capacity and Flexibility	Network	Multiple, nearby divisions/plants
			Preference of local suppliers
		Production System Practices	Slack capacity
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Differentiation	Customer Service	IS (Information Sharing)	Information Sharing
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
	Product/Process Development Capability	Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
			Collaboration in new product development
		Production System Practices	Plants and machines upgrade/replacement
	Financial Capability	Financial Practices	Strong relationships with banks and financiers
		Network	Maintaining large dimensions
			Acquisitions
Performance 3	Enabling capabilities	Implemented practices	Implemented actions

Flexibility	Capacity and Flexibility	Network	Multiple, nearby divisions/plants
			Preference of local suppliers
		Production System Practices	Slack capacity
	Customer Service	IS (Information Sharing)	Information Sharing
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Production System Practices	Product/process standardization (Postponement)
		Network	Limited number of suppliers

Table SVS1.5 – Supply chain configuration

The firm prefers purchasing from limited, local suppliers, since Italy is still the best place to make products with high technology content. This is due to the presence of strong infrastructures: Italian foundries, forgers, mechanical manufacturers and raw/special material suppliers can reach outstanding quality and reliability levels, enabling purchasing companies to establish profitable collaborations, without the need of vertical integration.

Firm flexibility enables many peculiarities, from the ability to provide design documents in a short time (less than a week) to the capacity of satisfying urgent requests exploiting an extra 15% capacity, useful in case of maximum demand. Indeed, normally 80-85% of central plant total capacity is used, without including extra capacity other near divisions can dedicate to specific operations or products.

Even if the client does not totally perceive firm's flexibility, the company builds it on every part of the process; for example, the firm is able to move the production of determined valves on different plants, to take advantage from unused capacity and shorten lead-time. This is possible thanks to local multi-skilled divisions, able to face the total products portfolio.

Commercial interaction with clients is regular during the order processing. There is usually a lack of communication after product delivery and installation. Indeed, feedbacks are sent only after sales assistance needs. EPC clients does not share information about its vendor rating criteria, but the firm attempt to perceive them from previous collaborations. Finally, the firm considers fundamental the entry in the end users' vendor list.

4.1.1.2 SVS – 2

Turnover [Mln €]		> 200
% of Special valves-Related turnover from the O&G sector		> 75%
Group Belonging		Yes
Supplied valves	Ball Plug Gate Globe Butterfly Check	
Main Business		"Special" ball valves

Table SVS2.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Europe / Gate	Almost stable, in spite of current oil price decrease	≡
Africa / Gate	Almost stable, in spite of current oil price decrease	≡
South-Eastern Asia / Ball	Almost stable, in spite of current oil price decrease	≡
Western-Central Africa / Ball	Almost stable, in spite of current oil price decrease	≡
Northern Africa / Ball	Almost stable, in spite of current oil price decrease	≡

Table SVS2.2 – Market/product scenario

Market	Motivations	Actions to undertake
Eastern Africa	New energy sources, New market for subsea offshore	/

Table SVS2.3 – Prospective markets

The firm is a division of an international group, whose headquarter is located in the USA: it counts 3-4 major divisions in the world, as well as important joint ventures with other companies, working also in the Oil&Gas sector. Recognized experience and references are very important for every company along with visibility and affirmation; however, sometimes they are not enough. The firm can guarantee product proper working for 12, 24 or 36 months, but many clients request specific tests to be sure of valve duration and reliability. Specific qualifying tests are typical of subsea valves and they request great investments in R&D function to be projected and made, as they have to simulate, in a short time, underwater working conditions.

Valves are tested through the simulation of thermic cycles (at high, low and ambient temperature) and critical pressures (pressure conditions at up to 4000 meters of depth), and through endurance tests (simulating up to 1200 cycles). For new project or highly customized valves, such tests are always necessary and strictly requested by clients. Nowadays, customers are usually inclined to strictly control almost all the production cycle (forging, heat treatments, mechanical manufacturing, etc.) and are willing to pay extras for top materials and qualifications, in order to assure safety and to prevent any sort of accident after product installation. They request all necessary certifications and participate in person to product tests.

Firm reference markets are currently subjected to oil price decrease and, consequently, to a lack of investments and new projects by EPC contractors and oil companies: however, the oil market has not undergone critical losses and it is expected to bounce back in a relative short time.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	4-5 forged components suppliers
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Labeling	IN	OUT	-

Table SVS2.4 – Production stages

Being part of a corporation allows the company to continuously participate to a constant, strong investment program and rationalization of the presence on the market. A widely affirmed group normally aims to reach worldwide excellence, relating to the most relevant products of its portfolio, and to avoid every unfeasibility (both in terms of projects and on-time delivery).

A strong group brand is usually the first guarantee for the client and a proof of reliability. On the other hand, a group usually has to submit to more severe bureaucracy procedures, including strict controls on project contracts and policies (formal behavior with clients, investment programs, etc.).

All product manufacturing, assembly and labeling phases take place internally for all products in the firm portfolio, starting from forged, basic components and auxiliary material purchase (nuts and bolts, gaskets, etc...).

To afford and rationalize the production in periods with numerous requests, the firm owns several minor plants (production workshops) for simple, standard products: they assure slack capacity and good flexibility in case, for example, of sudden order modifications.

For all selected market-product scenarios (Northern Sea, Western Africa, Brazil, Pacific Asia, and Mediterranean Sea), the fundamental performance their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Product/Process Development Capability	Production System Practices	Investment in R&D and Engineering functions
			Plants and machines upgrade/replacement
			External slack capacity
	Customer Service	IS (Information Sharing)	Information Sharing
		IT (Information Technology)	Constant delivery tracking
		IS – Customer to Firm	Expected performance specification (from clients)
	Project Management Capability	Project Management Practices	Risks and opportunities identifications and analysis methods
		Strategic Behavior	Emphasis on health and environmental safety issues
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Project Management Capability	Project Management Practices	Risks and opportunities identification and analysis methods
		Strategic Behavior	Emphasis on health and environmental safety issues
	Customer Service	IS (Information Sharing)	Information Sharing
		IT (Information Technology)	Constant delivery tracking
		IS – Customer to Firm	Expected performance specifications (from clients)
	Supply Chain Management Inbound	IS (Information Sharing)	Quality Supplier statistical data availability
		Long-term Relationships with Suppliers	Cooperation in order checking status
			Mutual performance measurement (Collaborative Performance Systems)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
			External slack capacity
	Market Development Capability	IS – Customers to Firm	Information about market opportunities and demand forecasting (from clients)

	Knowledge Management Capability	Strategic Behavior	Sharing sensitive information (clients' market strategies)
		Human Resource Management Practices	Multi-skilled human resource selection
			Staff training

Table SVS2.5 – Supply chain configuration

One of company's adopted rules about relationships with customers is "Engage to excel": surveys are regularly provided for clients, which are requested to explain, with openness, in what the firm is currently performing well and what it is not doing well, as well as the reasons of such assessments. The company knows making an offer to EPC contractors implies several costs, so it has to be sure it provides conform products and service, according to clients' vendor rating criteria. Surveys are also useful for the firm to know updated judgment criteria used by contractors. The most important ones are usually quality, delivery performance (on-time), possibility of constant delivery tracking and, sometimes, also competitive prices.

4.1.1.3 SVS – 3

Turnover [Mln €]	20-50
% of Special valves-Related turnover from the O&G sector	> 75%
Group Belonging	Yes
Supplied valves	Ball Plug Gate Globe Butterfly Check
Main Business	"Special" ball valves

Table SVS3.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Middle East / Ball	Gas market has a positive trend	☰
Far East / Ball	Gas market has a positive trend	☰
Southern America / Ball	Gas market has a positive trend	☰

Table SVS3.2 – Market/product scenario

Market	Motivations	Actions to undertake
Russia	Poorly explored, New energy sources	Local content
Southern America	Poorly explored, New energy sources	Local content, local companies endorsement, reinforcing local organizations

Table SVS3.3 – Prospective markets

The firm completely focuses on special valves in Oil&Gas sector and it belongs to a big, worldwide-working group. The company supplies a great number of countries all over the world, thanks to its acquisition by an international group: this guarantees a solid base to maintain the market share and a competitive position, even in spite of sudden geo-political mutations.

In addition to ball valves, also required in its three most significant markets, the firm produces a quote of butterfly valves.

Belonging to a group enabled the company to be near the customer and to intervene, in case of necessity, in less time. It also provides financial stability and capability, an important factor from the clients' point of view, because of the actual worldwide economic instability.

Southern America has been mentioned as the most relevant market for the future: the company is already working there with significant results, and it is trying to configure in a proper way to gain advantage from this area, which offers great possibilities for the future. Markets purely focused on Oil&Gas are expected to suffer a demand reduction due to oil price decrease; on the other hand, power and gas markets are probably rising in the next few years.

The firm can rely on high quality, specialized suppliers for materials and components: the company has selected 8-10 suppliers for forged and cast components and some mechanical manufacturers for welding operations and painting. This enables higher flexibility, since the firm can always be confident about suppliers' material availability.

For a smaller quote, around 10% of the overall, mechanical manufacturing is made internally by the company. Moreover, the company does not suffer the particular restrictions it would have to face if it had to produce components internally, with consequent capacity and production planning issues: collaborations with reliable, external suppliers enable the firm to organize and modify production plans in an agile way, always satisfying the demand in a short time.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	10-8 forged and cast components suppliers
Casting	IN	OUT	
Mechanical Manufacturing	IN	OUT	20-25 semi-finished components suppliers
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS3.4 – Production stages

All different product supplies share a unique supply chain configuration: this means there are not relevant differences between distinct scenarios.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Expediting (visiting suppliers' plants)
			Quality control and guarantee programs
		Production System Practices	Just In Time practices (JIT)

		IT (Information Technology)	Bar coding/automatic identification systems
		IS – Firm to Customer	Information about order status and expected lead-time
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
		Long-term Relationships with Customers	Close partnerships with customers
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
	Relationship Capability	Long-term Relationships with Customers	Collaboration in new product development
		Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Expediting (visiting suppliers’ plants)
			Quality control and guarantee programs
		Production System Practices	Just In Time practices (JIT)
		IT (Information Technology)	Bar coding/automatic identification systems
		IS – Firm to Customers	Information about order status and expected lead-time
	Supply Chain Management Outbound	Long-term Relationships with Customers	Quality control and guarantee programs
		IT (Information Technology)	Scheduling and planning software
			Monitoring order processing status, Manufacturing Execution Systems (MES)
			Customer Service
		IS – Customers to Firm	Information exchange about planned orders or order changes
	Expected performance specifications (from clients)		
	Performance 3	Enabling capabilities	Implemented practices
On-Time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Expediting (visiting suppliers’ plants)
			Quality control and guarantee programs
		Production System Practices	Just In Time practices (JIT)
		IT (Information Technology)	Bar coding/automatic identification systems
		IS – Firm to Customers	Information about order status and expected lead-time

	Capacity and Flexibility	Production System Practices	Cycle time reduction
			Agile manufacturing strategies
	Customer Service	IT (Information Technology)	Warehouse Management Software (WMS)
		IS – Firm to Customer	Information about delivery schedule and/or possible changes in delivery schedule
		IS – Customer to Firm	Information exchange about planned orders or order changes
			Expected performance specifications (from clients)

Table SVS3.5 – Supply chain configuration

It is possible to notice that Supply Chain Management is quite important for the company: the upstream SC is needed to achieve all the three main performances chosen, while the downstream one is required to guarantee quality.

Talking about the soft skill area, relationship capability is important to negotiate good Price with clients while customer service is relevant to provide Quality and On-Time Delivery; Product/Process Development Capability can be built on relationship with both clients and customers and investments in R&D.

The R&D function is always active for continuous improvements that ensure the respect of quality, environmental and reliability standards; however, it is also dedicated to product innovation and customization, depending on clients' requests.

Finally, in order to obtain Capacity and Flexibility, it is important to improve the production system and adopt new manufacturing techniques.

The main vendor rating criteria EPC contractors usually perceive as the most important to assess are:

- respect of product technical specifications;
- respect of delivery dates (on-time);
- possibility of accepting order modifications or changes during order processing (flexibility);

Entering in end users' vendor lists is necessary, since products cannot be supplied without their approval.

4.1.1.4 SVS – 4

Turnover [Mln €]	20-50
% of Special valves-Related turnover from the O&G sector	< 25%
Group Belonging	Yes
Supplied valves	Ball Plug Gate Globe Butterfly Check
Main Business	Ball valves

Table SVS4.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Italy / Ball, Check	Almost saturated	
Europe / Ball, Check	Almost saturated	
Northern America / Ball, Check	Not saturated, in spite of oil price	

Table SVS4.2 – Market/product scenario

Market	Motivations	Actions to undertake
Russia	Strong presence and good relationship due to previous standard valve supplies	Need of overtaking entry barriers: search for reliable local partners

Table SVS4.3 – Prospective markets

The firm currently owns a small-sized plant for standard and special valve manufacturing; nevertheless, since it entered the Oil&Gas market, it is continuously strengthening its competitive position: this is leading to continuous demand increases and better economic returns (especially in 2015, thanks to last received orders).

The company mainly produces ball, forged valves for job orders (1-2 valves per order) and it has to guarantee superior quality and certifications, because of stricter bureaucracy procedures, rather than real, higher product quality to assure (quality is equally achieved for both standard and engineered valves, for every sector).

For what concerns the main advantages the firm perceives for being part of a group, it is possible to identify cost synergies and the possibility to access shared resources (such as information infrastructures, systems and key functions).

At present, the firm is economically solid and do not need financial support; however, being part of a group can also assure a more financially stable position.

Small and medium groups, such as the group the firm is part of, usually do not have to face particular disadvantages; instead, this may not be true for big groups. Groups with different firms, each of them dedicated to different valve parts manufacturing (e.g. groups owning ball valves production plants and actuators production plants), usually have to afford a great competitive environment due to the presence of a large number of smaller, independent firms, only specialized in valve (or actuator) production.

For the Oil&Gas market, the firm now produces special ball valves and check valves (still ball valves): the second ones have more technological content than the first ones and, consequently, they are more remunerative and requested with lower frequency.

The company aims to enter the Russian market also with special valves supply; it would be easier and faster than in other markets, because the firm, during the years, has already received many orders for standard valves in Russia and it is keeping in touch with several Russian clients.

The company is now skeptical about trying to enter the African market, although many companies are declaring that it would give many business opportunities in the Oil&Gas sector, starting from the next years.

The firm purchases from a restricted number of suppliers: this is because it constantly aims to defend work ethic, without creating competitive scenarios and tensions, between numerous suppliers, to obtain the best offers in terms of price. Selected suppliers are in a limited number because they assure the perfect mix between all requested performance issues and, therefore, total reliability in terms of quality, price and delivery lead-time. Good delivery performance, after certified product quality, is fundamental for a production plant in which all components have to be available at the right time, and in the correct quantity, for assembly operations.

Having good knowledge of all supply levels is difficult: sometimes, the focal firm could not have visibility of intermediate suppliers. Anyway, a strict, regular control of last-tier suppliers for raw materials (steel and cast iron) is always fundamental.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	-
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	Up to certain valve sizes
Assembly	IN	OUT	Up to certain valve sizes
Testing	IN	OUT	Up to certain valve sizes
Labeling	IN	OUT	-

Table SVS4.4 – Production stages

For all selected market scenarios (Italy, Europe and Northern America) and ball valves, the fundamental performance issues to maintain in high level and their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Information Sharing
		Network	Limited number of suppliers
	Supply Chain Management Outbound	IS – Firm to Customer	Information Sharing (firm to customer)
		Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
			Expediting (visiting suppliers' plants)
	Customer Service	IS – Firm to Customer	Information Sharing (firm to customer)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Information Sharing
		Network	Limited number of suppliers
	Customer Service	IS – Firm to Customers	Information Sharing (firm to customer)
		Long-term Relationships with Customers	Information about order status and expected lead-time
			Information exchange about planned orders or order changes
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Information Sharing
		Network	Limited number of suppliers

	Market Development Capability	Long-term Relationships with Customers	Close partnerships with customers
		Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
	Product/Process Development Capability	Production System Practices	Plants and machines upgrade/replacement
			Product/process standardization (Postponement)
		Network	Limited number of suppliers

Table SVS4.5 – Supply chain configuration – Ball valves

For all selected market scenarios (Italy, Europe and Northern America) and check (ball) valve product category, the fundamental performance issues to maintain in high level and their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Information Sharing
		Network	Limited number of suppliers
	Supply Chain Management Outbound	IS – Firm to Customer	Information Sharing (firm to customer)
		Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
			Expediting (visiting suppliers' plants)
	Customer Service	IS – Firm to Customer	Information Sharing (firm to customer)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
		Production System Practices	External knowhow/technology acquisitions
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Information Sharing
	Customer Service	IS – Firm to Customer	Information Sharing (firm to customer)
			Information about order status and expected lead-time
		IS – Customer to Firm	Information Exchange about planes orders or order changes
			Close partnerships with customers

		Long-term Relationships with Customers	Collaboration in new product development

Table SVS4.6 – Supply chain configuration – Check ball valves

Quality and On-Time Delivery, performance important both for check and ball valves, are built in the same way: starting from a good IT and attention to suppliers (limited number, partnership) it is possible to obtain Supply Chain Management Inbound and Customer Service.

For more specific check valves, Engineering over Price is important, in order to deliver an excellent product for what concerns client's needs and technical specification.

The firm, being an almost new player in this market, is continuously willing to strengthen relationships with suppliers and customers. Establishing new close partnerships, in particular with key suppliers, enables the firm to benefit from better supplier performance and purchasing conditions, in terms of Price, delivery time and reliability (after the guarantee of the necessary quality standards and certifications the firm requests).

The company is sure it would benefit from having further information from clients after project completion, receiving, for example, positive or negative feedback and recommendations to improve product performance and service level. Since the firm has no visibility of EPC contractors' criteria for vendor selection, it has always concentrated its efforts only on those vendor lists the company has more chances to enter. Anyway, marketing strategies and business policies are so various between different contracting companies, that the supplying firm should collect a consistent data bank to be sure to select the clients it is likely to satisfy, according to their requests and expectations.

4.1.1.5 SVS – 5

Turnover [Mln €]	50-200
% of Special valves-Related turnover from the O&G sector	25%-50%
Group Belonging	No
Supplied valves	Ball Plug Gate Globe Butterfly Check
Main Business	"Special" ball valves

Table SVS5.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Middle East / Ball, Gate, Butterfly	Continuos investments in the area	↗
Northern America / Ball, Gate, Butterfly	Regular oil production, Investments in oil plant installations	↗
Far East / Ball, Gate, Butterfly	Growing oil derivates consumption	↗

Table SVS5.2 – Market/product scenario

Market	Motivations	Actions to undertake
Far East	Oil platforms construction	Marketing strategies to compete
Sub-Saharan Africa	Crude oil mining, Oil production	Further investments, Business plans
Middle East	Strategic market	Waiting for the end of the embargo
Russia	Strategic market	Waiting for the end of the embargo

Table SVS5.3 – Prospective markets

The company is headquartered in Italy and produces valves for onshore and offshore applications: the current valve portfolio includes butterfly, gate, globe, check and ball (floating and trunnion with API 6D qualification) valves, made of forged or cast steel.

Two machining units constitute the Italian production plant: the first one is specialized in high volume, small size valves with capacity in excess of 100,000 valves per month; the second one is dedicated to custom made, large size valves.

Investments in staff, training, facilities, equipment, software and business practices enable continuous processes improvement and manufacturing cycle optimization, helping the firm maintaining top quality standards and satisfactory service.

An in-house R&D team continuously performs advanced test activities (e.g. PR2, endurance tests) to validate designs before new products are commercialized. Tests always take place at the presence of major end users and third-party inspection authorities; design activities are audited and certified, according to the main standards. Non-destructive examinations are also provided in-house, while destructive tests are conducted in external qualified laboratories.

The firm is about to open a new manufacturing plant in Korea, where it is already present with a sales office: Korean market now generates about 25% of the company's turnover. Soon, sales in Korea are supposed to decrease of 50%. However, the company knows Power and Oil&Gas markets are usually cyclic markets, with continuously varying trends: the firm's marketing strategy consists in creating a competitive environment, trying to face and beat competitors' offers, before the Korean market turns out to be remunerative again.

The company purchases forged (or cast) valve bodies and auxiliary components (nuts and bolts, gaskets, etc.), and stocks them in (traditional and automatic) warehouses; it provides mechanical manufacturing, assembly and labeling, as well as delivery, in-house (Table SVS5.2). Depending on the amount of orders to complete, the firm may outsource larger-sized valves welding and painting operations; then, such valves return to the firm plant for the final stages (labeling and delivery).

Upstream supply chains are different, according to the valve type, their technological content and the component types they need: cast bodies for butterfly valves, forged rings for ball valves, forged and cast components for gate valves. This requires distinct purchase departments and, depending on product volumes and demands, different supply agreements (Kanban procedures to limit component stock, supply contracts with special purchase costs, etc...).

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Labeling	IN	OUT	-

Table SVS5.4 – Production stages

The company traditionally purchases only from Italian suppliers, and chooses them according to different selection criteria lists, provided by contractors. The firm does not have different second tier suppliers for each client; selected suppliers have to guarantee a good compromise between requested skills and provided performance levels for each skill.

For all selected market-product scenarios (Middle East, Northern America, South-Eastern Asia), the fundamental performance issues to maintain in high level and their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			International certifications (ISO 9001)
			Plants and machines upgrade/replacement
	Project Management Capability	Long-term Relationships with Customers	Collaboration in new product development
		Production System Practices	Advanced software for product development
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Financial	Supply Chain Management Inbound	IT (Information Technology)	Bar coding/automatic identification systems
		Production System Practices	Automatic warehouse
		Network	Limited number of suppliers
	Capacity and Flexibility	Production System Practices	External slack capacity
		Network	Limited number of suppliers
			Multiple, nearby divisions /plants
	External Integration	Network	Sections-network development (for commercialization, contracting and assistance)
			EPC contractor training teams
		Long-term Relationships with Customers	Close partnerships with customers
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Bar coding/automatic identification systems
		Production System Practices	Automatic warehouse
		Network	Limited number of suppliers
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			International certifications (ISO 9001)
			Plants and machines upgrade/replacement
	External Integration	Network	Sections-network development (for commercialization, contracting and assistance)
			EPC contractor training teams
		Long-term Relationships with Customers	Close partnerships with customers

Table SVS5.5 - Supply chain configuration

It is to be noticed in Table SVS5.5 that Financial performance is quite important to maintain client portfolio and obtain orders: companies that decided to compete as individual must demonstrate the financial stability and health, while this is not a problem for a great group with a bigger turnover.

Normally, once a valve supplier can guarantee the compliance of all quality standards, it can be considered at the same level of the other certified suppliers. For such reason, in contracting with EPC companies, all of them have to promote its offers through tenders. There are not many possibilities to differentiate production in terms of valve quality level; rather, valve suppliers can build competitive advantage improving service quality (e.g. on-time delivery performance) and assuring acceptable prices, according to the service level (e.g. flexible delivery times and dates) and the product customization level.

The company constantly aims for the creation of long-term relationships with customers, built on mutual trust and understanding: information exchange during project quotation, contract review (for client qualification, control and revision of commercial function decisions) and project execution phases is regularly encouraged. Several sales function divisions are located in the main reference markets and work to find satisfactory engineering solutions for clients, suggesting the most suitable combination of product design, material options and pricing. The company also provides after-sale services through a network of local distribution partners, audited and certified service centers for the most part of the markets and a team of engineers available to support customers during valves installation and maintenance.

Relationships with contractors are fundamental due to their usual, insufficient technical expertise: they have poor specific product knowledge and they do not really perceive what is behind cost differences between different supplies. This is because some clients usually purchase in Asia for standard components, having no perception of the superior quality and the high technological content of Italian specialized products. Finally, obtaining international standard certifications and qualification certificates, issued by specific oil companies and contractors, facilitates visibility and qualification for end users' projects.

4.1.1.6 SVS – 6

Turnover [Mln €]	50-200					
% of Special valves-Related turnover from the O&G sector	> 75%					
Group Belonging	Yes					
Supplied valves	Ball	Plug	Gate	Globe	Butterfly	Check
Main Business	Butterfly valves					

Table SVS6.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Europe / Butterfly	Not saturated	 
Northern America / Butterfly	Not saturated	 
Far East / Butterfly	Not saturated	 

Table SVS6.2 – Market/product scenario

Market	Motivations	Actions to undertake
Russia	Increasing projects number	Networking
South-Eastern Asia	Increasing projects number	Networking
Southern America	Increasing projects number	Networking

Table SVS6.3 – Prospective markets

The company has belonged to a corporation for almost a decade and is specialized on butterfly valves production. The main advantage of belonging to a group is surely being part of a great network: this enables the company to ease the entrance in new markets and overcome entering barriers. Visibility is also simplified. On the other hand, the group imposed a bureaucratic system that slows down the decision process. There is a constant effort to customize for clients: R&D function and production are uniquely based on customer requests.

At present, Russian, South-Eastern Asian and Southern American markets seem to be the most strategic for the future. The company, in particular, is focusing on the delineation of technical characteristics customers are expected to require, and on the building of a local network.

Projects number is expected to decrease because of oil price fall and, especially, due to a slowing down in growth of emerging markets, like China. Russia and Northern America seem to be areas where the market will grow quickly, probably from 2016, thanks to the start of many projects in the gas sector.

			Notes
Procurement	IN	OUT	-
Forging	IN	OUT	12 forged components suppliers
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS6.4 – Production stages

The firm can rely on high quality, specialized suppliers for the purchase of materials and components: the company selected reliable Italian and French supplier for casting, painting and packaging operations. Some mechanical manufacturers are needed only for simple operations in periods of high demand to gain a margin on flexibility. This choice has been made because, for the company, ensuring product quality carrying out directly the most critical phases is particularly important.

In every reference scenario, the most relevant performance items (with related capabilities – practices links to obtain them) for the company are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Customer Service	Long-term Relationships with Customers	Close partnerships with customers
		IS – Customer to Firm	Product design specifications (from clients)
		IS – Firm to Customer	Information about order status and expected lead-time
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		Project Management Practices	Cost Breakdown Structure (CBS)
	Market Development Capability	IS (Information Sharing)	Knowledge sharing about Core Business Processes

			Group coordination activities
		Long-term Relationships with Customers	Investments for evaluating customer's future needs
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Project Management Capability	IS (Information Sharing)	Frequent information exchange with suppliers/clients
		Production System Practices	International certifications (ISO 9001)
			Total Quality Management practices (TQM)
	Supply Chain Management Outbound	Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
		IS (Information Sharing)	Quality data availability
			Information exchange for improving supplier/client performance
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
		Strategic Behavior	Staff training
			Emphasis on health and environmental safety issues
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Product/Process Development Capability	Production System Practices	Cycle time reduction
		IT (Information Technology)	Production planning
		Long-term Relationships with Customers	Collaboration in new product development
	Internal Integration	Human Resource Management Practices	Multi-skilled human resource selection
		IT (Information Technology)	Bar coding/automatic identification systems
		Production System Practices	Plants and machines upgrade/replacement
	Capacity & Flexibility	IT (Information Technology)	Electronic mailing with key suppliers
		IS – Firm to Customers	Information about order status and expected lead-time
		Long-term Relationships with Customers	Collaboration in new product development

Table SVS6.5 – Supply chain configuration

The structure that enabled company's competitive advantage is centered on commercial and information relationships built with both upstream and downstream side of supply chain. Customization relevance emerges from the actions the firm has implemented: especially from the collaborations established with clients and selection of highly skilled employees.

The limited number of relevant endusers, working all over the world, enables standardizing commercial and technical behavior to approach different clients and markets. A relevant job rotation, with many employers moving from a country to another, has caused a sort of commercial and technical homogeneity. Finally, adaptation of product technical specification to the main endusers' requests is fundamental to obtain their qualifications and enter their vendor lists. This enables order increasing and market share stabilization.

4.1.1.7 SVS – 7

Turnover [Mln €]		50-200
% of Special valves-Related turnover from the O&G sector		50%-75%
Group Belonging		Yes
Supplied valves	Ball Plug Gate Globe Butterfly Check	
Main Business		Gate and Globe valves

Table SVS7.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America / Gate	Not saturated	
Middle East / Gate	Not saturated	
Europe / Gate	Saturated	

Table SVS7.2 – Market/product scenario

Market	Motivations	Actions to undertake
Middle East	Great number of projects	Local content
Northern Africa	Poorly explored, Great potential	Partnerships with local firms to get a boost in commercial presence

Table SVS7.3 – Prospective markets

The company is part of a moderate-dimensions international corporation, composed by valve producers from all over the world.

In addition to gate valves, that cover 60% of the production of special engineered valves and represent the core product type, the firm also supplies ball and globe valves, assuring a complete and wide choice.

Markets like Northern Africa, Iran and Iraq are likely to be particularly interesting for the future (Figure SVS7.2): the company is studying political situations and searching for reliable partners that could introduce the company to the main local clients. In Northern Africa, this action is necessary to satisfy local content legislations; in Iran and Iraq, it is needed to have good references and attract new clients, when trying to enter the market.

The main advantage the company obtained having been acquired by a corporation is the participation to constant market collaborations and a closer approach to clients. Being part of a well-known corporation facilitates clients' trust and eases approvals from buyers. On the other hand, an international group, of either big or smaller dimensions, usually imposes severe bureaucracy procedures.

Company's organization is developed on product excellence and ad-hoc product tracking systems, imposed by clients to suppliers. This enables clients to receive every information about the product, with a direct perception of the high product value.

			Notes
Procurement	IN	OUT	3 rough material suppliers
Forging	IN	OUT	-
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	Only critical manufacturing cycle stages
Assembly	IN	OUT	-
Testing	IN	OUT	-
Labeling	IN	OUT	-

Table SVS7.4 – Production stages

The firm can rely on three, high quality, specialized Italian suppliers for raw materials (Table SVS7.2). Components suppliers are 40 in total, and the 95% of them are Italian. Integration with suppliers is a main driver in firm's philosophy and, because of this, geographical proximity to vendors is a good element. In addition, Italian suppliers guarantee an outstanding quality level at a competitive price with a really good service. Mainly, these suppliers are small-sized and, in order to get particular components or adopt the company's information system, offering a financial help or guaranteeing a quote of work to have a return on investment is necessary.

Mechanical manufacturing is outsourced only for simple operations on non-critical components.

Technological content is important for a company that focuses on quality and develops a complex system to let clients perceive every production aspect. Because of this, a continuous improvement is necessary in production systems, even to achieve production costs reductions.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Project Management Capability	Project Management Practices	Risks and opportunities identification and analysis methods
			Cost Breakdown Structure (CBS)
	Internal Integration	Human Resource Management Practices	Staff training
		IT (Information Technology)	Constant delivery tracking
		Network	Preference of local suppliers
	Customer Service	Long-term Relationships with Suppliers	Expediting (visiting suppliers' plants)
		Long-term Relationships with Customers	Quality control and guarantee programs
Performance 2	Supply Chain Management Outbound	Human Resource Management Practices	Resources investment to keep a well-performing supply chain (Commitment)

		Long-term Relationships with Customers	Resources investment to keep a strong supply chain (Commitment)
		Long-term Relationships with Suppliers	Cooperation in checking order status
	Product/Process Development Capability	Production System Practices	Plants and machines upgrade/replacement
			External slack capacity
	Project Management Capability	Project Management Practices	Risks and opportunities identification and analysis methods
			Cost Breakdown Structure (CBS)
		Human Resource Management Practices	Staff training
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Cooperation in checking order status
			Close partnerships with strategic suppliers, commercial agreements
		Project Management Practices	Risks and opportunities identification and analysis methods
			Cost Breakdown Structure (CBS)
	Capacity and Flexibility	Production System Practices	Outsourcing (external slack capacity)
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
	External Integration	IT (Information Technology)	Constant delivery tracking
		Long-term Relationships with Customers	Collaboration in new product development

Table SVS7.5 – Supply chain configuration

The company focuses on project management to support clients during project conception and starting phases: this gives the client the possibility to have a reference figure in the company. These practices are also needed internally, to develop well-organized processes and suitable products. These figures, as many others inside the firm, are trained internally: special valves market is extremely specific, and finding external people strongly prepared on this kind of problems is very difficult. Because of this problem, staff training has been needed to enable many capabilities that increase the performance level. In price detail, explicit staff training actions are not present, but they are indirectly included in expediting and project management practices development.

In addition to project management and staff training, another company organization milestone is tracking system implementation: this information network enables to know everything interesting for the firm about products and suppliers, enabling clients' total trust about service quality and reliability.

The commercial interaction with clients is regular during the order processing, but not after product delivery and installation. Indeed, feedbacks are sent only in case of after sales assistance needs. Moreover, clients demonstrate a lack of openness in providing vendor rating criteria. Finally, the entrance in the end users' vendor list is fundamental in order to create business.

4.1.1.8 SVS – 8

Turnover [Mln €]		50-200
% of Special valves-Related turnover from the O&G sector		> 75%
Group Belonging		No
Supplied valves	Ball Plug Gate Globe Butterfly Check	
Main Business		"Special" ball valves

Table SVS8.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America / Ball	Little close active market	↗
Middle East / Ball	Positive forecast, in spite of a prominent price logic	↗
Far East / Ball	Almost rising market	↗

Table SVS8.2 – Market/product scenario

Market	Motivations	Actions to undertake
Northern Europe	Subsea and deep subsea are rising markets	Settle commercial divisions in strategic locations with technically competent personnel (Networking)
Northern America	Subsea and deep subsea are rising markets	Settle commercial divisions in strategic locations with technically competent personnel (Networking)

Table SVS8.3– Prospective market

The company is specialized in engineered ball valve production, which currently represents its core business; in addition, in one of its two plants, it has developed a division for gate and check valve production for subsea applications. R&D activities are mostly related to collaborations between technical office and testing division for special products. Since quality controls are becoming always more strict, non-quality data analysis (failure rates, etc.) and study of problems emerged in testing stages now have to be taken into account.

The testing division includes plants for tests under repetitive cycles, a hyperbaric chamber for subsea valves tests, etc... The firm guarantees all standard tests to simulate future product working conditions.

The firm's reference markets are Middle East, Northern America and Australia; it is also present in African market, through Northern American engineering companies: commercial functions for Africa are included in the Northern American market.

Over the years, the firm has managed an American commercial division with direct company personnel, specialized both in top side ball valves and subsea products.

The Oil&Gas market, in spite of last difficulties, is now a recovering market: last data and forecasts and new orders received are reassuring signals. On the other hand, the gas market is always active, particularly for extraction operations (upstream).

At present, the firm is not evaluating to enter a group, since it does not think it would take particular advantages or privileges.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	Around 10 forged components suppliers
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	Special coverings (OUT)
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	Packaging (OUT)

Table SVS8.4 – Production stages

In addition to valve bodies and minor components procurement, outsourcing production stages include: particular covering operations, which imply the application of specific technologies (e.g. tungsten carbide and nickel covering); printing; packaging. The firm may use outsourcing also for some mechanical manufacturing activities, depending on the quantity of orders it has to process periodically.

Valve bodies are supplied by around 10 Italian forgers. Minor components are purchased from about 70 suppliers, all Italian, except for some gaskets and particular items.

Suppliers are in small number and are selected according to a price logic: they are well-equipped to guarantee requested quality and prices. Firm quality system implements operative procedures for supplier qualification, to verify supplier production process respect all quality standards; regarding this, non-conformities number and on-time delivery data monitoring is fundamental for supplier regular assessment. Quality and security conformities (ISO 9001, OHSAS 18001) are always necessary. ISO 14001 is not requested yet, the firm itself aims to obtain this certification within 2015.

At present, the firm is not inclined to establish framework agreements or partnerships with suppliers.

Concerning the first market scenario (Middle East), the fundamental performance issues to maintain in high level and their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
	Financial Capability	IS (Information Sharing)	Quality data availability
		Financial Practices	Strong relationships with banks and financiers
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Project Management Capability	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
	Capacity and Flexibility	Project Management Practices	Work Breakdown Structure (WBS)
		Production System Practices	Plants and machines upgrade/replacement
			Outsourcing (external slack capacity)

	Supply Chain Management Inbound	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
		IS (Information Sharing)	Quality data availability

Table SVS8.5 – Supply chain configuration – Middle East

American market works according to a sort of stock logic, also with projects and commissions, requesting particularly short lead-times: on-time delivery is fundamental and represents the main performance item. For this reason, the firm may also accept the stocking of some products with consequent financial exposing, to satisfy some clients' needs. Concerning the second market scenario (Northern America):

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Project Management Capability	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
		Project Management Practices	Work Breakdown Structure (WBS)
	Capacity and Flexibility	Production System Practices	Plants and machines upgrade/replacement
			External slack capacity
	Supply Chain Management Inbound	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
		IS (Information Sharing)	Quality data availability
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Flexibility	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
	Customer Service	Network	Preference of local suppliers
			Close-to-customer (reference markets) locations
			Sections-network development (for commercialization, contracting and assistance)
	Capacity and Flexibility	Production System Practices	Plants and machines upgrade/replacement
			External slack capacity
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Service	Customer Service	Network	Preference of local suppliers
			Close-to-customer (reference markets) locations
			Sections-network development (for commercialization, contracting and assistance)
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training

Table SVS8.6 – Supply chain configuration – North America

Australian customers are known for particularly strict controls on every component type and certifications. Concerning the third market scenario (Far East, Australia):

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
	Supply Chain Management Outbound	IS (Information Sharing)	Quality data availability
		Long-term Relationships with Customers	Investments for evaluating customer's future needs
			Sharing market interests, firm policies and business goals
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Project Management Capability	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
	Capacity and Flexibility	Project Management Practices	Work Breakdown Structure (WBS)
		Production System Practices	Plants and machines upgrade/replacement
			External slack capacity
	Supply Chain Management Inbound	IT (Information Technology)	Production planning
			Enterprise Resource Planning Systems (ERP)
			Warehouse Management Software (WMS)
		IS (Information Sharing)	Quality data availability

Table SVS8.7 – Supply chain configuration – Far East/Australia

The firm has made great efforts to improve its project management internal function, for a better orders and documentation management and a constant presence in business relationships with clients. Certifications, procedures and tests may have to be verified even with multiple approval steps, generating order and documentation management issues: turnovers in contractor management teams usually causes lead-time increases or stops in order execution.

The company has constant commercial interactions with enduser, since they play a fundamental role in supplier qualification and introduction in vendor lists contractors' engineers will refer. There is not particular engagement during order processing, because the firm mostly have contacts with client's sales office: the firm engages with enduser only during the upstream stage, before order confirmation and not during order execution. During project execution, collaborations with enduser are simpler, since they do not have frequent technical turnover as contractors employed for plant installation usually have: they define general technical characteristics to be respected for all plant constructions in the world.

4.1.1.9 SVS – 9

Turnover [Mln €]		50-200				
% of Special valves-Related turnover from the O&G sector		50%-75%				
Group Belonging		No				
Supplied valves	Ball	Plug	Gate	Globe	Butterfly	Check
Main Business		"Special" ball valves				

Table SVS9.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America / Ball	Almost stable	☰
Southern America / Gate, Globe, Check	Slow recovery due to corruption scandals	↘
Middle East / Ball	Stability based on political situation	☰

Table SVS9.2 – Market/product scenario

Market	Motivations	Actions to undertake
Southern America	Rising market	Local agents

Table SVS9.3– Prospective market

The company is specialized in gate, globe, check, ball and modular DB&B valves production.

Concerning the R&D function, the improvement of product technological contents and the development of new product solutions are independent from clients' requests; however, their feedbacks in project stages are usually very useful for the firm.

The firm does not think that belonging to a group would bring particular benefits. At present, the judicial system guarantees to the firm some typical private society peculiarities (like fast decisional capability, flexibility, reliability), which enable the company offering clients high service level for all product portfolio.

				Notes
Procurement	IN	OUT		-
Forging	IN	OUT		-
Casting	IN	OUT		-
Mechanical Manufacturing	IN	OUT		-
Assembly	IN	OUT		-
Testing	IN	OUT		-
Painting	IN	OUT		-
Labeling	IN	OUT		-

Table SVS9.4 – Production stages

Raw materials (rods, valve bodies, cast items) are purchased from qualified suppliers; some mechanical manufacturing and painting operations are outsourced to external workshops; assembly and testing operations are performed in-house.

The suppliers qualifying process, managed by the quality office, aims to evaluate their competencies, capabilities and resources/equipment availability, along with qualifications and certifications in their possess and performance items (even depending on the product criticality level and the kind of service requested).

Vendor list access is necessarily limited to suppliers owning approved international qualifications or being directly specified and requested by clients.

For all selected market-product scenarios (Northern America, Southern America, Middle East), the fundamental performance, their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Project Management Practices	Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
	Customer Service	IS (Information Sharing)	Information Sharing
		Long-term Relationships with Suppliers	Cooperation in checking order status
			Quality control and guarantee programs
		Project Management Practices	Advanced methods for supplier selection
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Price	Capacity and Flexibility	IT (Information Technology)	Warehouse Management Software (WMS)
			Monitoring order processing status, Manufacturing Execution Systems (MES)
			Constant delivery tracking
	Customer Service	IS (Information Sharing)	Information Sharing
		Long-term Relationships with Suppliers	Cooperation in checking order status
			Quality control and guarantee programs
		Project Management Practices	Advanced methods for supplier selection
	Relationship Capability	Long-term Relationships with Customers	Close partnerships with customers
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Customer Service	IS (Information Sharing)	Information Sharing
		Long-term Relationships with Suppliers	Cooperation in checking order status
			Quality control and guarantee programs
		Project Management Practices	Advanced methods for supplier selection
	Market Development Capability	IS – Customer to Firm	Product design specifications (from clients)
			Expected performance specifications (from clients)
			Production planning specifications (from clients)
	Internal Integration	IS – Firm to Customer	Information about order status and expected lead-time

		Information about delivery schedule and/or possible changes in delivery schedule
	Network	Multiple, nearby divisions/plants

Table SVS9.5 – Supply chain configuration

The firm has made great efforts in building strategic and close relationships with EPC clients and final clients. Indeed, Customer Service, Market Development Capability and Relationship Capability influence the developing of all the three externally demonstrate performance. Not belonging to a group, relationships become fundamental to create a business.

Moreover, clients are totally open in providing the vendor rating criteria.

These relationships skills of the firm allow to firm to have not particular difficulties in communication with clients. Indeed, frequently face-to-face, e-mail and telephone contacts assure an optimal level of interaction. Finally, feedbacks are sent even during all the project execution stages. These contacts and references help the firm to enter in the end users' vendor list, which is fundamental to create a business.

4.1.1.10 SVS – 10

Turnover [Mln €]	20-50
% of Special valves-Related turnover from the O&G sector	50%-75%
Group Belonging	Yes
Supplied valves	☒ Ball ☐ Plug ☐ Gate ☐ Globe ☐ Butterfly ☐ Check
Main Business	ball valves

Table SVS10.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Europe/Ball	Projects delays, postponements or also cancellations	↘
Middle East/Ball	Projects delays, postponements or also cancellations	↘
Far East/Ball	Projects delays, postponements or also cancellations	↘

Table SVS10.2 – Market/product scenario

Market	Motivations	Actions to undertake
Africa	Rising market, Great future opportunities	Local content to guarantee simpler production operations locally
Middle East	Strategic and consolidated market for Oil&Gas special valve sector	Obtaining End-User's qualifications

Table SVS10.3– Prospective market

The firm is specialized in ball valves and covers a specific market position: it produces almost exclusively upstream valves for the Oil&Gas sector.

About the 98% of firm's turnover is generated externally to the group the firm belongs to: this means it almost plays as an independent company.

The firm assures in-house all standard testing operations: non-destructive evaluations (NDE) and special tests (cryogenic, high temperature, cyclic, emissions). Different tests are usually related to EN ISO normative or, in case, to new clients' specifics about emissions or new necessary qualifications in terms of cyclic activities. The company produces valve items up to 12 inches and it is not specialized, for example, in large-dimension ones, which may request particular testing procedures and equipment: also for this reason, special,

internally-developed tests would not be profitable for the firm, since clients pretend only product conformity, in terms of normative and respect of technical specifics.

In some countries, local content is strictly requested: in Brazil, it is a strategy to avoid duties; in Australia, the 10% of local content is managed by a local department. In Africa (Nigeria), the firm is trying to facilitate procedures relying on local agents for the management of local warehouses, at least for spare parts, or delivering finished material and local workers only have to test for the second time or complete with simple assembly operations: such activities do not affect product quality and are equally considered as local content. Anyway, it is important to have relationships with companies permanently situated “in loco”, having enough technical competencies to successfully manage local content.

Oil price decrease caused the delay, postponements or cancellations of many projects: it is difficult to carry out reliable market analysis for the next years; anyway, current projects, although they will be completed in many years, have to be financed with available profits, which are very low at the moment. Some clients make great efforts to complete already started projects, to avoid penalties from engineering companies.

At present, the firm does not perceive particular advantages from the belonging to a group, since it is concerned in a totally different business: it has different relationships and owns other supplying systems and channels, as well as a major financial solidity. In the future, since the leader group firm is trying to specialize also in Oil&Gas check valve production, worldwide assets sharing might be a possible advantage for the company.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	-
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	-
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS10.4 – Production stages

Supplier monitoring implies data gathering about on-time deliveries, non-conformity number, standards and certifications, if strictly requested. In case the firm suspends or cancels material orders from a specific supplier due to lacks on conformity, ad-hoc controls are carried out to check all corrective actions implemented.

Certifications are always indispensable for all critical processes and services: welding, painting, heat treatments. Often, contractors ask for auditing service suppliers in person, if they have not been already qualified by the most important oil companies (Shell, Total, etc.). In this case, all firms regularly purchasing from these qualified suppliers take outstanding advantages in rating procedures. Contractors pay particular attention on critical processes, because it is not possible, once the product has been manufactured, to totally assess quality service with NDE tests (only dimensional controls and porosity tests through liquid penetrating).

Close, long-term relationships with local suppliers ensure reliability and short delivery lead-times, but also enable suppliers themselves to improve their capabilities, when they have to face problems with clients, rising during new projects realization. This lets them achieve extra knowledge and competencies, representing also an optimal grading skill for other clients. On the other hand, clients take great advantages from suppliers' performance improvement. Italian spin-off is widely known for its top-quality level: some

foreign companies (e.g. French or Spanish) send their components in Italy to be manufactured, accepting extra delivery and management costs and product lead-time increases.

The firm relies at least on two suppliers for each component type or service (welding, painting, etc.) to guarantee a security margin and slack capacity, in case suppliers have to manage large work load or one of the two selected suppliers have to shut down for economic difficulties. An ERP system manages all material orders to be sent to suppliers: for each item, lists of main and secondary suppliers, prices, suppliers' availability even for small lots production, etc. are registered in firm's databases. According to the firm, there are no relevant differences, between different markets and contracting companies, about the main performance items and services requested, because market rules are global: rather, there are important differences in terms of cultural level and commercial and economic approach during bidding stages.

For all selected market-product scenarios (Europe, Middle East, Far East), the fundamental performance, their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
		Network	Limited number of suppliers
			Preference of local suppliers
	Dynamic Capability (Product/Process Development)	IT (Information Technology)	Enterprise Resource Planning Systems (ERP)
		IT (Information Technology)	Scheduling and planning software
		IS – Customer to Firm	Product design specifications (from clients)
		Production System Practices	Product modularization
	Customer Service	Long-term Relationships with Customers	Investments for evaluating customer's future needs
		Production System Practices	Use of top quality material
		Network	Sections-network development (for commercialization, contracting and assistance)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Flexibility	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
	Relationship Capability	IS (Information Sharing)	Frequent information exchange with suppliers/clients
		IS – Firm to Customer	Information about order status and expected lead-time

	Internal Integration	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Frequent, informal, timely information exchange
		Human Resource Management Practices	Participation in decisional stages (delegation of responsibilities, team work)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Communication	Project Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Giving information about events or changes that may affect the other part

Table SVS10.5 – Supply chain configuration

Many engineering companies have moved to Middle East or Korea, with other possible divisions in India, due to lower engineers' labor costs. Cultural issues in these areas are linked to engineers' lacks of mental flexibility, in spite of good (sometimes) technical competencies. Moreover, due to a strict company hierarchy, such employees usually have very specific mandates and none of them is permitted to make critical decisions, even if they are able to understand project technical dynamics and assess the proposed valve solution during the bidding stage. For this reason, many Italian firms, even if competitors, are taking part in common organizations and events born to offer technical training to engineering companies, to introduce to them sector's peculiarities and all technical specifications, in order to be able to select the best valve solutions.

Quality and technical competencies are fundamental for engineers: they should be able to perceive the actual product added value and select items not only according to price and on-time delivery logics. In opposite, Italian special valve market would no longer be able to compete.

All these competitors totally agree with a long-term goal sharing, also to defend an ethically-correct philosophy. This is because, sometimes, many (especially overseas) suppliers try to mislead contractors with limited technical skills, showing them false qualifications that certify false better product characteristics.

There are no particular issues about information exchange with clients: nowadays, all main contractors work with information platforms, through which project documentations are sent and shared and clients/suppliers are updated about releases, returns and approving lead-times. Contractors usually impose to suppliers using such information systems.

Establishing relationships and managing contacts with end users is the first, essential step to compete in the Oil&Gas market: contractors always request certifications released by end users and select suppliers according their specifics. Oil&Gas companies impose their shortlists and, in case contractors have their own vendor lists, they can purchase only from suppliers being also in end users' lists.

The firm has to start with the qualification process to enter in vendor list, then it can promote its product to contractors and, eventually, obtain the first bids by the same companies and enter their vendor lists. Once the firm succeeded in entering vendor lists, it can receive new bids automatically. However, end users' certification releases involve very long-lasting procedures (many years, in the majority of cases).

End users' qualification process starts with an initial audit, to assess company structure; then, the firm is asked to supply a product sample to be tested. If the test is successfully passed, the firm can enter the vendor list and gain positions in a qualifying scale, if all following supplies do not show malfunctioning in the long-term and do not achieve negative feedbacks.

The majority of oil companies, even the most relevant ones, is subcontracting an always larger number of projects to overseas engineering companies, due to lower costs (e.g. Indian companies, Hyundai and Samsung in Korea). For this reason, European and Japanese contractors keep on losing influence and market share. Indian and Korean engineers are cheaper, but also have inferior technical competencies; however, end users protect themselves signing turnkey contracts: contractors are paid only after plant completion, and only if it works properly.

Valve manufacturers should continuously perceive the Oil&Gas market trend, follow end users' business strategies and make efforts to be qualified by rising contracting companies.

4.1.1.11 SVS – 11

Turnover [Mln €]		20-50					
% of Special valves-Related turnover from the O&G sector		50%-75%					
Group Belonging		No					
Supplied valves	Ball	Plug	Gate	Globe	Butterfly	Check	
Main Business		Plug valves					

Table SVS11.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Middle East / Plug	Oil price decrease is slowing down new projects development	↓
Italy / Plug	Saturated market	↓

Table SVS11.2 – Market/product scenario

Market	Motivations	Actions to undertake
Asia	Markets constant development	/
Northern America	Rising of the shale gas market	Achieving all needed certifications due to procurement duties imposed to clients
Southern America	Rising market	Local agents and partners' network to promote products and to achieve clients' qualifications

Table SVS11.3 – Prospective markets

In the past, the company worked as second tier supplier, selling valves to firms selling the product with their own brand. During its business strategy evolution, there has also been a period where the company served only highly relevant clients. The company focuses its business on plug valves that is a less requested valve type, as it currently is a niche product. Its market position is strong, being in the vendor list of many relevant potential clients.

Such a particular production helps to face contingent economic crisis and scenarios changes, because this sector, at present, suffers lower competitiveness and there is no need for plug valve manufacturers to reduce prices. The niche characteristics of plug valve products also let the firm avoid the 2008 crisis consequences.

In addition, the advanced knowhow that is necessary to produce these valves avoids the risk of losing competitiveness and market share against Far East competitors.

Notes			
Procurement	IN	OUT	7-8 rods and laminates suppliers
Forging	IN	OUT	5 forged and cast components suppliers
Casting	IN	OUT	
Mechanical Manufacturing	IN	OUT	-
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS11.4 – Production stages

The firm can perform internally all production phases from raw valve bodies manufacturing to finished products, excepted for heat treatments, Teflon and nickel covering, painting and packaging.

Procurement is strongly based on price, because the company has limited dimensions and competitiveness is not high on this particular product. Because of this, materials and raw components are bought abroad, in countries assuring cheaper purchases. The company's vendor list contains, at least, five different material suppliers: this enables supplier differentiation in terms of material typologies (China or India for standard carbon steels, Italy for special steels or in case of made-in-Europe material requests), production capacity and prices.

Mechanical manufacturing operations may be outsourced, depending on the work load. However, since the company is specialized on a particular product, mechanical manufacturing could be difficult to be outsourced, since external workshops may not have the needed knowhow and competencies to perform certain critical operations. Instead, for a ball valve producer, outsourcing more standardized manufacturing operations is certainly easier.

Welding was initially outsourced, but the particular valve characteristics requested, later, to execute it internally. The company perceives its knowhow as fundamental to supply a competitive product. Indeed, although it has been trying to find reliable overseas suppliers, in order to have lower costs, but it found out buying manufactured products from Asian countries generates higher total costs.

Expediting activities are relevant with this kind of configuration, to ensure quality of low cost materials. To actuate this method, it is necessary to focus on a limited number of suppliers for the main products. Auxiliary components purchasing is managed through indirect, but constant relationships with some stock sellers. The supply is based on single order, there are no commercial agreements because products are totally engineered.

Valve testing is standardized following ISO certifications, to ensure product conformity. In addition, intense stress tests are made to assure technical performance to the company and show an added value to competitiveness in front of the client, even if this peculiarity is not always perceived.

For all selected market-product scenarios (Middle East - Saudi Arabia, Middle East - Kuwait, Italy), the fundamental performance, their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions

Quality	Supply Chain Management Inbound	Production System Practices	International certifications (ISO 9001)
		Long-term Relationships with Suppliers	Cooperation in checking order status
			Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
		Project Management Practices	Advanced methods for supplier selection
		IT (Information Technology)	Monitoring order processing status, Manufacturing Execution Systems (MES)
	Supply Chain Management Outbound	Production System Practices	International certifications (ISO 9001)
		Long-term Relationships with Suppliers	Quality control and guarantee programs
			Involving suppliers in new product design
	Customer Service	Project Management Practices	Advanced methods for supplier selection
		IT (Information Technology)	Production planning
		IS – Customer to Firm	Production planning specifications (from clients)
		IS – Firm to Customer	Information about order status and expected lead-time
		Production System Practices	Total Quality Management practices (TQM)
			Use of top quality material
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Production System Practices	International certifications (ISO 9001)
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Cooperation in checking order status
			Helping suppliers to improve their product quality (Top Management Support)
		Project Management Practices	Advanced methods for supplier selection
		IT (Information Technology)	Monitoring order processing status, Manufacturing Execution Systems (MES)
	Customer Service	Project Management Practices	Advanced methods for supplier selection
		IT (Information Technology)	Production planning
		IS – Customer to Firm	Production planning specifications (from clients)
		IS – Firm to Customer	Information about order status and expected lead-time
		Production System Practices	Total Quality Management practices (TQM)
			Use of top quality material
Performance 3	Enabling capabilities	Implemented practices	Implemented actions

On-Time Delivery	Project Management Capability	IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
		IS – Firm to Customer	Information about delivery schedule and/or possible changes in delivery schedule
		IT (Information Technology)	Production planning
		Production System Practices	Agile manufacturing strategies
		Project Management Practices	Risk and opportunities identification and analysis methods
	Customer Service	Project Management Practices	Advanced methods for supplier selection
		IT (Information Technology)	Production planning
		IS – Customer to Firm	Production planning specifications (from clients)
		IS – Firm to Customer	Information about order status and expected lead-time
		Production System Practices	Total Quality Management practices (TQM)
			Use of top quality material

Table SVS11.5 – Supply chain configuration

The firm always aims to be as competitive as possible and collaborate with clients with an extended pricing range, so that it can supply the best suited products with competitive prices for clients.

The commercial interaction with clients, after product delivery and installation, is poor. Indeed, feedbacks are sent only in case of sales assistance needs.

On the other side, clients assert their vendor selection criteria and usually allow firm to penetrate the end user's vendor list. Indeed, contractor's qualification usually enable the firm to enter final client vendor list.

4.1.1.12 SVS – 12

Turnover [Mln €]		50-200				
% of Special valves-Related turnover from the O&G sector		25%-50%				
Group Belonging		No				
Supplied valves	Ball	Plug	Gate	Globe	Butterfly	Check
Main Business		"Special" ball valves				

Table SVS12.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Middle East/Ball	Strategic area for market trends in other countries	
Far East/Ball	Oil price decrease	
Northern Europe/Ball	Oil price decrease	

Table SVS12.2 – Market/product scenario

Market	Motivations	Actions to undertake
Africa	Modest firm presence, Strategic market area in spite of the critical political situation	Local agents, end users' qualifications
Central-Southern America	Modest firm's presence	Local agents, end users' qualifications

Table SVS12.3 – Prospective markets

The company is specialized in ball valves, both for flow interception and regulation.

The R&D division, recently acquired by the company, includes a mechanical laboratory and is specialized in prototype development; it is always seeking for new product solutions and technological improvement, but it is also focused on particular clients' requests. Research function focuses on products, processes and also testing machineries and methods (special test benches for metal-metal coverings, etc...).

According to the respondent, being part of a group may help to gain market presence and visibility to new buyers and, in many cases, to end users. In addition, it is not irrelevant the financial stability a group could guarantee.

On the other side, a group introduces more rigid bureaucracy procedures and controls for quality standards; moreover, it tends to limit its clients into a fixed range, excluding other potential customers: usually, this is because they are competitors of the group leader firm.

Notes			
Procurement	IN	OUT	6 adaptors/actuators and 4 coverings suppliers
Forging	IN	OUT	5 rods and forged components suppliers
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	-
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS12.4 – Production stages

Being located in the center of Italy, the company has aimed to vertically integrate almost all production stages: casting, mechanical manufacturing, welding and painting are performed in-house, while only covering operations and forged component production are outsourced. Firm's suppliers are mainly Italian.

Concerning the first market scenario (Middle East), the fundamental performance, enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	External Integration	Long-term Relationships with Customers	Close partnerships with customers
			Investments for evaluating customer's future needs
		IS – Firm to Customer	Information about available production capacity
	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software
			Warehouse Management Software (WMS)
		Production System Practices	Product/process standardization (Postponement)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions

Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
		Network	Limited number of suppliers
	Supply Chain Management Outbound	Long-term Relationships with Customers	Preference of local suppliers
			Sharing marketing strategic decisions
			Investments for evaluating customer's future needs
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Dynamic Capability (Product/Process Development)	Human Resource Management Practices	Multi-skilled human resource selection
		IS – Customer to Firm	Staff training
			Information about market opportunities and demand forecasting (from clients)
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Interdisciplinary workgroups

Table SVS12.5 – Supply chain configuration – Middle East

Concerning the second market scenario (Far East), performance, capabilities and practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Internal Integration	IT (Information Technology)	Production planning
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software
		Warehouse Management Software (WMS)	
	Production System Practices	Product/process standardization (Postponement)	
	Relationship Capability	IS (Information Sharing)	Information exchange for improving supplier / client performance
		Long-term Relationships with Customers	Collaboration in new product development
		Network	Close-to-customer (reference markets) locations
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Dynamic Capability (Product/Process Development)	Human Resource Management Practices	Multi-skilled human resource selection
		IS – Customer to Firm	Staff training
			Information about market opportunities and demand forecasting (from clients)
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
		Staff training	
		Interdisciplinary workgroups	

Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Service	Customer Service	Human Resource Management Practices	Multi-skilled human resource selection
		IT (Information Technology)	Electronic mailing
		IS (Information Sharing)	Quality data availability
	Project Management Capability	Production System Practices	Just In Time practices (JIT)
			Stocking area for urgent orders
			Cycle time reduction
	External Integration	Long-term Relationships with Customers	Close partnerships with customers
			Investments for evaluating customer's future needs
		IS – Firm to Customer	Information about available production capacity

Table SVS12.6 – Supply chain configuration – Far East

Concerning the third market scenario (Northern Europe), the fundamental performance, enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
		Network	Limited number of suppliers
			Preference of local suppliers
	Supply Chain Management Outbound	Long-term Relationships with Customers	Sharing marketing strategic decisions
			Investments for evaluating customer's future needs
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Dynamic Capability (Product/Process Development)	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
		IS – Customer to Firm	Information about market opportunities and demand forecasting (from clients)
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Interdisciplinary workgroups
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Innovation	Dynamic Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training

	(Product/Process Development)	IS – Customer to Firm	Information about market opportunities and demand forecasting (from clients)
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Interdisciplinary workgroups

Table SVS12.7 – Supply chain configuration – Northern Europe

Frequent turnover in contractor's management team and interlocutors (especially in big companies' projects) causes management issues about documentation approvals and, consequently, delivery delays. Lack of communication after product delivery and installation: feedbacks are sent only in case of after sales assistance need. Clients are usually open about requested performance and certifications: qualification procedures and prototype realization to verify specifications compliance.

4.1.1.13 SVS – 13

Turnover [Mln €]		20-50
% of Special valves-Related turnover from the O&G sector		50%-75%
Group Belonging		No
Supplied valves	Ball Plug Gate Globe Butterfly Check	
Main Business		Control valves

Table SVS13.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern Africa / Globe	Firm's business focuses on growing Power market	↗
Far East / Globe	Firm's business focuses on growing Power market	↗
Central- Southern America / Globe	Firm's business focuses on growing Power market	↗

Table SVS13.2 – Market/product scenario

Market	Motivations	Actions to undertake
Northern America	Search for alternative markets	Local agents
Far East	Rising market	Already in touch with local contractors
Middle East	Recovering market due to last political issues	Reactivating existing commercial channels

Table SVS13.3 – Prospective markets

The company is specialized in control valve production, especially globe type valves. Its turnover is almost totally generated by special valve supply (including spare parts supply, after-sales service and maintenance activities); special valve supply for Power and Oil&Gas sectors generates the 65%, while other special products are dedicated to chemical and petrochemical industries, water treatment and desalination applications, etc...

Firm's specialization in a peculiar valve type enables its business protection both from the great competitiveness level of big companies and international groups, which usually have larger product portfolios (including also standard valves), and from the always more influent Far East market, which guarantees unbeatable prices thanks to much lower production costs.

Nowadays, Italian valve manufacturers usually build their business on a limited number of core, special products, with outstanding added value and high engineering content: they might be specialized in subsea valves, high rating classes, special materials use, etc. In any case, all of them no more produces standard valves.

R&D function is constantly active. There is no research for special testing methods and applications, because all machineries developed and installed during the years are sufficient for almost all requested tests. Particular product controls, needing special test benches or fluids, are committed to external, specialized workshops with adequate equipment.

The firm has never considered the idea of being absorbed by a group because it would be dangerous for the internal business, in case the group leader aims to keep only certain product items or adapt company's plants and functions to different group's sectors of interest.

Low levels of criticality, outstanding firm dimensions and a good, successful business strategy also help the firm preserving the independency. On the other hand, old companies led by senior managers, with no generation and technical turnover, may have the necessity to sell, due to a lack of financial and investing initiatives and insufficient dynamic capabilities to improve the product, try new business paths and follow market trends and needs.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	-
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	-
Welding	IN	OUT	Up to certain valve sizes
Assembly	IN	OUT	-
Testing	IN	OUT	Only standard simple tests
Painting	IN	OUT	Up to certain valve sizes
Labeling	IN	OUT	-

Table SVS13.4 – Production stages

Welding and painting are performed in-house only up to certain valve sizes; all heat treatments are outsourced.

Special product controls, as corrosion or cryogenic tests, are made externally by equipped centers. Internally, the firm guarantees only dimensional tests, electrostatic and endurance tests, and other simple testing procedures (with ultrasounds, penetrating liquids, etc.): at present, all firms can do such tests in-house because they do not need expensive machineries.

According to the firm, relying on a consistent suppliers' number is necessary: it would be risky if certain suppliers become too important and strategic, in case they start overpricing, go bankrupt or are absorbed by competitor groups. Moreover, supplying from India and China requests half costs. Obviously, each new supplier has to be inspected and qualified, and, for a certain period, is closely controlled by firm inspectors even after the completion of qualification process. Firm inspectors are also asked to search for other valid suppliers all over the world.

Firm's quality control system collects statistical data, non-conformity numbers, ratings about all registered suppliers and constantly monitors their performance; suppliers collecting an excessive number of product defects and delays are firstly suspended and, in case, cancelled.

Local suppliers guarantee shorter delivery lead-times and a closer control process; however, once they have been carefully inspected and qualified, selected suppliers are expected not to be further controlled to guarantee products with no defects and delivery dates respect.

For all selected market-product scenarios (Northern Africa, Far East, Central and Southern America), the performance, capabilities and practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
		IS (Information Sharing)	Quality data availability
			Frequent, informal, timely information exchange
	Dynamic Capability (Product/Process Development)	IS (Information Sharing)	Quality data availability
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Involving suppliers in new product design
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Involving suppliers in new product design
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Project Management Capability	IT (Information Technology)	Production planning
		Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
	Internal Integration	Production System Practices	Bottleneck controlling
			Cycle time reduction
			Just In Time practices (JIT)
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)

			Involving suppliers in new product design
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Service	Customer Service	Long-term Relationships with Customers	Investments for evaluating customer's future needs
			Sharing market interests, firm policies and business goals
		IS (Information Sharing)	Information exchange for improving supplier/client performance
	Product/Process Development Capability	IS (Information Sharing)	Quality data availability
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Involving suppliers in new product design

Table SVS13.5 – Supply chain configuration

One of the main issues about clients' behavior is a consistent lack of information sharing with suppliers, even if it would facilitate the qualification process. Furthermore, contractors would take advantage from their core suppliers' qualification, because they would have the possibility to propose key vendor names in tendering stages and gain more commissions.

In case of good service and good product performance during installation and plant start-up stages, clients are willing to send positive feedbacks to suppliers if they ask for them; however, they are not really valuable because they cannot certificate product durability. Only after some years of plant operation testing, in case the product has never caused problems and has always worked properly, end users could release useful references, representing optimal grading skills during other qualification processes. Contractors never release good references about product long-term reliability: until the plant is under guarantee and involved in testing stage, uncertainties about product future performance are very high.

Having feedback releases by contractors about vendor rating criteria is extremely difficult for manufacturers: if clients yearly provided an evaluation schedule about offered service level (including also observations about aspects to improve), suppliers would take outstanding advantages to obtain new qualifications. Instead, in the majority of cases, clients are not even disposed to compile simple questionnaires, sent by e-mail or available on suppliers' websites, to understand their satisfaction level and what items, in their opinion, suppliers should improve. Anyway, contractors are usually open, at least, about requested certifications.

Except for ISO 9001, which is obligatory in any case, the strict request of other standard ISO certificates (environment, safety and health, anticorruption, emissions, ethical code, etc.) depends on the political line the country in which the plant is being installed has taken: for example, Northern American market is very sensitive to all ISO certifications and always requests them.

Certifications about product (API 6A, API 6D, etc.) are very specific for every product type and also for each single commodities sector: in other words, they are limited to specific valve dimensions, rating classes and materials. They are obligatory or not, depending on the reference market/client. Since such certifications are not released for the total production plant, but for single product classes, suppliers are automatically excluded by clients' information systems if supply tenders are about products that are different from those included in supplier's qualified classes, even in spite of an ultra-qualified vendor brand.

In order to supply all the main markets, end users' qualification is mandatory. Contractors should exploit their strong political contacts to help suppliers to approach end users, mediating and supporting vendors' bids for a single project and, in case, their qualification. Product promotion, exhibitions, launches, dedicated technical seminars, etc. may be useful marketing actions: anyway, preferential channels and relationships with agents and distributors are needed. After that, a qualification process has to be engaged, through an audit of end user's inspectors.

4.1.1.14 SVS – 14

Turnover [Mln €]		> 200				
% of Special valves-Related turnover from the O&G sector		> 75%				
Group Belonging		Yes				
Supplied valves	Ball	Plug	Gate	Globe	Butterfly	Check
Main Business		"Special" ball valves				

Table SVS14.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern Europe / Ball, Gate, Globe, Check	Oil price decrease, Market fluctuation	↗
Central Asia / Ball, Gate, Globe, Check	Oil price decrease, Market fluctuation	↗
Far East / Ball, Gate, Globe, Check	Oil price decrease, Market fluctuation	↗

Table SVS14.2 – Market/product scenario

Market	Motivations	Actions to undertake
Far East	Rising market, Always new opportunities to gain further market share	Further commercial contacts, Re-contacting close local agents
Southern America	New market opportunities	Local agents, Enabling local contents where necessary

Table SVS14.3 – Prospective markets

The company is specialized in ball, gate and globe, check and control valves production, offering a very large product portfolio; it also produces special valves for particularly critical applications (e.g. subsea valves). This strategy enables the firm to be present in many different markets, which may request different product types, designs and specifics, according to the kind of project clients aim to realize and to the application.

The company both organizes product development programs and receives R&D orders for specific projects. A constant effort in R&D and an always active development function is highly appreciated and rewarded by clients. Qualifying tests based on clients' specifics are performed, including cycle tests with pressure and temperature ranges the client has previously defined. Non-destructive controls and inspections are carried out both with particular equipment and traditional instruments. Valves are tested in appropriate bunkers and with specific equipment that enable secure operations: gas tests (with nitrogen or helium), cryogenic tests (with liquid nitrogen), high temperature tests, subsea valves tests (in hyperbaric chambers), bending tests (very rare and complex) etc. are performed. Anyway, all tests, even the most complex ones, are performed in-house.

Special valves market is expected to rise, in particular, in the Far East more than in the other areas in the next years, due to a consistent increase of projects number. Moreover, South-Eastern Asia is a very active area also concerning the subsea valves market (in addition to Northern Europe and Gulf of Mexico).

The firm has been recently acquired by a group. Belonging to such a big group will certainly enable market grading, more business relationships and a larger number of contacts with clients; furthermore, this group will allow for the company's growth, guaranteeing further resources to invest, without substantial bureaucratic restrictions and firm integrations.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	Around 10 cast and forged components suppliers
Casting	IN	OUT	
Mechanical Manufacturing	IN	OUT	Only critical manufacturing operations
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS14.4 – Production stages

The most critical and complex mechanical manufacturing operations, as well as heat treatments, assembly and tests, are performed internally; simpler mechanical manufacturing and painting operations are outsourced. Welding operations are rarely realized; coating and finishing operations (especially outsourced: e.g. tungsten carbon coating) are more frequent.

Purchasing from local or relatively nearby implies quality guarantees and possible partnerships. Cast and forged components are purchased from almost all Italian foundries and forgers (about 10): special valves production requests highly qualified and reliable suppliers. The firm tried to buy materials also abroad (e.g. in India, China, Eastern Europe): however, many quality issues detected in manufacturing stages or during clients' inspections (causing also delivery delays), in addition to more complex and expensive quality controls and expediting procedures such issues required, convinced the company to a change its purchasing strategy, deciding on local procurement, in spite of higher costs.

All suppliers are qualified and certified through quality control programs and ISO certification systems; some suppliers may guarantee even higher quality standards, in case they obtained peculiar certifications, more difficult to achieve, which are often required by clients (e.g. NORSOK certifications). Suppliers of specific, peculiar materials or components must be qualified even by the client, in case it purchases a particular material, from a specific supplier, for the first time (in other words, qualification is necessary every time a new material type – supplier – client combination is implied).

For two out of the three selected market-product scenarios (Northern Europe, Central Asia), the main performance and their links with capabilities and practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering			Multi-skilled human resource selection
			Staff training

	Product/Process Development Capability	Human Resource Management Practices	Participation in decisional stages (delegation of responsibilities, team work)
			Interdisciplinary workgroups
	Customer Service	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Participation in decisional stages (delegation of responsibilities, team work)
			Interdisciplinary workgroups
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Quality control and guarantee programs
	Supply Chain Management Outbound	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
	Customer Service	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Participation in decisional stages (delegation of responsibilities, team work)
			Interdisciplinary workgroups
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Quality control and guarantee programs
	Customer Service	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Participation in decisional stages (delegation of responsibilities, team work)
			Interdisciplinary workgroups

Table SVS14.5 – Supply chain configuration – Northern Europe/Central Asia

For the remaining reference market, the supply chain is configured as follows:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Product/Process Development Capability	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Participation in decisional stages (delegation of responsibilities, team work)
	Customer Service		Interdisciplinary workgroups
			Multi-skilled human resource selection

		Human Resource Management Practices	Staff training
			Participation in decisional stages (delegation of responsibilities, team work)
			Interdisciplinary workgroups
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Quality control and guarantee programs
	Supply Chain Management Outbound	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
	Customer Service	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Participation in decisional stages (delegation of responsibilities, team work)
			Interdisciplinary workgroups
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Customer Service	Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
			Participation in decisional stages (delegation of responsibilities, team work)
			Interdisciplinary workgroups
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Quality control and guarantee programs
	Supply Chain Management Outbound	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs

Table SVS14.6 – Supply chain configuration – Other markets

Relationships with end users are fundamental, since they influence engineering companies and release technical specifications contractors and suppliers have to respect. The firm, when selected, collaborates with end user and engineering companies to define such specifications, establishing an open business relationship with the end user: information exchange begins from this stage and, then, focuses on the contractor when a specific project is started. Projecting phase and design development already begin during tendering and order acquisition stages; then, many details and modifications have to be specified during production and product testing stages, with consequent order processing management issues.

Moreover, there are usually order management issues, in terms of project and technical specifics definition with EPC clients: sometimes, clients release orders without previous project completion. In such situations, the following product checking stage becomes more complex and laborious, with sudden changes in clients'

requests. Finally, since the entry in the end user's vendor list is fundamental, the firm, through dedicated offices, keeps in contact with end users to understand their strategy: markets they are going to approach, projects to be developed, new technical choices, etc. Investments in constant R&D strongly focus on end users' requests.

4.1.1.15 SVS – 15

Turnover [Mln €]		20-50
% of Special valves-Related turnover from the O&G sector		50%-75%
Group Belonging		Yes
Supplied valves	Ball Plug Gate Globe Butterfly Check	
Main Business		Gate and Globe valves

Table SVS15.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern Europe / Ball, Gate, Globe, Check	Not saturated	↗
Caspian Area / Ball, Gate, Globe, Check	Not saturated	↗
Middle East / Ball, Gate, Globe, Check	Not saturated	↗
Southern Asia / Ball, Gate, Globe, Check	Not saturated	↗

Table SVS15.2 – Market/product scenario

Market	Motivations	Actions to undertake
Middle East	Market with great potential and development possibility	Local agents, Direct sales channel if the market grows, End users' qualifications
Northern America	Market with great potential and development possibility	Local agents, Direct sales channel if the market grows, End users' qualifications

Table SVS15.3 – Prospective markets

The company is specialized in ball, gate, globe and check valves production; valves do not represent the only business of the firm: it realizes also level gauges. In the past, the company mainly worked in niche markets of the Power sector and, even if it performed well making discreet profits, this way of working closed many opportunities of expansion. Afterwards, with the onset of the international crisis, the company, in order to stay competitive, preferred to concentrate on the production of more standard products for large distributors of the mentioned sector; during this period, thanks to its brand value, the firm also succeeded in maintaining profitable relationships with its old clients. Nowadays, the company, in order to expand its business, strategically decides to enter more deeply in the Oil&Gas sector. (Nowadays, the revenues from Power and Oil&Gas sector are respectively about 60% and 40%).

The membership to an international group is a very recent decision and represents one of the many ongoing changes. The group ensures the company greater financial strength and, thanks to its presence, new potential markets in the Far East area. The presence of the group in the Far East area, allowed the firm to open there a new production plant; therefore, the firm can now observe more closely the development of Chinese, Japanese, Indian and Korean markets.

In order to face the fluctuating situation of the oil price, the firm is doing huge internal changes.

All these new internal changes embrace different functions and activities: educate the sales force, in order to provide them a new proactive approach, invest in the suppliers upgrading (more control on supplies and

the enlargement of the supplier base), increase the production in the Far East area, and concentrate more efforts on core business activities, outsourcing all non-adding values activities.

The firm has a standard way to enter in a new geo-political market. Indeed, it penetrates markets with local agents and then, if the market grows, it usually sets up a direct sale channel. Out of this logic, the firm has signed a partnership with a Russian firm to better penetrate the local market. This relationship also permits the firm to strategically investigate the whole Ex USSR area.

Nowadays, the R&D function, located in Italy, is focused on the compliance of the actual product portfolio: product documentation, acceptance tests and new regulations impose continue investments, in order to make products suitable for international clients. Moreover, the firm is focusing its efforts in improving the R&D function in its Far East's plant with the purpose to enlarge the product portfolio.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	-
Casting	IN	OUT	-
Mechanical Manufacturing	IN	OUT	Only critical manufacturing cycle stages
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Labeling	IN	OUT	-

Table SVS15.4 – Production stages

Quality represents an important performance that must be maintained from upstream to downstream supply chain. The company qualifies suppliers through a qualitative and technical evaluation of the plant and their supplies. Indeed, the knowledge level of its supplier base is good and a further quality and dimensional control of incoming products is always leveraged to maintain the high level of quality required by clients.

The firm it's able to provide the following performance (with related capabilities-practices links to obtain them) in every relevant scenario:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Enhancement of each other's business (common growth)
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		Long-term Relationships with Customers	Close partnership with customers
	Supply Chain Management Outbound	Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Enhancement of each other's business (common growth)
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		Long-term Relationships with Customers	Close partnerships with customers

	Knowledge Management Capability	IT (Information Technology)	Information Technology
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (SC)	Capacity and Flexibility	IS – Customer to Firm	Information exchange about planned orders or order changes
			Information exchange about inventory level
	Knowledge Management Capability	IT (Information Technology)	Information Technology
	Project Management Capability	IT (Information Technology)	Information Technology
		Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Knowledge	Knowledge Management Capability	IT (Information Technology)	Information Technology
	Internal Integration	IT (Information Technology)	Information Technology
		IS (Information Sharing)	Knowledge sharing about Core Business Processes
			Quality data availability
			Frequent, informal, timely information exchange
	External Integration	IS – Firm to Customer	Information about available production capacity
			Information about order status and expected lead-time
		Long-term Relationships with Customers	Close partnerships with customers

Table SVS15.5 – Supply chain configuration

Quality, Flexibility and Knowledge represent the performance the firm is able to provide to its clients. Moreover, the great internal renewal is improving other two performance: On-Time Delivery and Price. In order to achieve these two goals, the company is planning to invest more towards information sharing, project management practices and the improvement of the production system.

Nowadays, as represented in the table above, one of the most important capability is the Knowledge Management Capability. Indeed, the company has already achieved a very wide ranging know-how that manages investing in information technology. New knowledge is managed through the capability of coordination of the internal management functions and the ability to integrate the company with the upstream and downstream parts of the supply chain. These two last capabilities are enabled through a constant exchange of strategic information between the firm's internal functions and its clients.

Talking about clients, the firm do not see differences between clients from different geo-political markets: the globalization has standardized every aspect in communication and ways of working. Communication with clients is constant and active on both sides during all the projects phases. Indeed, the company has several windows of communication with its customers: from the offer request, passing from the order management

and up to the shipments. Finally, an adding window of communication is opened in case of any after sale issue.

The great amount of internal approval documentation usually (certifications and paper deliverables) complicates planning and generates delivery delays.

Moreover, even if it is essential, there is no a particular strategy to enter in the end user's vendor list. The company is known by the local End user through local agents, references and, eventually, through partnership with local companies. Moreover, the possibility to offer different types of products, allows the company to enter in different end users' vendor lists. Indeed, if the firm gets the qualification for a generic product, it uses this factor as a strategic path, in order to qualify and offer to the final client all the other remaining products.

4.1.1.16 SVS – 16

Turnover [Mln €]		50-200				
% of Special valves-Related turnover from the O&G sector		> 75%				
Group Belonging		Yes				
Supplied valves	Ball	Plug	Gate	Globe	Butterfly	Check
Main Business		"Special" ball valves				

Table SVS16.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern Europe / Ball	Not saturated	
Northern America / Ball	Not saturated	
Far East / Ball	Not saturated	
Middle East / Ball	Not saturated	

Table SVS16.2 – Market/product scenario

Market	Motivations	Actions to undertake
Middle East	New projects, New investments in the area	Already present in the area
Caspian Area	New projects, New investments in the area	Already present in the area
Asia	New projects, New investments in the area	Already present in the area

Table SVS16.3 – Prospective markets

The company is part of a huge international group specialized in the Oil&Gas and Power sectors. The firm is focused on ball valves production and, in the last few years, due to a group's membership, has increased the production of engineered valves for niche markets within the Oil&Gas sector (around 95% of valves' turnover comes from the Oil&Gas sector). The valves production mainly includes: On-Off ball valves (Trunnion valves), TMC and RS ball valves. The product portfolio of the first group of valves is not only composed by "standard" valves but, due to the continuous design improvement and engineering development, allows the firm to supply a wide offer of special valves to its customers. Moreover, the firm is constantly careful to fulfill customers' wishes before they make specific requests. The true specialization of the firm started with the production of the second and the third group of valves, allowing it to expand its influence in many niche markets and offer a more engineered and complete product portfolio.

The company produces ball valves for both midstream and downstream sectors. The international crisis has first damaged the upstream sector, stopping a lot of projects and investments, and touched slightly the other two sectors. In the last years, the firm has benefited of backlog profits coming from past projects but now, the reduction of investments in the midstream and downstream sectors, due to the decreasing of the oil price, leads the company to face with the crisis. Moreover, the investments uncertainty in traditional markets has led customers to make cost saving and to propose disadvantageous terms and conditions to suppliers. However, the financial solidity and worldwide presence of the group and the continuous development in the R&D function allow the firm to continue to effectively supply niche markets, where price is important but the technological and quality level of products are often fundamental.

The group has not only helped the company to expand the product portfolio, but has also helped the improvement of all the internal functions; indeed, substantial investments in human resource training and in new qualitative compliance procedures were made. In order to be aligned with the group policy and push the firm towards more competitive scenarios, the firm has made huge investments in staff training from the production function, passing through the technical office, to the commercial office.

Talking about the product/market scenarios, the American market and the Middle East market are two of the historical markets of the firm. Moreover, thanks to the strong internal improvement of more engineered valves, the company is now starting to produce valves also for the off-shore markets in the Northern Europe and the Caspian area.

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	20 forged components suppliers
Casting	IN	OUT	Around 4 cast components suppliers
Mechanical Manufacturing	IN	OUT	Only critical manufacturing cycle stages
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS16.4 – Production stages

The company relies on Italian suppliers, that ensure reliability and high quality on purchased cast and forged components. Moreover, if the market demand increase, the firm may outsource the manufacturing stage of non-critical parts to a restrict number of qualified suppliers. A total knowledge of the upstream supply chain allows the firm to ensure a quality and price competitive product to its customers.

A qualitative and technical check of the plant and products represent the two of the main steps that the firm does in order to qualify new suppliers. Suppliers must have all the international quality certifications and, in order to let the firm produces a compliance product, all the components certifications every specific market requests.

For all selected market-product scenarios (Northern America, Northern Europe, Far East and Middle East), the fundamental performance and their links with enabled capabilities and implemented practices are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Capacity and Flexibility	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selections

		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
	Customer Service	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selections
		Production System Practices	Investments in R&D and Engineering functions
			Use of top quality material
	Supply Chain Management Inbound	IT (Information Technology)	Scheduling and planning software use and/or development
			Production planning
		Long-term Relationships with Suppliers	Close Partnerships with strategic suppliers, commercial agreements
			Quality guarantee programs for suppliers' processes
			Cooperation in checking order status
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Outbound	Long-term Relationships with Customers	Close partnership with customers
			Collaboration in new product development
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
		Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-Customer (reference markets) locations
		Strategic Behavior	Sharing sensitive information (about finance, production, design, research, competing scenarios, etc.)
			Industrial group participation
	Capacity and Flexibility	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selections
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
	Customer Service	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selections

		Production System Practices	Investments in R&D and Engineering functions
			Use of top quality material
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	IT (Information Technology)	Scheduling and planning software use and/or development
			Production planning
		Long-term Relationships with Suppliers	Close Partnerships with strategic suppliers, commercial agreements
			Quality guarantee programs for suppliers' processes
			Cooperation in checking order status
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
	Supply Chain Management Outbound	Long-term Relationships with Customers	Close partnership with customers
			Collaboration in new product development
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
		Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-Customer (reference markets) locations
		Strategic Behavior	Sharing sensitive information (about finance, production, design, research, competing scenarios, etc.)
			Industrial group participation
	Project Management Capability	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for suppliers selection
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
			Cycle time reduction
			Use of top quality material

Table SVS16.5 – Supply chain configuration

The three main performance the firm has developed are: Price, On-Time Delivery and Quality.

Engineering is at the fourth position, although it is of rising importance; indeed, “special” valves represent the only category of products that allow the firm to penetrate niche markets, especially off-shore markets.

The 90% of company production goes out from the Italian boundaries; Customer Service is fundamental in order to reach convenient agreements with end users. Moreover, the group, with its worldwide presence, allows the firm to stay in touch with its clients and offer a fast and local service, if the customer needs it. A

consultancy selling is often requests by clients and sponsored by the firm, in order to demonstrate the high level of quality of the selling product and justify the price.

The firm communicates daily with its customers. A customer satisfaction survey, each time a contract is closed, is sent by the group to customers. These surveys allow the firm to verify the qualitative compliance of its supplies.

Thanks to the group presence, the firm is already present in the main end user's vendor lists. Finally, contacts with end users are reinforced where the market becomes more consistent, moving in order to complete and consolidate the firm's presence into those lists where products are not already present.

4.1.1.17 SVS – 17

Turnover [Mln €]	50-200
% of Special valves-Related turnover from the O&G sector	< 25%
Group Belonging	Yes
Supplied valves	☒ Ball ☐ Plug ☒ Gate ☒ Globe ☒ Butterfly ☒ Check
Main Business	Gate and Globe valves

Table SVS17.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Russia / Gate, Globe, Check, Butterfly, Ball	Political instability	
Far East / Gate, Globe, Check, Butterfly, Ball	Waiting for new projects and investments	
Middle East / Gate, Globe, Check, Butterfly, Ball	Waiting for the end of the embargo	

Table SVS17.2 – Market/product scenario

Market	Motivations	Actions to undertake
Southern America	Already present with another kind of product	End users' qualifications
Middle East	New investments, New projects	Reconnect end users
Africa	Market with great potential and resources	/
Far East	New investments, New projects	Reconnect end users

Table SVS17.3 – Prospective markets

The company produces ball, globe, gate, check and butterfly valves. The richness of its portfolio is due to a particular function and structure of the firm. Italy represents the place where the realization of valves, and particularly special valves, is supported by a network of reliable components suppliers and valves producers with an high level of knowledge. The company, even if it is able to produce valves internally, in order to have a very complete product portfolio and outsource the production of the less remunerative valves, collaborates and directly sells products of a discreet number of external satellite companies. Indeed, the firm, during the past years, has established very close relationships with these small Italian firms and now considers them as an extension of the firm itself. These collaborations allow the firm to enlarge its product portfolio and create new contacts with new potential customers. Indeed, since customers prefer to make less possible products orders, the capacity to provide a wide product portfolio allows the firm to competitively overcome the offers of different competitors. Moreover, the firm, through these collaborations, has the possibility to enlarge the customers' network. Indeed, these satellite companies have provided their customer's contacts directly to the firm, benefiting from the firm's domain experience, in order to sell their products. The firm is both

responsible for the selling of valve products of these small companies with the brand of the group or directly to their customers.

These strategic collaborations also allow the firm to concentrate its efforts on the core business activities.

This way of interacting with all these local companies and with new potential clients has allowed the company to carve out a special role into the group; indeed, the company is responsible of the logistic of the whole European zone. The exploitation of the richness of the Italian environment allows the firm to get focal commercial responsibilities that are far from the duties of a common branch.

Finally, it possible to say that, if on one side the firm benefits from the possibility to offer different types of valves and enlarge its customer base, on the other side, the mentioned small Italian companies exploit the great commercial network and visibility of the firm.

The firm, in addition to the valves' supply, also produces pumps for the Oil&Gas, Power, civil and naval sector. The ability of working simultaneously on sever tables, allowed the firm to overcome the crisis and, in general, to overcome issues every sector periodically has. Belonging to an international group, and the importance reached in the Italian area, allowed the company to have all the advantage a group guarantees (solid financial base, a global network and a wide product portfolio) and the peculiarity of a small/medium independent firm (flexibility and direct relationship with suppliers, satellite companies and Italian clients). Talking about the production, the company realizes around the 45% of its turnover from the selling of special valves and less than the 25% is from special valves production for the Oil&Gas sector.

The company does not have an R&D department. This choice is aligned with the strategic decision of working strictly with the other satellite companies of the area. An external company does not only supply products or components, but also knowledge. Indeed, working strictly with these small firms, allow the company to absorb their product and process knowledge.

Nowadays, the company directly deals with the Italian market through agents, but the European area and the other markets area, where the firm works, are directly managed by the group through an area manager. In order to enter in a new geo-political market scenario, a decennial strategy is made. This analysis is composed by different sub-analysis that primarily allow to define the category of the product for the specific market (valves, pumps, etc.) and secondly the type of the product to sell (gate, globe, ball, etc.).

Notes			
Procurement	IN	OUT	-
Forging	IN	OUT	10 - 20 forged and cast components suppliers
Casting	IN	OUT	
Mechanical Manufacturing	IN	OUT	-
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS17.4 – Production stages

Cast and forged components are mostly purchased from Italian suppliers: Italian components suppliers are reliable and provide quality components. Suppliers are qualified through control programs and the request of quality and international certifications. Historical suppliers of every area are usually shared between the different companies of the group and, if a supplier has to supply a company of the group of another geo-

political area, only other few and not onerous local qualifications are needed. The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Electronic Data Interchange (EDI)
			Warehouse Management Software (WMS)
		Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Quality guarantee programs for suppliers' processes
		Long-term Relationships with Customers	Close partnerships with customers
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			Setup time reduction
	Capacity and Flexibility	Production System Practices	External knowhow/technology acquisition
			Setup time reduction
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	IT (Information Technology)	Electronic Data Interchange (EDI)
			Warehouse Management Software (WMS)
		Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Quality guarantee programs for suppliers' processes
		Long-term Relationships with Customers	Close partnerships with customers
	Supply Chain Management Outbound	IT (Information Technology)	Electronic Data Interchange (EDI)
			Warehouse Management Software (WMS)
		Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Quality guarantee programs for suppliers' processes
		Long-term Relationships with Customers	Close partnerships with customers
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			Setup time reduction
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
			Electronic Data Interchange (EDI)

On-Time Delivery	Supply Chain Management Inbound	IT (Information Technology)	Warehouse Management Software (WMS)
		Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Quality guarantee programs for suppliers' processes
	Customer Service	Long-term Relationships with Customers	Close partnerships with customers
		Network	Sections-network development (for commercialization, contracting and assistance)
			Limited number of suppliers
		IS – Firm to Customer	Information about order status and expected lead-time
			Information about delivery schedule and/or possible changes in delivery schedule
		Human Resource Management Practices	Staff training

Table SVS17.5 – Supply chain configuration

The high logistic capability the firm has and the duty of taking care of commercial interests of other different local firms, has led the company to forge strong relationships with all the actors of the supply chain. These inner skills of interaction are supported through a good internal information technology that primarily pertains, due to the logistic duties of the company, the warehouse management. The extremely large product portfolio and the utilization of external firms, force the firm, in order to guarantee a good capability of customer service, to be extremely coordinated and timely in giving delivery and schedule changes information.

Since it represents the only way that allows the firm to work in a specific market area, the entry in the end user's vendor list is fundamental. The firm also considers not less important the entry in the EPC's vendor list. Indeed, this list is combined with the end user's vendor list and suppliers present in both lists have much more likely to be chosen. The large product portfolio, and the international group's membership allow the firm to be present in almost all the main important EPC and end user's vendor lists.

4.1.1.18 SVS – 18

Turnover [Mln €]	50-200
% of Special valves-Related turnover from the O&G sector	> 75%
Group Belonging	Yes
Supplied valves	☒ Ball ☐ Plug ☐ Gate ☐ Globe ☐ Butterfly ☐ Check
Main Business	"Special" ball valves

Table SVS18.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Middle East/ Ball	Principal reference market	
Far East / Ball	Strongest EPC presence	
Europe / Ball	/	

Table SVS18.2 – Market/product scenario

Market	Motivations	Actions to undertake
Northern America	Group headquarter presence	Presence of a salesman
Caspian Area	New projects, Future investments	Local agents, Salesmen

Table SVS18.3 – Prospective markets

This firm is specialized in ball valves production and is almost completely focused on special valves production for the Oil&Gas sector (Table SVS18.1). Moreover, the company belongs to a big international group that primarily works in the same sector of the firm and assures to the firm a solid financial base and a worldwide visibility. The firm, without weighting on the group's finance, during the last years, has highly improved the service and on-time delivery performance. The improvement of these two performance allowed the firm to face and come out from the crisis period began at the end of the 2010. The service performance, that was already performing well, due to the previous group affiliation, has been improved with a more aggressive approach to the market and clients, even accepting orders that mainly contained not already developed products. Nowadays, the company relies on four Italian salesmen and four other salesmen strategically placed in the main strategic markets of the firm. The service level is grown also due to the attention of the firm to the enhance the on-time delivery performance. Indeed, the great attention that the company gave to the reduction of internal bottlenecks, to the automation of its production, and, in general, to the incrementing of quality through a continuous internal improvement, allowed the firm to effectively develop both the performance of service and on-time delivery.

Nowadays, the company works in three principal markets: Middle East, Far East and Europe. Middle East is the most relevant market where the firm works. Far East and Europe markets (Figure SVS18.1) are strategically important in order to create strong relationships with clients and final clients. The company, in the past, tried to enter in the Southern America market with negative results, and now, exploiting the presence of the group and the feasible positive trend of the market, the firm is concentrating its efforts in the northern side of America.

The firm builds its competitiveness on a high internal coordination. Eight qualified project managers allow the company to effectively manage the documentation and ensue different offers and projects at the same time. Another important function the firm has, is the R&D function; two people are involved in this function and they are able to grant and provide what customer needs. Indeed, as previously mentioned, the firm, maintaining its aggressive market approach and accepting new orders containing new products, forces the R&D function to constantly work on new possible product design and improvement.

			Notes
Procurement	IN	OUT	-
Forging	IN	OUT	20-25 forged components suppliers
Casting	IN	OUT	Around 10 cast components suppliers
Mechanical Manufacturing	IN	OUT	Only critical manufacturing cycle stages
Welding	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-

Table SVS18.4 – Production stages

The company is totally concentrated on its core business, outsourcing all its production non-adding value stages. The production system, thanks to the presence of many reliable and cost-effective suppliers able to realize a quality manufactured product, focus its efforts only on critical mechanical manufacturing stages. Nowadays, the firm purchases also from Chinese and Indian suppliers. The selection of these suppliers has been very thorough, due to the common low quality of the bulk of the Far East suppliers.

Moreover, even if the firm guarantees a total knowledge of its upstream supply chain, only the 10%-15% of its customers accept Chinese and Indian suppliers.

All the different supplied products, share a unique supply chain configuration: this means there are not relevant differences between distinct scenarios.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Helping Suppliers to improve their product quality (Top Management Support)
			Mutual performance measurement (Collaborative Performance System)
			Cooperation in checking order status
	Customer Service	Network	Close-to-customer (reference markets) locations
		Production System Practices	Total Quality Management practices (TQM)
		Long-term Relationships with Customers	Close partnerships with customers
	Project Management Capability	IT (Information Technology)	Enterprise Resource Planning Systems (ERP)
		IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
		Project Management Practices	Work Breakdown Structure (WBS)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions

Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Helping Suppliers to improve their product quality (Top Management Support)
			Mutual performance measurement (Collaborative Performance System)
			Cooperation in checking order status
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			Product modularization
			Total Quality Management practices (TQM)
	Capacity and Flexibility	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Solid and durable relationships with key suppliers (considered as a part of the firm)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			Product modularization
			Total Quality Management practices (TQM)
	Capacity and Flexibility	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Solid and durable relationships with key suppliers (considered as a part of the firm)
	Internal Integration	Human Resource Management Practices	Staff training
		Strategic Behavior	Joint Decision Making
			Involving both marketing and manufacturing functions in supply chain planning process

Table SVS18.5 – Supply chain configuration

The wideness of the firm's supplier base, has led the company to forge strong relationships with its suppliers, in order better control them. These suppliers are mainly small companies and, for this reason, the company, during the years, has not forged binding agreements but has always helped these firms, in order to grant all the support, they needed in case of delays or quality problems. In order to externally grant the performance of Quality and Engineering, it is fundamental the continuous improvement of product modularization, that allows the firm to innovate and following easily customer requests. Almost all the implemented actions aim to realize a better communication and coordination with all the actors of the supply chain, allowing the firm to directly request from the upstream part of the supply chain what clients ask to it.

The entry in the end user vendor list is fundamental to compete in the international scene. The firm is already present in almost all the principal end users' vendor list and it is working in order to enter in small/medium end users' vendor lists.

4.2 Companies overview – SES

Static equipment best performers sample is quite homogeneous: the companies have to the small-medium size turnover and they usually belong to a group or are the headquarter of other companies.

The group presence seems to be focal in order to help financially the firm to supply huge and expensive equipment.

The static equipment sector globally realizes a turnover of around 3400 Million of Euro and around the 40%-50% of this turnover comes from the Oil&Gas sector. The global turnover of the interviewed companies is around 700-800 Million of Euro and the part of this turnover that derives from the selling of the investigated static equipment is around 500 Million of Euro.

Moreover, surveyed companies represent 25%-35% of the Italian manufacturers of static equipment items. Finally, 1 out 3 of premium static equipment value for Oil&Gas sector is manufactured in Italy.

Company	Turnover in millions € [2014]	% of static equipment-related turnover	Production plants	Production plants in Italy	Number of employees	Belonging to a group
1	20-100	>75%	1	1	100-1000	YES
2	20-100	50%-75%	<5	1	100-1000	YES
3	-	>75%	<5	1	-	YES
4	20-100	>75%	2-5	2-5	-	YES
5	100-200	>75%	2-5	2-5	-	YES
6	20-100	50%-75%	2-5	2-5	100-1000	NO
7	20-100	<25%	1	1	<100	YES
8	100-200	25%-50%	2-5	2-5	100-1000	YES
9	100-200	<25%	1	1	100-1000	YES
10	20-100	50%-75%	1	1	<100	NO
11	20-100	< 25%	1	1	<100	YES
12	20-100	>75%	1	1	100-1000	YES

Table 4.4 Best Performers data – SES

Company	Group turnover in million € [2014]	Group employees
1	1000-2000	-
2	100-1000	100-1000
3	100-1000	100-1000
4	>2000	-
5	>2000	-
7	100-1000	-
8.1	-	>10000
8.2	-	>200000
9	100-1000	100-1000
12	100-1000	>2000

Table 4.5 Best Performers' group data – SES

4.2.1 Single cases – SES

In this paragraph, static equipment producers are analyzed using the single case technique.

This will enable to understand and focus the peculiarities of each company composing the sample and collect the main data, in order to gather many critical and interesting aspects, depending on the different market contexts they work in, and understand what different configurations and strategies they adopt.

4.2.1.1 SES – 1

Turnover [Mln €]		20-100	
% of Static equipment-Related turnover from the O&G sector		> 75%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES1.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Far East/PE	Good opportunities	☰
Northern Europe/Piping	New off-shore projects	↗
Europe/PE	Revamping of old plants	↗

Table SES1.2 – Market/product scenario

Market	Motivations	Actions to undertake
Northern America	New extraction methods (like shale gas)	Local agents, Certifications
Middle East	Strong internal market, suppression of Iranian embargo	Local agents
Far East	-	-

Table SES1.3 – Prospective markets

Since the foundation, the firm has focused its attention on titanium manufacturing: it has collected over thirty years of expertise about this capability.

The company decided to join a group which was totally aligned with his strategy: this group is nowadays one of the most important titanium manufacturing group with a wide range of markets served (commercial aerospace, defense, other industry).

This allowed to build main strategic advantages:

- Financial solidity, considered by the contractor as a cutting capability, rising in importance;
- Realize synergies to buy rough material, in order to guarantee quality and a reduction on unitary cost (in this sector, it represents the 70% of the overall);
- Build a central research and development department that could improve the materials properties and quality and further improve save money.

The last two advantages could be built just because of the strategic alignment between the affiliated company and the group; moreover, the companies included in the group, apart for the materials procurement, acts like single company, so the company benefits of the financial solidity without having bureaucratic issues.

The company is specialized in equipment and piping spool: the company has its own core-business managed independently from the group.

During the 90s, the firm has achieved many quality certification, including ISO 9001, ASME and SQLC.

Nowadays the company is one of the most competitive firm in titanium manufacturing and supply most of the clients that need this kind of production.

From the firm's point of view, mostly the innovation in this sector is brought by material development and improvement: to do that, the companies belonging to the group work in synergy. This means that the single firm does not have a R&D specific department; however, it is able to meet the client's specification and problems about new details in product design.

In particular, the respondent underlines the increasing need to have an advanced project management capability: contractors trend is to transfer to the supplier the engineering phase to save money and reduce contractor company costs.

About the market scenario, the company's product is primarily requested in really corrosive environment: the most important field is the off-shore plants.

Middle East Market (Gulf Peninsula) represents a really attractive reality: here there are many opportunities and projects starting.

Another important market is the Norway: here the market is nearly totally composed of off-shore platform and Europe in general for the revamping market.

For the future, the respondent is quite prudent: all depends on the fluctuation of oil price.

Anyway, Northern America could represent a great opportunity for new method of extraction (like Shale Gas);

Because of the suppression of the embargo, Iran could be a good market to exploit. It must be considered that the penetration of the market couldn't happen easily because of the strong internal market.

China, that was historically a firm's client and in the last years has invested on internal market, could return to be an important market, considering the inability of the local supplier to produce the requested quality.

In order to penetrate all this market, it is important to possess all the requested certifications and can count on experienced local agent. In particular, the latter factor is the most important to enable the company to have simplified relationship with end users and enter in the end users short-list.

Notes			
Procurement	IN	OUT	Around 50 titanium suppliers
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Assembly	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES1.4 – Production stages

The company can manufacture all the product stages internally (vertical integration): apart from the first matter that is procured by the group, the firm does all the production phases from manufacturing to labeling by itself. Sometimes it turns to suppliers in order to cover production peaks and urgent requests by the customer: anyway, the company outsources only not critical manufacturing phases, involving "standard" materials like carbon or stainless steel.

All the products are made in the same plant, so the supply chain configuration is identical for all the scenarios.

The material supplying strategy is differentiated between titanium and steel: while for the first the firm maintain a quite reduced supply base (in order of 50 suppliers), for the steel it tries to increase as much as it can the number of suppliers, where price is the only choice criteria (with a cutting level of quality).

Anyway, there is a high effort on supplier's selection: annually the company performs visits and assessment, while more frequent information sharing is kept.

Moreover, it applies a win-win strategy with the material suppliers in order to obtain bigger discount on material and create long-term relationships.

In order to assure the requested quality, suppliers must have quality certifications (for example, ISO 9001) and have to demonstrate great attention to on-time delivery and quality.

In fact, the company is responsible to the client for the material quality.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Production System Practices	Plants and machines upgrade/replacement
			External knowhow/technology acquisition
			Cycle time reduction
			Agile manufacturing strategies
			Stocking area for urgent orders
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
			Enhancement of each other's business (common growth)
		Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
	Project Management Capability	Production System Practices	Plants and machines upgrade/replacement
			External knowhow/technology acquisition
			Cycle time reduction
			Agile manufacturing strategies
			Stocking area for urgent orders
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
			Group coordination activities
			Production planning

		IT (Information Technology)	Bar coding/automatic identification systems
			Monitoring order processing status, Manufacturing Execution Systems (MES)
			Warehouse Management Software (WMS)
	Supply Chain Management Outbound	Production System Practices	Plants and machines upgrade/replacement
			External knowhow/technology acquisition
			Cycle time reduction
			Agile manufacturing strategies
			Stocking area for urgent orders
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
			Enhancement of each other's business (common growth)
		Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
		Long-term Relationships with Customers	Close partnerships with customers
			Investments for evaluating customer's future needs
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Knowledge Management Capability	IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
			Group coordination activities
		Strategic Behavior	Joint Decision Making
			Industrial group participation
	Relationship Capability	Production System Practices	Plants and machines upgrade/replacement
			External knowhow/technology acquisition
			Cycle time reduction
			Agile manufacturing strategies
			Stocking area for urgent orders
		Network	Sections-network development (for commercialization, contracting and assistance)

		Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
	Project Management Capability	Production System Practices	Plants and machines upgrade/replacement
			External knowhow/technology acquisition
			Cycle time reduction
			Agile manufacturing strategies
			Stocking area for urgent orders
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
			Group coordination activities
		IT (Information Technology)	Production planning
			Bar coding/automatic identification systems
			Monitoring order processing status, Manufacturing Execution Systems (MES)
			Warehouse Management Software (WMS)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	Production System Practices	Plants and machines upgrade/replacement
			External knowhow/technology acquisition
			Cycle time reduction
			Agile manufacturing strategies
			Stocking area for urgent orders
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
			Enhancement of each other's business (common growth)
		Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
	Supply Chain Management Outbound	Production System Practices	Plants and machines upgrade/replacement
			External knowhow/technology acquisition
			Cycle time reduction

			Agile manufacturing strategies
			Stocking area for urgent orders
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
			Enhancement of each other's business (common growth)
		Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
		Long-term Relationships with Customers	Close partnerships with customers
			Investments for evaluating customer's future needs
	Project Management Capability	Production System Practice	Plants and machines upgrade/replacement
			External knowhow/technology acquisition

Table SES1.5 – Supply chain configuration

It can be noticed that Project Management Capability is mainly important: as said before, because of the contractor's trend to transfer the engineering phase on the supplier, it becomes extremely important for the supplier to have the capability to deal with the project in an efficient way in order to reduce cost and make competitive offers.

For the company is of paramount importance to have good and long-lasting relationships with end users. It is essential in many market (like Middle East) to be in the end user short-list: to enter the list, the company employs experienced local commercial agents that simplify the first contact with end users. Indeed, the company can't count on extensive local content because of the not common capability a firm must have to treat titanium.

Because of the trend to use Indian or Korean buyers by the contractor, experience is decreasing and the position of the project manager is going to extinguish; this cause the people the suppliers deal with loses the decision power.

The latter event makes it hard for the company to deal with specifications and enables supplier's knowledge and quality to stand out.

4.2.1.2 SES – 2

Turnover [Mln €]		20-100	
% of Static equipment-Related turnover from the O&G sector		50%-75%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES2.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America / HPE	New projects, New extraction technology	
Middle East / HPE	Constant investments in new plants	
Far East / HPE	Internal competitors threat	

Table SES2.2 – Market/product scenario

Market	Motivations	Actions to undertake
Russia	New market	Local partnership to enter in the End-user vendor list
Middle East	Opening markets	Local partnership to enter in the End-user vendor list

Table SES2.3 – Prospective markets

The company had as core-business the pharmaceutical industry. Then, during the late '70, in spite of the oil crisis, the company obtained the first petrochemical order: from that on, the Energy & Petrochemical Division continued to manufacture tailor-made, medium and high static equipment like reactors, heat exchangers, columns and special vessels.

The group claims 4 companies, 5 production sites in 3 different country, over 100 M€ of turnover and 700 employees.

Recently the group has acquired a competitor in order to increase the overall knowledge (the acquired company has been in the industry for a long time). The company is focused on the Oil&Gas Industry (it covers more than half of the turnover).

Even if the company is very dynamic in term of effort to develop technology and new products (the company has developed the Flash Technology), it doesn't have a R&D division because of the high investments it needs.

Clients usually does not request new technology, so it is to the company to search and exploit new business possibilities. This means also performing research on the clients' unexplored needs.

North America is interesting because it was never exploited by the firm and because of the new extraction technology that is starting to be applied in USA, assuring new projects and investments. Middle East is always a guarantee in term of projects and investments and the company has been present in this market enough time to consolidate relationship with end users in order to have a privileged way for new orders.

In 2015, China has been a good market, but for contingency reasons and for the emergent local competitors, also favored by the government politics, it seems intended to fall in importance for the kind of products the company manufactures (premium products).

For the future, Russia could be an attractive market (the company is trying only now to enter this market); because of the embargo withdrawal, Iran will probably be a really important one. It seems even more attractive because it has been historically a good target for Italians suppliers.

In order to enter new markets, the company indicates that the only way is activate local partnerships with experienced and well-introduced agents who can introduce the company to clients and end users, starting relationships in order to enter vendor lists.

In the current markets, the company is able to supply all the products the portfolio presents: because of the tailor-made nature of the products, the company has developed great skills to cover all the possible kind of products (except for steam generators that uses heaters, air coolers and Trays & Internals).

The company is specialized in shell&tube heat exchangers, columns&drums and pressure vessels, in particular it tends to sell the high-static equipment (where they are more competitive).

Entering the group enabled the companies to internationalize their clients, building a global experience and spreading cultural horizon and barriers.

It helped to spread the knowledge inside the firm, to find new business and to create corporate synergies (but not production ones).

Notes			
Procurement	IN	OUT	Less than 20 Trays&Internals/Packages suppliers
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Assembly	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES2.4 – Production stages

The company systematically outsources packages and Trays&Internals: this kind of products needs specific engineering competences that the company decided not to develop.

For what concerns the products in the portfolio, the company can manufacture every step of the production process.

Basic components like raw materials, tubes and rods are outsourced from a high number of suppliers: because of the numerousness, close relationships cannot be maintained and suppliers' assessment are based on documents and previous performance.

Instead, for critical components that integrates the company offer (Packages, Trays, Internals) close relationships are developed in order to guarantee the excellent quality the company aim for. For this kind of outsourcing, information sharing and audit are frequently performed in order to strengthen relationships and assure reliability; the number of suppliers is reduced (<20 per types) and long-term relationships are preferred.

Important performance are quality and engineering (in term of design); knowledge capability must be demonstrated, assuring the performance just cited.

Quality certifications must have been obtained (ISO 9001).

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, for each market, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Differentiation	Supply Chain Management Outbound	IS – Customer to Firm	Information about order status and expected lead-time
			Information about delivery schedule and/or possible changes in delivery schedule
		Long-term Relationships with Customers	Close partnerships with customers
			Resources investment to keep a well-performing supply chain (Commitment)
			Investments for evaluating customer's future needs

	Market Development Capability	IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
		IS – Firm to Customer	Information about available production capacity
		Long-term Relationships with Customers	Close partnerships with customers
			Resources investment to keep a well-performing supply chain (Commitment)
			Investments for evaluating customer's future needs
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	IS (Information Sharing)	Quality data availability
			Frequent, informal, timely information exchange
			Information exchange for improving supplier/client performance
			Mutual feedback
	Internal Integration	IT (Information Technology)	Inter-organizational coordination through electronic links
			Electronic mailing with key suppliers
			Production Planning
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
		Network	Sections-network development (for production)
			Close-to-customer (reference markets) locations
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IS (Information Sharing)	Quality data availability
			Frequent, informal, timely information exchange
			Information exchange for improving supplier/client performance
			Mutual feedback
	Dynamic Capability (Product/Process Development)	IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
		Human Resource Management Practices	Advanced methods for employee selection
			Multi-skilled human resource selection
	Capacity and Flexibility	Production System Practices	Investments in R&D and Engineering functions
			International certifications (ISO 9001)
			Plants and machines upgrade/replacement
			External knowhow/technology acquisition

			Cycle time reduction
			Use of top materials

Table SES2.5 – Supply chain configuration

The company strategy is reflected in the Supply Chain structure. Differentiation is really important in order to excel: to obtain this performance, two capabilities must be developed. It must be built an excellent supply chain management (referred to the supplier's side): this enable not just to assure quality at the best price, but also operate in order to efficient introduce and exploit new technology. In order to manage the suppliers in the best possible way, good relationship must be developed and information sharing must be kept (even with investments).

On the other side, internal integration is important because it complete the supply chain: only with internal integration the company is able to manufacture with effectiveness and efficiency: investments in Information Sharing and Information Technology must be done in order to provide the right means to communicate inside the company.

Market Development Capability is used to integrate Supply Chain Management Inbound to obtain quality: in order to focus on the market needs and manage the relationship with the customer in the right way, great effort must be done to maintain good and frequent information sharing with the customer.

Price is obtained with SCM Outbound, Product/Process Development Capability, Capacity and Flexibility.

The process and product development capability is built on skilled human resource and information sharing, while investments in new machinery, process research, licenses and patents are needed to develop Capacity and Flexibility.

Today the Price has become extremely important: the contractor has gotten aggressive about cutting the expanses and obtaining the best price. Because of the contingent economy, many suppliers have to accept condition out of market (not profitable orders) and the long-term consequences are suppliers' failure and declining level of quality and competence.

If the contractor is not enough experienced, it is hard to deal with specifications and negotiate contracts; moreover, contractors are going not to be able to tackle engineering and transfer this phase to the suppliers.

Linguistic barriers are still present for far east contractor like Japanese and Korean ones.

Anyway, as a consequence of the globalization, contractors behave in the same way, no matter where they are from or which market they operate in.

In order to support the transfer of engineering, the company employs resources that have great experience and are able to perform project management.

However, the company can afford in term of time and money expenses to make human resource specialize in PM study.

Anyway, good relationships are maintained with the contractors and information sharing is constant.

However, the contractors usually do not communicate the vendor rating criteria: the firm spends effort and money to gather information about short-list and feedback in order to understand such criteria.

Entering in the end user's vendor list is really important in order to compete on niche and specialized market: the best way to enter these lists are employing local agent or establish local partnership in order to start a long-term relationship with end user.

4.2.1.3 SES – 3

Turnover [Mln €]		-	
% of Static equipment-Related turnover from the O&G sector		> 75%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES3.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America / Stainless Steel, s > 50[mm], D > 5[m]	New oil sources	↔
Middle East / Cr-Mo clad, s < 50[mm], D > 5[m]	Demographic growth	↔
Far East / Cr-Mo clad, s > 50[mm], D > 5[m]	Demographic growth	↗

Table SES3.2 – Market/product scenario

Market	Motivations	Actions to undertake
Middle East	Demographic growth	/
Far East	Demographic growth	/
Southern America	Demographic growth	/
Northern America	New oil sources	/

Table SES3.3 – Prospective markets

The company was founded as a family business.

One of the core-business was nuclear supply: during the 80s, due to the Chernobyl events and consequences, the company changed owners and business, entering an international group.

Because of international owners, the firm internationalized the client portfolio and broadened the market horizon.

Now it is one of the most important suppliers for CPEs (Critical Process Equipment) and can count on a network that includes offices and plants in Italy, Middle East and USA.

The company perseveres technological leadership: this means that the R&D is really important. Anyway, it is driven by the clients: the company is proactive to catch client's undiscovered needs and tackle unsolved issues and to propose new technology and innovation.

The main markets are North America, Middle East and Far East.

North America is a usual market: the holding company is American so businesses are eased by local network. Here more common products are supplied in term of material (stainless steel): anyway, they are considered critical in term of size (diameter > 5 m, thickness > 50 mm).

Another typical market is Middle East: here the company entered when the market started its orders (the firm have a local plant, even if belongs to another business unit). Local strong relationship helps to easy deal

within the market and obtain certifications and, therefore, orders. The flagship product in this market is critical products in term of material (low alloy steel Cr-Mo) and size (diameter > 5 m).

Far East is the third main market: here the company tries to differentiate in order to avoid competing on price with products critical in term in size and material.

Middle East and Far East are seen as attractive markets even in the future, because of the growing request of energy (demographic growth).

For the same reason, South America could be an interesting market for the future, although the company remembers the past experience EPC contractors had in this field (corruption and bureaucracy).

Anyway, the company is skeptical about indicating interesting markets for far horizon because of the fluctuation of the oil price.

Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Assembly	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES3.4 – Production stages

The supply chain is managed in order to maintain a perfect alignment.

The supplier's side is the mirror of the client's one: it means that the firm requests from the suppliers what it is requested from the customers and it also means that the material supplier must have performance, capabilities and certifications that the firm owns.

To assure this alignment, the suppliers must succeed a well-structure qualification process: it starts from the certification the supplier must have. The suppliers' performance are monitored in order to maintain the short-list updated. Audit is also performed.

Anyway, the company is vertically integrated and only raw materials are purchased outside the firm.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Outbound	Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
			Cooperation in checking order status
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			External knowhow/technology acquisition
	Project Management Capability	Project Management Practices	Cycle time reduction Risks and opportunities identification and analysis methods

			Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Outbound	Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
			Cooperation in checking order status
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			External knowhow/technology acquisition
			Cycle time reduction
	Project Management Capability	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Outbound	Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
			Cooperation in checking order status
	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			External knowhow/technology acquisition
			Cycle time reduction
	Project Management Capability	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)

Table SES3.5 – Supply chain configuration

It is possible to notice that the company decided to focus on few practices and capabilities in order to compete on all the three performance considered strategically important.

Price, Quality and On-Time Delivery are perceived as the most important performance to chase. For the company three capabilities are essential to compete on both the three performance: Supply Chain Management Outbound in order to be able to monitor and control the downstream supply chain, Product/Process Development Capability to always be capable to engineer the product in the right way and Project Management Capability in order to manage all the project stages in the right way.

Practices require to improve supplier and firm knowledge and to apply the latest PM techniques.

Commercial interaction with clients is good: only routine issue (about specifications, for example) are indicated.

Anyway, the increasing number of contractor brings more competition and unbalances market's price. It means reducing profits for the whole supply chain (suppliers included).

Moreover, the price war reduces the quality and the reliability of the suppliers' sector. In order not to lose profits and to follow the strategy of premium products, the company decided to bid no more in low price markets or markets where local suppliers are extremely preferred (like India).

In order to enter end users' vendor lists, the company entered in the licensor's short list: it is extremely significant to place the premium products in the right market and obtain a good market share, in order to improve the company's competitiveness. In order to be in the licensor's list, partnerships with them are evaluated to obtain specific patents for particular products.

Project partnerships with competitors are also evaluated to obtain major orders and further reduce the bid competition.

4.2.1.4 SES – 4

Turnover [Mln €]			20-100
% of Static equipment-Related turnover from the O&G sector			> 75%
Group Belonging			Yes
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES4.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America / HPHE, AC	New projects	↗
Middle East / HPHE, AC	Constant investments	↗
Europe / HPHE, AC	Historical clients	↗

Table SES4.2 – Market/product scenario

Market	Motivations	Actions to undertake
Far East	Growing energy demand	Local partnership for local content
Middle East	Growing energy demand	Local partnership for local content

Table SES4.3 – Prospective markets

The company is totally focused on the manufacturing of high pressure shell&tube heat exchangers and air-coolers. It is possible because the company belongs to a group: it is a business centre and control, with the coordination of the group commercial division, every stage for this kind of products (procurement, design,

R&D, engineering, quality, commercial) in the market of refinery (20%), petrochemical (50%), fertilizing (15%), power (5%).

The turnover is purely indicative: the market has trends during the years and the presence in different sectors (the ones cited above) allows to balance the orders.

The group is not specialized in Oil&Gas industry: it is one of its realities that span from food processing to marine and inorganic chemical. Anyway, the Oil&Gas division is considered a core business for the group.

The affiliation of the company, gave mutual benefits: completion of the product portfolio in order to offer complete packages, knowledge, financial stability and assets, increase the market share and client portfolio.

It enables to have local presence with local agents and local commercial agency.

However, the group belonging requires more structured decision processes that, sometimes, reduce the flexibility and the decisional speed.

The group performs a central R&D and invests every year about 2-3% of the profit in the research. The company have an R&D internal division but it is more focused on the client's issues and requests (it is more a way to improve the product care and try to suggest new technology more than develop innovative solutions.

The company is still present in West Europe: historically the company has worked with local EPC: even in the next future, the company thinks it will be a profitable market.

Middle East represents another important actual market: the constant investments made in the country and the well-structured and developed network the group can count on (in term of local commercial agencies) allows the right exploitation of this market, especially in the next future.

Finally, the most important market in which the company is present now is North America: because of the new projects coming from new energy sources (like shale gas) it seems the most profitable horizon for the next future.

Looking forward, Middle East will require investments in network and commercial impact in order to assure information and relationship continuity.

Another important market could be China: here the local competitors are a lot, but very few are able to supply with the right quality critical parts, so growing energy demand could be a great opportunity for the company. However, entering the market is possible only through local partnership and local manufacturing. It is hard to have local plant but guarantee total quality processes.

Notes			
Procurement	IN	OUT	Around 5 rough material suppliers
Manufacturing	IN	OUT	Only critical manufacturing stages
Assembly	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES4.4 – Production stages

The company is quite vertically integrated: only purchasing and manufacturing of non-critical stages are outsourced.

For the outsourced parts and material, few qualified and well-known suppliers are preferred: the company has close relationships with suppliers and it is able to fully monitor and control the supply chain.

When the firm entered the group, it was decided to generate a more structured qualification process and performance monitoring of the upstream supply chain: this process is still on-going but it could benefit the entire supply chain and in particular the company capability of supply chain management (before the suppliers were managed more like a family business).

Usually, the performance and certifications required from the suppliers are the ones requested for the project: there is a sort of back-to-back approach in term of requisitions.

This is a trial to guarantee alignment along the supply chain.

Specific market certifications and general certifications, like ISO 9001, are mandatory.

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
			Solid and durable relationships with key suppliers (considered as a part of the firm)
	Product/Process Development Capability	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		IS (Information Sharing)	Mutual feedback
	Capacity and Flexibility	IT (Information Technology)	Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
		Production System Practice	Predictive maintenance
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (SC)	Capacity and Flexibility	IT (Information Technology)	Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
		Production System Practice	Predictive maintenance
	Internal Integration	Human Resource Management Practices	Staff training
			Job enrichment and job enlargement
			Participation in decisional stages (delegation of responsibilities, team work)
	Project Management Capability	Project Management Practices	Interdisciplinary workgroups
			Risks and opportunities identification and analysis methods

			Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
			Work Breakdown Structure (WBS)
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Long-term Relationships with Customers	Close partnerships with customers
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Customer Service	Long-term Relationships with Customers	Close partnerships with customers
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
			Information exchange for improving supplier/client performance
			Mutual feedback
			Benchmarking
	Relationship Capability	Long-term Relationships with Customers	Close partnerships with customers
			Resources investment to keep a well-performing supply chain (Commitment)
			Sharing market interests, firm policies and business goals
			Collaboration in new product development
			Sharing marketing strategic decisions
			Investments for evaluating customer's future needs
		Human Resource Management Practice	Multi-skilled human resource selection
	Project Management Capability	Project Management Practices	Risks and opportunities identification and analysis methods
			Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
			Work Breakdown Structure (WBS)
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements

		Long-term Relationships with Customers	Close partnerships with customers

Table SES4.5 – Supply chain configuration

Flexibility of the supply chain is indicated as a really important performance: it seems important to demonstrate this performance because the products are tailor-made and, because of always stricter delivery due dates, the clients perceive the flexibility the company is able to assure in order to follow their requests. To generate this performance, it is important to have a good production system, able to generate the conditions for the flexibility (Capacity and Flexibility), to have a good way to monitor and control the project (here once again is underlined the necessity to develop the PM Capability) and have a good Internal Integration to perfectly control the internal stages. In particular, internal integration is enabled by the staff training and the job enrichment and enlargement.

The personnel should know more than just one specific aspect in order to better understand the needs from different point of view: to support this aspect, it is important to adopt interdisciplinary workgroups.

It is really important to enter the end users' vendor list: in order to do that, licensors' list enables a privileged way. After having this important certification, the firm must be introduced to the end user by a local agent through a market promotion and the qualify itself with the end user's qualification process (to enter some markets, this is a must-have).

It was noticed a decline in the contractors' project management and technical capability, as well as very limited empowerment: this slow down the stage of specific definition and it does not allow to be responsive when an issue occurs.

The clients are always stricter about the specifications (but the interviewed signaled that they are in the same situation suppliers are: they have to guarantee some performance for the client and are not allowed to change because of the technical limits and empowerment limitation). This indication is truer for Indian and Chinese contractors.

However, the requirements are increasing at a constant pace in term of Price and On-time Delivery.

4.2.1.5 SES – 5

Turnover [Mln €]		100-200	
% of Static equipment-Related turnover from the O&G sector		> 75%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES5.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Far East / HE, AC	Local plants, Growing energy demand	↗
Middle East / HE, AC	Constant investments	/
Northern Africa / HE, AC	New projects, but internal political instability	↗

Table SES5.2 – Market/product scenario

Market	Motivations	Actions to undertake
Far East	Growing energy demand	Open a local technical-commercial office
Russia	Growing market, Privatization, Obsolete technology	Open a local technical-commercial office
Northern America	Growing market, New technology applied	Open a local commercial office, Employ local experienced personnel

Table SES5.3 – Prospective markets

The company is totally focused on items to manage gas flows: it is specialized in heat exchanger for low and medium pressure (<50 bar) and air coolers.

The group is composed of 5 companies that have their own core business, but are managed, for what concerns administration, commercial office and direction, by a corporate board.

This kind of control allows to align the companies with the same strategic direction, but set the companies free to manage the core-business in an independent way; this means that every company doesn't feel the constriction typical of a group and operational decisions can be made with readiness and without the typical bureaucratic slowing-down structure.

The main advantages of belonging to a group is:

- Offer a wide portfolio and packages of products;
- Balancing orders (to maintain the turnover even with market contingent crisis);
- Reach new markets and clients, easing marketing and internationalizing the company;
- Increase the financial strength;

The R&D is quite developed internally: the firm bases his strength on the innovation of items.

There are two kinds of innovation:

- Incremental, that aims at the improvement of the performance of the products, learning from problems solved for the clients;
- Step-wise, that aims to generate new designs and introduce new technologies (this kind of innovation is mainly requested in West Europe).

The R&D division is able to manage both the cases, meaning that the company reinvests part of the profit in research and pays attention to the human resource involved in this activity.

The company is present in:

- India, where it has just built a new plant and foreseen to enlarge it in the next years because of the rising internal demand;
- Northern Africa, where it has been actively present for many years (gathering a good experience of the market) and where the only problem for further development could be the political instability;
- Middle East, where constant investments make feel the market a good opportunity for the future but political development could change the situation.

For the future, the company is thinking about Far East markets, such as Indonesia and Vietnam because of the fast development this kind of regions are having and the related need of energy.

Russia could be interesting because of the obsolete technologies (revamping) but it is essential to open local sales office (this is a valid strategy for every new market).

USA seems a good perspective because of the growing energy demand and the application of new technologies.

Usually the company exploits a structured sequence to enter new markets: first of all, it tries to employ local experienced agents, then it opens local technical-commercial offices and, if the market allows it, the firm considers the possibility to build a local production plant (this kind of sequence has been followed in India).

The local plant does not aim at costs reduction but, instead, be close to the customer and increase the local content (important vendor rating criterion).

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	Only critical manufacturing stages
Assembly	IN	OUT	-
Labeling	IN	OUT	-

Table SES5.4 – Production stages

The company can manufacture all the critical stages internally.

However, the main strategy to enter a market is to use local manufacturers (or create local partnership and build new plants). The company operates through the group commercial channel for scouting reliable local companies to outsource non-critical phase like case building, painting, carpentry. This is really important because typically this manufacturing stages are quite expensive (in term of costs for the order) but does not add any value, so, in the end, they weight a lot in term of final expense but the value-adding operations (that are also the more critical ones) are kept under the control of the company.

Anyway, every supplier that wants to work for the company, must succeed the company's internal qualification: local certification and international certification like ISO 9001 are must-have; sometimes the end user or the contractor already have a list of local reliable suppliers. Because of this approach, the number of suppliers are always rising.

The firm also applies, sometimes, win-to-win approach to take an order: in this sector, the raw materials can have an important role in term of final product cost, so it is possible to share the profit in order to reduce the total expenses.

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
			Close partnerships with customers

		Long-term Relationships with Customers	Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
	Supply Chain Management Outbound	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
	Product/Process Development Capability	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs

		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
	Supply Chain Management Outbound	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
	Product/Process Development Capability	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction

	Supply Chain Management Outbound	IT (Information Technology)	Cycle time reduction
			Inter-organizational coordination through electronic links
			Production planning
		Long-term Relationships with Customers	Monitoring order processing status, Manufacturing Execution Systems (MES)
			Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
	Product/Process Development Capability	IT (Information Technology)	Inter-organizational coordination through electronic links
			Production planning
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction

Table SES5.5 – Supply chain configuration

As said before, the company manages the core-business as an independent and small size company: this can explain why the company focuses on the same three capabilities to build every performance and apply the same practices to generate each capability.

The company concentrate on effectively monitor and control the supply chain (both upstream and downstream) and develop an excellent product/process development (Product/Process Development Capability) in order to obtain Quality, Price and On-time Delivery. To do that, the company invests in an updated production system (machines upgrade and replacement, process improvement like setup and cycle time reduction) and pays attention to collaboration, investing in IT and supporting the Long-term Relationships with Customers.

4.2.1.6 SES – 6

Turnover [Mln €]	20-100		
% of Static equipment-Related turnover from the O&G sector	50%-75%		
Group Belonging	No		
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES6.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Far East / Internals	/	/
West Africa / Internals	/	/
Middle East / Internals	/	/

Table SES6.2 – Market/product scenario

Market	Motivations	Actions to undertake
/	The market is global and it is not possible to indicate which seems to become important market	/

Table SES6.3 – Prospective markets

The contractor always tries to impose the specifications and contractual terms established with the end user (back-to-back approach).

This usually generates issues during the final negotiation where the firm can propose their own solution (applying the high knowledge of the product): this kind of issues is mainly caused by the lack of empowerment the contractor's agent are suffering. Moreover, contractor's employers are reducing their experience and technical capability, making this situation even worse.

However, the communication has been improved thanks to new information technologies that virtually deleted distances.

Vendor rating criteria can be obtained by advisors, but this kind of information is not reliable: contractors are not willing to explicitly communicate this information, even if more experienced suppliers are well aware of the main drives of this criteria. Rarely the contractors release reference letters (very useful to establish relationships with new clients).

Being in the end user vendor lists is a good way to understand the real specifications and needs that the client (i.e. the contractor) is going to request (so what the end user are going to ask during the bidding phase). Being in this short-list is a must-have for many markets, especially the emergent ones (Middle East, Far East).

It is also useful to influence the contractual terms, but this happens rarely because the EPC contractor guarantee the performance just if his terms are accepted (so, in the end, usually the contractor decides the specifications).

The best way to enter the end user's vendor list is being qualified by the end user: it is a problem when the group aims to offer different products as a package. In this case, it is possible that the end user requests up to 5 different types of qualifications that means expenses an individual company couldn't afford.

The company does not belong to a group: this has been a strategic decision in order to keep the decisional independence and, more important, always maintaining an eye on the long-term results, more than on periodical results (like turnover or profit).

In this way, the company has always invested in new technology and kept the knowledge leadership. The company flagship product is the column internal.

The company is highly specialized for this kind of product: this particular market means a different relationship with EPC stakeholders. In fact, usually companies that supply internals have relate with licensors or columns suppliers, that leverage internals suppliers to complete the product to offer to contractors.

This leads to a situation where the clients are no more contractors; moreover, it enables the company to further reduce the competition level and guarantee great profits.

The company has made great effort to build a strong and close relationship with customers through the attention to their needs and developing high knowledge and engineering capabilities to tackle customer's issue. Moreover, the company has an internal R&D department which aim is to improve internal process to obtain cost savings and quality enhancement.

Actually, the company is active in Malaysia, Nigeria and Emirates; Africa, Indonesia (Far East) and Middle East seem to be the more important markets nowadays.

However, the company does not have an inclination for foreseeing future interesting markets: what is really important is to stay close to customers in order to effectively perceive their needs and attractive possibilities.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Assembly	IN	OUT	-
Labeling	IN	OUT	-

Table SES6.4 – Production stages

The company has a complete control on raw materials (the only stage outsourced) and are able to manufacture products from raw material to packaging and delivery.

Because the clients are usually licensors, the material traceability is really important; moreover, often licensors impose their own list of raw material manufacturers (they have a list for each geographical zone). For bigger orders, the company is able to treat the raw material directly with most important steel producers: this way they are able to specifically chose the chemical composition of the raw material and better guarantee mechanical properties and characteristics.

In addition, having a list to use to outsource raw material allows the company not to worry about internal qualification; anyway, certificate of origin is always requested.

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	IS – Customer to Firm	Product design specifications (from clients)
			Expected performance specifications (from clients)
			Production planning specifications (from clients)
	Knowledge Management Capability	Long-term Relationships with Suppliers	Quality control and guarantee programs
			Use of suppliers' technical support and test machines
		IT (Information Technology)	Scheduling and planning software (use and/or development)
			Production planning

			Enterprise Resource Planning Systems (ERP)
			Bar coding/automatic identification systems
			Warehouse Management Software (WMS)
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Human Resource Management Practices	Staff training
			Performance-related payments (Reward Alignment)
			Internal Labor Market
	Project Management Capability	IT (Information Technology)	Scheduling and planning software (use and/or development)
			Production planning
		IS (Information Sharing)	Frequent, informal, timely information exchange
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Project Management Practices	Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
			Work Breakdown Structure (WBS)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	IT (Information Technology)	Scheduling and planning software (use and/or development)
			Production planning
			Enterprise Resource Planning Systems (ERP)
			Bar coding/automatic identification systems
			Warehouse Management Software (WMS)
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Human Resource Management Practices	Staff training
			Performance-related payments (Reward Alignment)
			Internal Labor Market
	Product/Process Development Capability	IS (Information Sharing)	Information exchange for improving supplier/client performance
			Formal Information Sharing agreements
			Mutual feedback
			Group coordination activities
			Benchmarking
			Close partnerships with customers

		Long-term Relationships with Customers	Collaboration in new product development
			Investments for evaluating customer's future needs
		Human Resource Management Practices	Interdisciplinary workgroups
	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software (use and/or development)
			Production planning
			Warehouse Management Software (WMS)
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Benchmarking
		IS – Firm to Customer	Information about available production capacity
		Production System Practices	Agile manufacturing strategies
	Performance 3	Enabling capabilities	Implemented practices
	Flexibility (SC)	Supply Chain Management Inbound	IS – Customer to Firm
			Product design specifications (from clients)
			Expected performance specifications (from clients)
			Production planning specifications (from clients)
		Long-term Relationships with Suppliers	Quality control and guarantee programs
			Use of suppliers' technical support and test machines
		Product/Process Development Capability	IS (Information Sharing)
			Information exchange for improving supplier/client performance
			Formal Information Sharing agreements
			Mutual feedback
			Group coordination activities
			Benchmarking
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Human Resource Management Practice	Interdisciplinary workgroups
	Capacity and Flexibility	IT (Information Technology)	Scheduling and planning software (use and/or development)
			Production planning
			Warehouse Management Software (WMS)
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Benchmarking

		IS – Firm to Customer	Information about available production capacity
		Production System Practices	Agile manufacturing strategies

Table SES6.5 – Supply chain configuration

It can be noticed that company essentially leverages supply chain capabilities, knowledge capability, dynamic capability and capacity and flexibility.

Once again, it shows the importance of a proper mixture between know-how company's heritage and capabilities related to the production processes.

This is perfectly reflected by the practices: Information Technology and Information Sharing, appears to be mainly important to support internal know-how.

Project Management Practices are extensively used to obtain Project Management Capability, affecting Quality.

As said above, the supply chain is quite different for internal manufacturers from the traditional supply chain for EPC suppliers: the company's clients are mainly the licensors, i.e. the stakeholder that own the rights for particular production processes. Being related to this type of clients allows the company to really focus on niche technologies and have worldwide leadership.

Anyway, it is really important to keep closely in touch with the clients, in order to maintain a privileged position in the licensor's list and develop new processes with partnership.

In order to achieve this necessity, investments are made for marketing and relationship with customer. It is also important to have local experienced agents to stay physically close to the customer.

4.2.1.7 SES – 7

Turnover [Mln €]		20-100	
% of Static equipment-Related turnover from the O&G sector		< 25%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES7.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
East Europe/SE	-	≡
Southern America/SE	-	≡
Northern Africa/SE	New projects, new oil sources	≡

Table SES7.2 – Market/product scenario

Market	Motivations	Actions to undertake
Middle East	Political issues	Local agents, distribution channels
Russia	Waiting for the end of political instability	Local agent, distribution channels, end users' qualification
Northern America	The market could take off for the huge oil resources in the area	Local agent, distribution channels, end users' qualification

Table SES7.3 – Prospective markets

The company and the group to which it belongs work in the same sector, that is the Oil&Gas. Although the sector is the same, the group and the firm realize different kind of products. The firm is specialized in the production of some specific static equipment, piping and piping equipment, while the group, specialized in other products, grants the company a high degree of independence. This peculiarity allows the firm to assure a superior internal flexibility and to have few constraints in forging relationships with clients or other firms of the sector.

However, the group membership is fundamental, since EPC clients rely on the company reassured by group references and by the solid financial base that the group assures to them.

Indeed, in order to provide a wide product portfolio of large size static equipment, the firm has to count on a solid financial base, but, at the same time, has to have the possibility to manage itself the huge flux of materials and certifications without further bureaucratic impediments that an international group may impose.

The growth or the decrease of the profits of the firm is strictly correlated with the production of special induction bends. The other equipment that compose the product portfolio of the firm are: pig traps, standard piping and, talking about the investigated products:

- Pressure vessels made of carbon steel or stainless steel;
- Pressure vessels made of low alloy steel Cr-Mo, clad, with thickness lower than 50 mm;
- Columns and drums made of carbon steel;
- Columns and drums made of low alloy steel Cr-Mo, clad, with thickness lower than 50 mm;
- Shell and tube heat exchanger;
- Steam generators and industrial boilers.

During the last years, the firm has forged a strong relationship with a big Italian company specialized in the piping production. This firm, in the past, produced induction bends for the Power and Oil&Gas sector, but, the lack of profitability of this product led the firm to outsource this specific production. Few years ago, the production of induction bends and its related know-how were handed over to the firm by this big Italian company in exchange for a privileged supply commercial channel.

Nowadays, the firm, thanks to this past strategic action, is a worldwide leader in the production of the mentioned special product within the Petrochemical, Oil&Gas and Power sector.

The R&D function is mainly involved in the improvement of internal processes and in the innovation of design, looking for new interesting solutions in term of innovative materials. This function, composed by two employees, operates following client's requests and, if the firm is not able to create or supply a particular product, it investigates the market, in order to buy that product and offer a complete products package to the customer.

The firm exports around the 95% of its production thanks to its international relationships with end user and EPC clients. Moreover, since the firm worked for many years in the sector, clients, thanks to the high level of trust they have in the firm's domain experience, usually ask for advices on products realized by other firms. Nowadays, the firm produces both directly for end users and for EPC companies. The firm, exploiting the strong connection with end users and its capability to be always aligned with the local market regulations, has built a profitable business of spare parts and equipment.

About the future market scenarios, the firm is waiting for new political development in the Russian and Middle East areas, looking for opportunities to penetrate these two rich markets; another important future market would be situated in the Canadian area due to shale gas (Figure SES7.2).

The firm's presence to international fairs is the first way the firm uses to present its offers and products to new potential final clients. In order to approach a new client, the firm relies on local agents, and, after this first approaching step, a long procedure of audits and qualifications is made to entry in the end user's vendor list.

Notes			
Procurement	IN	OUT	10-15 material suppliers
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Assembly	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES7.4 – Production stages

The upstream supply chain is composed by around 10-15 qualified (ISO 9001) rough material suppliers. The trust in these suppliers is constantly evaluated supply after supply. Indeed, the firm's supplier base is composed by suppliers that, buying components abroad, sometimes deliver delayed goods. Since this behavior leads to obscure the upstream supply chain, the firm is forced to constantly control the order processing status of their suppliers and the level of quality of every supply.

Moreover, the firm is vertically integrated and internally realizes all the production cycle stages. This integration allows the firm to grant quality, a high level of engineering to customers, and, thanks to the constant development and improvement of new machineries and the alignment to the requested compliance product tests (Ultrasonic test, non-destructive test, hydraulic test, magnetic test, etc.), the firm ensures items aligned with the latest market/products regulations. Indeed, the strictly control of the production system by clients and end users forces the firm to be always compliance in term of quality.

The most important performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Scheduling and planning software use and/or development
		IS (Information Sharing)	Information exchange for improving supplier/client performance
		IS – Customer to Firm	Information exchange about planned orders or order changes
		Human Resource Management Practice	Staff training
		Production System Practices	Bottleneck controlling
	Product/Process Development Capability	Long-term Relationships with Customers	Close partnership with customers
			Resources investment to keep a well-performing supply chain (Commitment)
			Collaboration in new product development
		Production System Practices	Plants and machines upgrade/replacement
			Use of top quality material

		Project Management Practices	Risks and opportunities identification and analysis methods
			Cost Breakdown Structure (CBS)
	Capacity and Flexibility	Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
Quality	Enabling capabilities	Implemented practices	Use of top quality material
			Implemented actions
			Investment in R&D and Engineering functions
			Product/process standardization (Postponement)
			Close partnership with customers
			Resources investment to keep a well-performing supply chain (Commitment)
			Collaboration in new product development
			Plants and machines upgrade/replacement
			Use of top quality material
			Risks and opportunities identification and analysis methods
			Cost Breakdown Structure (CBS)
			Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
			Use of top quality material
On-Time Delivery	Enabling capabilities	Implemented practices	Implemented actions
			Scheduling and planning software use and/or development
			Information exchange for improving supplier/client performance
			Information exchange about planned orders or order changes
			Staff training
			Bottleneck controlling
			Close partnership with customers
			Resources investment to keep a well-performing supply chain (Commitment)
			Collaboration in new product development
			Plants and machines upgrade/replacement
			Use of top quality material

		Project Management Practices	Risks and opportunities identification and analysis methods
			Cost Breakdown Structure (CBS)
	Capacity and Flexibility	Production System Practices	Plants and machines upgrade/replacement
			Setup time reduction
			Cycle time reduction
			Use of top quality material

Table SES7.5 – Supply chain configuration

The company focus most of its efforts in the improvement of the capability of Project Management. The project management department is composed by experienced employees who have to constantly face and solve documentation issues. This problem is increased by clients, that, if they need to postpone payments or have to face with organizational problems, usually exploit this mass of papers in their favor (missing papers, approvals delays, etc.).

Moreover, the constant improvement of the internal process (cycle time reduction, setup time reduction and machines upgrade) allows the firm to generate the Price, Quality and On-Time Delivery performance. Indeed, since the firm internally realizes all the production cycle stages, actions related to the manufacturing and assembly stages significantly affect the enabling of all the three performance.

The firm, instead of buying new machines, in order to save finances, use to internally revamp/improve the present machine base, using its skilled technical human resources.

Another important aspect on which the firm build its competitiveness is the, previously mentioned, close relationships with a big size Italian company. This strategic bond allowed the firm to further improve its Dynamic and Capacity and Flexibility capability. Indeed, this relationship has recently helped the firm to improve its hardening process and to buy a new expensive but more effective machine involved in the mentioned process.

Finally, the capability of Internal Integration, the specialization in niche products, and close relationships with clients during the project stage, leads the firm to consider the production system as the core function of its competitiveness.

4.2.1.8 SES – 8

Turnover [Mln €]		100-200	
% of Static equipment-Related turnover from the O&G sector		25%-50%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES8.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern America/SE	Shale gas, New projects	
Middle East/SE	Strong internal market, Waiting the end of the embargo	

Table SES8.2 – Market/product scenario

Market	Motivations	Actions to undertake
Northern America	Shale gas, Future investments in the area	End users
Russia	Firm presence, Future investments in the area	Local agent
Africa	Oil sources, Political instability at the moment	-
Southern America	Oil sources, Future investment in the area, Firm presence	Local agent, end users' qualification

Table SES8.3 – Prospective markets

The firm is specialized in the production of pressure vessels, columns, drums and heat exchangers for the Oil&Gas, Power and Nuclear sectors. During the last years, the strategic penetration of the Nuclear sector has been remarkable thanks to the new group membership; precisely, the firm belongs to two different international groups that work both in the mentioned sector. The firm has been independent for several years, and, only recently, due to an unsustainable financial situation, it had to forge these memberships. The new financial stability eliminated all the past financial constraints that blocked a lot of opportunities of business. Indeed, these affiliations have been vital for the firm, but being still a new situation, the firm is working hard on the group policies' alignment and on the solving of all the new bureaucratic discrepancies between the group and the firm itself.

Moreover, the firm is strategically starting to exploit the worldwide presence of the group, in order to expand its influence in new potential markets.

The decision to expand the firm's presence in the Nuclear sector was taken into consideration during one of the most profitable periods for the Oil&Gas sector: from 2004 to 2008. This unusual choice, turned out to be crucial in order to lay the foundations for the new nuclear market and to face the next period of crisis of the Oil&Gas sector. An important strategic step of the firm, was that to build a second production plant, specialized in nuclear equipment, near the sea.

This choice allowed the firm to divide static equipment production for the Nuclear sector and for the Oil&Gas one, leading the company to organize and better manage the production stages.

Moreover, the proximity of the second plant to the sea allowed the firm to decrease the shipments cost and improve the On-Time Delivery performance.

Since the Oil&Gas sector, due to the fluctuating price of the sector, does not allow the firm to have stable profits and constantly feed the huge critical mass of the company, the necessity to expand the business towards other sectors is mandatory. The firm does not internally have an R&D function, but it concentrates its efforts on the improvement of the production process. Employees, involved in these tasks, are mainly welders or production engineers, that work in order to realize a defect-free product and, in general, to increase the general level of the process quality: price is certainly important, but quality is not negotiable

The Oil&Gas sector and, especially, the nuclear sector, lead the firm to constantly work with very big projects and, the necessity to be compliant with a huge mass of documentation, obliges the company to count on a skilled project management department. One of the groups to which the company belongs, forges its business on the project management function; thanks to this fact, the firm was introduced by the group to project management's tasks.

Notes			
Procurement	IN	OUT	5-8 formed ends suppliers
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Assembly	IN	OUT	-
Painting	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES8.4 – Production stages

The firm, in the past, outsourced part of its manufacturing stages, but now, thanks to the new production plant and the new financial stability, the only outsourced production cycle stages are painting and the realization of formed ends.

The establishment of a reliable supplier base is a strategic target for the firm. Indeed, in the past, the lack of a systematic approach to qualify and evaluate the upstream supply chain, led the firm to management issues and approximate evaluations of its suppliers. Nowadays, suppliers are qualified through audits and inspections, and the firm requires from them the total quality compliance.

The company, over the years, through different collaborations and agreements, has built strong and durable relationships with some suppliers; this kind of relationships represent targets the firm aims to forge also with new suppliers.

Talking about the internal supply chain, the performance enabled by the firm depend on the supplied product. Indeed, heat exchanger (especially high-pressure heat exchanger) are built through a different supply chain configuration compared to the other products.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in the production of Pressure Vessels and Columns and Drums in every relevant geopolitical market are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
		IT (Information Technology)	Scheduling and planning software use and/or development
			Production Planning
			Enterprise Resource Planning System (ERP)
			Bar coding/automatic identification system
	Capacity and Flexibility	IS (Information Sharing)	Mutual feedback
			Information exchange for improving supplier/client performance
	Capacity and Flexibility	Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements

	Project Management Capability	IT (Information Technology)	Helping suppliers to improve their product quality (Top Management Support)
			Scheduling and planning software use and/or development
			Production Planning
			Enterprise Resource Planning System (ERP)
		Project Management Practices	Bar coding/automatic identification system
			Risks and opportunities identifications and analysis methods
			Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
			Work Breakdown Structure (WBS)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Capacity and Flexibility	Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
	Customer Service	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments in evaluating customer's future needs
		Network	Close-to-customer (reference markets) locations
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
		IT (Information Technology)	Scheduling and planning software use and/or development
			Production Planning
			Enterprise Resource Planning System (ERP)
			Bar coding/automatic identification system
		IS (Information Sharing)	Mutual feedback
			Information exchange for improving supplier/client performance
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Relationship Capability	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments in evaluating customer's future needs
		IT (Information Technology)	Inter-organizational coordination through electronic links

		Project Management Practices	Cost Breakdown Structure (CBS)
	Customer Service	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments in evaluating customer's future needs
		Network	Close-to-customer (reference markets) locations

Table SES8.5 – Supply chain configuration – Pressure Vessels/Columns and Drums

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in the production Heat Exchanger equipment in every relevant geopolitical market are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
		IT (Information Technology)	Scheduling and planning software use and/or development
			Production Planning
			Enterprise Resource Planning System (ERP)
			Bar coding/automatic identification system
		IS (Information Sharing)	Mutual feedback
			Information exchange for improving supplier/client performance
	Capacity and Flexibility	Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
	Project Management Capability	IT (Information Technology)	Scheduling and planning software use and/or development
			Production Planning
			Enterprise Resource Planning System (ERP)
			Bar coding/automatic identification system
		Project Management Practices	Risks and opportunities identifications and analysis methods
			Advanced methods for supplier selection
			Cost Breakdown Structure (CBS)
			Work Breakdown Structure (WBS)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Capacity and Flexibility		Close partnership with strategic suppliers, commercial agreements

		Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
	Customer Service	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments in evaluating customer's future needs
	Supply Chain Management Inbound	Network	Close-to-customer (reference markets) locations
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
		IT (Information Technology)	Scheduling and planning software use and/or development
			Production Planning
			Enterprise Resource Planning System (ERP)
			Bar coding/automatic identification system
		IS (Information Sharing)	Mutual feedback
			Information exchange for improving supplier/client performance
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Innovation	Financial Capability	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		Financial Practices	Strong relationships with Banks
	Capacity and Flexibility	Long-term Relationships with Customers	Strong relationships with Financiers
			Close partnership with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
	External Integration	IT (Information Technology)	Inter-organizational coordination through electronic links
		Long-term Relationships with Suppliers	Close partnership with strategic suppliers, commercial agreements
			Helping suppliers to improve their product quality (Top Management Support)
		Long-term Relationships with Customers	Close partnership with customers
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
			Product/Process standardization (Postponement)

Table SES8.6 – Supply chain configuration – Heat Exchangers

Quality and On-Time Delivery represent two solid and indisputable performance in order to compete. The management of the upstream supply chain allows the firm to enable both these two performance. Indeed, historical suppliers, provides a solid reliable base.

The Project Management capability, realized through an efficient IT system in the production plant, allows the firm to assure a complete quality product. Moreover, Quality and On-Time delivery depend on the capability of the firm to manage changes in volumes and production mix. This reactivity is developed through the project management function that manage and effectively coordinate the upstream supply chain.

The two supply chain configuration differ in the enabling of two performance: the production of heat exchanger is based on the innovation performance, while the realization of the other static equipment is based on a high engineering level.

Heat exchangers, especially high-pressure heat exchangers, are realized for very niche and profitable markets and, in order to maintain a technologic advantage, the innovation of materials and design are needed.

A constant collaboration and interaction with both clients and end users represents the turn point, in order to create a new product aligned with the market demand.

On the other side, the other products of the portfolio, are built with the high design and technical capabilities of firm's employees.

The firm realizes these products for markets that requires products made of non-standard materials (Cr-Mo, inox steel, duplex steel, nickel alloys, etc.) , with high thickness or of large sizes. The engineering function, in order to reduce the production cost of these products, based its competence on the capability of project management. Indeed, this capability allows the firm to have an efficient cost breakdown structure.

Finally, since quality represents a cutting factor in order to create business, the firm is constantly working to maintain high the level of this performance as requested by clients. Moreover, in order to further improve quality, since clients usually opens a window of communication after the realization of the project only in case of urgent issues in the new plant, the firm is developing a new feedback system to suggest to its clients.

4.2.1.9 SES – 9

Turnover [Mln €]		100-200	
% of Static equipment-Related turnover from the O&G sector		< 25%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES9.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Middle East/HE	High demand	↗
Northern Africa/HE	High demand	↗
Europe/HE	Maintenance of current market share	↘

Table SES9.2 – Market/product scenario

Market	Motivations	Actions to undertake
Northern America	Future investments, New projects	Partnerships for local content
Europe	Firm presence, Future investments	-
Southern America	Future investments, New projects	Partnerships for local content

Table SES9.3 – Prospective markets

The company is specialized in the heat exchangers production. Actually, it is able also to internally realize columns and drums equipment, but, in the last three years, this kind of products were no more requested by the clients. Nowadays, in addition to the production of heat exchanger, the firm is able to supply also steam generators and industrial boilers, outsourcing the production stage of manufacturing. The extremely high level of competition in the Oil&Gas sector, forced the firm to focus its businesses in niche markets, outsourcing all the non-added value production stages.

However, the production of static equipment fully saturated the production of the firm and less than the 25% of this production is for the Oil&Gas sector; Indeed, most of the firm's turnover comes from the nuclear sector.

The company is the Italian headquarter of other three societies, located in the Northern Europe and in the Far East area. The strategic decision to acquire companies was taken at the beginning of the twenty-first century. These affiliated companies led the company to penetrate new sectors in addition to its traditional Oil&Gas market. The Oil&Gas sector, due to its fluctuating periods and high competition on costs, led the firm to broaden its horizon towards the nuclear and the environmental sectors, where quality and engineering are usually the main requested performance by clients. Moreover, these acquisitions were also instrumental in order to allow the firm to expand its worldwide presence and acquire new licenses and know-how.

Seven main actions, represent the principal strategic decisions the firm has taken in the last ten years:

- The acquisitions of three firms;
- The entrance in the Nuclear and Environmental sectors;
- The exploitation of the European 20-20-20 program;
- The increasing of worldwide presence;
- Focus on the product diversification;
- Expansion of its presence in profitable, although not safe, markets in Africa;
- The utilization of project companies in the Asiatic area.

These strategic decisions allowed the firm to successfully face the crisis started in the 2008.

Nowadays, the oil price drop leads the company to have lower profits but, thanks to its past strategic choices, it still remains competitive in the international scene.

The R&D function allows the firm to realize new palatable products for the international market. Indeed, since final clients request plants with a high level of performance, market increasingly requires new products made of innovative materials. End user are very interested in innovation and usually prefer a high engineered product than a cheaper one with lower performance.

Nowadays, although the not positive period of the sector, the high specialization in heat exchanger production allows the firm to have positive trends in the Middle East and Africa areas.

The firm is focused on the possible opening market in America, due to the future exploiting of the shale gas and the continuous exploiting of the oil sources in the Southern area.

In order to approach a new market, the firm considers as fundamental the enabling of the local content through partnerships with local companies. This expensive solution leads the firm to penetrate the market and to forge long-term collaborations with the local authorities and manufacturing companies.

Finally, in order to extend the product portfolio, the firm externally purchases boilers and pressure vessels. Indeed, since these static equipments have high shipment costs, due to their volumes and sizes, the company exploits its reliable network of foreign companies to realize these products directly on site, enabling, at the same time, the local content.

Notes			
Procurement	IN	OUT	3-4 rough materials, 7-8 formed ends and 7-8 piping suppliers
Manufacturing	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES9.4 – Production stages

The level of quality of its Italian suppliers' base and the strong control the firm has on them, allow the company to assure a quality product to its customers. The firm usually requests from its suppliers, especially from foreign suppliers, special production certifications, in order to know if the firm is able to realize quality static equipment or it has the required level of knowledge in welding operations.

The firm has a total control of its Italian supplier base.

In order to enable the local content, the firm, through audits and the request of certifications, establishes the same high level of control on its foreign supplier base.

The firm can control easily its supplier base also thanks to the decision to supply from a very restricted number of suppliers.

In order to globally consider the whole supply chain configuration of the firm, now there will be indicated the most relevant performance items (with related capabilities – practices links to obtain them) for the company:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Electronic mailing with key suppliers
			Scheduling and planning software use and/or development
			Production Planning
			Monitoring order processing status, Manufacturing Execution System (MES)
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
		IS – Customer to Firm	Production Planning specifications
		IS – Firm to Customer	Information about order status and expected lead-time
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements

	Product/Process Development Capability	Long-term Relationships with Customers	Collaboration in new product development
		Human Resource Management Practices	Interdisciplinary workgroups
		Production System Practices	Investments in R&D an Engineering functions
	Capacity and Flexibility	IS (Information Sharing)	Frequent, informal, timely information exchange
		IS- Customer to Firm	Information exchange about planned orders or order changes
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	IT (Information Technology)	Electronic mailing with key suppliers
			Scheduling and planning software use and/or development
			Production Planning
			Monitoring order processing status, Manufacturing Execution System (MES)
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
		IS – Customer to Firm	Production Planning specifications
		IS – Firm to Customer	Information about order status and expected lead-time
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
	Product/Process Development Capability	Long-term Relationships with Customers	Collaboration in new product development
		Human Resource Management Practices	Interdisciplinary workgroups
		Production System Practices	Investments in R&D an Engineering functions
	Capacity and Flexibility	IS (Information Sharing)	Frequent, informal, timely information exchange
		IS- Customer to Firm	Information exchange about planned orders or order changes
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (SC)			Electronic mailing with key suppliers

	Supply Chain Management Inbound	IT (Information Technology)	Scheduling and planning software use and/or development
			Production Planning
			Monitoring order processing status, Manufacturing Execution System (MES)
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
		IS – Customer to Firm	Production Planning specifications
		IS – Firm to Customer	Information about order status and expected lead-time
	Product/Process Development Capability	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		Long-term Relationships with Customers	Collaboration in new product development
		Human Resource Management Practices	Interdisciplinary workgroups
	Capacity and Flexibility	Production System Practices	Investments in R&D an Engineering functions
		IS (Information Sharing)	Frequent, informal, timely information exchange
		IS- Customer to Firm	Information exchange about planned orders or order changes
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements

Table SES9.5 – Supply chain configuration

The three most important performance that the firm enables are: Price, On-Time delivery and Flexibility.

The Price performance is fundamental to work in the Oil&Gas sector. Indeed, the choice to rely on a very flexible supplier base, able, as the firm, to face quickly market change, allows the company to decrease logistic costs during the purchasing phase. Moreover, the capabilities to be flexible and to effectively manage the upstream supply chain are used also to implement the other two performance: Flexibility and On-Time Delivery.

These capabilities were implemented through the high level of communication between actors of the whole supply chain, from clients to suppliers. Indeed, the information exchange about order changes, planning issues and processing order status with its clients allows the firm to grant an optimal response reactivity to any of customers' requests.

4.2.1.10 SES – 10

Turnover [Mln €]		20-100	
% of Static equipment-Related turnover from the O&G sector		50%-75%	
Group Belonging		No	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES10.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Northern Europe / PE	Investments in exploiting resources, Quality oriented market	
Middle East / PE	High demand	

Table SES10.2 – Market/product scenario

Market	Motivations	Actions to undertake
Middle East	Future investments, New projects	Local agents, local content, end users
Africa	Oil resources	Local agents, local content
Caspian Area	Oil resources	Local agents, local content

Table SES10.3 – Prospective markets

The firm is an independent company situated in the Northern side of Italy. This firm has a very wide product portfolio and can assure a complete offer to its customers. Talking about the investigated products, the firm realizes:

- Pressure vessels made of carbon steel, stainless steel or low alloy steel Cr-Mo;
- Columns and drums made of carbon steel, stainless steel and low alloy steel Cr-Mo;
- Shell and tube heat exchanger and other heat exchanger;
- Steam generators and industrial boilers.

The 80% of its turnover is reached with products supplied for the Oil&Gas sector and around the 50% with static equipment that this study investigates. Indeed, the firm, in addition to common static equipment items, realizes also piping components and other special products for the desalination process of the seawater.

Large thickness products, or, in general, large size equipment have a relevant shipping cost. Indeed, before accepting customers' offers, the firm scrupulously estimates shipping costs and, only secondly, makes evaluations about the production planning of the requested products and the dimension of the project.

The firm does not belong to any group and (Table SES10.1) finds difficult to compete with big international groups in term of price. Indeed, the company, relying on an outstanding Quality performance, supplies markets where the engineering competence and quality compliance of products are evaluated more than grading assets.

The company has always built its competitiveness on its welding department, that allowed it to serve products of different materials but with always the same high level of welds. The ability to weld special materials or large thickness equipment allows the firm to be recognized by its customers and by the other firms of the sector as one of the best companies, situated in the Northern Italy, able to perform the welding process.

The R&D function, composed by one person, is totally focused on the improvement of the welding process and technology. The development of new different products is not a less important R&D action, but it pertains to the improvement and development of desalination products.

Nowadays, the two main geo-political markets where the firm works are the Northern Europe and the whole Middle East area.

New technologies of extraction and investments in the Northern Sea area, allow companies to extract oil from old oilfields. Indeed, the Norwegian market, thanks to the presence of an extra light and fine oil in the area, still represents the 7-8% of the global petroleum market.

Middle East is the core market of the Oil&Gas sector and, for this reason, thanks to always new opportunities of investments, the firm works in different regions of this huge area.

Talking about future profitable markets (Figure SES10.2), three important markets could be: Middle East, the Caspian area, and Africa. The firm already works in the first two markets and, if political and safety condition will change in the future, it will surely try to enter in the African one (Mozambique).

In order to approach a new market, the company is always looking for possible partnerships that enable the local content. This way of penetrating the market, although it is expensive in the short term, allows the firm to forge strong relationships with local companies, useful in case of future projects or investment in the area.

Notes			
Procurement	IN	OUT	Around 12 rough material suppliers (laminates, forged, piping, etc...)
Manufacturing	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES10.4 – Production stages

The firm purchases the 80% of its supplies from the 20% of its suppliers and the 20% of the remaining supplies from the 80% of its suppliers. Indeed, the firm focus its efforts in controlling its piping, laminate and forged components suppliers, that represent one-fifth of its supplier base.

These suppliers are located in Italy and Europe and are qualified by the main end users within the Oil&Gas sector. Then, these suppliers can assure an absolute compliance in term of documentation and certifications, allowing the firm to externally provide compliance products and avoid loss of time due to the lack of products proper certifications.

Moreover, quality rough materials allow the firm to maintain the quality performance unchanged through the whole supply chain.

Rough materials have to comply with restricted specific metallurgical standards, created each time by the firm. Indeed, if rough materials suppliers are compliant with ASTM and EN standards, the firm requests to its suppliers to supply materials that respect more restricted metallurgical specifics. The quality level, requested by standards, is usually considered inappropriate by the end user and the firm itself.

Moreover, the firm verifies the material quality with mechanical, hardening and chemical tests.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development

		Human Resource Management Practices	Staff Training
	Product/Process Development Capability	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		Production System Practices	Investments in R&D and Engineering functions
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
	Project Management Capability	Project Management Practices	Risks and opportunities identifications and analysis methods
			Cost Breakdown Structure (CBS)
		Human Resource Management Practices	Staff Training
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic supplier, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
	Supply Chain Management Outbound	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
	Product/Process Development Capability	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		Production System Practices	Investments in R&D and Engineering functions
		Long –Term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic supplier, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)

		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
	Supply Chain Management Outbound	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Frequent face-to-face planning/communication with suppliers/clients
	Relationship Capability	Long-term Relationships with Suppliers	Close partnerships with strategic supplier, commercial agreements
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development

Table SES10.5 – Supply chain configuration

The internal capability to manage projects is high. The company relies on a high number of internally trained project managers.

The extended internal know-how used in the production stages allows the company to externally demonstrate an effective Engineering performance.

The Engineering performance is based on the great capability of the firm to perform the manufacturing stages, especially the welding one. The weld capability is highly requested in this sector, due to the necessity to work with non-standard materials, keeping unchanged the quality level on outbound products.

On the other hand, Quality and Price performance are based on relationships capabilities both with clients and suppliers.

Collaboration in new product development with EPC clients is a common strategic action, mainly demanded from clients themselves. Indeed, clients barely purchase a new product without references or a previous collaboration in the product development.

It is possible to say that the firm enables the performance of Price through a solid network of relationships, both with suppliers and customers, that allow the company to evaluate and share a generic offer with all the actors of the supply chain. Indeed, these collaborations allow the company to help its customers during the bidding phase through an accurate estimation of future project due date and costs.

Finally, thanks to its close relationships with end users and thanks to its knowledge of different markets, the firm, in order to maintain close contacts, usually provides help to EPC companies, suggesting them possible future competitive market scenarios.

4.2.1.11 SES – 11

Turnover [Mln €]		20-100
% of Static equipment-Related turnover from the O&G sector		< 25%
Group Belonging		Yes
Static equipment supplied	Pressure Vessels	Air Coolers
	Heat Exchangers	Industrial Boilers
		Columns&Drums
		Trays&Internals

Table SES11.1 – Vital Statistics

Market/Product Scenario	Motivations	Trend
Southern America / PV, HE	Investments in the area	☰
Russia / PV, HE	Investments in the area	☰ ↗
Europe / PV, HE	Required quality products, The firm is competitive on price	☰

Table SES11.2 – Market/product scenario

Market	Motivations	Actions to undertake
Northern America	Competitive price, Future high demand	Local partnerships
Middle East	Firm presence, Future investments	Local partnerships

Table SES11.3 – Prospective markets

This firm is the headquarter of other two Italian firms that primary work in the environmental and automation sectors. The firm, unlike its affiliates, produces the following static equipment for the Oil&Gas and Power sectors:

- Pressure vessels made of carbon steel, stainless steel or low alloy steel Cr-Mo with a diameter less than five meters;
- Shell and tube heat exchanger;
- Air coolers;
- Steam generators and industrial boilers.

These mentioned products covered the 15% of the turnover in 2014; this percentage is a variable number correlated with the fluctuation of market demand within the Oil&Gas sector. Most of the revenue comes from services the firm provides for the metalworking sector and from the production of other big size components like turbine casings.

The firm, being the leader of other companies that work in other sectors, can benefit from the typical advantages an independent firm has: the capability to respond to rapid market changes and the capability to forge collaborations and partnerships without the constraints of the policy of a group. The aim of the firm is that to continue to acquire companies instead join a big group, since, in this way, the company can increase the critical mass without any bureaucratic slowdown that any group membership could impose.

In the last decade, the firm has endeavored to improve its commercial offer within the Oil&Gas sector, through the hiring of new skilled employees. Indeed, this new staff has assured the extension of the product portfolio and of the internal know-how.

Nowadays, the past mentioned internal changes and the will to continue to expand its presence in different sectors through acquisitions allows the company to remain competitive in the worldwide market. Indeed, firm's profits coming from exports now exceed those coming from Italy.

In 2008 the firm has been hard affected by the crisis and, not being able to compete on costs, it started to expand its presence in those markets where quality and the engineering performance were considered more important than the price one.

Nowadays, the firm mainly works in Europe, Russia and Southern America (Figure SES11.1). The choice of a proactive local representative base is considered the first step in order to approach a new market area. Then, strategic partnerships with local firms that realize standard static equipment or components are forged, in order to decrease shipments costs and increase the worldwide presence. This way of operating will be used to approach the feasible future markets in the Northern America and Middle East areas.

The great competitiveness on price present in Italy and Europe, has forced the firm to work hard on an internal costs reduction. This burdensome situation forced the firm to make expensive improvement on its internal processes and manufacturing cycle stages, in order to improve the externally demonstrated performance of Price. After years of onerous investments, the firm can now compete in different market scenarios supplying quality and reliable equipment with reduced production costs.

Thanks to the strong settlement the firm has realized in the past in the area, the Russian market represents another strategic scenario for the firm. Indeed, the actual political situation, which exclude many important competitors from the area, and a strong partnership with a Russian static equipment supplier allow the company to count on a strong base of competitiveness in the area.

Notes			
Procurement	IN	OUT	3 rough material suppliers (laminates, piping, etc...)
Manufacturing	IN	OUT	Only critical manufacturing stages
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES11.4 – Production stages

The firm relies on few reliable rough materials suppliers (Table SES11.2). The level of knowledge and control of the upstream supply chain is high, but, due to the great importance of On-Time Delivery performance within the Oil&Gas sector, the firm is working hard to achieve a total control on it. Suppliers must be able to provide the right competence to manage all the specific documentation of their products and, in order to improve the coordination and the reactivity, a good relationship capability is requested.

The firm does not have an R&D function due to its small dimension, but is ready to satisfy every customer requests. The internal system is divided into three principal area of responsibility: technical area, commercial area and production area. Nowadays, these three functions are not governed by a project manager thanks to the good capacity of the firm to manage projects without these figures.

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
On-time Delivery	Supply Chain Management Inbound	Network	Section-network development (for commercialization, contracting and assistance)
			Close-to-customers (reference markets) locations

		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Frequent, Informal, timely information exchange
	Customer Service	IT (Information Technology)	Production Planning
		Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
		Human Resource Management Practices	Multi-skilled human resource selection
	Relationship Capability	IS (Information Sharing)	Frequent, informal, timely information exchange
		Human Resource Management Practices	Staff training
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Network	Section-network development (for commercialization, contracting and assistance)
			Close-to-customers (reference markets) locations
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IS (Information Sharing)	Frequent, Informal, timely information exchange
	Customer Service	IT (Information Technology)	Production Planning
		Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
		Human Resource Management Practices	Multi-skilled human resource selection
	Relationship Capability	IS (Information Sharing)	Frequent, informal, timely information exchange
		Human Resource Management Practices	Staff training
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Supply Chain Management Inbound	Network	Section-network development (for commercialization, contracting and assistance)
			Close-to-customers (reference markets) locations
		Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements

	Customer Service	IS (Information Sharing)	Frequent, Informal, timely information exchange
		IT (Information Technology)	Production Planning
		Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
	Knowledge Management Capability	Human Resource Management Practices	Multi-skilled human resource selection
		Human Resource Management Practices	Multi-skilled human resource selection
		Network	Sections-network development (for commercialization, contracting and assistance)
			M&A
		Production System Practices	External knowhow/technology acquisition

Table SES11.5 – Supply chain configuration

The firm primary bases its competitiveness on a very skilled human resource base. The staff, from the production area to the commercial functions, assures the firm the capability to internally realize different mechanical and industrial specific manufacturing cycle stages and, at the same time, to find the best commercial way to approach new clients. Moreover, the continuous attention to possible M&A, in order to acquire new licenses and knowledge, assures the firm to maintain and externally demonstrate an outstanding Engineering performance. The Engineering performance is also improved staying close to customers location with local representatives or, indirectly, with partnerships with local firms; indeed, since clients increasingly require innovative equipment, know in advance possible clients' needs and end users' requests allow the firm to align its production with the market demand.

The performance of On-Time Delivery and Price are both enabled through three main capabilities: Customer Service, Relationship Capability and Supply Chain Management Inbound. These three capabilities show as the firm, in order to be competitive, has to control the whole supply chain, from its supplier (SCMI) to the downstream side (Customer Service).

The capability of Customer Service is mainly enabled through production planning actions, that assure the respect of due dates, and through the capability to manage the supplier base (SCMI).

SCMI is enabled with long term collaboration actions with Italian suppliers and, through partnerships with on-site market companies, with the improvement of the foreign suppliers' network.

4.2.1.12 SES – 12

Turnover [Mln €]		20-100	
% of Static equipment-Related turnover from the O&G sector		> 75%	
Group Belonging		Yes	
Static equipment supplied	Pressure Vessels	Air Coolers	Columns&Drums
	Heat Exchangers	Industrial Boilers	Trays&Internals

Table SES12.1 – Vital statistics

Market/Product Scenario	Motivations	Trend
Europe/ PE	/	
Northern America / PE	/	

Table SES12.2 – Market/product scenario

Market	Motivations	Actions to undertake
Middle East	Market expansion	Local partnership, local agents
Southern America	New investments, New perspective	Local partnership, local agents

Table SES12.3 – Prospective markets

The firm is completely involved in the production of static equipment items for the Oil&Gas and Power sectors. The firm supplies:

- Pressure vessels made of carbon steel, stainless steel or low alloy steel Cr-Mo;
- Columns and drums made of carbon steel, stainless steel, or low alloy steel Cr-Mo;
- Shell and tube heat exchangers;
- Trays and internals.

The company can realize static equipment of large size (diameter > 5 m) or critical pressure heat exchangers (pressure > 50 bar). Although the company is specialized in the production of these high engineered products, it realizes also more standard dimension products, in order to cover all the possible requests.

The group allows the company to achieve a major critical mass, that provide to the firm a worldwide visibility and the possibility to supply a very complete products package to its customers.

Moreover, the major critical mass, being difficult to feed during crisis periods, can be see also as a disadvantages. The crisis, started in 2008, has affected the firm, bringing it to take different strategic choices, in order to survive: improve the product diversification, expand the product portfolio, realize new partnerships and work in new niche markets. The first two mentioned actions now strictly depend on the improvement of the third one. Indeed, the firm, due to the low oil price, before expanding its commercial offer, wants to find new palatable markets. It is to be noticed that new possibility of business will come from the Africa area (Mozambique and Egypt) and, for this reason, the firm is trying to find possible way to enter in this future advantageous market.

Over three years from now, the company will probably expand its business in the Middle East and Southern America areas. The great capability of the firm to build, at the same time, businesses in different geo-political areas is possible only thanks to the worldwide network of the group.

Notes			
Procurement	IN	OUT	More than 20 rough material, 5 formed end suppliers
Manufacturing	IN	OUT	-
Labeling	IN	OUT	-
Packaging	IN	OUT	-

Table SES12.4 – Production stages

The upstream supply chain is composed by reliable suppliers and the company has a total knowledge of every actor of this part of the supply chain. The firm purchases rough material and outsource the production stages of ends forming.

Since the company, due to the extended product portfolio, has to work with many different suppliers, it relies on high qualified project managers (BR, FBR, IPMA certified).

The most relevant performance items (with related capabilities – practices links to obtain them) for the company, in every relevant scenario, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IT (Information Technology)	Monitoring order processing status, Manufacturing Execution System (MES)
	Product/Process Development Capability	IS (Information Sharing)	Frequent, Informal, timely information exchange
		Human Resource Management Practices	Delegation of responsibilities
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-Time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IT (Information Technology)	Monitoring order processing status, Manufacturing Execution System (MES)
	Product/Process Development Capability	IS (Information Sharing)	Frequent, Informal, timely information exchange
		Human Resource Management Practices	Delegation of responsibilities
	Project Management Capability	IS (Information Sharing)	Frequent, Informal, timely information exchange
		Human Resource Management Practices	Delegation of responsibilities
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with strategic suppliers, commercial agreements
		IT (Information Technology)	Monitoring order processing status, Manufacturing Execution System (MES)
	Financial Capability	Financial Practices	Strong Relationships with Banks
			Strong Relationships with Financiers

Table SE512.5 – Supply chain configuration

The firm enables all its performance with its strong relationships with suppliers. This action, in combination with an internal developed IT and IS system and the empowerment of internal employees, allows the firm to build a reactive and lean supply chain configuration. Nowadays, the company is working to improve two other important performance: Engineering and Innovation. In order to realize this target, the company is investing in licenses/knowledge acquisition and product modularization.

Finally, the firm realizes the performance of Price with the participation of banks and financiers, that allow the company to feed the critical group mass in this period of crisis.

Talking about clients, the firm considers Italian and European clients holder of a great know-how and professionalism, while in the Far East area are present different clients with many different characteristics. Indeed, Koreans clients generally have an aggressive commercial behavior in term of requested price,

Japanese have a valued supply chain and a huge internal organization and, lastly, Indians base their competition on huge low cost engineering centers.

4.3 Companies Overview – SWS

The Best Performers in switchgears sector are very similar, with a turnover ranging between 20 and 50 million, except for one, and, other than one company, they belong to small familiar group or they work independently, thus reducing their financial impact on the market.

These companies have to compete, also on national market, with big multinationals, that also possess the core electrical technologies for the switchgears, from which they have to buy it. This leads to a very complex situation in which these SME relate with these international groups both as competitors, during tendering with EPC, and as suppliers, since they buy from them these core elements.

Respect to the other sectors, the majority of these suppliers don't have the Oil&Gas as their primary market, where they get, on average, 30% of their overall turnover, and they produce the switchgears almost completely in Italy.

Errore. L'origine riferimento non è stata trovata.	Turnover [Mln €]	% of turnover related to Oil&Gas	Production plants	Production plants in Italy	Number of employees	Belonging to a group
1	< 20	50%	1	1	< 50	NO
2	20 - 50	-	2	2	> 200	NO
3	20 - 50	-	2	2	100	NO
4	20 - 50	< 25%	1	1	100 - 200	SI
5	20 - 50	< 25%	1	1	50 - 100	SI
6	20 - 50	< 25%	2	1	100 - 200	SI
7	20 - 50	-	2	2	> 200	NO
8	20 - 50	100%	1	1	50 - 100	NO
9	20 - 50	> 75%	1	1	100 - 200	SI

Table 4.6 Best Performers data – SWS

Company	Group turnover [Mln €]	Group employees
EP – 4	-	-
EP – 5	20 - 50	100 - 200
EP – 6	100 - 200	-
EP – 9	> 200	> 200

Table 4.7 Best Performers groups data – SWS

4.3.1 Single cases - SWS

In this chapter, every supplier of switchgears is described using the information gathered during the interviews. The format used is the same for all the companies and it is the following: at the beginning, there are two tables, the first one containing the vital statistics of the company and the other describing reference and future interesting markets; then there is an introduction of the company along with its contextual environment; it follows a table listing the production process stages, that are fully described later, and

whether these are internally executed or outsourced; at the end, we have the supply chain configuration and its description, followed by a brief explanation of the relationships between the supplier and EPC companies and end users.

Differently by the other two sectors, for switchgears suppliers, since low and medium voltage switchgears are usually sold together, they do not distinguish between the different market/product, but they only identify the single market, onto which they sell everything.

The following table describes the abbreviations present in vital statistics, related to the products:

Abbreviation	Product
LV – PC	Low Voltage Power Center
LV – Sec.D	Low Voltage Secondary Distribution Switchgear
LV – MCC	Low Voltage Motor Control Center
LV – Cont.	Low Voltage Automation and Control Switchgear
LV – Exp-P	Low Voltage Explosion-Proof Switchgear
LV – Synopt.	Low voltage Synoptic Switchboard
MV – McA	Medium Voltage Metalclad Air-Insulated
MV – McG	Medium Voltage Metalclad Gas-Insulated
Mv – MenA	Medium Voltage Metal Enclosed Air-Insulated
MV – MenM	Medium Voltage Metal Enclosed Hybrid
MV – Meng	Medium Voltage Metal Enclosed Gas-Insulated

Table 4.8 Products abbreviations

4.3.1.1 SWS – 1

Turnover [Mln €]	< 20
% of turnover related to Oil&Gas	50%
Group Belonging	No
Electrical Panelboards Produced	LV – PC LV – Sec.D LV – MCC LV – Cont. LV – Exp-P LV – Synopt. MV – McA MV – McG MV – MenA MV – MenM MV – Meng
Core Panelboard(s)	LV – MCC

Table SWS1.1 – Vital statistics

Market	Motivations	Trend
Libia	Unstable market	
Congo	Already present on market	
Kazakhstan	Signed local partnership	

Table SWS1.2 – Market scenario

Market	Motivations	Actions to undertake
Iraq	Market is recovering	Old client
Algeria	Old local contacts	Recover old partnerships
Russia	Unexplored market	End users' relationships

Table SWS1.3 – Prospective markets

The company mainly works in Oil&Gas and Power generation. For the Oil&Gas, they can produce low voltage MCC, Power Center and secondary distribution, while for medium voltage they only have primary distribution, isolated in air. If required, they are able to buy and provide the other typologies.

The firm bases its competitiveness on MCC switchgear and they would like to be able to partner up with competitors, strong in other products, in order to provide more competitive packages of products. The difficulty is always related to the management of the order between different companies. The other sectors in which it works are water and air treatment and chemical sector. The firm is trying to move towards foreign countries, especially in Libia, where it has offshore jobs, and it made trials in Algeria, Tunisia and Congo. From a commercial point of view, the firm made a partnership with a supplier in Kazakhstan and it could reach another one with a client in Iraq. The Northern America is quite complex to be reached, because of the different certifications that it requires, that are barriers to foreign suppliers, while the company misses contacts in Southern America. At the beginning, the firm used to work only on low voltage switchgears, but since EPC contractors are starting to agglomerate low and medium voltage supplies, they bought the license for the production of a medium voltage switchgear.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Copper processing	IN	OUT	-
Wiring	IN	OUT	In case of peaks of demand (OUT)
Painting	IN	OUT	Single supplier
Galvanic treatments	IN	OUT	Single supplier
Assembly	IN	OUT	-
Testing	IN	OUT	-

Table SWS1.4 – Production stages

The firm keeps the majority of processes internal, except painting, galvanic treatments and wiring. Also, the printing of plastic components is outsourced, but the company provides to the suppliers' design, molds and the raw material, that is purchased from multinationals, to avoid low quality supplies.

Near the company there is a very high sub-supplying potential, meaning that they do not need to look to far to satisfy its needs, and that is why the majority of the suppliers are local, other than the provider of particular copper profiles, that are purchased in France. The main requirements are related to quality, low price, flexibility and reliability of supplies.

The company manages internally the bulk of after-sales services, but in case it does not have the manpower, it has reliable suppliers, also for sea maintenance. The market is changing also for the kind of activities, because fifteen years ag, companies used to only install the materials provided, while now the request for retrofit activities is increased a lot, so the company does not have to change the whole switchgear, but it only has to supply and change some parts. Recently, the firm obtained the certificate to make this service both on onshore and offshore.

The most important performance items are now listed, along with capabilities and practices required for their enabling:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions

Engineering	Knowledge Management Capability	Human Resource Management Practices	Staff training
			Job enrichment and job enlargement
		Production System Practices	External knowhow/technology acquisition
			Investments in R&D and Engineering functions
	Relationship Capability	Project Management Practices	Project Management Practice
		IS – Customer to Firm	Product design specifications
		Long-term Relationships with Customers	Collaboration in new product development
			Investments for evaluating customer's future needs
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Knowledge Management Capability	Human Resource Management Practices	Staff training
			Job enrichment and job enlargement
		Production System Practices	External knowhow/technology acquisition
			Investments in R&D and Engineering functions
	Product/Process Development Capability	Production Systems Practices	Product/process standardization (Postponement)
			External knowhow/technology acquisition
			Investments in R&D and Engineering functions
			Bottleneck controlling
			Plants and machines upgrade/replacement
			Product/process standardization (Postponement)
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with suppliers
			Quality guarantee programs for suppliers' processes
		Network	Preference of local suppliers
			Limited number of suppliers
		Production Systems Practices	Use of top quality materials

Table SWS1.5 – Supply chain configuration

The company choose Quality and Engineering as its main performance. The historicity of the firm and having kept all the key-processes inside helped developing a knowledge system that can now be translated in technical capability, that favors the correct realization of the processes.

The decision of maintain the most important processes internal was considered retrograded until some years ago, instead it proved a winning strategy, since it allowed better realization and control.

Quality processes are very important and they require production system practices as support, but also skilled personnel, that is usually trained inside.

The firm tried to develop a R&D process that could involve all the levels of the firm, so that they could use all the different points of view, from the workers to the management, and then testing the product in the lab.

Years ago, they improved all the machineries, for copper working and bending of the carpentry. The standardization of some features on the switchgear allowed the company not to buy laser machines, since they are considered too precise for this kind of operations, reducing maintenance costs.

Furthermore, the company strengthened its bond with end users, and this helped having economic benefits, but also an improvement of technical knowledge, while usually the relationship with EPC contractors is only commercial.

The bulk of their requests comes from the EPC, even if the commercial dynamics require them to be in end users' vendor list in order to get the jobs.

The relationships with the EPC became more complicated, because of a continuous decreasing of their engineering, that makes very difficult this interaction, and it increases the number of technical alignments required. This also increases costs, because there is a continuous necessity of interrupting the production. Relationships with the EPC usually happen on their IT platforms, where tendering documents are loaded.

4.2.3.2 SWS – 2

Turnover [Mln €]					20 – 50	
% of turnover related to Oil&Gas					-	
Group Belonging					No	
Electrical Panelboards Produced	LV – PC	LV – Sec.D	LV – MCC	LV – Cont.	LV – Exp-P	LV – Synopt.
	MV – McA	MV – McG	MV – MenA	MV – MenM	MV – MenG	
Core Panelboard(s)					LV – PC, MV – MenA, MV – MenG	

Table SWS2.1 – Vital statistics

Market	Motivations	Trend
Middle East	Stable market	≡
Northern-Central Africa	Stable market	≡
Brazil	Present locally	≡

Table SWS2.2 – Market scenario

Market	Motivations	Actions to undertake
Congo	Unexplored market	-

Table SWS2.3 – Prospective markets

The company has familiar origin and it provides, other than the production of the switchgear, also installation and after-sales services, which count for a big quote of the overall turnover related to switchgears. The firm can provide the whole range of switchgears related to the Oil&Gas and it produces them or it can buy them from certificated suppliers, as it happens for the explosion-proof ones. The core products are the Power Center and medium voltage metal enclosed switchgears, isolated in both gas and air.

The company covers, other than Oil&Gas, the majority of the industrial sectors, such as Power Generation, chemical, pharmaceutical and metal working.

The department of Research & Development is inside the company, and its target is the development of customized products for each order and, eventually, the adaptation of possible new technological solutions, obtained for a certain order, on the other products of different sectors.

The majority of the offers comes directly from the end users, while the remainder arrives from the EPC, with a proportion of 80-20. The firm mainly works in Middle East, Bahrein, Kuwait, with major offers coming also from Africa, in Nigera, where it works with EPC, and in Algeria, where it has contact with the end user.

The company has a commercial branch in Brazil, required to handle the local market, and one in Czech Republic. In Europe, there are not a lot of contacts for the Oil&Gas, only in Kazakhstan and Russia, but they are a small quote respect to other countries. Nowadays, other than investing to strengthen its presence on markets in which it already worked, the company is evaluating to move in Congo, where there are different possibilities. Actually, there is no interest in investing in order to get certifications to sell switchgear in Northern America, but it prefers to invest to consolidate bonds with already existing clients.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Wiring	IN	OUT	-
Painting	IN	OUT	-
Materials treatments	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-

Table SWS2.4 – Production stages

Other than the most technical phases, such as the engineering, technical office and testing, all the other production stages are kept inside the firm, except the painting and materials treatment. This choice has been taken in order to have a stronger control on both products and processes, to increase the internal flexibility and quality, and to reduce production costs. For the carpentry, the firm acquired specialized machineries, such as laser cutting and robotic machines, for bending and welding.

Also, the secondary production processes, such as wirings, are kept inside. The company never outsourced these processes, preferring, during demand peaks, increasing the manpower from the outside.

The electrical components are mainly acquired from multinationals, while the firm owns the rights for the production of switches for medium voltage switchgears, that it developed for products destined to Power Production and, later, adapted also to Oil&Gas sector.

The relationships with suppliers have strengthened during the years, allowing it to receive these components within 24 hours, removing the necessities of storing these parts in the warehouse.

The raw materials are bought mainly in Italy, but the company also purchases from America and Northern Europe. It often happens that sub-suppliers are imposed by the end users, and it has to adapt to their choice.

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Customer Service	Long-term Relationships with Customers	Collaboration in new product development

			Investments for evaluating customer's future needs
			Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
			On-time delivery directly to customer's points of use
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
	Knowledge Management Capability	Production System Practices	Investments in R&D and Engineering functions
			External knowhow/technology acquisition
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Mutual feedback
		IS – Customer to Firm	Product design specifications
	Product/Process Development Capability	Production System Practices	Use of top quality material
			Product/process standardization (Postponement)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Production System Practices	Investments in R&D and Engineering functions
			External knowhow/technology acquisition
		Human Resource Management Practices	Multi-skilled human resource selection
	Relationship Capability	Long-term Relationships with Customers	Collaboration in new product development
			Investments for evaluating customer's future needs
		IS – Customer To Firm	Product design specifications
		Production System Practices	External knowhow/technology acquisition
	Product/Process Development Capability	Project Management Practices	PM Practices
		Production System Practices	Use of top quality material
			Product/process standardization (Postponement)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-time Delivery	Product/Process Development Capability	Production System Practices	Product/process standardization (Postponement)
			Slack capacity
			Bottleneck controlling
		IT (Information Technology)	Inter-organizational coordination through electronic links
			Monitoring order processing status, Manufacturing Execution Systems (MES)

			Production Planning
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with suppliers
			Quality guarantee programs for suppliers' processes
		IT (Information Technology)	Direct computer-to-computer links with key suppliers
			Information Technology-enabled transaction processing
		Network	Preference of local suppliers

Table SWS2.5 – Supply chain configuration

On-time Delivery, Engineering and Quality are the three main performance. For the Engineering, the design capability is extremely important, along with technical capacity, that is the know-how. The knowledge of the product comes from internal factors, such as investments in R&D and adaptation and development of new products, continuous training of personnel, but also external ones, mainly related to partnerships with suppliers and end users, or eventual collaboration or acquisition of know-how from competitors.

In particular, the collaborations with competitors are a very important source of competitiveness for the firm. This knowledge is also used to obtain the necessary quality to satisfy the necessities of customers. The after-sales services, other than completing the offer to the client, allow the firm to increase its knowledge through the experience on the yard, that is then used inside the office, for improvement of the product.

Also for the Quality, the design and the realization of the products are of paramount importance.

The technical capacity, required for the production of the switchgears, is favored by the internal processes, that increase the control of the finite product. Internal production is also very useful to schedule and monitor the production, increasing the flexibility and reducing costs and delivery times.

The company works especially with end users because there is an exclusivity of the relationship that misses when it is dealing with the EPC, and this has repercussions on a higher technical and economical satisfaction.

Technical capability becomes fundamental in order to work with the end users and this is why the company always pushes on that side, trying to satisfy technical requirements and fostering the relationship, once it is acquired.

The capability of management a project becomes very important, so the firm invested a lot in Project Management, that favors the handling of orders, allowing a better costs control and also the realization, having the proper schedule under control.

4.3.2.3 SWS – 3

Turnover [Mln €]				20 – 50			
% of turnover related to Oil&Gas				-			
Group Belonging				No			
Electrical Panelboards Produced	LV – PC	LV – Sec.D	LV – MCC	LV – Cont.	LV – Exp-P	LV – Synopt.	
	MV – McA	MV – McG	MV – MenA	MV – MenM	MV – MenG		
Core Panelboard(s)				LV – MCC, LV – PC, MV – McA			

Table SWS3.1 – Vital statistics

Market	Motivations	Trend
France	Stable market	☰
Italy	Stable market	☰
Germany	Stable market	☰

Table SWS3.2 – Market scenario

Market	Motivations	Actions to undertake
Middle East	Great possibilities of investment	Networking, local agents

Table SWS3.3 – Prospective markets

The firm has familiar origin and its core products for the Oil&Gas are the Power Center, Motor Control Center and medium voltage metalclad switchgears, isolated in air. Sells are mainly focused on the European market, especially in Italy, France and Germany, that collect almost the 80% of the turnover, but it also works in Middle East, Northern Africa and America. The Middle East is still a prospective target, very difficult to enter and consolidate, because it requires a strong local presence.

Generally, the company works with Main Contractor, because it is much easier than contacting directly the end users, since it is necessary to have strong bounds with agents that, at the moment, it do not have.

The firm invested a lot in the development of products so that it is possible to certificate them through specific tests that allow it to sell of foreign markets. Another important category of products is related to generator products, that is not sold on the Oil&Gas market, but being a very dynamic environment, it allows the firm to continuously create and transfer this technology also on other switchgears.

This kind of innovation is critical on this market because, being the Oil&Gas families of products are very mature, the company needed a way to defend from low-quality and low-price competitors from other countries.

Improvement is also often related to collaborations with bigger competitors to which, sometimes, they sell innovative products, while it is much more difficult to undertake similar reasonings with companies with same dimension, especially in an unstable market as the Oil&Gas, where there is no certainty of having profits.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Wiring	IN	OUT	-
Painting	IN	OUT	-
Secondary machining	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-

Table SWS3.4 – Production stages

The company decided to maintain inside the majority of production process stages, both core activities, for example technical offices which follow the development of the switchgears, both lower impact processes, such as wirings. This is done because of the higher control and quality that the firm succeeds in generating, considering that it also builds more complex products.

Suppliers, especially third-party ones, are mainly local, and they have to satisfy requirements related to quality and, above all, the capability of providing quickly respond to sudden orders or modifications. The selection process usually is repeated for each order, even if the choice falls on the same subset of suppliers with which, as a consequence, they created a stingier bond, even if, formally, there are no partnerships.

The level of vertical integration allows it to reduce the contribution of suppliers to the production process and so, the firm does not need a continuous flow of information, but, in case there is something necessary, it is able to obtain information about their remaining production capacity.

Raw materials, copper and plates, can also be purchased from foreign countries, such as Bulgaria, China or Turkey, where they have 4-5 high level suppliers, whose requirements of quality have been checked, that help reducing the costs. It is important to notice that the company always set quality as the main performance requested to suppliers, so it tries to reduce the costs without impacting on quality or reliability.

The company does not produce any electrical components, that are purchased from the multinationals. Even if sometimes companies leave an open choice for the type of components, the firm buys them from the multinationals, because, although the costs are higher, they provide a much more complete after-sales services.

It is also important to foster the relationships with these huge suppliers in order to get, after a while, discounts on the final price or help in case there will be trouble with components installed on the switchgear, that can miss whenever the supplier is not a usual one.

The company provides after-sales services but, being a scarce resource, they prefer to use it for orders in which it is mandatory.

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Human Resource Management Practices	Staff training
			Multi-skilled human resource selection
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
	Product/Process Development Capability	Production System Practices	Plants and machines upgrade/replacement
	Relationship Capability	Long-term Relationships with Suppliers	Involving suppliers in new product design
		Long-term Relationships with Customers	Collaboration in new product development
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Price	Relationship Capability	Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
		Network	Preference of local suppliers

		Human Resource Management Practices	Multi-skilled human resource selection
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Quality	Product/Process Development Capability	Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
			International certifications (ISO 9001)
			Use of top quality materials
	External Integration	Long-term Relationships with Customers	Collaboration in new product development
		IS (Information Sharing)	Frequent, informal, timely information exchange
			Formal Information Sharing agreements
		IS – Customer to Firm	Information exchange about planned orders or order changes
	Knowledge Management Capability	Human Resource Management Practices	Staff training
			Multi-skilled human resource selection
		Production System Practices	Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
		Long-term Relationships with Suppliers	Involving suppliers in new product design

Table SWS3.5 – Supply chain configuration

The most important performance for the company are Price, Engineering and Quality.

The critical contribution to reach competitive prices is given by its capacity of handling the suppliers, both third-party and electrical components ones, whose long-term relationships allow it also to cooperate in the product development and in reducing the purchasing cost.

Furthermore, this kind of fostered bonds with multinationals helps the company obtaining also a more complete after-sales service, which helps in providing a much more complete product to the client.

The Engineering is developed inside the company and this is due thanks to the investments made both in the products, which they started to export thanks to the certifications they made, and in the personnel, creating a diffused business culture. At the same time, the firm often collaborates with electrical components' suppliers and with clients to improve their switchgears.

Maintaining the different activities inside the company helped in increasing a higher control on the production process, guaranteeing a better quality of the products. Investments in machineries, purchasing automated ones, helped in getting a production process perfectly fitting to the necessities.

Information sharing is usually done with some clients, for example, through an IT platform that increases the coordination of the order and its better development. In some case, it is also possible to get to a combined development of the switchgear.

At the moment, the company does not have certifications in Project Management, since it states that the dimensions and the types of order do not require them. They would be fundamental in case the firm decided to strongly invest in increasing its own presence in Middle East.

The relationships with the EPC are quite complex because the strength relationships are unbalanced toward them. Furthermore, these companies lost part of their technical capacity and it becomes very difficult to develop a dialogue to present variations of the products that they required, even if these modifications could affect positively both the sides.

4.3.2.4 SWS – 4

Turnover [Mln €]					20 – 50	
% of turnover related to Oil&Gas					< 25%	
Group Belonging					No	
Electrical Panelboards Produced	LV – PC	LV – Sec.D	LV – MCC	LV – Cont.	LV – Exp-P	LV – Synopt.
	MV – McA	MV – McG	MV – MenA	MV – MenM	MV – MenG	
Core Panelboard(s)					LV – PC, LV – MCC, MV – McA	

Table SWS4.1 – Vital statistics

Market	Motivations	Trend
Europe	Stable market	☰
Middle East (Saudi Arabia)	Fostered relationships with clients	☰
Southern America	Contacts with end users	☰

Table SWS4.2 – Market scenario

Market	Motivations	Actions to undertake
Northern Africa	Future investments in the area	Local agents
Central Africa	Future investments in the area	Local agents

Table SWS4.3 – Prospective markets

The company is at the top of a group that mainly works in the electrical sector. The core of the production, in the Oil&Gas sector, is related to low voltage Power Center and Motor Control Center switchgears and medium voltage metalclad isolated in air. Other than these categories, the company is able to produce low voltage switchgears for secondary distribution and medium voltage metal enclosed, mixed and air isolated.

The organization covers European and Middle East markets, especially in Saudi Arabia, to which it provides only European certificated products. The firm succeeded in fostering the relationships with end users and now it also receives orders straightly from them, especially in Southern America. It also operates, through EPC contractors, in Northern Africa.

Furthermore, the company created local partnerships with suppliers in Southern America, Northern Europe and in the Middle East, that allow it to foster the presence on the territory, and to provide much more complete after-sales services.

Because of a growth of markets in Northern and Central Africa, the company is trying to find local agents, to enter in these territories.

The access in Northern America is very complex, since the required certifications are very different, but the firm is looking to establish partnerships with competitors to access those markets, even if it is not a priority, yet.

There have not been, lately, strategies centered on Oil&Gas market, but only an adaptation of products from other sectors.

The R6D department mainly follows the directions indicated by the marketing one, that sets the priority on the market and, when it is necessary, the R&D realizes the customization required by clients. Usually, this office works on adaptations related to norms or on more specific technical solutions.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	-
Copper processing	IN	OUT	-
Wiring	IN	OUT	In case of peaks of demand (OUT)
Painting	IN	OUT	-
Resin processing	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-

Table SWS4.4 – Production stages

All the main production process stages are realized internally. Through continuous investments, the products range has become wider, increasing also the number of customization for each type of switchgear and, since there are not a lot of sub suppliers in the area, the company had also to invest in the improvement of production process. It also owns the know-how for the creation of electrical components for medium voltage metal enclosed switchgears, that has been developed along with competitors.

The remaining components are usually purchased by multinationals. During the past years, the company defined strategies for the development of switchgears that would better fit some type of electrical components rather than others, considering the most requested on the market, so that they could store than inside the warehouse.

Other than plastic and resin workings, in case of demand peaks, the firm can outsource a bit the wiring operations. These suppliers are usually subjected to an internal qualification process, in order to verify their conformity to its quality, price and on-time delivery criteria. Actually, these suppliers are Italian, since they do not have a sufficient demand to purchase from foreign ones.

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (SC)	Knowledge Management Capability	Human Resource Management Practices	Staff training
			Multi-skilled human resource selection
		Production System Practices	Product/process standardization (Postponement)
			Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement

	Relationship Capability	Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
			Investments for evaluating customer's future needs
		Long-term Relationships with Suppliers	Close partnerships with suppliers
			Involving suppliers in new product design
			Enhancement of each other's business (common growth)
	Capacity and Flexibility	Network	Preference of local suppliers
			Limited number of suppliers
		Long-term Relationships with Suppliers	Close partnerships with suppliers
			Solid and durable relationships with key suppliers (considered as a part of the firm)
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-time delivery	Relationship Capability	IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
			Formal Information Sharing agreements
		IS – Customer To Firm	Product design specifications
			Investments for evaluating customer's future needs
		Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
			Preference of local suppliers
			Limited number of suppliers
	Capacity and Flexibility	Network	Preference of local suppliers
			Limited number of suppliers
		Long-term Relationships with Suppliers	Close partnerships with suppliers
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		Human Resource Management Practices	Multi-skilled human resource selection
			Job enrichment and job enlargement
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Quality	Knowledge Management Capability	Human Resource Management Practices	Staff training
			Multi-skilled human resource selection
		Production System Practices	Product/process standardization (Postponement)

			Investments in R&D and Engineering functions
			Plants and machines upgrade/replacement
	Product/Process Development Capability	Production System Practices	Bottleneck controlling
			Plants and machines upgrade/replacement
			Use of top quality material
		IS – Customer To Firm	Product design specifications
			Investments for evaluating customer's future needs
		Long-term Relationships with Customers	Investments for evaluating customer's future needs
			Investments for evaluating customer's future needs
	Customer Service	Network	Close-to-customer (reference markets) locations
			Sections-network development (for commercialization, contracting and assistance)
		Long-term Relationships with Customers	Investments for evaluating customer's future needs
			Investments for evaluating customer's future needs

Table SWS4.5 – Supply chain configuration

The company targets On-time Delivery, Quality and Flexibility (SC) as its most important performances. Quality is assured by both its capability of supplying customized products to the customers and its offer of order with after-sales service included.

In order to increase their relationships with clients, the Flexibility of the firm is too important, since it helps following and satisfying their necessities, and the role of the sub suppliers is very high, because they help achieving this high level. The company is trying to keep a reduced number of suppliers, in order to create partnerships, and making a more interesting commercial relationship.

The sector is so specific that is very difficult to acquire quality personnel from outside and the internal training gains a lot of importance, in order to get high quality and flexible operators that allow a simplification of both managerial and production processes.

The company is more focused on fostering or creating relationships with suppliers, rather than acquiring know-how by acquisitions of other companies.

The firm usually interfaces both with the EPC contractors and end users, depending on the market. It tried to improve their presence on end users' vendor lists, but this is hindered by their lack of desire of expanding them.

The relationships with the EPC are getting more and more difficult, because of the excessive bureaucracy that it requires time for scarce adding value activities. Often contractors miss internal coordination that leads to a partial or incorrect information sharing that, at the end, generates delays.

Knowing the increasing weight in the sector, the company has decided to invest in training the personnel on Project Management, since they miss the necessary certifications.

4.3.2.5 SWS – 5

Turnover [Mln €]	20 – 50
% of turnover related to Oil&Gas	< 25%
Group Belonging	Si
Electrical Panelboards Produced	LV – PC LV – Sec.D LV – MCC LV – Cont. LV – Exp-P LV – Synopt. MV – McA MV – McG MV – MenA MV – MenM MV – MenG
Core Panelboard(s)	LV – PC, LV – MCC, LV – Sec.D, MV – McA, MV – MenM

Table SWS5.1 – Vital statistics

Market	Motivations	Trend
Persian Gulf	Stable market	
Northern Africa (Maghreb)	-	
Eastern Europe	-	
Southern America	Contacts with end users and partnerships	

Table SWS5.2 – Market scenario

Market	Motivations	Actions to undertake
Mozambique	Local branch	Waiting for the market to recover

Table SWS5.3 – Prospective markets

The company belongs to a familiar group that occupies of the production of low and medium tension switchgears, design and engineering activities, realization of industrial plants and electrical maintenance.

The core switchgears are, considering low voltage, Motor Control Center, Power Center and secondary distribution, while, for the medium voltage, metalclad isolated in air and metal enclosed, with mixed and air isolation.

Sometimes it happens that clients require these products inside specific packages, for example along with automation and control switchgears or synoptic switchboards, that the company is able to produce, even if they do not provide a source of competitiveness.

The range of products for the Oil&Gas is complete and it is mainly driven by reference markets: the categories of switchgears that are not produced are justified by a lack of demand, not by missing technical capability.

Other than the Oil&Gas, the firm produces also switchgears for Power Generation, chemical and hydroelectric sectors, where it operates in a niche market with very specific orders, that it can satisfy thanks to its high engineering of their products.

During the last few years there have been targeted investments for the internationalization of the firm but, because of its small-medium nature, still the relationships with end users are not so strong, meaning that it has to continuously related with EPC.

This internationalization process led the company working in United Arab Emirates, through Japanese and Southern Korean EPC, but it still cannot work in Saudi Arabia market, because of the different certifications required.

Also, the firm have not entered yet in Northern American market because of diverse types of certifications, that act as a barrier that, at the moment, has been overcome only by multinationals, which have a different financial potential. In order to enter on these markets, it is necessary to obtain these certifications and to create a structure on the territory.

The company would like to set an alliance with a competitor, in order to actuate an entry strategy on these area, or for product development, but, as always, it is difficult to integrate two different companies, usually because of different points of view of the business.

India and Russia are two interesting markets where the company is working, with the first one being a stable market, logistically difficult to interact with, while from the second it received offers straightly from the end user.

The firm covers Northern Africa and, for Power Generation, it received offers from Tanzania and Malawi. Finally, the company has also projects for both Power Generation and Oil&Gas, in South America, where it went with a national colossus.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Carpentry	IN	OUT	20-30% is realized internally
Copper processing	IN	OUT	-
Wiring	IN	OUT	In case of peaks of demand (OUT)
Painting	IN	OUT	-
Standard drawers	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-

Table SWS5.4 – Production stages

Initially, painting and carpentry were executed inside the firm. Now, it found suppliers that, exploiting economies of scale, are able to provide these processes with the same quality at a lower price, while it keeps inside a small number of machineries to increase flexibility and work a smaller percentage of overall carpentry.

Wirings, workings of standard drawers and mechanical assemblies are all outsourced processes, while the company maintains internally the most value adding activities, such as the engineering of the switchgear and testing.

The firm owns a network of sub-suppliers, that is local and well tested, allowing a much higher reactivity on customers' variations, but also flexible respect to production volumes.

The performances enabled by the companies, along with relative capabilities and practices, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Product/Process Development Capability	Long-term Relationships with Suppliers	Involving suppliers in new product design
			Close partnerships with suppliers

		Production System Practices	Investments in R&D and Engineering functions
			International certifications (ISO 9001)
	Knowledge Management Capability	IT (Information Technology)	Inter-organizational coordination through electronic links
		Human Resource Management Practices	Advanced methods for employee selection
			Staff training
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Lead-time	Capacity and Flexibility	Production System Practices	Slack capacity
		IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
			Formal Information Sharing agreements
		Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
			Close partnerships with suppliers
			Expediting (visiting suppliers' plants)
	Supply Chain Management Inbound	Network	Preference of local suppliers
			On-time delivery directly to customer's points of use
		IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
			Formal Information Sharing agreements
		IT (Information Technology)	Bar coding/automatic identification systems
			Warehouse Management Software (WMS)
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (SC)	Knowledge Management Capability	Human Resource Management Practices	Staff training
			Advanced methods for employee selection
		IT (Information Technology)	Inter-organizational coordination through electronic links
	Capacity and Flexibility	Production System Practices	Slack capacity
		IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
			Formal Information Sharing agreements
		Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
			Expediting (visiting suppliers' plants)
	Customer Service	Long-term Relationships with Suppliers	Involving suppliers in new product design
			Collaboration in new product development

		Long-term Relationships with Customers	Investments for evaluating customer's future needs
		Network	On-time delivery directly to customer's points of use

Table SWS5.5 – Supply chain configuration

The company is considered forefront and flexible, it has a lot of technical certifications and the possibility of making complex tests for high quality products. Flexibility is considered both in terms of lead-time and productive capacity. The latter is obtained thanks to internal flexibility, scheduling and organization, and to suppliers.

Currently, the firm also provides after-sales services and the bulk of switchgears sold is also installed. Due to their small-medium dimension, there are difficulties in constantly moving outside national boundaries for the after-sales services, so it needs to use them only when they are required to win the order. The creation of international branches is helping them to increase its influence on foreign markets.

The company is also investing in internal improvement, it acquired certifications that allow selling on foreign countries, courses for the interaction with foreign clients are held and the management of documentation has been improved.

The majority of the critical processes is held inside and this allows to create a knowledge system that is related both on certifications and products. The suppliers' network is usually constant since, because of the peculiarity of the sector, it is very difficult to substitute them, and this led to partnerships, in particular with multinationals, with which there have been collaborations for the creation of new products.

The company mainly works with EPC contractors because most of end users blocks their vendor list, thus reducing the possibilities of entering it. In other cases, these lists are more open, but in order to access them it is important to increase the local presence and to effectuate activities of lobbying. The effort in this direction has been appreciated, since, recently, the firm has been contacted directly from end users for new orders.

4.3.2.6 SWS – 6

Turnover [Mln €]				20 – 50		
% of turnover related to Oil&Gas				< 25%		
Group Belonging				Si		
Electrical Panelboards Produced	LV – PC	LV – Sec.D	LV – MCC	LV – Cont.	LV – Exp-P	LV – Synopt.
	MV – McA	MV – McG	MV – MenA	MV – MenM	MV – MenG	
Core Panelboard(s)				LV – PC, MV – McA		

Table SWS6.1 – Vital statistics

Market	Motivations	Trend
United Arab Emirates	Local branch	
Northern Africa (Algeria/Morocco)	-	
Mozambique	Local branch	
Eastern Europe - Bulgaria	Local plant	

Table SWS6.2 – Market scenario

Market	Motivations	Actions to undertake
Mexico	Future investments in the area	Local agents and relationships
Southern America	Future investments in the area	Local agents and relationships
Iran	Future investments in the area	Stabilization of the area

Table SWS6.3 – Prospective markets

This company is the biggest of a familiar holding, which also owns a firm that produces electrical material and one that delivers engineering services. Being part of a holding helps presenting with a stronger financial capability, giving major security to the customers, but also, in case they are required, it can provide engineering services along with the delivery of switchgears.

Low voltage Power Center and medium voltage metalclad isolated in air are the core switchgears, while, whether they are required as part of a bigger package, the company can provide other kinds of switchgear, such as Motor Control Center, low voltage secondary distribution, automation and control and medium voltage metal enclosed.

The firm operates not only in Oil&Gas sector, but also in Power Production, in the industrial and marine/naval ones, where it handles orders for cruise and military ships.

Starting 15 years ago, the company started a process of internationalization, that strongly contributed to the increase of the company, moving towards Middle East and Northern Africa, taking contacts with local agents through the commercial office. Later, it understood how important is the local presence to get the orders directly from end users. The organization identified and purchased, in the Middle East area, a company provider of other kinds of electronical products, which had the necessary licenses to operate in that market. The acquirement of that entity proved to be incredibly important since it greatly fostered the relationships with local end users, so the strategy has been replicated also in Brazil and Mozambique.

A strategically interesting market is the Northern American one, but its entrance is very complex due to huge investments required, that are required to purchase the certifications, reconfigure and retest the switchgears, that are much more different than the European ones.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	Some SF6 disconnectors are produced internally
Carpentry	IN	OUT	-
Wiring	IN	OUT	In case of peaks of demand (OUT)
Painting	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-

Table SWS6.4 – Production stages

All the production process stages are kept inside the firm, including painting, since it is a very important activity in naval sector, that has to be internally executed to provide the necessary quality.

The company is renewing the assembly chain and it is replacing the old machineries with automatic ones, with the target of reducing uncertainties due to manual assembly. The automation process has also been applied on the warehouse, improving the monitoring of stocks and optimizing internal logistic.

Externally, the firm purchases the plates, raw materials and electrical components, even if, as opposed to some competitors, it owns the know-how for SF6 disconnectors, certified for the Oil&Gas. Furthermore, there is a great commercial relationship with one of the main electrical components producer that helps in a further reduction of purchasing costs.

The suppliers' network is mainly local, close to the production plant, in order to guarantee higher flexibility and lower logistic cost. Recently, the firm started to search suppliers outside national boundaries, that could help it with some criticalities related to technical aspects of the switchgears and to production capacity.

The supply chain configuration identified by the company does not depend nor on the product or on the market, and it is defined as follow:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Supply Chain Management Inbound	IT (Information Technology)	Warehouse Management Software (WMS)
			Scheduling and planning software use and/or development
		Long-term Relationships with Suppliers	Close partnerships with suppliers
		Network	Sections-network development (for production)
			Preference of local suppliers
	Product/Process Development Capability	Production System Practices	Plants and machines upgrade/replacement
			Product/process standardization (Postponement)
			Slack capacity
		Human Resource Management Practices	Staff training
	Capacity and Flexibility	Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
			Close partnerships with suppliers
		Production System Practices	Slack capacity
			Monitoring order processing status, Manufacturing Execution Systems (MES)
			Cycle time reduction
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Quality	Relationship Capability	Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
		Long-term Relationships with Customers	Collaboration in new product development
			Investments for evaluating customer's future needs
		Long-term Relationships with Suppliers	Close partnerships with suppliers
			International certifications (ISO 9001)

	Product/Process Development Capability	Production System Practices	Plants and machines upgrade/replacement
			Investments in R&D and Engineering functions
			Use of top quality materials
	Knowledge Management Capability	IS – Customer to Firm	Product design specifications
			Advanced methods for employee selection
			Staff training
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
On-time delivery	Supply Chain Management Inbound	IT (Information Technology)	Warehouse Management Software (WMS)
			Scheduling and planning software use and/or development
			Monitoring order processing status, Manufacturing Execution Systems (MES)
		Long-term Relationships with Suppliers	Expediting (visiting suppliers' plants)
		Network	Preference of local suppliers
		Production System Practices	Automatic warehouse
	Supply Chain Management Outbound	Project Management Practices	PM Practices
		Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
		Production System Practices	Automatic warehouse
		IT (Information Technology)	Monitoring order processing status, Manufacturing Execution Systems (MES)
	Product/Process Development Capability	Production System Practices	Plants and machines upgrade/replacement
			Process/product standardization (Postponement)
			Cycle time reduction

Table SWS6.5 – Supply chain configuration

The practices of Network and Production System, related to the development of the relationships with end users and suppliers and the renewal of the production system become extremely relevant in obtaining the three selected performances.

For the enablement of the On-time Delivery the management of the internal flow of raw materials and other parts required for the assembly of the switchgears becomes very important, but also the management of the order, to which a competent Project Manager can strongly contribute.

The selected performances are also enabled, through the capabilities of supply chain management inbound and outbound, by IT practices, mainly related to monitoring of the production and orders, along with usage of the automated warehouse.

The most important competitive element in this market is the qualification of products and their presence in end users' vendor list; without these certifications, it is impossible to win the orders, because, often, EPC contractors do not have the contractual force to impose their vendor list to the end user.

The opening of these local branches allowed to relate in a much more efficient way with the end users. From this point of view, the after-sales services are starting to grow in importance in the company's strategy, since, other than completing the package that can be offered to the client, they can also increase to maintain a continuous contact with the end user, even after the supply.

The figure of the Project Manager has also become very important, because he helps both in the management of the supply and in the relationship with the client, because he is the central figure that unites all the different voices inside the company, rationalizing the communication with the client.

4.3.2.7 SWS – 7

Turnover [Mln €]					20 – 50	
% of turnover related to Oil&Gas					-	
Group Belonging					No	
Electrical Panelboards Produced	LV – PC	LV – Sec.D	LV – MCC	LV – Cont.	LV – Exp-P	LV – Synopt.
	MV – McA	MV – McG	MV – MenA	MV – MenM	MV – MenG	
Core Panelboard(s)					LV – PC, MV – McA	

Table SWS7.1 – Vital statistics

Market	Motivations	Trend
Middle East	-	☰
Brazil	Local partnership	☰ ↗
Eurasia	Stable market	☰

Table SWS7.2 – Market scenario

Market	Motivations	Actions to undertake
Ghana	Growing markets	-
Nigeria	Growing markets	-
Congo	Growing markets	-

Table SWS7.3 – Prospective markets

The company belongs to a family and it was born to produce switchgears for the Power Production during combined cycles period and, later, it started proliferating also in Oil&Gas market. With the arrival of renewables, Power Production sector has changed and so the firm shifted mainly to work in Oil&Gas.

Since this market is mainly international, huge investments have been done to obtain the necessary qualifications and to increase the range of products, since it had to align to end users' requests. One of the main strategy has been the stipulation of alliances and know-how transfer with electrical components' producers.

Its only focus air isolation and the firm produces, for low voltage, Power Center, secondary distribution, Motor Control Center, automation and control and explosion-proof switchgears while, for medium voltage, it has both metalclad and metal enclosed.

The primary distribution, both in low and medium voltage, represents the core business of the firm, which accounts for almost the 75% of the overall turnover.

The company has grown constantly and it started to make relationships with international clients, with the biggest difficulties met in Middle East, because of the protectionist nature of that market. Because of the complication derived from accessing this market, the firm had to lean on EPC contractors, since it needed them to be a bridge with the clients.

End users, especially in these countries, have vendor lists that are hardly expanded, so investments have been made to increase its capability of structuring the commercial proposal, in order to help the EPC contractors, during tendering phase, to formulate a satisfactory offer for the clients.

The company preferred to invest, with a lower overall risk, in improving the relationships with the EPC, rather than trying to access by themselves to those markets through a local agent. Another advantage of this strategy has been that working in synergy with the EPC gives the possibility of relating to several countries, which is something that the single company would hardly be able to do.

Other than the Middle East, the company works also in Southern America, where it formed a partnership with a Brazilian company, and in Eurasian region while, in Africa, other than Sub-Saharan countries, it is targeting growing markets, such as Ghana, Nigeria and Congo.

The firm has also been interested in accessing the Canadian market, which has grown a lot during previous years, but the difference of certifications acted as an insuperable barrier.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	Some SF6 disconnectors are produced internally
Carpentry	IN	OUT	-
Wiring	IN	OUT	In case of peaks of demand (OUT)
Painting	IN	OUT	-
Secondary machining	IN	OUT	-
Assembly	IN	OUT	-
Testing	IN	OUT	-

Table SWS7.4 – Production stages

The company was born for installation services and, later, after it acquired the know-how, it also started producing switchgears. At the beginning, a plant for their production has been purchased and, through the analysis of its costs, the management decided to revolutionize the internal production processes, outsourcing painting and investing for the internalization of carpentry operations. The latter produced huge benefits because, as opposed to traditional carpenters, working only plates for switchgears allowed increasing the precision of workings, increasing the overall quality of products. In order to saturate the machineries, the firm signed a cooperation partnership with some competitors, to which it started selling carpentry. Furthermore, the internalization of these operations allowed a further reduction of costs, because it was possible to remove control costs related to suppliers.

The firm purchases raw materials, plates and electrical components; besides, wirings, whenever there are peaks of demand, are outsourced to trusted and qualified suppliers. Internally, there is also the possibility of realizing a set of SF6 switches for medium voltage switchgears.

The suppliers' network is mainly local, especially the wiring workshops, so that it is possible to create competence and flexibility around the plant, while reducing time and costs related to logistic. Firm's target is the development of partnerships, while keeping open the vendor list for possible addition of new suppliers.

The testing phase is performed inside the plant and it is critical for the comprehension and the development of the know-how, because it helps understanding whether what has been developed can effectively work and it shows possible adjustments that can be seen during the assembly.

The three main performances and the related capabilities and practices are shown below:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Quality	Customer Service	IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
			Frequent, informal, timely information exchange
		Long-term Relationships with Suppliers	Helping suppliers to improve their product quality (Top Management Support)
			Expediting (visiting suppliers' plants)
			Involving suppliers in new product design
			Enhancement of each other's business (common growth)
		Human Resource Management Practices	Advanced methods for employee selection
			Staff training
	Product/Process Development Capability	Production System Practices	International certifications (ISO 9001)
			Plants and machines upgrade/replacement
			Bottleneck controlling
			Use of top quality materials
		IT (Information Technology)	Scheduling and planning software use and/or development
			Production Planning
	Knowledge Management Capability	Human Resource Management Practices	Staff training
		Production System Practices	External knowhow/technology acquisition
			Investments in R&D and Engineering functions
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
On-time delivery	Capacity and Flexibility	Network	Preference of local suppliers
			On-time delivery directly to customer's points of use
		Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
		Production System Practices	Setup time reduction
			Product modularization

	Supply Chain Management Outbound	IT (Information Technology)	Monitoring order processing status, Manufacturing Execution Systems (MES) Constant delivery tracking, Radio Frequency Identification (RFID)
		Production System Practices	Automatic warehouse
	Supply Chain Management Inbound	IT (Information Technology)	Warehouse Management Software (WMS) Production Planning
		Network	Preference of local suppliers
		Production System Practices	Automatic warehouse
		Long-term Relationships with Suppliers	Involving suppliers in new product design
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (Supply Chain)	Capacity and Flexibility	Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm) Expediting (visiting suppliers' plants)
		Network	Preference of local suppliers On-time delivery directly to customer's points of use
		Human Resource Management Practices	Multi-skilled human resource selection Delegation of responsibilities Staff training
		IS – Customer To Firm	Information exchange about planned orders or order changes
	Relationship Capability	Long-term Relationships with Suppliers	Solid and durable relationships with key suppliers (considered as a part of the firm)
		Project Management Practices	Project Management Practices
		IS (Information Sharing)	IS (Information Sharing)

Table SWS7.5 – Supply chain configuration

There is no dependence between the supply chain configuration and markets and products. The main performances, that the company selected, are Quality, Flexibility (SC) and On-time Delivery. Price is considered an important competitive element, but it is not fundamental, since usually the client usually brings you to the price that he desires.

The quality of the products and flexibility, intended as the capability of adapting the order work in progress, are of paramount importance. The management of the processes of the engineering and construction constitute the basic capabilities required to enable the performance listed above. During the years, the company invested in acquiring and development personnel, in information sharing with clients and customers and in informatization, that is mainly used to foster the internal coordination.

Being born as an installer company, strongly advantaged it from the point of view of after-sales services, since it already has the experience and knowledge to provide them as part of a more complete package for the customers.

The presence of a local network of experienced suppliers allows the company to extremely enhance its flexibility, but, above all, it helps spreading knowledge, increasing their technical capability, having positive repercussions on the quality of the switchgears.

The company succeeded in developing warehouse management logic for the electrical components because, after an analysis of the demand, it focused on purchasing those elements from one multinational, pushing the end users to use switchgears containing those parts, proposing lower price and delivery celerity.

The Project Manager has become a central figure in the company, becoming the alter ego of the entrepreneur in front of the client and allowing to better understand end users' necessities, increasing flexibility and dynamism.

4.2.3.8 SWS – 8

Turnover [Mln €]		20 – 50				
% of turnover related to Oil&Gas		100%				
Group Belonging		No				
Electrical Panelboards Produced	LV – PC	LV – Sec.D	LV – MCC	LV – Cont.	LV – Exp-P	LV – Synopt.
	MV – McA	MV – McG	MV – MenA	MV – MenM	MV – MenG	
Core Panelboard(s)		LV – PC, LV – MCC				

Table SWS8.1 – Vital statistics

Market	Motivations	Trend
Kazakhstan	Local branch	
Middle East	Local branch	
Mozambique	Local branch	

Table SWS8.2 – Market scenario

Market	Motivations	Actions to undertake
-	-	-

Table SWS8.3 – Prospective market

The company has familiar origin and it operates exclusively in Oil&Gas market, where it can relate both with end users and EPC contractors. Its core products are low voltage Motor Control Center and Power Center switchgears, but it can cover almost the whole range of products required in Oil&Gas, concurring on offers for both low and medium voltage.

The firm also sells modular substations and provides after-sales services. The latter ones have become a very important part of the business and they take into account installation, pre-commissioning and commissioning. In case the customers require it, the company is able to implement modifications to the switchgears already present in the plant. This led the company, especially for orders with a huge amount of switchgears to provide and manage, to create local branches that could handle these services.

When the number of switchgears for an order is very high, the company has the possibilities of triplicate the number of employees and to take from outside other Project Managers, required to handle the job.

Being focused entirely on Oil&Gas, the company works almost completely in foreign countries, mainly in Kazakhstan, Azerbaijan, Georgia, Middle East and Africa. The company has created, or acquired, a local branch in each of these countries that are used to foster the relationships with clients and to provide better after-sales services. Currently, there are no future markets in which the company think it could settle, it usually moves following end users' requests. The firm is not interested in investing to acquire certifications required for accessing the market of Northern America.

			Notes
Procurement	IN	OUT	-
Manufacturing	IN	OUT	-
Standard carpentry	IN	OUT	1 supplier
Customized carpentry	IN	OUT	-
Copper processing	IN	OUT	-
Wiring	IN	OUT	3 suppliers
Painting	IN	OUT	-
Assembly	IN	OUT	3 suppliers
Testing	IN	OUT	-

Table SWS8.4 – Production stages

The majority of production process stages are outsourced, mainly the ones with low adding value, such as wiring, painting and assembly. The company keeps a low number of suppliers, so that they can be saturated as much as possible.

The standard carpentry, made by different standardized columns of different dimension, it produced by a single supplier and it is kept in the warehouse. The remaining carpentry, that is around 15% of the overall, is the customizable part for each order, and it is worked inside the company using special machineries, that allow the required flexibility and quality. The copper is worked internally too.

The company did not decide to own its line of switches and electrical components since it did not evaluate the convenience of the investment since it should compete on the market with multinationals with a much bigger financial capability.

The most important performances, capabilities and practices are then listed:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Engineering	External Integration	Long-term Relationships with Suppliers	Close partnerships with suppliers
			Involving suppliers in new product design
			Solid and durable relationships with key suppliers (considered as a part of the firm)
	Customer Service	IS (Information Sharing)	Giving information about events or changes that may affect the other part
			Frequent face-to-face planning/communication with suppliers/clients
	Product/Process Development Capability	IS – Customer to Firm	Information exchange about planned orders or order changes
			Product design specifications
Performance 2	Enabling capabilities	Implemented practices	Implemented actions

Commercial Impact	Customer Service	Long-term Relationships with Customers	Resources investment to keep a well-performing supply chain (Commitment)
			Investments for evaluating customer's future needs
	Knowledge Management Capability	Network	Close-to-customer (reference markets) locations
			On-time delivery directly to customer's points of use
	Market Capability	Strategic Behavior	Communication of firm's strategies
			Emphasis on health and environmental safety issues
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Service	Customer Service	Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
			On-time delivery directly to customer's points of use
	Supply Chain Management Outbound	Production System Practices	Product/process standardization (Postponement)
			Product modularization
			Use of top quality materials
	External Integration	Long-term Relationships with Suppliers	Close partnerships with suppliers
			Solid and durable relationships with key suppliers (considered as a part of the firm)
			Enhancement of each other's business (common growth)

Table SWS8.5 – Supply chain configuration

There is no dependency between the supply chain configuration and products/markets related to the company.

During the last years, the firm implemented a strategy completely centered on customer satisfaction, with investments on information sharing, closeness to the client and management of documentation, that can be huge especially for some kinds of project, whose optimization can be incredibly effective.

There have been strong investments on switchgears, reaching their almost complete standardization, albeit retaining the possibility of customizing the project under clients' requests. The company created an internal archive containing hundreds of thousands of typologies of switchgears, that vary depending on client's requirements, such as the dimension, the type or position of the switch etc... Especially for Power Center and Motor Control Center switchgears, the level of standardization has reached 85%, with the remaining part that can be customized by the client.

All these different combinations have been certified, during the years, at the end users, also for the ones with stricter qualifications required, and it has testing machines that can reproduce also the most complex environmental conditions. The R&D department works in the perspective of inserting new possible innovations inside di archive, and to make more structural the standardization process.

The Price and Quality performance are considered very important, but not fundamental, they are not considered as a source of competitive advantage. The first one is not a determinant factor for winning of a contract in Oil&Gas market, assuming that the price is at least aligned with market, while the Quality is seen as a prerequisite.

The relationships with EPC are good. The company identifies difficulties related to the information sharing, that is often incomplete, inadequacy of technical information that they provide, delays and unplanned modifications; yet, these problems can be managed. There are cases in which international EPC contractors utilize instrumentally clauses present in the contracts to unload on the suppliers their own mistakes; the company network of clients is wide enough to be able to avoid these contractors. The supply of switchgears is a small percentage of the overall cost of an Oil&Gas plant, so the claims are rarer.

The process to access end users' vendor list is very long and, first of all, it is necessary to have past experience in Oil&Gas sector. Then, there is a phase of presentation to the customer, an analysis of the requirements and certifications and the compilation of forms, with data about the company. Later on, there is the audit phase, for both the production process and the management of the documentation. Once obtained, the qualification must be maintained through continuous visits to the end user.

4.2.3.9 SWS – 9

Turnover [Mln €]					20 – 50	
% of turnover related to Oil&Gas					< 75%	
Group Belonging					Si	
Electrical Panelboards Produced	LV – PC	LV – Sec.D	LV – MCC	LV – Cont.	LV – Exp-P	LV – Synopt.
	MV – McA	MV – McG	MV – MenA	MV – MenM	MV – MenG	
Core Panelboard(s)					LV – PC, MV - McA	

Table SWS9.1 – Vital statistics

Market	Motivations	Trend
EMEA	Stable market	≡
Southern America	Stable market	≡
Northern Africa	Stable market	≡

Table SWS9.2 – Market scenario

Market	Motivations	Actions to undertake
-	-	-

Table SWS9.3 – Prospective markets

The company belongs to a group that is centered on the development of projects and solutions in the energy sector. The firm's target is the realization of switchgears, mainly for the Oil&Gas. The products portfolio is complete, they can cover the whole classification, except medium voltage metalclad isolated in gas. In particular, the core products are low voltage Motor Control Center and medium voltage metalclad isolated in air, that almost cover the 80% of turnover related to Oil&Gas.

The company mainly oversees EPC contractors, while the group, thanks to a bigger financial capacity, is able to relate with end users, providing a significant advantage to the firm.

At the moment, its coverage extends to the Northern Africa, Southern America and EMEA, except Asia Pacific, China and India mainly, because they have internally ruled markets, that are difficult to access.

Notes			
Procurement	IN	OUT	-
Manufacturing	IN	OUT	In case of end users' explicit request (OUT)
Carpentry	IN	OUT	-
Copper processing	IN	OUT	-
Wiring	IN	OUT	-
Painting	IN	OUT	-
Assembly	IN	OUT	In case of peaks of demand (OUT)
Testing	IN	OUT	-

Table SWS9.4 – Production stages

The most critical phases are design and testing, which is fundamental to understand how and how well the different parts inside the switchgears are communicating, and these ones are always performed internally. Once the switchgear has been entirely defined, the other phases are less critical, even if the company performs inside the assembly, copper workings and carpentry. Usually, secondary workings, such as wirings, can be outsourced.

The electrical components are acquired by multinationals, even if, conversely to other competitors, they own a line of switches, that is hardly used with Oil&Gas end users, because they require proven technology. Its components are used every time the offer is not constrained on the technology and this allows a higher competitiveness on the offer price.

The suppliers are very important for the flexibility of the companies, especially for the assembly, when there is a peak of demand, because they can improve the overall production capacity. Furthermore, for each outsourced activity, the company has more than one supplier, in order to decrease the financial risk.

After-sales services are performed directly by the company and, even if they are not a core activity yet, there is a spread awareness that improving actions will be required, since these activities could potentially raise the overall turnover.

The performances, capabilities and practices, selected by the company, are:

Performance 1	Enabling capabilities	Implemented practices	Implemented actions
Price	Product/Process Development Capability	Production System Practices	Production system practice
	Project Management Capability	Project Management Practices	Risk and opportunities analyzing methods
			Advanced methods for supplier selection
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		IS (Information Sharing)	Frequent face-to-face planning/communication with suppliers/clients
Performance 2	Enabling capabilities	Implemented practices	Implemented actions
Engineering	Knowledge Management Capability	Production System Practices	Investments in R&D and Engineering functions
			External knowhow/technology acquisition

		Human Resource Management Practices	Multi-skilled human resource selection
			Staff training
	Relationship Capability	Project Management Practices	Project Management Practices
		Long-term Relationships with Customers	Close partnerships with customers
			Collaboration in new product development
		Network	Sections-network development (for commercialization, contracting and assistance)
			Close-to-customer (reference markets) locations
		IS – Customer to Firm	Product design specifications
			Information exchange about planned orders or order changes
Performance 3	Enabling capabilities	Implemented practices	Implemented actions
Flexibility (Supply Chain)	Capacity and Flexibility	Production System Practices	Slack capacity
		Long-term Relationships with Suppliers	Close partnerships with suppliers
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		IT (Information Technology)	Monitoring order processing status, Manufacturing Execution Systems (MES)
	Supply Chain Management Inbound	Long-term Relationships with Suppliers	Close partnerships with suppliers
			Solid and durable relationships with key suppliers (considered as a part of the firm)
		Network	Preference of local suppliers
	Project Management Capability	Project Management Practices	Risk and opportunities analyzing methods
			Advanced methods for supplier selection

Table SWS9.5 – Supply chain configuration

For the Price performance, one of the main element is being a company that was born to operate with EPC contractors and to be oriented to projects and their management. The optimal management of projects allows them to offer lower costs related to contingencies.

Its high technical capability and its communication abilities allow the company to be recognized by customers as a reliable and rarely claim-oriented partner, reducing possible costs due to compliance and discussion during the project.

The performance of Engineering is obtained through two capabilities, one internal and the other external. The first one is related to investments on personal and R&D, which are required to achieve the necessary technical capability to develop and customize products. The second factor is related to relationships with clients, especially end users, and the collaborations that the firm created to collaborate in the development of customized products.

The company happened to acquire suppliers in order to incorporate new technologies, while it is much more difficult to form long-term partnerships with competitors because of the instability of the market. In other

sectors, this kind of alliances exists. Belonging to a group, that is fully related to these markets, helps a lot, because the firm can exploit an international network of relationships, that improves its visibility.

The Project Management allows the company to optimize the management of documentation received by the EPC contractors and it improves its flexibility. Its network of suppliers further helps the company to foster its flexibility, especially in relation to the production capacity and secondary processes. The information sharing is extremely important in this sector along with monitoring the orders. This coordination with the clients is managed through an IT platform that, in the majority of the cases, is the one used by the end users'.

5. Intra-sector Supply Chain Configurations Analysis

In this chapter, the analysis on the supply chain configurations, defined during the interviews by the respondents, will be carried out. Each company, depending on its contextual environment, identifies different ways to acquire and bundle its own resources, in order to assess and strengthen its position on the market, that can be identified through the Performance selected by the same companies.

The research applies the multi-case approach, that is required to describe in detail the complex dynamics under which these companies are subjected to.

5.1 Considerations about the framework

Even if the literature review allowed the identification of the elements of the framework that cover a wide range of possible configuration choices, during the interview it has been noticed that it was possible to integrate the already existing set of practices with a more specific group of actions. This addition only confirms the nature of the framework, which represents perfectly the dynamic environment that describes, being open and in continuous evolution, through the insertion of new possible elements, whenever there is the necessity.

In the following table, the new actions, and relative practices, are presented:

PRACTICES	ACTIONS	CODE
Long-term Relationships with Customers	Co-Engineering	F7
Production System Practices	External slack capacity	J21
	Automatic warehouse	J22
	Advanced software for product development	J23
Network	Multiple nearby plants	K8
	EPC Contract Training	K9
	M&A	K10
	Large dimension	K11
Financial Practices	Strong relationships with banks	M1
	Strong relationships with financiers	M2

Table 5.1 New actions added during the interviews

5.2 Introduction to supply chain configuration

The framework provides the description of supply chain configuration of each suppliers, that has been enriched by company's context during each interview. It is possible to notice that there is a minority of these companies which decided to provide different supply chain configurations depending on its market or product delivered, highlighting how these factors can effectively modify the choices made by companies.

It is necessary to notice that different factors have been used for the description of the company during the multi-case study. This is particularly relevant in the switchgear sector. While special valves and static equipment suppliers are classified based on dimension (turnover in Million euro), main product and group

membership, for switchgears sector additional contextual factors have been found relevant for the distinction between companies. This is mainly due to the fact that, apart for few exceptions, these suppliers belong to a restricted range of dimension, their belonging to group is not significant in the most cases and their product portfolio, especially considering the core products, is almost the same. The additional factors used for switchgears suppliers clustering are listed and described below:

- Core after-sales services: they can lead companies to provide different supply chain configurations;
- Direct Interaction with end users': presence in end users' vendor list implies the usage of different practices, capabilities or performance;
- Foreign Branches: being directly present on the most important foreign markets strongly impact on supply chain configuration.

After this analysis, it will be possible to identify which are the most important performance that suppliers belonging to different sectors have to follow in order increase their competitiveness, and how these performance are obtained, through the combination of capabilities and practices.

5.3 Multi-case study

In the following paragraphs, the multi-case study will be applied to the three sectors separately, in order to study altogether the different supply chain configurations and to identify which are the most selected performance and which combinations of capabilities and practices are required to achieve them. The results of these study will present the answer to the first two research questions.

The three sectors will be studied in the following order: Special Valve, Static Equipment and Switchgears.

5.3.1 Special Valves sector

5.3.1.1 Performance – SVS

In this paragraph the most selected performance, for the special valves' sector, are identified and described.

Company	SVS – 1	SVS – 2	SVS – 3	SVS – 4A*	SVS – 4B*	SVS – 5	SVS – 6	SVS – 7	SVS – 8A*	SVS – 8B*	SVS – 8C	SVS – 9	SVS – 10	SVS – 11	SVS – 12A*	SVS – 12B*	SVS – 12C*	SVS – 13	SVS – 14A*	SVS – 14B*	SVS – 15	SVS – 16	SVS – 17	SVS – 18
Main business	Wide product portfolio	"Special" Ball valves	"Special" Ball valves	Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	"Special" Ball valves	"Special" Ball valves	Control valves	"Special" Ball valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
Group belonging	No	Yes	Yes	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Turnover [Mln €]	>200	>200	20-50	20-50	20-50	50-200	50-200	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	50-200	50-200	20-50	>200	>200	20-50	50-200	50-200	50-200
Overall frequency																								

Price			X	X		X	X	X	X			X		X		X			X			X	X		12
Quality	X	X	X	X	X		X	X			X	X	X	X	X		X		X	X	X	X	X	X	19
On-time Delivery		X	X	X	X			X	X	X	X	X		X	X			X		X		X	X	X	16
Engineering		X			X	X	X		X		X				X	X	X	X	X	X				X	13
Innovation																	X								1
Differentiation	X																								1
Flexibility (SC)	X									X			X								X				4
Financial						X																			1
Service										X						X		X							3
Communication													X												1
Knowledge																				X					1

*Just three companies out of fourteen change the configuration depending on market scenario.

Following, there's the classification for these three companies depending on market.

Company SC	Reference Market
SVS-8A	Middle East
SVS-8B	Northern America
SVS-8C	Far East
SVS-12A	Middle East
SVS-12B	Far East
SVS-12C	Europe
SVS-14A	Europe, Central Asia
SVS-14B	Far East

Table 5.2 Performance – SVS

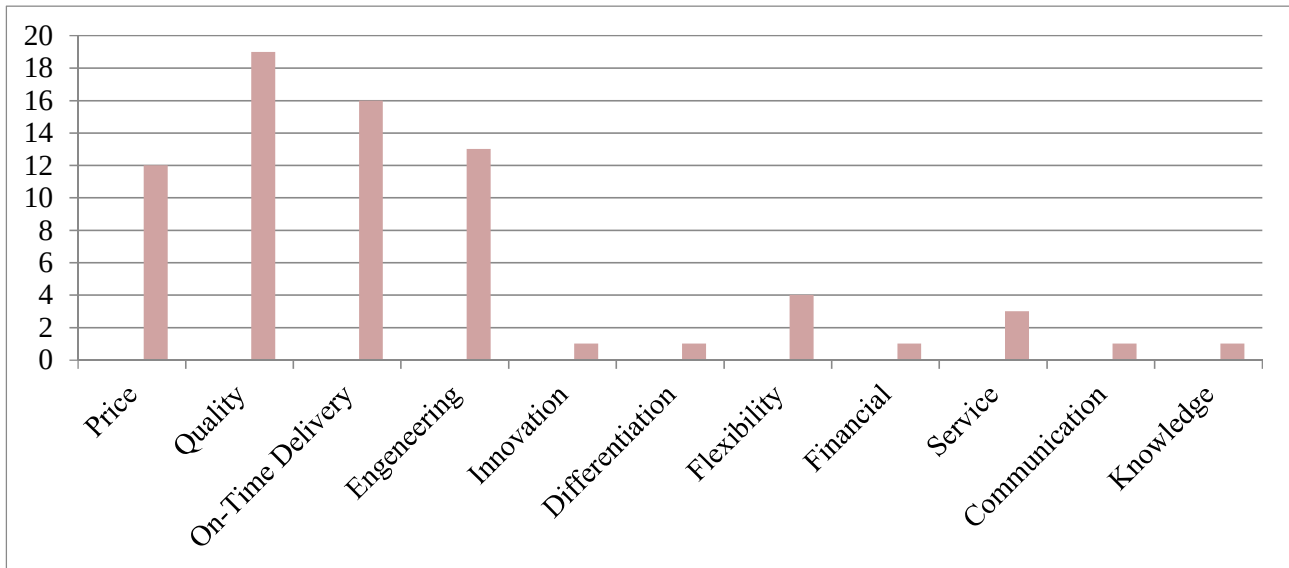


Figure 5.1: Performance overview - SVS

It is possible to notice most of the choices are enclosed in a group of four performance: this is another confirmation that the sample belongs to best performers well aligned with the market.

The key performance items are:

- Quality;
- On-time Delivery;
- Engineering;
- Price.

These should be the preferred performance to improve in order to increase the competitiveness.

A customer, reading this classification, may have some doubts. Indeed, Price is positioned at the fourth position (Figure 5.1) and, on the other side, clients have always required to their suppliers Price as the most important performance to improve. This behavior is explained by the fact that suppliers have to be aligned with customers' requests, but they have also to compete with the other companies of the sector and try to match the end user's will. All these considerations lead every supplier to improve also other important performance, in addition to Price, in order to compete.

Nowadays the sector indicates us that, in order to reduce internal and external costs, and to tackle the financial crisis, EPC contractors outsource the procurement phase to buyer companies. Buyers are evaluated only on cost-competitiveness: they do not demonstrate enough experience to manage projects in the proper way, and consider a supplier bid only based on the final price. Such situation forces valve suppliers to increase the Engineering performance in order to guarantee the quality to the end user and the Price performance in order to successfully obtain the work order.

The most chosen and, consequently, enabled performance by interviewed best-performers is Quality. Indeed, Quality is a must-have in order to enter the market: large-dimension plants are constructed to last for a long term, and the entity of the investment and strategic importance for end users made this performance the most important in order to fulfill the clients' requests. Quality, understood as compliance to technical specification, represents, in order to enter in a vendor list, a cutting performance.

Finally, On-Time Delivery is probably the performance that most allow the supplier to build its reliability and trustworthiness. Indeed, due to the stringent delivery time and the variable due dates within Large Projects sector, suppliers have to demonstrate the capability to be always on time.

In the fifth position, far from the first four performance, we find:

- Flexibility.

Flexibility is considered a characteristic of the Italian suppliers: they are able to find a compromise in order to satisfy the client's needs and urgent order change.

Anyway, this is considered a surplus in order to compete and it is also taken for granted by the clients (but basically not important as the performance named before). It is interesting to see that three out of four companies that enable this performance, also enable the Quality performance. This means that companies with an high capability to quickly respond to all customers requests, have to internally maintain the product quality and the safety adherence anyway. Probably, Flexibility is improved by companies that are able to change production plans, easily expand its production volume or quickly change its product mix, without affecting the quality level of manufactured products. It also seems essential to possess a good dimension (by yourself or through group synergy) to achieve flexibility: only exploiting different products and market and having different production lines and machinery could allow to tackle urgent order change and accept last minute orders (group assets utilization).

Not far from the Flexibility performance, there is:

- Service.

This performance was indicated only by few companies that not belong to a group. The group membership allows the other companies to compete worldwide without the worries of having to develop and improve an efficient customer service. Indeed, the capillary network and the domain experience of a group allow the companies to concentrate its efforts on other fundamental performance.

Independent firms, on the other side, in order to increase its visibility and increase its network, have to mature client and end users' relationships. Moreover, they have to face clients' and end users' field problem (Company with bigger dimension or belonging to a Group can put less effort on this problem because of the financial research). Suppliers, who chose Service as a strategic performance prefer the satisfaction of the client over price. Indeed, these companies indicate Engineering and/or On-Time Delivery in addition to Service.

Observing the less enabled performance, and so, focusing on peculiar aspect of every single firm, in Table 5.1, is possible to observe that two big companies chose two not-common performance:

- Differentiation;
- Innovation.

Asking for the best price means reduce quality and innovation: this is a real danger for a sector that sets up its strength on the uniqueness of the product.

It brings the risk of a standardization process: companies no more help the contractor during the plant design; instead, it is provided a list of specifications that can't be modified, even with benefit.

This process exposes the sector to the emerging markets competitors: they have less experience and so are not able to consult the contractor in order to obtain the quality requested at the smallest price, but they are able to save money on the engineering phase and put a bid characterized by a lower price. In order to overcome this issue, companies try to increase the perception of the distinctiveness by the clients and, more important, end users and to innovate in order to exceed the "standardization" process the buyers are doing with the lowest price politic.

It is also important to say that innovation is mostly about quality assessment process. Products have a reduced innovation content (the main way to innovate is through the material). Instead, process to assure quality are always getting more sophisticated and expansive (usually the main issue is the valve's main dimension, i.e. diameter that can reach some meters).

Finally, the last three selected performance are:

- Financial;
- Communication;
- Knowledge.

Financial must be carefully considered; indeed, just one company indicated this performance as priority, but companies belonging to a group, during the interview, testify that the main value of belonging to a group is the financial solidity, essential for granting the bigger orders. This must be considered as a dangerous signal for smaller companies: in the future, financial solidity and therefore turnover dimension will become a cutting asset: just bigger companies will compete for big orders.

Communication was chosen just by one company; it was indicated as a strategy to overcome a common problem about buyers: product specifications bargaining and low experience. Increasing information accuracy, cultural fitment and skill level of the staff is an alternative way to tackle the weak project management capability buyers have.

Knowledge was chosen by a company that owns an extended internal know-how and capacity to produce a wide product portfolio. This company indicated also the need to improve On-Time Delivery and Price, because Knowledge performance can't be the base of the competitiveness of the firm.

None of the interviewed companies indicated the following performance:

- Commercial Impact;
- Lead-time;
- Variety.

Excellent firms of the sample mainly concentrate their efforts in the developing of four principal performance: Quality, On-Time Delivery, Price and Engineering. All the firms of the sample develop at least one of these four principal performance. This information specifies the actual importance of Engineering, Price, On-Time Delivery and Quality and the competitive alignment of the sample.

It is important to highlight that Quality, On-Time delivery, Price and Engineering are performance that best performers companies mostly develop and performance that are required by interviewed EPC clients.

Performance
Quality
On-time Delivery
Engineering
Price

Table 5.3 Recommended performance – SVS

In Table 5.3 it is possible to see the most significant performance in order to compete in the “special” valve sector that will be later addressed in the following sections of the chapter, considering the linkages between these performance and the other two configuration items blocks.

These data allow the study to provide a global supply chain configuration overview for the “special” valve industry’s suppliers. The globality is given by the fact that just 4 out of 18 companies decided to provide different supply chain configurations for different markets, thus leading to not consider the market as a clustering factor.

5.3.1.2 Performance – Capabilities – SVS

The performance-capabilities link enables to understand what kind of abilities, particular assets, knowledge, skills, privileges and partnerships a firm has to identify in order to create the conditions to demonstrate a certain performance to the client.

In this paragraph are presented which capabilities first tier suppliers enable in order to achieve the required performance.

Moreover, considering the four fundamental performance of the valve sector, illustrated in Table 5.3 of the previous section, indications on which capabilities the industry have to enable, in order to achieve those specific items, are reported.

Quality

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18	Frequency
Main Business	Wide product portfolio	"Special" Ball valves	"Special" Ball valves	Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	
Group Belonging	No	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	
Turnover [Mln €]	>200	>200	<50	<50	50-200	50-200	50-200	50-200	<50	<50	50-200	>200	< 50	50-200	50-200	50-200	
SCM Inbound	X		X	X	X		X	X	X	X	X	X	X	X	X	X	14
SCM Outbound			X	X			X			X	X	X	X		X		8
Knowledge Management Capability	X						X	X					X				4
Prod./Proc. Dev. Capability		X							X						X	X	4
Capacity and Flexibility	X													X			2
Customer Service		X	X	X		X		X	X	X		X		X		X	10
Market Capability					X												1
Internal Integration						X											1
Project Management Capability		X			X	X											3

Table 5.4 Quality – SVS

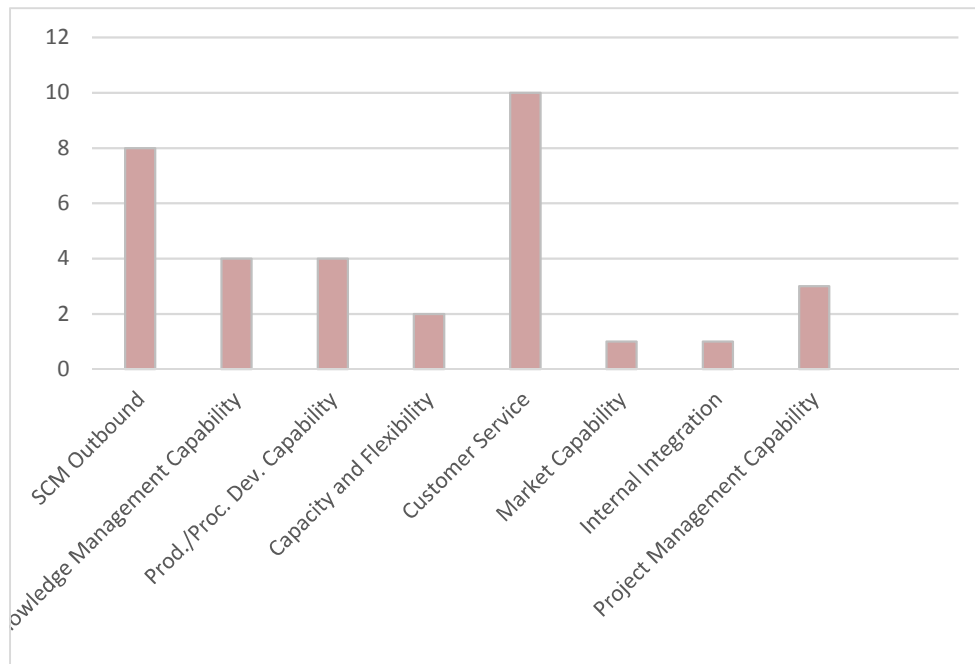


Figure 5.2 Quality overview – SVS

The achieving of the Quality performance through the SCMI capability is mandatory. Quality is obtained by the company mainly with Supply Chain Management Capability (Both Inbound and Outbound) and with Customer Service.

This means that controlling and monitoring the entire supply chain enables to control the product in order to respect the quality promised to the client. The Quality performance has to be kept unchanged from the rough material to the delivery phase. SCMI is the most chosen capability due to the necessity to buy quality forged, cast and auxiliary components.

The only two companies that do not chose SCMI, enable both the capabilities of Customer Service and Project Management. The first firm produces high engineering subsea valves and controls the quality thanks to its capability of improve and manage the production system, while the second one has the possibility to realize internally cast and forged components and, for this reason, the SCMI represents a secondary capability to implement.

Three out of the four companies that rely on Knowledge Management Capability are independent. These suppliers do not benefit from the horizontal knowledge a group can spread and, in order to achieve a high level of quality for their engineered valves, have to internally build this capability.

Performance	Set – 1 of capabilities
Quality	Supply Chain Management Inbound
	Supply Chain Management Outbound
	Customer Service

Table 5.5 Recommended Quality enabling capabilities – SVS

Generally, it is noticed that Quality is mostly developed through three principal capabilities: Supply Chain Management Inbound, Supply Chain Management Outbound and Customer Service.

Four out of sixteen supply chains are configured with linkages reported in Table 5.5, while nine out of sixteen companies develop Quality activating at least two of the three mentioned capabilities.

These indications can be utilized by the valve industry in order to route a preferential way to develop the Quality performance.

On-time Delivery

Company	SVS-2	SVS-3	SVS-4A	SVS-7	SVS-8	SVS-9	SVS-11	SVS-12	SVS-13	SVS-14	SVS-16	SVS-17	SVS-18	Frequency
Main Business	"Special" Ball valves	"Special" Ball valves	Ball valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	
Group Belonging	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	Yes	
Turnover [Mln €]	>200	<50	<50	50-200	50-200	50-200	<50	50-200	<50	>200	50-200	50-200	50-200	
SCM Inbound	X	X	X		X				X	X	X	X	X	9
SCM Outbound				X						X	X			3
Prod./Proc . Dev. Capability				X									X	2
Capacity and Flexibility		X			X			X					X	4
Customer Service	X	X	X			X	X			X		X		7
Market Capability						X								1
Internal Integratio n						X			X					2
External Integratio n								X						1

Project Management Capability	X			X	X		X		X				6

Table 5.6 On-time Delivery – SVS

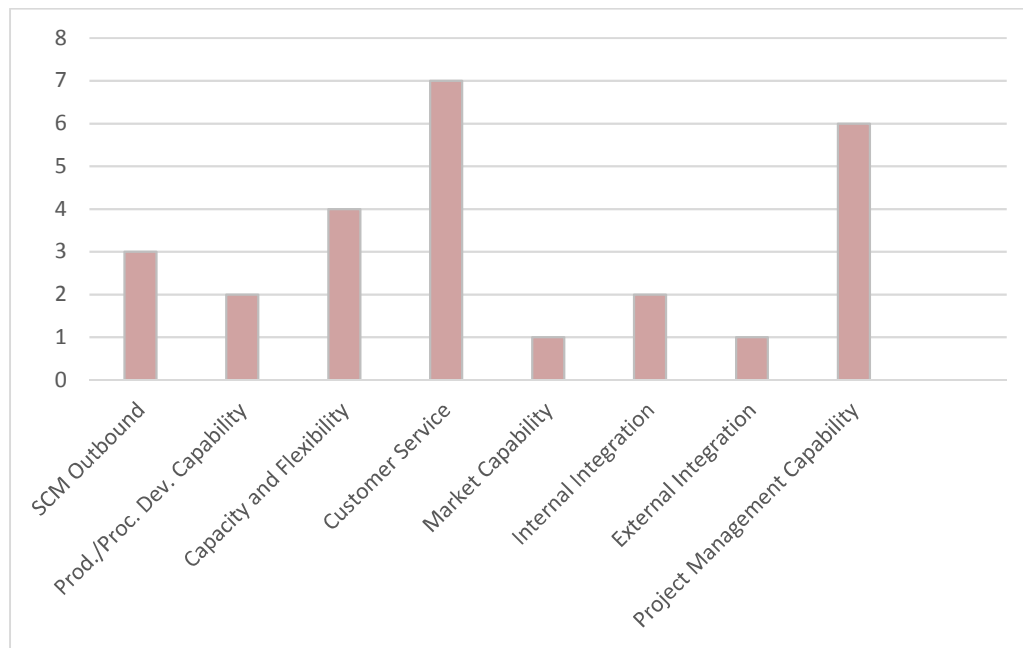


Figure 5.3 On-time Delivery overview – SVS

Once again Supply Chain Management Inbound demonstrates its important role to obtain the performance requested. Being able to control and monitor the parts ordered enables to better control the delivery and being able to understand the lead-time of the supply, in order to be on-time.

In order to monitor the order's status and perform a fast delivery, the Customer Service is also requested.

The capability of Project Management is of rising importance in order to tackle project issue and being able to schedule the order in the right way. Indeed, the coordination of all the internal functions and the capability to quickly handle the technical documentation are effective only with the presence of project managers inside the company.

Having Capacity and Flexibility can allow to better manage urgent orders or production issues and production peak that enables to always perform the on-time delivery: being ready to tackle production rate and have big volume capacity allows always to keep the orders and produce in the right time. About this topic, Internal Integration supports the production enabling to integrate and coordinate all the production stages, avoiding possible issue that could put on the line the delivery.

It is noticed that On-Time Delivery is developed through three principal capabilities: Supply Chain Management Inbound, Project Management Capability and Customer Service.

Almost all the companies, in order to obtain On-Time Delivery, enable SCMI capability with Customer Service or PM capabilities. The link between Customer Service and PM capability is less strong (only two out of thirteen configuration uses both these two capabilities) but, the moderate frequency of selection indicates the preference of first tier suppliers towards these two capabilities instead of Capacity and Flexibility or SCMO.

Performance	Set – 1 of capabilities
On-time Delivery	Supply Chain Management Inbound
	Project Management Capability
	Customer Service

Table 5.7 Recommended On-time Delivery enabling capabilities – SVS

Table 5.8, as for the Quality performance, do not indicate the best capabilities in order to develop the On-Time Delivery performance, but represent a recommendation for the sector in order to route a right path to reach the On-Time Delivery performance.

Engineering

Company	SVS-2	SVS-4B	SVS-5	SVS-6	SVS-8A*	SVS-12	SVS-13	SVS-14	SVS-18	Frequency
Main Business	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	"Special" Ball valves	"Special" Ball valves	Control Valves	"Special" Ball valves	"Special" Ball valves	
Group Belonging	Yes	Yes	No	Yes	No	No	No	Yes	Yes	
Turnover [Mln €]	>200	<50	50-200	50-200	50-200	50-200	<50	>200	50-200	
SCM Inbound							X			1
KM Capability	X	X	X		X	X	X			6
Prod./Proc. Dev. Capability	X		X	X		X	X	X	X	7
Capacity and Flexibility				X					X	2
Customer Service								X		1
Market Capability	X									1
Internal Integration				X					X	2
Project Management Capability			X							1

Table 5.8 Engineering – SVS

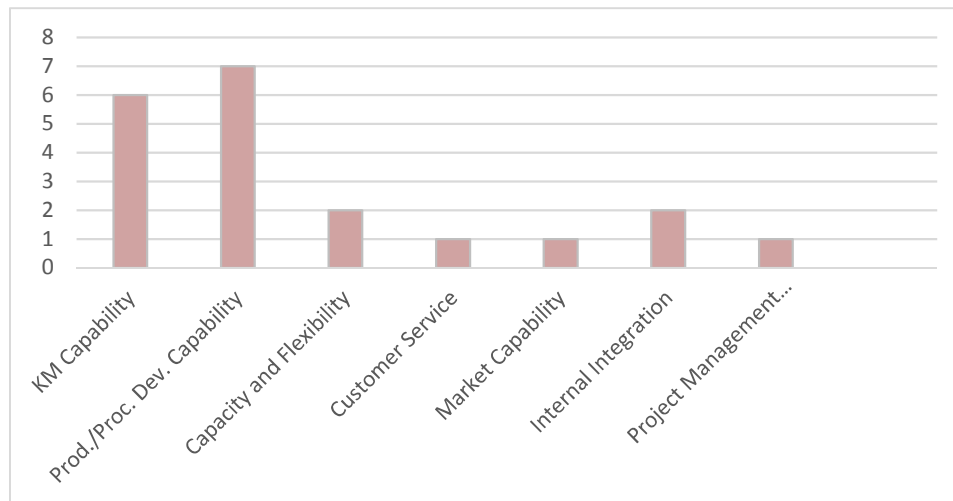


Figure 5.4 Engineering overview – SVS

Valve manufacturers are quite aligned about how to obtain Engineering. Indeed, is quite eloquent, that, in order to obtain this performance, the firm has to have the capability of Knowledge Management and of Product/Process Development. Engineering is the core performance for “Special” valve suppliers; indeed, eight out of nine companies that are able to realize this performance produces very complex and high engineered valves.

Each project is different from the previous and only experience and technical knowledge can tackle new challenge and issue; in order to better take advantage of the technical capabilities, a structure able to develop the product and the process must have been built.

Another possible way to be competitive for these “Special” companies is represented by the possibility to realize the performance of Differentiation or Innovation but, due to the substantial investments these two performance need in order to be developed, companies prefer to build the Engineering performance. Anyway, Capacity and Flexibility together with Internal Integration can enhance and simplify the engineering stages (two out of eight firms enable Engineering through these two capabilities), Customer Service can ease the comprehension of customer need in order to give Engineering the right specifications and Project Management Capability can anticipate which issues and situations could be pull out of the engineering phase, assuring the success of the stage.

Performance	Set – 1 of capabilities
Engineering	Knowledge Management Capability
	Product/Process Development Capability

Table 5.9 Recommended Engineering enabling capabilities – SVS

It is noticed that Engineering is mostly developed through two capabilities: Knowledge Management Capability and Production/Process Development Capability.

All the companies develop at least one of these two capabilities while, four out of nine companies are aligned with the configuration represented in Table 5.9. Knowledge Management Capability and Prod./Proc. Dev. Capability are the two recommended capabilities for the sector in order to effectively develop the Engineering performance.

Price

Company	SVS-3	SVS-4A	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-11	SVS-12	SVS-14	SVS-16	SVS-17	Frequency
Product	"Special" Ball valves	Ball valves	"Special Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Plug valves	"Special" Ball valves	"Special" Ball valves	"Special" Ball valves	Gate&Globe valves	
Group Belonging	Yes	Yes	No	Yes	Yes	No	No	No	No	Yes	Yes	Yes	
Turnover [Mln €]	<50	<50	50-200	50-200	50-200	50-200	50-200	<50	50-200	>200	50-200	50-200	
SCM Inbound	x	x	x	x	x	x		x		x		x	9
SCM Outbound											x		1
Prod./Proc. Dev. Capability	x	x	x									x	4
Capacity and Flexibility					x		x		x		x	x	5
Customer Service				x			x	x		x	x		5
Relationship Capability	x						x		x				3
Market Capability		x		x									2
Financial Capability						x							1
Internal Integration									x				1
External Integration			x		x								2

Table 5.10 Price – SVS

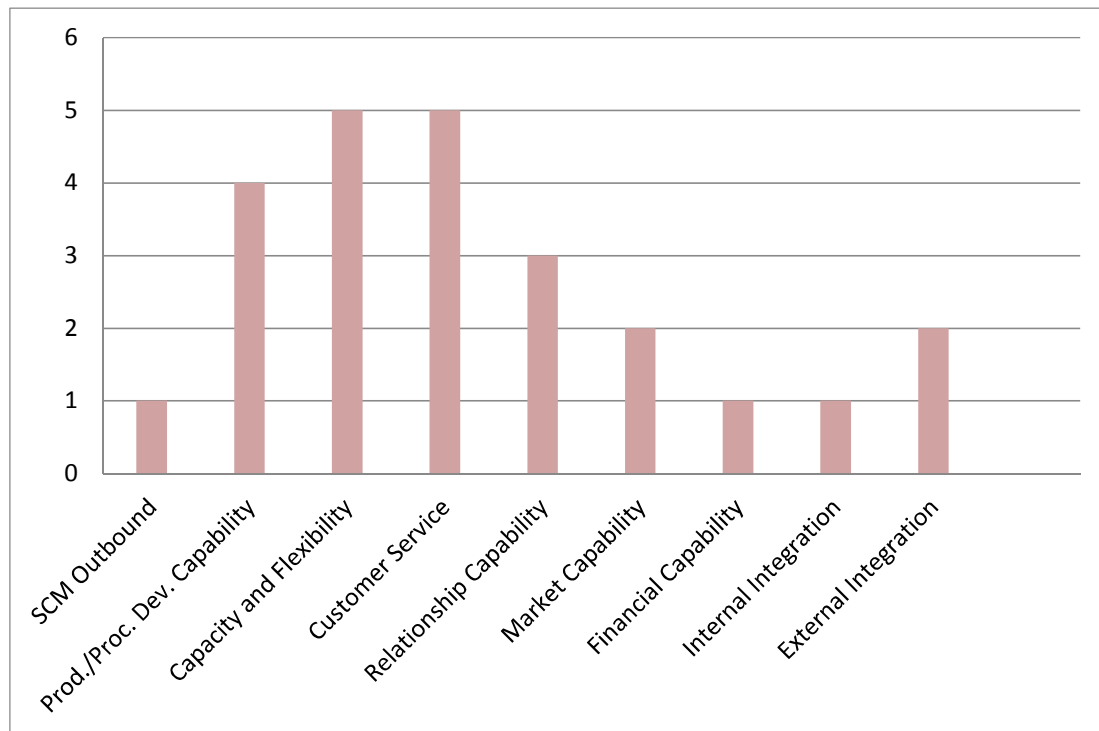


Figure 5.5 Price overview – SVS

To reach the Price performance, the first step to take is developing the Supply Chain Management Inbound (SCMI): it means pay attention to the purchasing activity, focusing on the capability of monitoring and controlling the company suppliers.

We can see from the table that there is a trade-off between the Product/Process Development Capability and the Customer Service: the companies decide to increase the ability to design and engineer or to make endeavor on the delivery and client's decisions' support. These two capabilities are probably built in order to reduce costs related to non-compliance and adapting the line to the product (i.e. leverage the production system).

The Product/Process Development Capability seems to be strictly correlated with the implementation of the capability of Supply Chain Management Inbound. Indeed, four out of twelve companies develop these two capabilities as primary to enable the performance of Price. Capacity and Flexibility is also considered important: develop the economy of scales capability allows to reduce internal costs. This capability seems to be synergic with previous capability of Customer Service: delivery and production system flexibility must maintain unchanged the customer service. Indeed, the combination of these two capabilities allows the firm to avoid the increasing of cost of the product or shipment costs. Finally, Relationship Capability allows to reduce communication costs and negotiate with the client.

Performance	Set – 1 of capabilities
Price	Supply Chain Management Inbound
	Product/Process Development Capability

Table 5.11 Recommended Price enabling capabilities – SVS – 1

Performance	Set – 1 of capabilities
Price	Supply Chain Management Inbound

	Capacity and Flexibility
	Customer Service

Table 5.12 Recommended Price enabling capabilities – SVS – 2

The two recommended configurations for industry illustrated in Table 5.11 and Table 5.12 are both composed by Supply Chain Management Inbound capability: this capability is the most enabled item by first tier suppliers by far (nine out of twelve companies enable this capability).

SCM Inbound capability is strongly linked with the Prod./Proc. Dev. Capability. Indeed, all the companies that activate the second capability, enable also the first.

Customer Service and Capacity and Flexibility are put together in the second configuration due to their moderate level of synergy and high level of selection.

Flexibility (SC)

Company	SVS-1	SVS-8	SVS-10	SVS-15	Frequency
<i>Main Business</i>	Wide product portfolio	"Special" Ball valves	Ball valves	Gate&Globe valves	
<i>Group Belonging</i>	No	No	Yes	Yes	
<i>Turnover [Mln €]</i>	>200	50-200	<50	<50	
SCM Inbound	X				1
Knowledge Management Capability		X		X	2
Capacity and Flexibility	X	X	X	X	4
Customer Service	X	X			2
Relationship Capability			X		1
Internal Integration			X		1
Project Management Capability				X	1

Table 5.13 Flexibility (SC) – SVS

In order to reach Flexibility, the basic capability must be Capacity and Flexibility (indicated by every company that strategically decided to develop SC Flexibility). Of course, this is not just because both have the term “flexibility”: Capacity and Flexibility is a capability that means being able to tackle difficulties in term of urgent change while the performance is evaluated in term of results (frozen time, volume flexibility, delivery system flexibility). Only with the capability to tackle these situations the company can reach the performances.

To complete the set of capabilities, big size company prefers Customer Service with Supply Chain Management Inbound or Knowledge Management Capability: this is another evidence that Customer Service can be developed in a suitable way only by great size companies that have the means to support this decision. Knowledge Management Capability and SCM Inbound can be a way to complete the set with the capability to face and tackle issue in two alternative way. The first is to use human experience, the second is to monitor and control the supply chain in order to better tackle change coming from flexibility opportunity. Small size companies prefer to improve the Internal Integration (i.e. develop teamwork) in order to generate a solution to demonstrate flexibility and Relationship Capability to create network and external collaboration to generate flexibility.

Service

Company	SVS-8	SVS-12	SVS-13	Frequency
<i>Product</i>	"Special" Ball valves	"Special" Ball valves	Control valves	
<i>Group Belonging</i>	No	No	No	
<i>Turnover [Mln €]</i>	50-200	50-200	<50	
KM Capability	X			1
Prod./Proc. Dev. Capability			X	1
Customer Service	X	X	X	3
External Integration		X		1
Project Management Capability		X		1

Table 5.14 Service – SVS

Customer Service (i.e. control and monitor the orders status, offer a post-sales service and a life-cycle service to the client) is the key capability to build the Service performance.

Knowledge Management and Product/Process Development Capability seems to be important for valve manufacturer when a customer need that can't be previously predicted is to be satisfied (it is quite common that issue is always new because of the uniqueness nature of large project).

However, External Integration and Project Management Capability can help to assure Service: these capabilities allow to know the supply chain as the internal company and control the project stages, i.e. they could offer better quality credence and billing accuracy.

Innovation

Company	SVS-12	Frequency
<i>Turnover [Mln €]</i>	50-200	
<i>Group Belonging</i>	No	
<i>Main Business</i>	"Special" Ball valves	
Knowledge Management Capability	X	1
Product/Process Development Capability	X	1

Table 5.15 Innovation – SVS

Innovation is chosen together with the Engineering performance. This is reflected by the fact that both Innovation and Engineering are reached in the same way.

Being able to build and improve personnel's skills is requested to innovate: this capability sustains the process of customization and product improvement, a key for the innovation. Innovation is an offspring of the engineering function. This mean that, in order to reach the performance of Innovation an incremental process, starting from the Engineering function, is needed.

Differentiation

Company	SVS-1	Frequency
<i>Turnover [Mln €]</i>	>200	
<i>Group Belonging</i>	No	

<i>Main Business</i>	Wide product portfolio	
Capability		
Product/Process Development Capability	X	1
Customer Service	X	1
Financial Capability	X	1

Table 5.16 Differentiation – SVS

In order to obtain Differentiation, the company must have a mixture between capability to adapt the product to the production lines, introducing innovation in the right way and being able to assist the client during decisional stages. In order to do that, Financial Capability seems really important to support the two previous capabilities.

This performance, due to its great investment requirements, is developed only by one company with significant dimension.

Financial

Company	SVS-5	Frequency
<i>Turnover [Mln €]</i>	50-200	
<i>Group Belonging</i>	No	
<i>Main Business</i>	"Special" Ball valves	
Supply Chain Management Inbound	X	
Capacity and Flexibility	X	1
External Integration	X	1

Table 5.17 Financial – SVS

Just one company indicated Financial as a priority performance, anyway it was also indicated by many companies that this performance continuously increases in importance. This performance is indicated by an independent firm that can't take an advantage from a solid financial base that a group could give.

In order to demonstrate the reliability and the solidity of the firm, the capability of External Integration is fundamental.

The company has also to demonstrate its capabilities of management of the upstream supply chain, in order to provide warranties to customers and reduce stock wastes.

Finally, the Financial performance is related to the capability of the company to manage big orders and be flexible during all the production stages (Capacity and Flexibility).

Communication

Company	SVS -10	Frequency
<i>Dimension</i>	<50	
<i>Group Belonging</i>	Yes	
<i>Main Business</i>	Ball valves	
Project Management Capability	X	1

Table 5.18 Communication – SVS

Project Management Capability allows to have all the information about the project timely and so being able to communicate them effectively to the client.

Knowledge

Company	SVS-15	Frequency
<i>Dimension</i>	<50	
<i>Group Belonging</i>	Yes	
<i>Main Business</i>	Gate&Globe valves	
Knowledge Management Capability	X	1
Internal Integration	X	1
External Integration	X	1

Table 5.19 Knowledge – SVS

This performance is indicated by only one firm that is able to offer a wide product portfolio and, thanks to its extended know-how, always new solutions to customers. This performance is enabled through the great capacity of the firm of taking data and information out of the boundaries of the firm, in order to continuously increase its internal know-how. Moreover, the company is able to manage this know-how thanks to its

explicitly capability of Knowledge Management and its capability to coordinate and effectively organize all the internal functions for a shared development of companies' strategies.

In the following table (5.20) the most recommended capabilities are reported. They represent those items that can be useful for a supplier to achieve the four main performance presented in the previous chapter.

Capabilities
Supply Chain Management Inbound
Supply Chain Management Outbound
Knowledge Management Capability
Product/Process Development Capability
Customer Service
Project Management Capability
Capacity and Flexibility

Table 5.20 Recommended capabilities – SVS

5.3.1.3 Capability – Practices – SVS

In this paragraph, the relationships between practices and capabilities are explored and described. In each table, the number of selected actions for each practice is depicted using a chromatic reference (Table 5.21).

Finally, considering the seven recommended capabilities for industry, reported in Table 5.20, in this paragraph are also recommended possible set of actions in order to achieve the mentioned capabilities.

Legend	
Color	Explanation
	In order to enable the capability, the company indicates more than three actions
	In order to enable the capability, the company indicates three actions
	In order to enable the capability, the company indicates two actions
	In order to enable the capability, the company indicates a single action

Table 5.21 Explanation of chromatic indicators

Supply Chain Management Inbound

It can be noticed that all the company intervene in Long-term Relationships with suppliers: it is important to collaborate with suppliers to improve their quality and generate strategic partnership and assure quality along the supply chain.

Also Network and Information Technology are highly selected: introducing technology to monitor the supply information is the only way to understand how to improve the performance and use supplier in loco and with reduced number allows to know appropriately the inbound supply chain and control it.

With less frequency, Project Management Practice is chosen: it is another way to control the orders during project stages (usually it is chosen with Long-term Relationship with Suppliers; however, in one case Project Management Practice and Human Resource Management is a set of practices). This could be a way to obtain SCM Inbound: having the mean to control projects and develop multi-skilled personnel could allow to control

all the supplier's order and manage the spare parts needed to build the final product. Only twice, Information Sharing was indicated (in one case, the more specific Firm to Customer).

IS could improve the condition of the relationship, but it seems not so important in order to control the supply chain: anyway, one company basis its SCM Inbound capability only on IT and IS.

It is possible because having the assets and the structured processes to manage information enables to manage the inbound materials and parts. Production System Practices could improve the control on internal and external production processes to increase the control on SCM inbound.

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18
Main Business	Wide product portfolio	"Special" Ball valves	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
Group Belonging	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Dimension Turnover [Mln €]	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
A IT- Information Technology																		
B IS - Information Sharing																		
D IS - Firm to Customer																		
E Long-Term Relationship with Supplier																		
F Long-Term Relationship with Customer																		
H Project Management Practice																		

J Production System Practice																			
K Network																			

Table 5.22 Supply Chain Management Inbound – SVS

The enabling of long-term Relationships with Suppliers is a mandatory step in order to develop the capability of SCM Inbound (Table 5.23). Indeed, sixteen out of eighteen companies enable this capability through specific actions towards the upstream supply chain. LTRS may be used alone to develop the capability of management of the upstream supply chain, but, actually, it is not unusual the coordinated activation of Network or Project Management Practices as support peculiar practices.

Capability	Common Practices	Peculiar Practices
Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Network (K)
		+ Project Management (H)
		+ No further practices to (E)

Table 5.23 Recommended practices for SCM Inbound – SVS

Actually, also other practices are used to develop the capability of SCM Inbound, but they are not considered in Figure 5.23 due to their low frequency of selection (IS, ISCF, LTRC), or due to the fact that their usage is not distinctive for the activation of one specific capability (IT practice is highly used to enable different capabilities, but, although it has a high frequency of selection, do not represent a distinctiveness of this capability-practices link).

Eventually, although it is difficult to evaluate the impact of IT actions in enabling this specific configuration link, it can be eventually leveraged.

Supply Chain Management Outbound

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18
Main Business	Wide product portfolio	"Special" Ball valves	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
Group Belonging	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Dimension Turnover [Mln €]	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200

Clients usually request from its suppliers a total control of their upstream supply chain and do not allow them to buy components abroad. Indeed, suppliers manage their downstream supply chain avoid obscuring its supplier base, buying in Italy or from suppliers indicated by the customers.

Three companies develop both strong upstream and downstream relationships (SVS – 17, SVS – 15, SVS – 7). It can be notice that Long-term Relationships with Suppliers are mostly chased by the small size companies while the Long-term Relationships with Customers are mostly chased by the big size companies.

The level of utilization of the other practices seem not to be relevant.

Capability	Common Practices	Peculiar Practices
Supply Chain Management Outbound	Long-term Relationships with Suppliers (E)	+ Long-term Relationships with Customers (F)
		+ No further practices to (E)
	Long-term Relationships with Customers (F)	+ No further practices to (F)

Table 5.25 Recommended practices for SCM Outbound – SVS

In Table 5.25 the recommended practices for the valves sector, in order to activate the capability of SCM Outbound, are reported. These possible configurations of practices derive from considerations about indications given by best performers of the sector.

Three interviewed companies, forging Long-term Relationships with Customers, are able to develop the capability of Supply Chain Management Outbound: this linkage, can be considered effective and significant.

The control of the downstream supply chain is the second possible way to provide a reliable control of the upstream supply chain. If, on one hand, relationships with customers allow the firm to effectively and quickly respond to customer's requests or needs, on the other hand, relationships with suppliers allow the firm to be more concentrated in ensuring a compliance and quality product to customers.

The possibility to forge relationships both with clients and suppliers certainly enable an outstanding vision of the whole supply chain, allowing the firm to directly ask their suppliers what customers ask to it.

Knowledge Management Capability

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18
Main Business	Wide product	"Special" Ball valves	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
Group Belonging	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Dimension Turnover [Mln €]	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
A IT- Information Technology																		

B IS - Information Sharing																		
G Human Resource Management Practices																		
J Production System Practices																		
L Strategic Behaviour																		

Table 5.26 Knowledge Management Capability – SVS

The Table 5.26 is quite eloquent: all the companies that chose to cultivate the Knowledge Capability indicated, as important to generate this ability, the Human Resource Management Practice. It is needed to pay great attention to the personnel capability, with emphasis on multi-skilled human resource selection and staff training.

To complete the set of actions, it is possible to implement also Information Sharing and Strategic Behavior (sharing sensitive information) to stimulate the communication to improve extensive knowledge

It is quite strange that Production System Practices could affect Knowledge Capability: it is probably leveraged as a stimulation for knowledge; apply new technology and machinery stimulate the knowledge updating and ability of the personnel.

Capability	Common Practices
Knowledge Management Capability	Human Resource Management Practices (G)

Table 5.27 Recommended practices for Knowledge Management Capability - SVS

It is clear that the management of the human resource is the principal and characteristic action in order to enable the capability of Knowledge Management.

Product/Process Development Capability

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18

<i>Main Business</i>	Wide product	"Special" Ball valves	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
<i>Group Belonging</i>	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
<i>Dimension Turnover [Mln €]</i>	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
A IT- Information Technology																		
B IS - Information Sharing																		
C IS - Customer to Firm																		
D IS - Firm to Customer																		
E Long-term Relationships with Suppliers																		
F Long-term Relationships with Customers																		
G Human Resource Management Practices																		
H Project Management Practices																		
J Production System Practices																		

K Network																	
L Strategic Behaviour																	

Table 5.28 Product/Process Development Capability – SVS

Usually, companies invest in Production System practice (adoption of new technology for managing the order, investment in new machinery and R&D) to realize Product/Process Development Capability: there is a deep awareness that latest way to manage and produce can help in realize customized products, improve products, design innovative products and reduce cost (trust of technology).

Anyway, an alternative possibility could be to invest in the Human Resource Management Practice. Indeed, human resource represents the real alternative to machines in order to improve or re-design products and reduce production' costs.

To complete the set of practices, few times Long-term Relationships with Suppliers is chosen to help the internal process to develop the customized products, Network to have nearby and well-known suppliers in order to share and exploit suppliers' Product/Process Development Capability and Long-term Relationships with Customers to align the production or the design of new products with customers' requests.

Capability	Common Practices	Peculiar Practices
Product/Process Development Capability	Production System Practices (J)	+ Long-term Relationships with Customers (F)
		+ No further practices to (J)
	Human Resource Management Practices (G)	+ No further practices to (G)

Table 5.29 Recommended practices for Product/Process Development Capability – SVS

In Table 5.29 the recommended practices for the valves sector, in order to activate the capability of Prod./Proc. Dev. Capability, are reported. This capability can be activated following two different ways. Indeed, one firm (SVS-14) obtains the mentioned capability through huge investments in the Human Resource practice, while, the majority of the firms tend to invest in Production System actions. Moreover, Production System Practice can be supported by Long-term Relationships with Customers allowing a complete product alignment between the firm and its customer.

It is noticed that the dispersion of practices' data (Table 5.28) does not allow to indicate to industry other significant ways to enable the Prod./Proc. Dev. Capability.

Capacity and Flexibility

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18

<i>Main Business</i>	Wide product	"Special" Ball valves	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
<i>Group Belonging</i>	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
<i>Dimension Turnover [Mln €]</i>	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
A IT- Information Technology																		
C IS - Customer to Firm																		
D IS - Firm to Customer																		
E Long-term Relationships with Suppliers																		
F Long-term Relationships with Customers																		
H Project Management Practices																		
J Production System Practices																		
K Network																		

Table 5.30 Capacity and Flexibility – SVS

Information Technology and Production System are preferred to reach Capacity and Flexibility.

To respond quickly to change in requested volumes, mixes and product types having a production system updated and effective is essential as having the assets to share information proactively and timely (i.e. give the information needed to leverage the updated production system).

It is important to notice that many companies, instead of developing and using an internal slack capacity, usually prefer to exploit an external slack capacity, in order to use all the potentiality of the plant and activate external production stages when demand peaks occur. Usually, the benefits deriving from the exploitation of the external slack capacity are increased if the firm can activate or produce in multiple near plants. Indeed, the capacity to rationalize the production of different products in different plants, allow the firm to be extremely flexible and timely.

The other main selected practice by interviewed best performer is IT. The ability to be updated and follow in real time the order progress allows companies to effectively allocate all the internal production stages if a schedule change occurs.

Capability	Common Practices	Peculiar Practices
Capacity and Flexibility	Production System Practices (J)	+ Long-term Relationships with Customers (F)
		+ Network (K)
		+ No further practices to (J)
	Long-term Relationships with Suppliers (E)	+ No further practices to (E)
	Information Technology (A)	+ No further practices to (A)

Table 5.31 Recommended practices for Capacity and Flexibility – SVS

The high dispersion of data suggests us the possibilities of using different ways to enable this capability. IT practice is selected by two companies as the unique set of actions on which build Capacity and Flexibility: this particularity leads this practice to be considered as a mandatory practice for this capability.

Moreover, Production System Practice is clearly an important set of actions to implement Capacity and Flexibility. Production System Practice can be supported by IT or Network actions in order to coordinate shipments, order's change information and internal production management.

Another possible way to reach the mentioned capability is that to invest in Long – Term Relationships with Suppliers. This is a little trodden road, but highlights the possibility to be flexible, forging strong relationships with the upstream supply chain.

Customer Service

The first finding about Customer Service is that it is not possible to indicate a single strategy to activate it.

Even if it is one of the most populated capability (17 companies out of 18 indicated it), there are many different set of practices to implement in order to reach it.

One first way is focusing on Long-term Relationships with Customers (important to collaborate for new products and understand customer needs to be satisfied) together with investments in Information Sharing (in order to allow the support in customer's decisions); it is to be noticed that Information Sharing can be general, or focused on Firm to Customer and Customer to Firm.

Companies that do not invest in Long-term Relationships with Customers (LTRC), dedicate attention to the Human Resource Practices; this practice, as the LTRC, is realized with the assist of Information Sharing. Personnel is important in order to follow customer requests, order changes and ensure the respect of the planning time.

Another way to reach the Customer Service capability, is represented by the implementation of Production System Practices and Project Management Practices. Finally, being close to customers through local branches or partnerships with local market firms, allow the company to offer a timely assistance or technical consultations.

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18
Main Business	Wide product	"Special" Ball valves	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
Group Belonging	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Dimension Turnover [Mln €]	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
A IT- Information Technology																		
B IS - Information Sharing																		
C IS - Customer to Firm																		
D IS - Firm to Customer																		
E Long-term Relationships with Suppliers																		
F Long-term Relationships with Customers																		
G Human Resource Management Practices																		

<i>Dimension Turnover [Mln €]</i>	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
B IS - Information Sharing																		
D IS - Firm to Customer																		
E Long-term Relationships with Suppliers																		
F Long-term Relationships with Customers																		
K Network																		

Table 5.34 Relationship Capability – SVS

As expected, to build Relationship Capability, Long-term Relationships with Suppliers and Customers are needed. However, half of the companies that build Relationship Capability, also invest in Information Sharing (one also in the more specialized Firm to Customer): this to support collaboration with effectively data exchange.

It is to be noticed that Long-term Relationships with Suppliers are chosen by Ball small size suppliers only: this is probably caused by the needs to control and deeply know the upstream supply chain to tackle the customer needs when the company is small and supply more standardized items. Network is also indicated: prefer local supplier enable to have a closer relationship.

Market Development Capability

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18
<i>Main Business</i>	Wide product	"Special" Ball valves	"Special" Ball valves	Ball valves	"Special" Ball valves	Butterfly valves	Gate valves	"Special" Ball valves	"Special" Ball valves	Ball valves	Plug valves	"Special" Ball valves	Control valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves	Gate&Globe valves	"Special" Ball valves
<i>Group Belonging</i>	No	Yes	Yes	Yes	No	Yes	Yes	No	No	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes

<i>Dimension Turnover [Mln €]</i>	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
B IS - Information Sharing																		
C IS - Customer to Firm																		
F Long-term Relationships with Customer																		
K Network																		
L Strategic Behaviour																		

Table 5.35 Market Development Capability – SVS

In order to control the marketing side of the company and effectively promote products and control the client network, it is important to develop Long-term Relationships with Customers (i.e. collaboration) and Information Sharing Customer to Firm (i.e. stimulate the communication of specifications and market opportunities).

Four out of five companies that develop the market capability are big companies. Indeed, this capability is mostly implemented by firms that have to build a close connection with its customers (IS – Customer to Firm). The small firm, not be able to rely on the possibility to have strategic and business information to its customers, builds this capability exploiting the network of its group.

It must be noticed that Long-term Relationships with Customers is never developed alone, but Information Sharing or Network is needed to reach Market Development Capability.

Network can spread the company marketing and increase the local presence, while Information Sharing allows to communicate with the market and stay close to the customer.

Financial Capability

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18

Main Business	Group Belonging	Dimension Turnover [Mln €]	K Network	M Financial Practice
Wide product	No	>200		
"Special" Ball valves	Yes	>200		
"Special" Ball valves	Yes	20-50		
Ball valves	Yes	20-50		
"Special" Ball valves	No	50-200		
Butterfly valves	Yes	50-200		
Gate valves	Yes	50-200		
"Special" Ball valves	No	50-200		
"Special" Ball valves	No	50-200		
Ball valves	Yes	20-50		
Plug valves	No	20-50		
"Special" Ball valves	No	50-200		
Control valves	No	20-50		
"Special" Ball valves	Yes	>200		
Gate&Globe valves	Yes	20-50		
"Special" Ball valves	Yes	50-200		
Gate&Globe valves	Yes	50-200		
"Special" Ball valves	Yes	50-200		

Table 5.36 Financial Capability – SVS

This capability is mainly implemented through Financial actions: forge close relationship with banks and financiers. One company exploits its critical mass and the strategic action of M&A in order to reach a great international visibility and advantageous financial agreements.

Internal Integration

Company	Main Business	Group Belonging	Dimension Turnover [Mln €]	A IT- Information Technology	B IS - Information Sharing
SVS-1	Wide product	No	>200		
SVS-2	"Special" Ball valves	Yes	>200		
SVS-3	"Special" Ball valves	Yes	20-50		
SVS-4	Ball valves	Yes	20-50		
SVS-5	"Special" Ball valves	No	50-200		
SVS-6	Butterfly valves	Yes	50-200		
SVS-7	Gate valves	Yes	50-200		
SVS-8	"Special" Ball valves	No	50-200		
SVS-9	"Special" Ball valves	No	50-200		
SVS-10	Ball valves	Yes	20-50		
SVS-11	Plug valves	No	20-50		
SVS-12	"Special" Ball valves	No	50-200		
SVS-13	Control valves	No	20-50		
SVS-14	"Special" Ball valves	Yes	>200		
SVS-15	Gate&Globe valves	Yes	20-50		
SVS-16	"Special" Ball valves	Yes	50-200		
SVS-17	Gate&Globe valves	Yes	50-200		
SVS-18	"Special" Ball valves	Yes	50-200		

Main Business	Group Belonging	Dimension Turnover [Mln €]	A IT- Information Technology	D IS - Firm to Customer	F Long-term Relationships with Customers	K Network
Wide product	No	>200				
"Special" Ball valves	Yes	>200				
"Special" Ball valves	Yes	20-50				
Ball valves	Yes	20-50				
"Special" Ball valves	No	50-200				
Butterfly valves	Yes	50-200				
Gate valves	Yes	50-200				
"Special" Ball valves	No	50-200				
"Special" Ball valves	No	50-200				
Ball valves	Yes	20-50				
Plug valves	No	20-50				
"Special" Ball valves	No	50-200				
Control valves	No	20-50				
"Special" Ball valves	Yes	>200				
Gate&Globe valves	Yes	20-50				
"Special" Ball valves	Yes	50-200				
Gate&Globe valves	Yes	50-200				
"Special" Ball valves	Yes	50-200				

Table 5.38 External Integration – SVS

All the companies indicated Long-term Relationships with Customers important to reach External Integration: it seems that these suppliers tend to integrate more frequently with customers than suppliers, probably due to the necessity of collaborating for the delivery and product creation.

Project Management Capability

Company	Main Business	Group Belonging
SVS-1	Wide product	No
SVS-2	"Special" Ball valves	Yes
SVS-3	"Special" Ball valves	Yes
SVS-4	Ball valves	Yes
SVS-5	"Special" Ball valves	No
SVS-6	Butterfly valves	Yes
SVS-7	Gate valves	Yes
SVS-8	"Special" Ball valves	No
SVS-9	"Special" Ball valves	No
SVS-10	Ball valves	Yes
SVS-11	Plug valves	No
SVS-12	"Special" Ball valves	No
SVS-13	Control valves	No
SVS-14	"Special" Ball valves	Yes
SVS-15	Gate&Globe valves	Yes
SVS-16	"Special" Ball valves	Yes
SVS-17	Gate&Globe valves	Yes
SVS-18	"Special" Ball valves	Yes

<i>Dimension Turnover [Mln €]</i>	>200	>200	20-50	20-50	50-200	50-200	50-200	50-200	50-200	20-50	20-50	50-200	20-50	>200	20-50	50-200	50-200	50-200
A IT- Information Technology																		
B IS - Information Sharing																		
D IS - Firm to Customer																		
F Long-term Relationships with Customers																		
G Human Resource Management Practices																		
H Project Management Practices																		
J Production System Practices																		
K Network																		
L Strategic Behaviour																		

Table 5.39 Project Management Capability – SVS

While Project Management practices are the foundational base for this capability, it is still possible to notice how there are plenty of other useful practices that can be used.

Even if not definitively, there are conclusions that can be tracked about Project Management capability. Companies with turnover under 50 M€ seem to prefer to invest in Information Technology and Sharing, while bigger size companies adopt the latest Project Management practices (with the exception of company SVS-11 that produce plug valves and is one of the four leaders in the global market of this type of valves). Small companies do not have to manage with huge volumes of products and, for this reason, tend to invest in

practices, like IS or IT, that are not completely focused on the PM function, but allow the firm to improve also other fundamental capabilities. So, Project Management practices are reserved only to companies that have medium-large size or that have the means to extensively invest (i.e. high profit). Production System practice are also implemented to better control the production stage and so the internal project stage. Once, Long-term Relationships with Customers has been indicated to develop Project Management capability: probably the reason is the collaboration with customers favors a better control of project.

The company SVS-15 indicated Network is leveraged to reach Project Management Capability (i.e. having nearby few suppliers helps to monitor and control the project and ease intervention when needed).

Capability	Common Practices	Peculiar Practices
Project Management Capability	Project Management Practices (H)	+ Information Technology (A) and Information Sharing (B)
		+ Human Resource Management Practices (G)
		+ Production System Practices (J)

Table 5.40 Recommended practices for Project Management Capability – SVS

In Table 5.40 the recommended practices for the valves sector, in order to activate the capability of Project Management, are reported. These possible configurations of practices derive from considerations about indications given by best performers of the sector.

Project Management practices do not seem to be able to enable by itself the capability of Project Management, requiring support from other practices, such as IT, IS, Human Resource Management Practices and Production System Practices.

5.3.1.4 Actions overview – SVS

In this section, the practices, related to special valves sector, will be analyzed from the point of view of the configuration actions that have been selected to define them. First of all, a table provides the actions that each supplier has selected, without any regard on the capability or performance that has been enabled through it. Then, each practice is going to be studied in detail, calculating the relative frequencies of its actions, in order to see which are the most used configuration actions.

Company	SVS-1	SVS-2	SVS-3	SVS-4	SVS-5	SVS-6	SVS-7	SVS-8	SVS-9	SVS-10	SVS-11	SVS-12	SVS-13	SVS-14	SVS-15	SVS-16	SVS-17	SVS-18
A IT- Information Technology		A16	A9		A13	A4	A16	A10	A14	A9	A10	A4	A10		A	A9	A11	A12
			A13			A10		A12	A15	A10	A15	A9				A10	A14	
			A14			A13		A14	A16	A12		A10						
			A15							A15		A14						
B IS - Information Sharing	B3	B3		B3		B1		B2	B	B3	B5	B2	B2		B1			B5
						B2				B4		B3	B3		B2			
						B3						B6	B6		B3			
						B6						B8						
C IS - Customer to Firm						B9												
		C4	C1	C1		C3			C3	C3	C5	C6			C1			
		C6	C4						C4						C3			
D IS - Firm to Customer									C5									
			D2	D		D2			D2	D2	D2	D1			D1		D2	
E Long-term Relationships with Suppliers			D3	D2					D3		D3				D2		D3	
	E1	E5	E1	E1		E1	E1		E1	E1	E1	E6	E1	E1	E1	E1	E1	E1
		E7	E2	E2		E2	E7		E7	E2	E2		E2	E2	E6	E7	E9	E2
			E6	E7		E6	E9		E9		E3		E3	E9	E8	E9		E5
			E7								E7							E7
			E9								E9							

F Long-term Relationships with Customers	F1		F1	F1	F1	F1	F2	F3	F1	F6		F1	F3	F1	F1	F1	F1	F1
	F2		F4	F4	F4	F4	F4	F6				F4	F6	F4		F4		
	F4					F6						F5		F6				
G Human Resource Management Practices												F6						
	G2	G2		G2	G2	G2	G3	G2	G2	G2		G2	G2	G2			G3	G3
	G3	G3		G3	G3	G3		G3	G3	G6		G3	G3	G3				
H Project Management Practices												G8		G6				
														G8				
J Production System Practices						H3	H1	H4	H2		H1					H1		
							H3		H3		H2					H2		
J Production System Practices	J3	J1	J1	J3	J1	J2	J3	J3		J6	J2	J5	J10			J1	J2	J1
	J5	J3	J10	J4	J2	J3	J21	J21		J17	J14	J10	J11			J3	J4	J6
	J8	J21	J13	J5	J3	J10					J15	J13	J13			J10	J11	J14
K Network					J21	J14					J17	J20				J17		
					J22													
					J23													
K Network	K3			K1	K1		K3	K1	K8	K1		K3			K1	K1	K1	
	K4			K4	K4			K3		K3		K4			K5	K5	K4	
	K8			K5	K8			K5		K4		K5						
L Strategic Behaviour	K10				K9													
	K11																	
L Strategic Behaviour		L1				L7										L1		L2
																L8		L4
M Financial Practices	M1							M1										
	M2							M2										

Table 5.41 Configuration actions overview – SVS

In the Table above, all the configuration actions selected by the Best Performer for special valves are listed. Other than few exceptions, every time a company selects one practices, it is likely that it is going to choose more than one action, meaning that in order to be truly effective, these actions must be selected in group, in order to exploit a synergic effect.

While the relative frequency of selection will be addressed later, it is possible to notice that the most selected actions are related to Production System Practices, Information Technology and Long-term Relationships with Suppliers, while Strategic Behavior and Financial Practices are the less used, probably due to its specificity.

It is possible to notice that some company selected the only practice, without specifying the action; this happens when firms invest in the overall resource, without focusing on specific aspects.

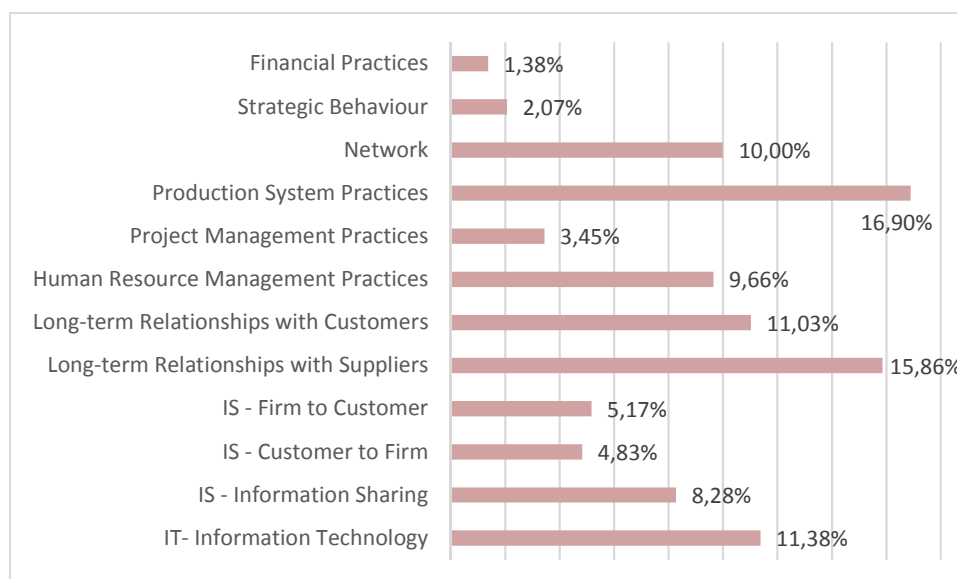


Figure 5.5 Relative frequency of selection of actions respect to the practices

The chart above shows the frequency of selection of the actions referred to their practices. From a pure quantitative point of view, the most important practices are Production System Practices, Long-term Relationships with Suppliers and Information Technology. Even if the figure gives an idea of how Best Performers select their practices, it does not state whether these practices are used for strategic capabilities or for less important ones.

It is now interesting to investigate, for each practice, which are the most selected configuration actions.

IT (Information Technology)

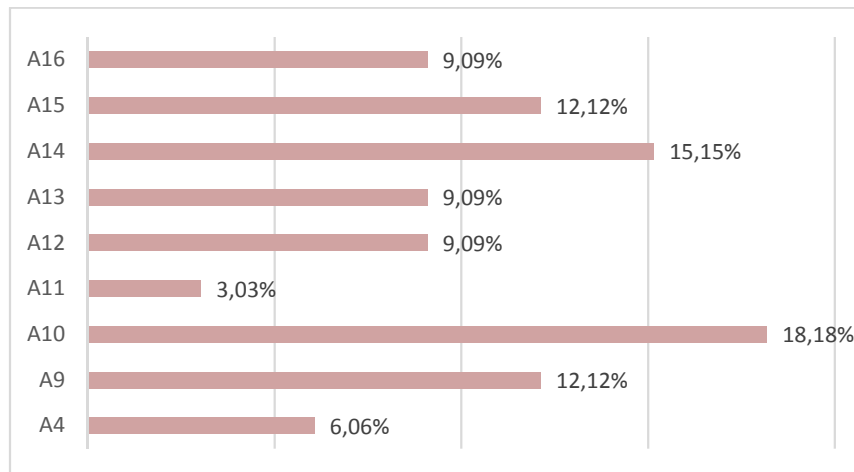


Figure 5.6 Actions related to Information Technology

Primary actions	
A10	Production Planning
A14	Warehouse management Software (WMS)
Secondary actions	
A15	Monitoring order processing status, Manufacturing Execution Systems (MES)
A9	Scheduling and planning software use and/or development

Table 5.42 Primary and secondary actions for Information Technology – SVS

IS (Information Sharing)

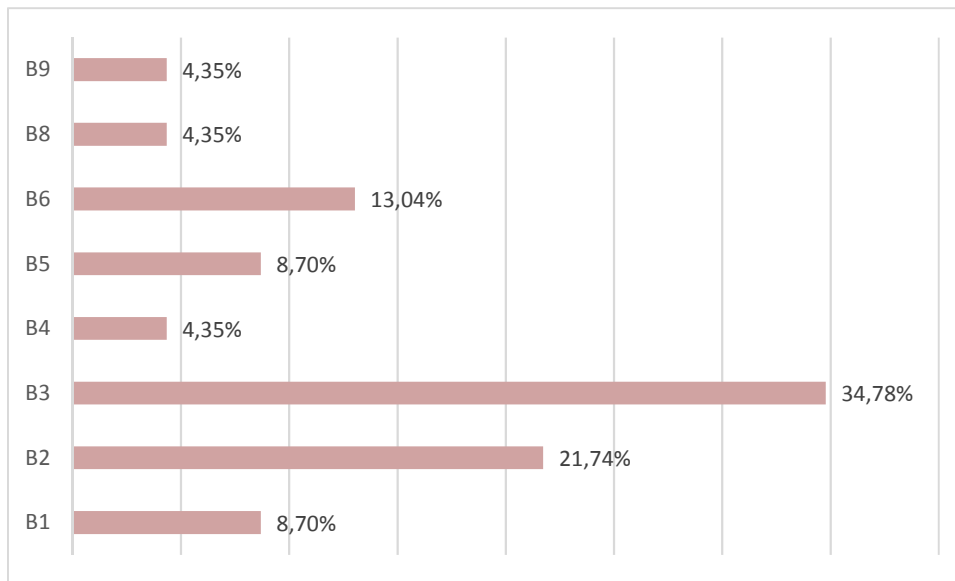


Figure 5.7 Actions related to Information Sharing – SVS

Primary actions	
B3	Frequent, informal timely information exchange
Secondary actions	
B2	Quality data availability

Table 5.43 Primary and secondary actions for Information Sharing – SVS

IS – Customer to Firm

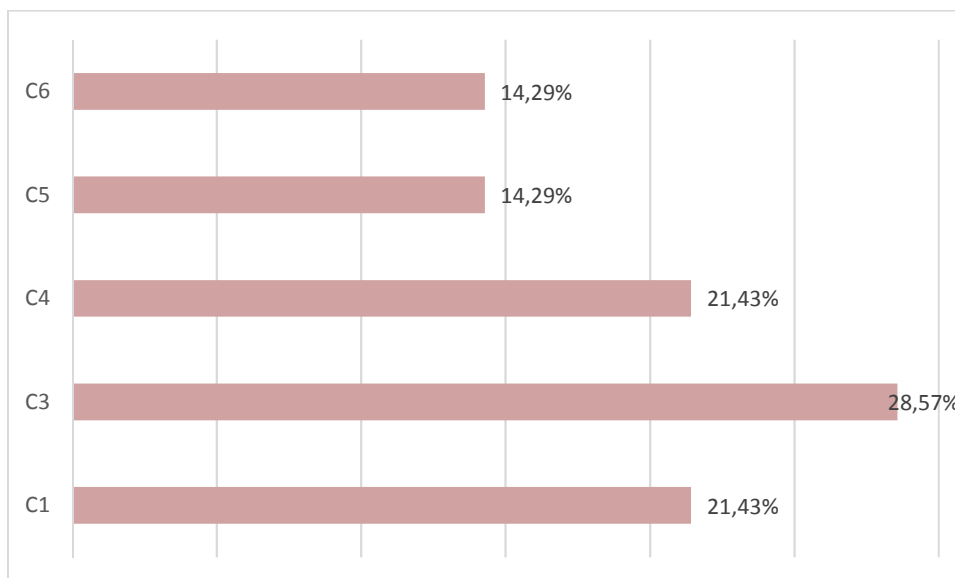


Figure 5.8 Actions related to IS Customer to Firm – SVS

Primary actions	
C3	Product design specification
Secondary actions	
A15	Expected performance specifications
A9	Information exchange about planned order or order changes

Table 5.44 Primary and secondary actions for IS Customer to Firm – SVS

IS – Firm to Customer

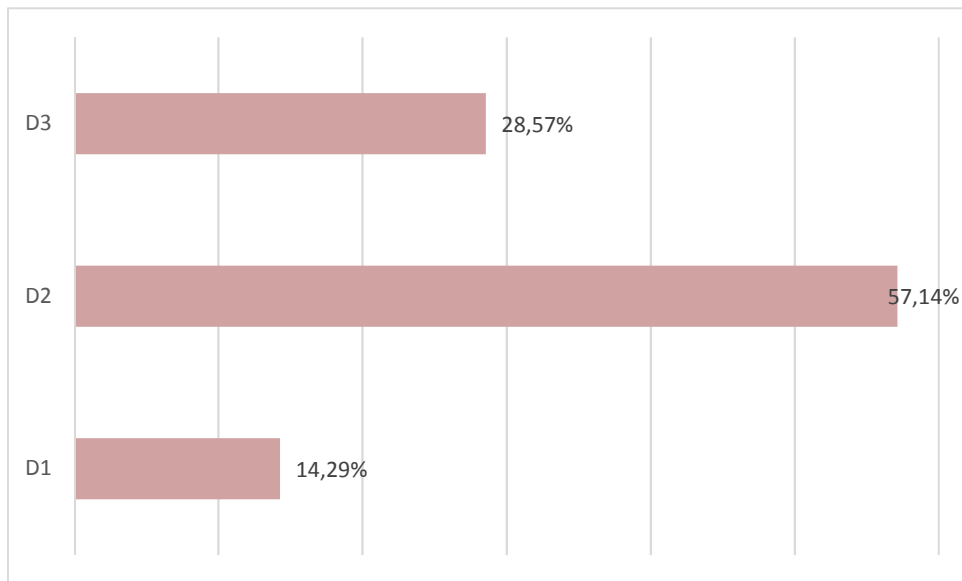


Figure 5.9 Actions related to IS Customer to Firm - SVS

Primary actions	
D2	Information about order status and expected lead-time
Secondary actions	
D3	Information about delivery schedule and/or possible changes in delivery schedule

Table 5.45 Primary and secondary actions for IS Firm to Customer – SVS

Long-term Relationships with Suppliers

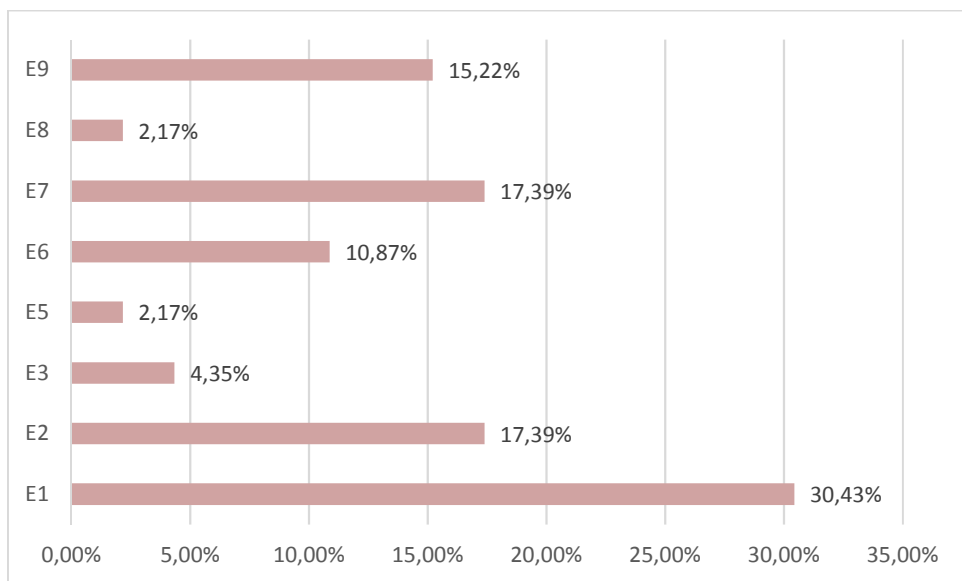


Figure 5.10 Actions related to Long-term Relationships with Suppliers – SVS

Primary actions	
E1	Close relationships with strategic suppliers, commercial agreements
Secondary actions	
E2	Helping suppliers to improve their product quality (Top Management Support)
E7	Cooperation in checking order status
E9	Quality guarantee programs for suppliers' process

Table 5.46 Primary and secondary actions for Long-term Relationships with Suppliers– SVS

Long-term Relationships with Customers

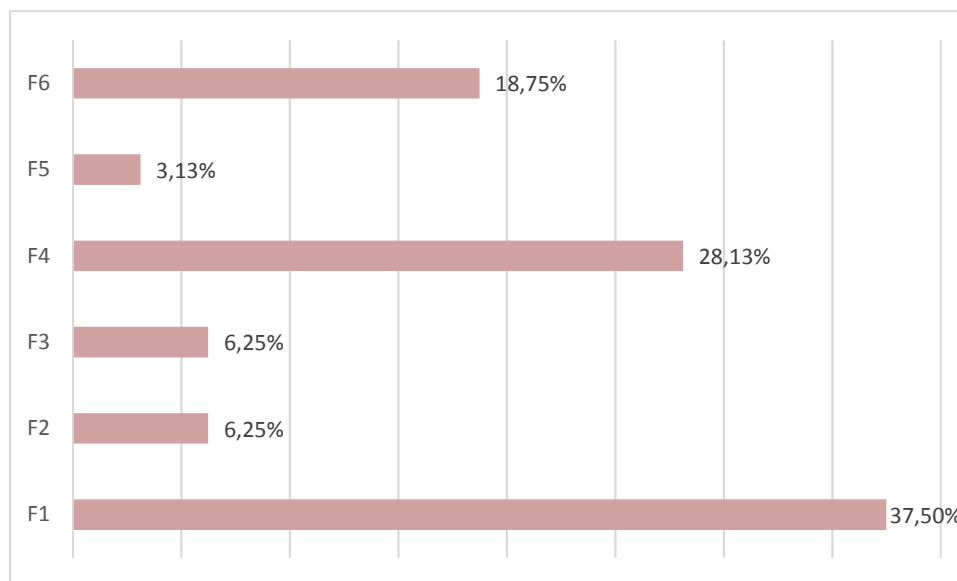


Figure 5.11 Actions related to Long-term Relationships with Customers – SVS

Primary actions	
F1	Close partnerships with clients
Secondary actions	
F4	Collaboration in new product development
F6	Investments for evaluating customer's future needs

Table 5.47 Primary and secondary actions for Long-term Relationships with Customers – SVS

Human Resource Management Practices

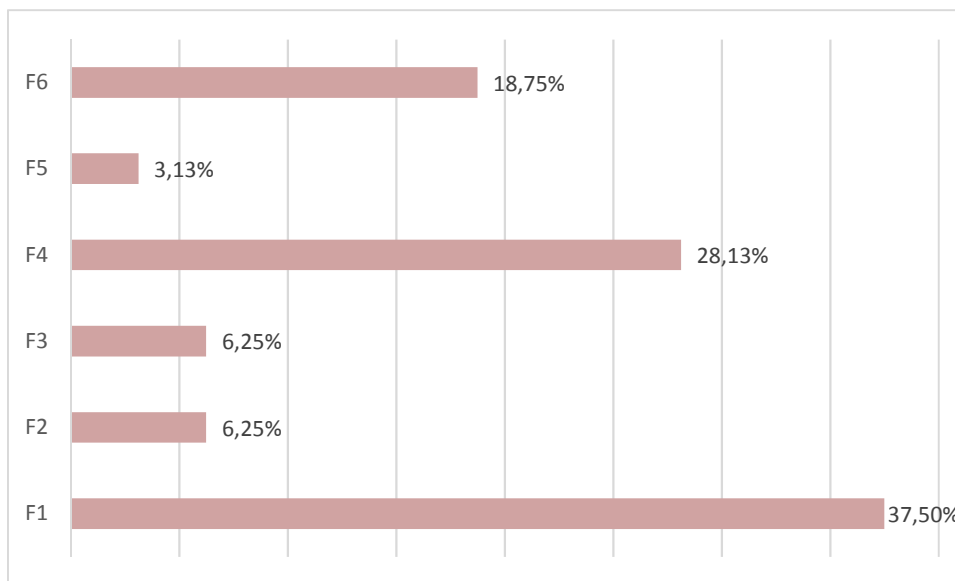


Figure 5.12 Actions related to Human Resource Management Practices – SVS

Primary actions	
G3	Staff training
G2	Multi-skilled human resource selection
Secondary actions	
-	

Table 5.48 Primary and secondary actions for Human Resource Management Practices – SVS

Project Management Practices

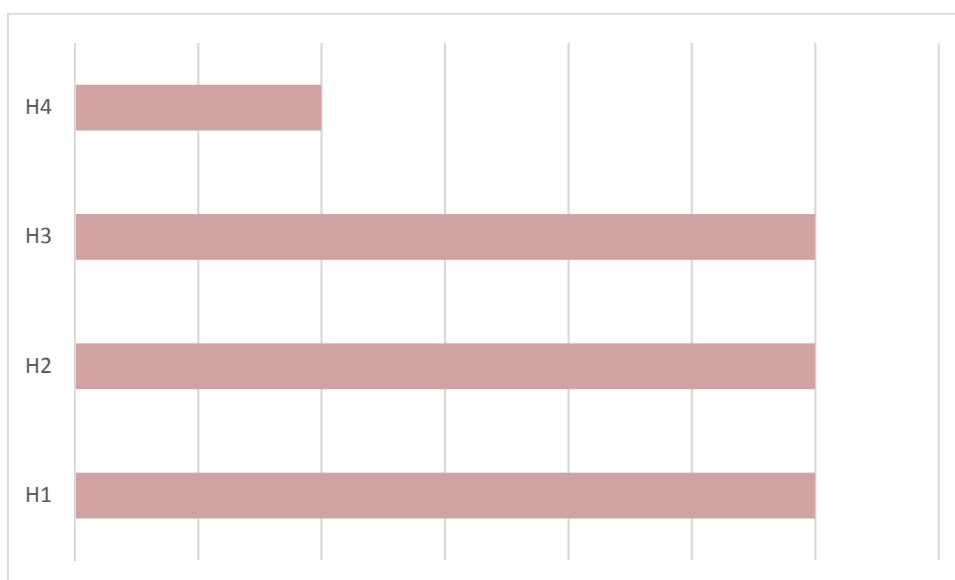


Figure 5.13 Actions related to Project Management Practices – SVS

Primary actions

H1	Risk and opportunities identification analysis methods
H2	Advanced methods for supplier selection
H3	Cost Breakdown Structure
Secondary actions	
-	

Table 5.49 Primary and secondary actions for Project Management Practices – SVS

Production System Practices

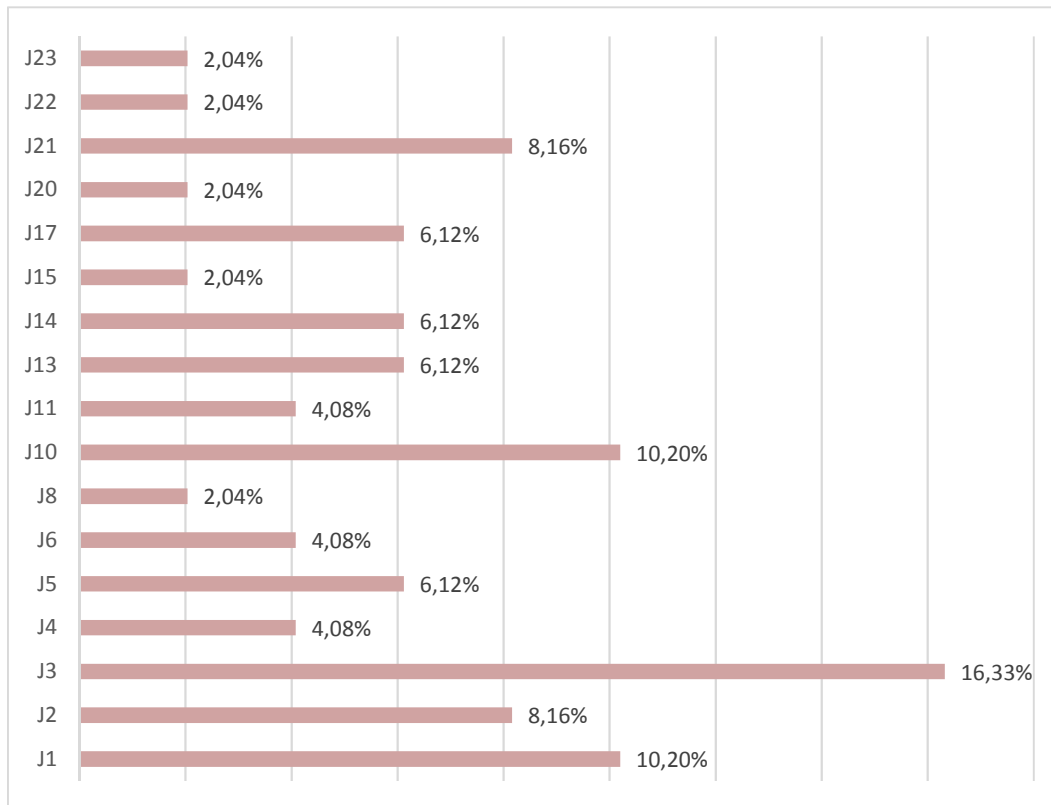


Figure 5.14 Actions related to Production System Practices – SVS

Primary actions	
J3	Plants and machines upgrade/replacement
Secondary actions	
J1	Investments in R&D and Engineering functions
J2	International certifications (ISO 9001)
J10	Cycle reduction time
J21	External Slack Capacity

Table 5.50 Primary and secondary actions for Production System Practices – SVS

Network

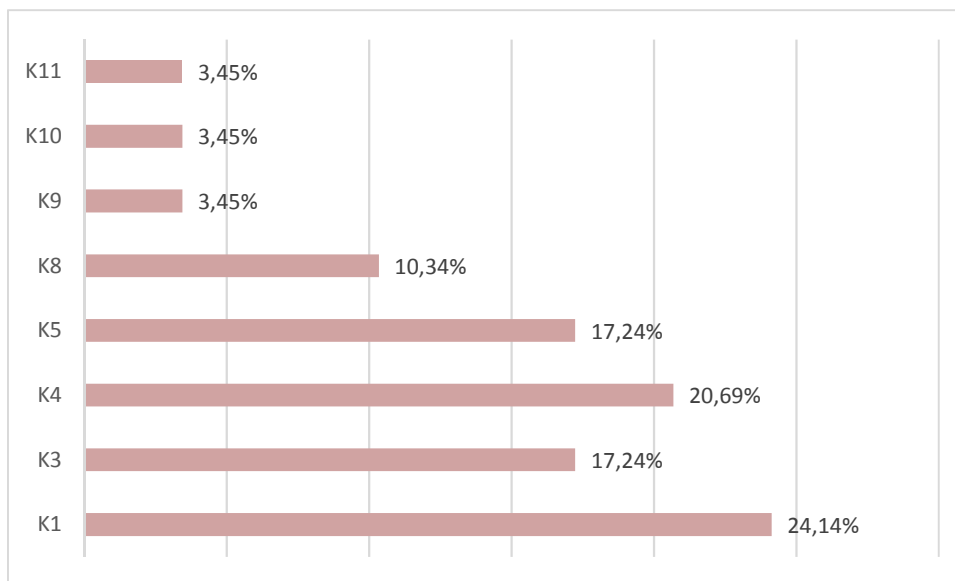


Figure 5.15 Actions related to Network - SVS

Primary actions	
K1	Sections-network development (for commercialization, contracting and assurance)
K4	Limited number of suppliers
Secondary actions	
K3	Preference for local suppliers
K2	Section-network development (for production)

Table 5.51 Primary and secondary actions for Network – SVS

Strategic Behavior

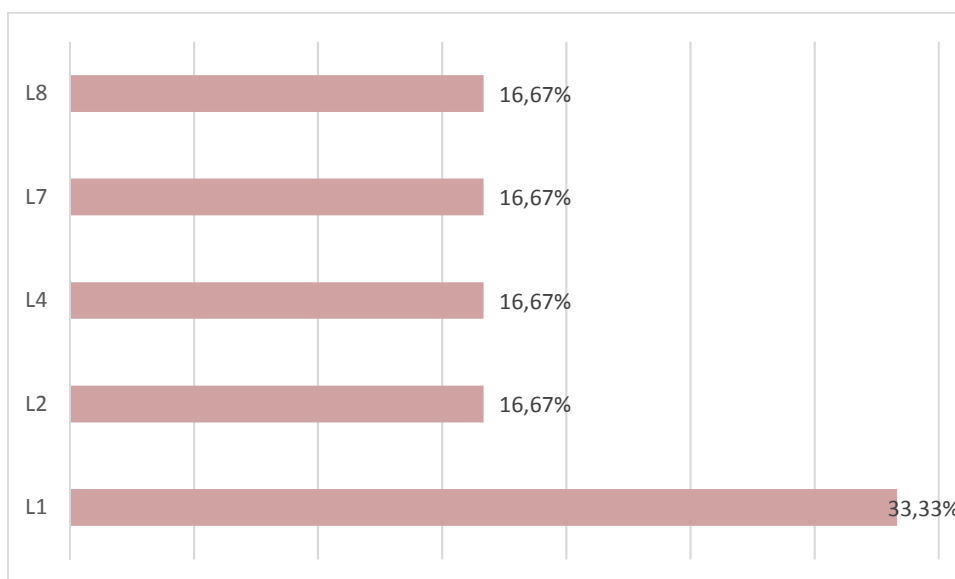


Figure 5.16 Actions related to Strategic Behavior – SVS

Secondary actions
None, only a few companies selected this practice, so there is no significative action.

Table 5.52 Primary and secondary actions for Strategic Behavior – SVS

Financial Practices

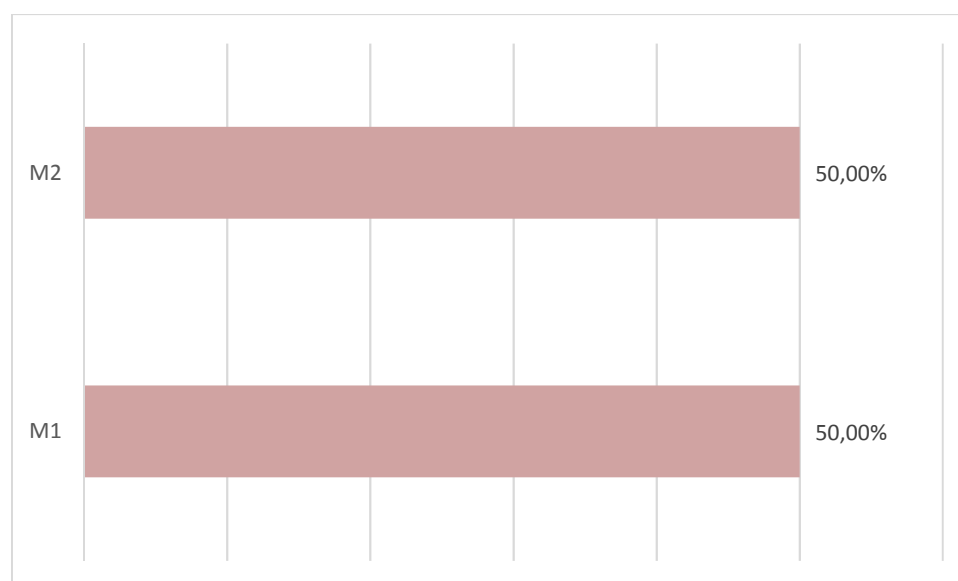


Figure 5.17 Actions related to Financial Practices – SVS

Secondary actions
None, only a few companies selected this practice, so there is no significative action.

Table 5.53 Primary and secondary actions for Financial Practices – SVS

5.3.1.5 Summary of the results – SVS

The scope of this final section of the multi-case study is to summarize the different results that have been obtained during the previous analysis of the linkages of the elements related to the framework, in the special valves industry.

Starting from the most targeted performance, the different set identified will be plugged together, in order to expand and identify possible combinations of practices and capabilities that can enable one of the three most important performance.

The most targeted performance, for the Special Valves sector, have been *Quality, On-time Delivery, Price* and *Engineering*.

As an initial consideration, it is possible to see that the Best Performers are perfectly aligned with the requests of the Main Contractors, that is an expected result, given that the status of excellence have been given exactly by those clients.

For each of those performance, one or more set of capabilities have been identified, that, if developed, could provide the performance with which they were connected. Grouping all the capabilities, the following set has been identified: *Supply Chain Management Inbound, Supply Chain Management Outbound, Knowledge Management Capability, Product/Process Development Capability, Customer Service, Project Management Capability* and *Capacity and Flexibility*.

Finally, for each capability different sets of bundled practices, common and peculiar, could be identified. Uniting all these bonds, it is possible to obtain sets of practices-capabilities that can be used to as a reference for the suppliers of the sector to achieve competitive advantage.

In the following tables, the summary of the results, described as different sets, coming from the previous analysis, is presented:

Performance	Capabilities	Common Practices	Peculiar Practices
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Network (K)
			+ Project Management Practices (H)
			+ No further practices to (E)
	Supply Chain Management Outbound	Long-term Relationships with Suppliers (E)	+ Long-term Relationships with Customers (F)
			+ No further practices to (E)
	Customer Service	Long-term Relationships with Customers (F)	+ No further practices to (F)
		Long-term Relationships with Customers (F)	+ IS – Customer to Firm (C) and IS – Firm to Customer (D)
			+ Production System Practices (J) and Network (K)
		Human Resource Management Practices (G)	+ Information Technology (A) and Information Sharing (B)
			+ No further practices to (G)
		Network (K)	+ No further practices to (K)
		Project Management Practices (H) and Production Process Practices (J)	+ No further practices to (H) and (J)

Table 5.54 Quality suggested configuration – 1 – SVS

Performance	Capabilities	Common Practices	Peculiar Practices
On-time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Network (K)
			+ Project Management Practices (H)
			+ No further practices to (E)
	Project Management Capability	Project Management Capability	+ Information Technology (A) and Information Sharing (B)

			+ Human Resource Management Practices (G)
			+ Production System Practices (J)
	Customer Service	Long-term Relationships with Customers (F)	+ IS – Customer to Firm (C) and IS – Firm to Customer (D)
			+ Production System Practices (J) and Network (K)
		Human Resource Management Practices (G)	+ Information Technology (A) and Information Sharing (B)
			+ No further practices to (G)
		Network (K)	+ No further practices to (K)
		Project Management Practices (H) and Production Process Practices (J)	+ No further practices to (H) and (J)

Table 5.55 On-time Delivery Set suggested configuration – 1 – SVS

Performance	Capabilities	Common Practices	Peculiar Practices
Engineering	Knowledge Management Capability	Human Resource Management Practices (G)	
	Product/Process Development Capability	Production System Practices (J)	+ Long-term Relationships with Customers (F)
		Human Resource Management Practices (G)	+ No further practices to (J)
			+ No further practices to (G)

Table 5.56 Engineering suggested configuration – 1 – SVS

Performance	Capabilities	Common Practices	Peculiar Practices
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Network (K)
			+ Project Management Practices (H)
			+ No further practices to (E)
	Product/Process Development Capability	Production System Practices (J)	+ Long-term Relationships with Customers (F)

			+ No further practices to (J)
		Human Resource Management Practices (G)	+ No further practices to (G)

Table 5.57 Price Set suggested configuration – 1 – SVS

Performance	Capabilities	Common Practices	Peculiar Practices
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Network (K)
			+ Project Management Practices (H)
			+ No further practices to (E)
	Capacity and Flexibility	Production System Practices (J)	+ Long-term Relationships with Customers (F)
			+ Network (K)
			+ No further practices to (J)
		Long-term Relationships with Suppliers (E)	+ No further practices to (E)
		Information Technology (A)	+ No further practices to (A)
	Customer Service	Long-term Relationships with Customers (F)	+ IS – Customer to Firm (C) and IS – Firm to Customer (D)
			+ Production System Practices (J) and Network (K)
		Human Resource Management Practices (G)	+ Information Technology (A) and Information Sharing (B)
			+ No further practices to (G)
		Network (K)	+ No further practices to (K)
		Project Management Practices (H) and Production Process Practices (J)	+ No further practices to (H) and (J)

Table 5.58 Price suggested configuration – 2 – SVS

5.3.2 Static Equipment sector

Before starting to perform the multi-case study on this sector, it is necessary to provide a list of the products related to the Static Equipment sector, that are coded, in order to be able to use them in a synthetic way inside the description of the companies.

Static Equipment Classification and Coding	Code
Pressure Vessels, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter < 5 m	A
Pressure Vessels, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter < 5 m	B
Pressure Vessels, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter > 5 m	C
Pressure Vessels, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter > 5 m	D
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness < 50 mm diameter < 5 m	E
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness > 50 mm diameter < 5 m	F
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness < 50 mm, diameter > 5 m	G
Pressure Vessels, Low Alloy Steel Cr-Mo, clad, thickness > 50 mm, diameter > 5 m	H
Other static equipment	I
Columns and Drums, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter < 5 m	J
Columns and Drums, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter < 5 m	K
Columns and Drums, Carbon Steel or Stainless Steel, thickness < 50 mm, diameter > 5 m	L
Columns and Drums, Carbon Steel or Stainless Steel, thickness > 50 mm, diameter > 5 m	M
Columns and Drums, Low Alloy Steel Cr-Mo, clad, thickness < 50 mm, diameter < 5 m	N
Columns and Drums, Low Alloy Steel Cr-Mo, clad, thickness > 50 mm, diameter < 5 m	O
Columns and Drums, Low Alloy Steel Cr-Mo, clad, thickness < 50 mm, diameter > 5 m	P
Columns and Drums, Low Alloy Steel Cr-Mo, clad, thickness > 50 mm, diameter > 5 m	Q
Shell and Tube HEX, low pressure (< 50 bar)	R
Shell and Tube HEX, high pressure (> 50 bar)	S
Other Heat Exchanger, low pressure (< 50 bar)	T
Other Heat Exchanger, high pressure (> 50 bar)	U
Air Coolers	V
Packages	Y
Trays and Internals	Z
Steam Generators and Industrial Boilers	AA

Table 5.59 Static Equipment classification and coding

5.3.2.1 Performance – SES

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8.1	SES-8.2	SES-9	SES-10	SES-11	SES-12	Overall Frequency

<i>Supplied Products</i>	A, B, J, K, R, I, T	A- Q, R, S	A- Q, R, S	S, U, V	R- V	Z	A, B, E, F, J, K, N, O, R-U, AA	A- Q, AA	R- U	R- U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A- U, Z	
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	
<i>Turnover [Mln €]</i>	20- 100	20- 100	/	100- 200	20- 100	20- 100	20- 100	100- 200	100- 200	>200	20- 100	20- 100	20- 100	
Price	X	X	X	X	X		X			X	X	X	X	10
Quality	X	X	X		X	X	X	X	X		X		X	10
On-Time Delivery	X		X	X	X		X	X	X	X		X	X	10
Engineering						X		X			X	X		4
Differentiation		X												1
Flexibility				X		X				X				3
Innovation									X					1

*Just one company out of twelve changes the strategic behavior based on supplied products.

Company SC	Reference Products
SES-8A	Pressure Vessels, Columns and Drums, Steam Generators and Industrial Boilers
SES-8B	High Pressure Heat Exchanger

Table 5.60 Performance – SES

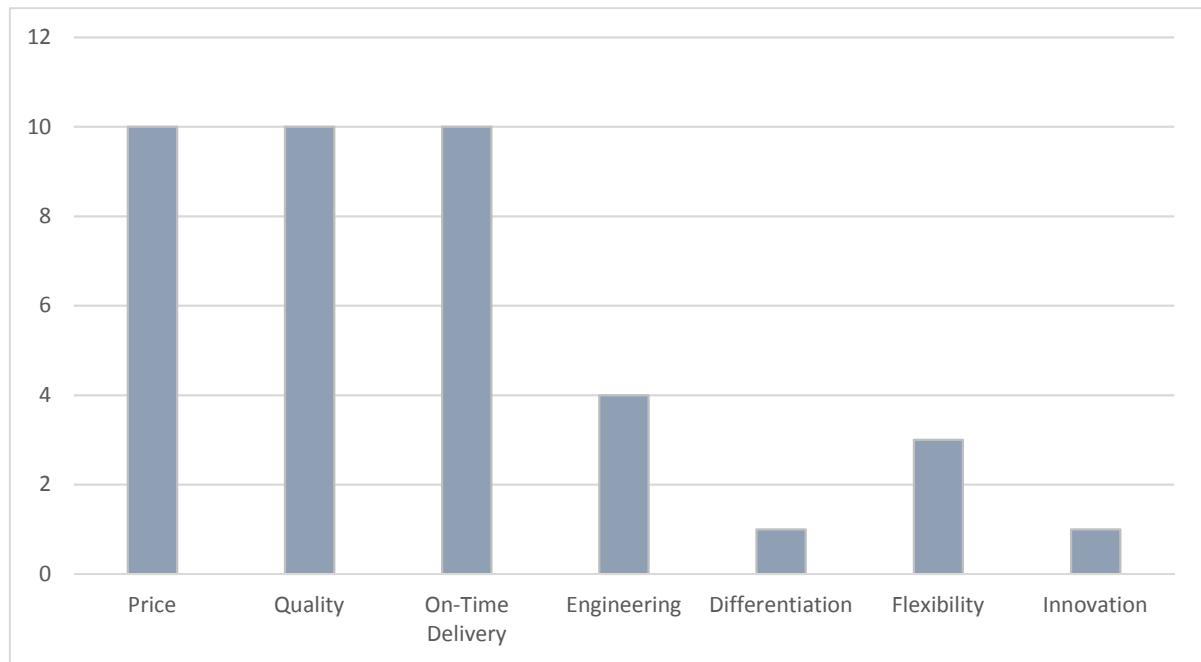


Figure 5.18 Performance overview – SES

It can be noticed that the sector is nearly perfectly aligned and that those companies tend to focus almost completely on three main performance, that are:

- Price;
- Quality;
- On-time Delivery.

Since these are the performance indicated by the contractors as most important, it is possible to see that this sector is perfectly aligned with their requests. Price is still the most important performance to demonstrate to the client in order to obtain the orders.

As said before, this behavior is due to oil price fluctuation and contingent crisis that are lowering the profits within overall sector; Price is needed to survive the competition of emergent markets, even if their quality is far inferior.

The only possibility of competing on market without having the Price as one of the main performance is given by the provision of extremely engineered products, that allow to maintain a low competitiveness.

For example, SVS-6 supplies internals to licensors and, because of the technical complexity of these products, licensors have a short-list of manufacturers capable to manufacture this kind of products and having less competitiveness it is able to obtain higher margins. However, this company indicated that Price is becoming more important even in their supply chain and intervention to reduce costs is needed.

On-Time Delivery is becoming more and more important for end users: it happens that, for fast delivery projects, this is the crucial performance (instead of Price).

Quality is a prerogative for items suppliers; moreover, the static equipment sector is quite standardized in term of design (exceptions are Shell&Tube and Trays & Internals), so quality is the privileged way to be chosen by the client. In addition, because of outstanding dimension and non-common materials, quality is even more important to make the items work the way it is requested.

In Figure 5.18 it is possible to see that the difference between the first three performance and the others is very high. After Quality, Price and On-time Delivery there are:

- Engineering;
- Flexibility.

Engineering was chosen by four companies. Three out of four companies demonstrate a turnover of less than 40 [Mln €] highlighting the necessity of small companies to compete on engineered products and they use it instead of one of the three main performance in order to remain competitive.

Flexibility (SC) appears to be also important for companies who decides to compete in product's market where design and innovation are more influential. Being able to develop Flexibility (SC) could represent an advantage in term of capability to supply what requested by the client and being able to follow the customer's needs (it is really important in this sector).

Finally, the last two performance are:

- Differentiation;
- Innovation.

Differentiation was chosen just once: anyway, during interviews, many companies indicated that it is a fundamental aspect of the sector. Even if it is less important than what is really requested by the client (Price, Quality and On-Time Delivery), Differentiation (and Innovation too) is a cornerstone in order to stay in the market. Moreover, many companies have a R&D division that tries to develop new technologies (the last affirmation is truer for heat exchangers design).

Innovation and Differentiation can be considered as a development of the Engineering performance. Indeed, many of the interviewed firms have a solid engineering function and most of them, instead of utilizing only their advanced know-how to gain a competitive advantage, make investments in the R&D function (Innovation) in order to find new outstanding materials or improve the process inside some specific equipment (Shell&Tube and Internals). Since the period does not allow to make huge investments in order to realize unique products, Differentiation as Innovation are rare developed performance.

Performance
Quality
On-time Delivery
Price

Table 5.61 Recommended performance – SES

In the following paragraph, the analysis on relationships performance-capabilities will be made, focusing in particular to those capabilities that are required to obtain the three main performance listed above.

5.3.2.2 Performance-Capabilities – SES

The performance-capabilities link enables to understand what kind of abilities, particular assets, knowledge, skills, privileges and partnerships a firm has to identify in order to create the conditions to demonstrate a certain performance to the client.

In this paragraph, the bonds between the performance and capabilities are presented, in order to see which capabilities are used by best performers to achieve the different performance, focusing especially on the three performance identified in the previous part, that will be described more in detail.

Price

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-7	SES-9	SES-10	SES-11	SES-12	Frequency
Supplied Products	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	A, B, E, F, J, K, N, O, R-U, AA	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z	
Group Belonging	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	
Turnover [Mln €]	20-100	20-100	/	20-100	100-200	20-100	100-200	20-100	20-100	20-100	
SCM Inbound	X	X		X	X	X	X	X	X	X	9
SCM Outbound	X		X		X			X			4
Prod./Proc. Dev. Capability		X	X	X	X	X	X				6
Capacity and Flexibility		X		X		X	X				4
Customer Service									X		1
Relationship Capability								X	X		2
Financial Capability										X	1
Project Management Capability	X		X								2

Table 5.62 Price – SES

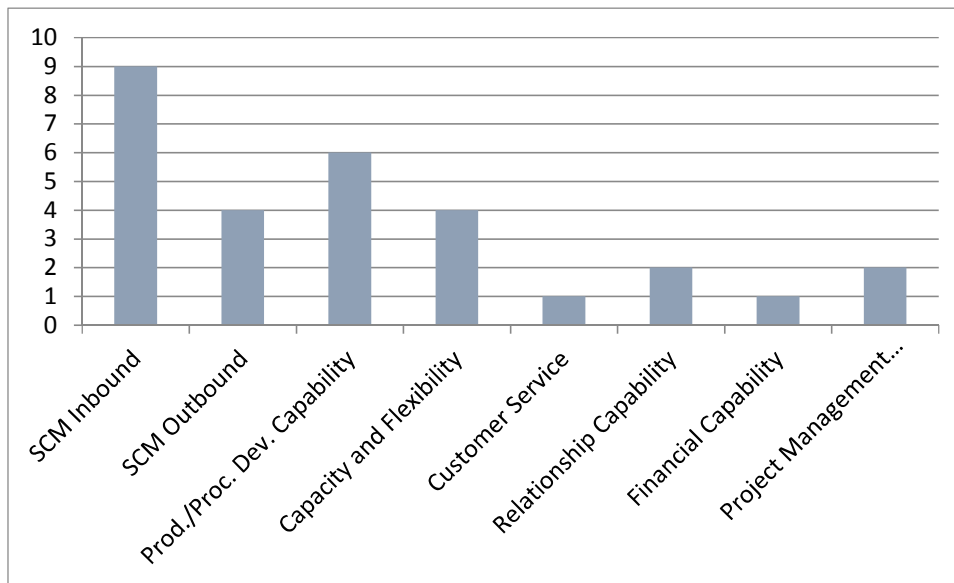


Figure 5.19 Price overview – SES

Price is obtained mainly through Product/Process Development Capability and Supply Chain Management Inbound: the proper management of suppliers and efficient production process are extremely important to achieve cost reduction.

Furthermore, around 50% of costs are related to raw materials thus, is extremely important to find good quality suppliers that can ship at a lower price.

Product/Process Development capability is related to the nature of the products: they are “standard” in term of technology applied to manufacture but the criticality is related to the quality and the experience of the processes applied, nonetheless the customization level of the products. Because the design is well- known (less true for heat exchangers and internals), customization is required about material and dimension; in order to reduce development costs and be effective in the production, Product/Process Development capability are needed to tackle new challenging projects.

Volumes and frozen times management must be kept under control, thus Capacity and Flexibility can help in limiting possible cost increase due to those factors. The correct management of the delivery through the Supply Chain Management Outbound is of paramount importance to reduce possible contingencies or non-conformity of the shipment.

The proper management of the project, through the utilization of Project Management Capability, can be important to reduce costs due to errors or delays.

Performance	Set-1 of capabilities
Price	Supply Chain Management Inbound
	Supply Chain Management Outbound
	Product/Process Development Capability

Table 5.63 Recommended Price enabling capabilities – 1 – SES

Performance	Set-2 of capabilities
Price	Supply Chain Management Inbound
	Capacity and Flexibility
	Product/Process Development Capability

Table 5.64 Recommended Price enabling capabilities – 2 – SES

Being the Price one of the three main performance, two different sets of capabilities have been identified, whose enabling can help a company achieve the targeted performance. The only difference in the two configuration is given by the fact that a firm can decide to invest in Capacity and Flexibility or in Supply Chain Management Outbound.

The three out of four companies that chose SCM Outbound, also chose the SCM Inbound capability, because it means having a strong control over the supply chain, collaborating on one side with customers, and on the other with suppliers.

Table 5.64 indicates a second a possibility of enabling the performance of Price, since four out of six firms that indicated Production/Process Development Capability, also indicated the Capacity and Flexibility, meaning that the mere possession of a reliable assembly line is not enough if is not handled properly, through an adequate scheduling and maintaining the necessary amount of slack production.

The static equipment sector, having more standardized products, leans more on process development rather than products one.

Quality

Company	SES-1	SES-2	SES-3	SES-5	SES-6	SES-7	SES-8	SES-10	SES-12	Frequency
<i>Supplied Products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA	A-Q, R-U, AA	A-U, Z	
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	
<i>Turnover [Mln €]</i>	20-100	20-100	/	100-200	20-100	20-100	100-200	20-100	20-100	
SCM Inbound		X		X	X		X	X	X	6
SCM Outbound			X	X				X		3
KM Capability	X				X					2
Prod./Proc. Dev. Capability			X	X		X		X	X	5
Capacity and Flexibility						X	X			2
Relationship Capability	X									1
Internal Integration		X				X				2
Project Management Capability	X		X		X		X			4

Table 5.65 Quality – SES

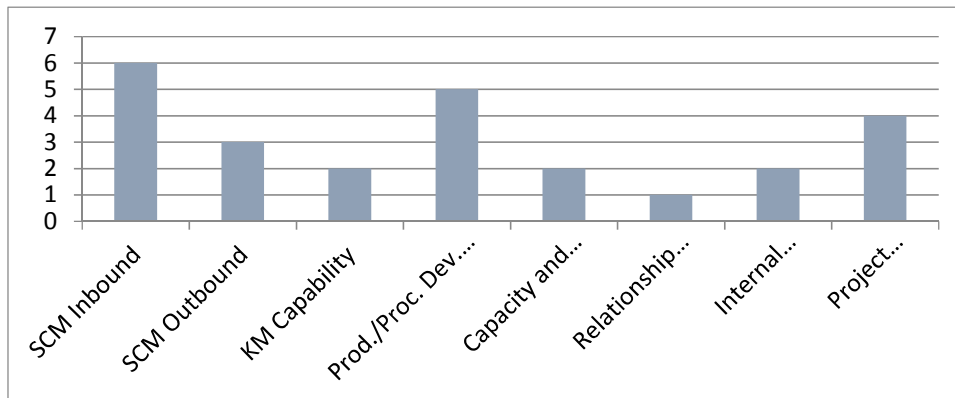


Figure 5.20 Quality overview – SES

Also in case of Quality, SCM Inbound and Product/Process Development capability are of paramount importance. The quality of the raw materials is too important, thus a strong control on suppliers is required.

Similarly, it is important to have strong control also on the production process, since this sector is characterized by a strong vertical integration, thus production process stages are kept internally, leading the quality of the final product to be strongly related to the ones of the workings.

Project Management Capability is needed because of the tailor-made nature of the sector: perceive the risks and reduce impact of the issues are needed to understand before the practical stages where quality could be a problem takes place and to intervene to overtake possible critical situations.

The monitoring of the downstream supply chain, through Supply Chain Management Outbound is then required to avoid discrepancies between orders and shipments.

Finally, possessing a spread know-how in the company is very important to be able to identify which are the features of projects that can match customers' requirements, but also to be able to follow the products certifications, supporting the realization of the products on the line. Compliance of the product is extremely important in this sector.

Performance	Set-1 of capabilities
Quality	Supply Chain Management Inbound
	Project Management Capability
	Product/Process Development Capability

Table 5.66 Recommended Quality enabling capabilities – 1 – SES

Performance	Set-1 of capabilities
Quality	Supply Chain Management Inbound
	Supply Chain Management Outbound
	Product/Process Development Capability

Table 5.67 Recommended Quality enabling capabilities – 2 – SES

Even for this performance, two set of capabilities have been identified. Similarly to Price, there are two very similar sets, in which both SCM Inbound and Product/Process Development Capability are present. There is also a synergy between SCM Outbound and Product/Process Development, because three companies have

selected those performance altogether, meaning that there is a strong level of coordination required between the production process and the finite products warehouse and delivery system.

In this second proposed configuration, a strong product-base relationship with customers is highlighted, since it is required to produce high Quality and compliant products, through collaborations.

On-time Delivery

Company	SES-1	SES-3	SES-4	SES-5	SES-7	SES-8	SES-9	SES-11	SES-12	Frequency
<i>Supplied Products</i>	A, B, J, K, R, I, T	A-Q, R, S	S, U, V	R-V	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA	R-U	A, B, E, F, R, S, V, AA	A-U, Z	
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
<i>Turnover [Mln €]</i>	20-100	/	20-100	100-200	20-100	100-200	100-200	20-100	20-100	
SCM Inbound	X			X	X	X	X	X	X	7
SCM Outbound	X	X		X						3
Prod./Proc. Dev. Capability		X		X	X		X		X	5
Capacity and Flexibility					X	X	X			3
Customer Service			X			X		X		3
Relationship Capability			X					X		2
Project Management Capability	X	X	X						X	4

Table 5.68 On-time Delivery – SES

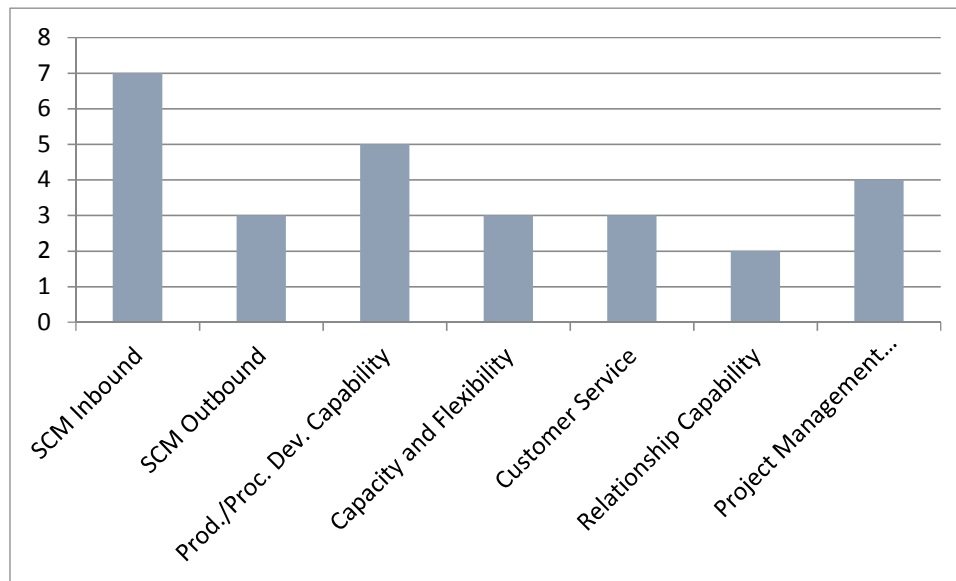


Figure 5.21 On-time Delivery overview – SES

The role of SCM Inbound and Product/Process Development is major also for On-time Delivery; the proper control on production processes and suppliers is fundamental to be able to provide the right products at the right period of time. Having a safety network of suppliers can be useful in case of problems inside the plants.

Improvement of the machineries can also lead to improvement in cycle time and in the proper monitoring of the bottleneck. Also, the delivery system plays an important role in On-time delivery, since it is necessary to provide the products on the yard with within the timetable.

Project Management Capability is of paramount importance; with projects growing in dimensions, Project Management is fundamental to handle the coordinate the different activities and to monitor that they are performed effectively and in the proper time.

Finally, it seems that big companies use to improve the capability of Capacity and Flexibility in order to realize On-Time Delivery. Indeed, since they have to manage a major number of orders, the capacity to efficiently allocate semi-finished products and increase/decrease the production in the eventuality of an order change, allow the firm to avoid chain delays on other orders.

Performance	Set-1 of capabilities
On-time Delivery	Supply Chain Management Inbound
	Project Management Capability
	Product/Process Development Capability

Table 5.69 Recommended On-time Delivery enabling capabilities – 1 – SES

Performance	Set-2 of capabilities
On-time Delivery	Supply Chain Management Inbound
	Capacity and Flexibility
	Product/Process Development Capability

Table 5.70 Recommended On-time Delivery enabling capabilities – 2 – SES

Performance	Set-3 of capabilities
On-time Delivery	Supply Chain Management Inbound
	Supply Chain Management Outbound
	Product/Process Development Capability

Table 5.71 Recommended On-time Delivery enabling capabilities – 3 – SES

The three different suggested configurations have in common always the same two capabilities, that are Supply Chain Management Inbound and Product/Process Development Capability.

Capacity and Flexibility is used since it can be very useful in case of saturation or damages, the firm must be able to cover them through flexibility, that can be both internal or external, in order to maintain the promised delivery date.

Engineering

Company	SES-6	SES-8	SES-10	SES-11	Frequency
<i>Supplied Products</i>	Z	A-Q, AA	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	
<i>Group Belonging</i>	No	Yes	No	Yes	
<i>Turnover [Mln €]</i>	20-100	100-200	20-100	20-100	
SCM Inbound				X	1
KM Capability	X		X	X	3
Prod./Proc. Dev. Capability	X		X		2
Capacity and Flexibility	X				1
Customer Service		X		X	2
Relationship Capability		X			1
Project Management Capability			X		1

Table 5.72 Engineering – SES

The knowledge of the products is extremely important in order to be able to achieve Engineering. In particular it is necessary to develop a system of know-how internal to the company, that can help fitting customers' requirements or improve, autonomously, the products.

Also having the proper production system is very important thanks to Production/Process Development capability.

Finally, Customer Service can be used to stay close to the customer, in order to properly identify its technical needs.

Engineering is developed by firms that realize products that directly influences the process of the plant.

Innovation

Company	SES-8	Frequency
<i>Supplied Products</i>	A-Q, AA	
<i>Group Belonging</i>	Yes	
<i>Turnover [Mln €]</i>	100-200	
Capacity and Flexibility	X	1
Financial Capability	X	1
External Integration	X	1

Table 5.73 Innovation – SES

Only one company indicated Innovation. This company externally demonstrate this performance, in order to offer innovative high-pressure heat exchangers.

Since the achievement of this performance requires to invest part of the profit in not always remunerative targets, the firm need to base on a solid financial base (Financial Capability) before embarking on this road. In fact, the company is one of the biggest of the sample.

Differentiation

Company	SES-2	Frequency
<i>Supplied Products</i>	A-Q, R, S	
<i>Group Belonging</i>	Yes	
<i>Turnover [Mln €]</i>	20-100	
SCM Outbound	X	1
Market Capability	X	1

Table 5.74 Differentiation – SES

Differentiation was selected just once. Supply Chain Management Outbound is required to properly manage the delivery system and to make the customers understand the importance of the products, while Market Development Capability is used to perform marketing operations to the different customers.

Flexibility (SC)

Company	SES-4	SES-6	SES-8	Frequency
<i>Supplied Products</i>	S, U, V	Z	R-U	
<i>Group Belonging</i>	Yes	No	Yes	
<i>Turnover [Mln €]</i>	20-100	20-100	100-200	
SCM Inbound		X		1
Prod./Proc. Dev. Capability		X		1
Capacity and Flexibility	X	X	X	3
Financial Capability			X	1
Internal Integration	X			1
External Integration			X	1
Project Management Capability	X			1

Table 5.75 Flexibility (SC) – SES

Capacity and Flexibility is the most important capability to build to obtain Flexibility (SC): the reduction of frozen time and the possession of volume flexibility are the basis to be able to act in a flexible way.

Capacity and Flexibility has been coupled in three different ways, through Financial Capability and External Integration, if the intention is focusing on customers; through Internal Integration and Project Management Capability, if the firm desires to achieve Flexibility optimizing internally the management activities; relying on Product/Process Development Capability and Supply Chain Management Inbound, with the necessity of obtaining additional capacity and flexibility through production system efficiency and a reliable network of suppliers.

Considering the three main performance, it is possible to indicate the list of most important capabilities that have been chosen to enable them. Among this list, the two vital capabilities are Supply Chain Management Inbound and Product/Process Development, that are mandatory for the development of the three performance.

Capabilities
Supply Chain Management Inbound
Product/Process Development Capability
Supply Chain Management Outbound
Capacity and Flexibility
Project Management Capability

Table 5.76 Recommended capabilities – SES

5.3.2.3 Capability-Practices – SES

The last section of the analysis of the framework is the definition of the links between capabilities and practices. In order to show how many actions, for each practice, have been selected by the company for the capability, it is going to be used a chromatic reference, that can be expressed in Table 5.77.

Particular attention will be made to the capabilities previously identified, that are necessary to enable the 3 most selected performance in the Static Equipment sector.

Legend	
Color	Explanation
	In order to enable the capability, the company indicates more than three actions
	In order to enable the capability, the company indicates three actions
	In order to enable the capability, the company indicates two actions
	In order to enable the capability, the company indicates a single action

Table 5.77 Explanation of usage of chromatic indicators

Supply Chain Management Inbound

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT - Information Technology												
B IS - Information Sharing												
C IS - Customer to Firm												

D IS - Firm to Customer												
E Long-term Relationships with Suppliers												
F Long-term Relationships with Customers												
G Human Resource Management Practices												
H Project Management Practices												
J Production System Practices												
K Network												

Table 5.78 Supply Chain Management Inbound – SES

Supply Chain Management Inbound is mainly enabled through the selection of Long-term Relationships with Suppliers. Also having good relationships with customers can help, since it is possible to learn how to relate with its own suppliers through the interactions with customers.

Coordination among members is extremely important and that is why companies tend to select Information Sharing, that can be strongly supported through Information Technology.

Investing in improving the production system can help understanding which are the assets that can be required to the suppliers, improving the quality of the process selection.

Another way to foster the control over suppliers is given by the utilization of Project Management Practices.

Being Supply Chain Management Inbound one of the most strategic practices, a guideline with the most used practices is described below.

Long-term Relationships with Suppliers is a mandatory step in order to enable the capability of SCM Inbound (Table 5.79). Indeed, eight out of twelve companies enable this capability through specific actions towards

the upstream supply chain. While this practice can be enough just by itself, it has synergic effects if combined with Information Technology and Information Sharing or Production System Practices.

Capability	Common practices	Peculiar practices
Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
		+ Production System Practice (J)
		+ No further practices to (E)

Table 5.79 Recommended practices for Supply Chain Management Inbound – SES

Supply Chain Management Outbound

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
D IS - Firm to Customer												
E Long-term Relationships with Suppliers												
F Long-term Relationships with Customers												

H Project Management Practices												
J Production System Practices												

Table 5.80 Supply Chain Management Outbound – SES

The downstream side of the supply chain is managed by fostering relationships with customers or suppliers, that are usually selected as an alternative.

While the link between Supply Chain Management Outbound and Long-term Relationships with Customers is more direct, the same link with suppliers is a bit more occult.

Companies that focus on highly engineered products, usually purchases more standardized items, thus, in order to provide complete packages that satisfy the customers, it is necessary to firmly control also the downstream side of the supply chain.

Long-term Relationships with Customers can be further fostered by using also Information Technology and Information Sharing.

Only one company develops both Long-term Relationships with Customers and Suppliers.

It can be notice that Long-term Relationships with Suppliers are mostly chased by small size companies, while big ones rely on Long-term Relationships with Customers.

Capability	Common practices	Peculiar practices
Supply Chain Management Outbound	Long-term Relationships with Customers (F)	+ Long-term Relationships with Suppliers (E) and Production System Practices (J)
		+ Information Technology (A) and Information Sharing (B)
		+ No further practices to (F)
	Long-term Relationships with Suppliers (E)	+ No further practices to (E)

Table 5.81 Recommended practices for Supply Chain Management Outbound – SES

Knowledge Management Capability

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes

<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
F Long-term Relationships with Customers												
G Human Resource Management Practices												
J Production System Practices												
K Network												
L Strategic Behavior												

Table 5.82 Knowledge Management Capability – SES

It is clear to say that Human Resource Management Practices are fundamental to develop Knowledge Management Capability, since they allow the training and formation of personnel capable of improving the company processes under different points of view.

Production System Practices are required in order to obtain the certification and external know-how.

Other than Human Resource Management Practices, the other companies have selected very different practices, such as Information Technology, Long-term Relationships with Customers, that can be fundamental for the combined development of products, or Network.

The only company which did not select human related practices focused on Strategic Behavior and Information Sharing, that allow to communicate information and align strategies with the different sides of the supply chain.

Product/Process Development Capability

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
E Long-term Relationships with Suppliers												
F Long-term Relationships with Customers												
G Human Resource Management Practices												
H Project Management Practices												
J Production System Practices												

Table 5.83 Product/Process Development Capability – SES

Product/Process Development Capability is another extremely important capability. A high importance relies on the Relationships with Customers, that provides the correct needs that are later used to shape the product as it is required. In order to closely satisfy the requirements of the customers, it is necessary to have an upgraded production system, able to perform the customization to match what is requested.

Also, Information Sharing is very important, since it is the base for the communication and it can be further improved if it is coupled with Human Resource Management Practices, since having personnel able to realize the products and their customization correctly plays a very important role in competitiveness.

Capability	Common practices
Product/Process Development Capability	Long-term Relationships with Customers (F) and Production System Practices (J)
	Information Sharing (B) and Human Resource Management Practices (G)

Table 5.84 Recommended practices for Product/Process Development Capability – SES

Capacity and Flexibility

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
C IS - Customer to Firm												
D IS - Firm to Customer												
E Long-term Relationships with Suppliers												

J Production System Practices												
Table 5.85 Capacity and Flexibility – SES												

Production System Practices, Information Technology and Information Sharing are preferred to obtain Capacity and Flexibility.

Being able to quickly respond to sudden order changes is critical, in order not to lose margin or the order itself and the production system becomes extremely important along with its management and scheduling.

The benefits provided by the production process can be fostered through the usage of practices such as Information Technology and Information sharing since timely and fast communication can help overcoming problems and delays.

Two companies indicated the machines upgrade/revamp as an action that allows them to avoid downtimes and improve the capability to respect due dates. The mentioned target is also reached through the utilization of top quality material and the continuous investments in actions involved in the cycle time reduction.

Another possible way to improve Capacity and Flexibility is that to create and maintain strong relationships with the upstream side of the supply chain. This development of the Capacity and Flexibility capability is implemented by firms that need to purchase not only rough materials but also other different static equipment's components.

Capability	Common practices	Peculiar practices
Capacity and Flexibility	Production System Practices (J)	+ No further practices to (J)
		+ Information Technology (A) and Information Sharing (B)
	Long-term Relationship with Suppliers (E)	+ No further practices to (E)

Table 5.86 Recommended practices for Capacity and Flexibility – SES

Customer Service

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												

B IS - Information Sharing												
F Long-term Relationships with Customers												
G Human Resource Management Practices												
K Network												

Table 5.87 Customer Service – SES

Customer Service has only been selected three times. As expected, the most important practice is Long-term Relationships with Customers, that can be used along with Information Sharing, to fortify communications. Also, the proximity to the end users' can help, for example, in providing after-sales services.

Relationship Capability

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
E Long-term Relationships with Suppliers												

F Long-term Relationships with Customers												
G Human Resource Management Practices												
H Project Management Practices												
J Production System Practices												
K Network												

Table 5.88 Relationship Capability – SES

Relationship Capability can be primarily pursued through practices can help fostering relationships with customers or suppliers, or that improve the exchange of information, such as Information Technology and Information Sharing.

Furthermore, being close to the end users' or suppliers can be helpful (Network).

Market Development Capability

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
B IS - Information Sharing												
D IS - Firm to Customer												

F Long-term Relationships with Customers											

Table 5.89 Market Development Capability – SES

Market Development Capability can be obtained through continuous networking and marketing with customers; thus, they are required practices can help increasing information exchange and, more in general, fostering relationships with clients, in order to be able to make them perceive the importance of the supplier's products and the strength of its brand.

Financial Capability

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
C IS - Customer to Firm												
D IS - Firm to Customer												

E Long-term Relationships with Suppliers												
F Long-term Relationships with Customers												
M Financial Practices												

Table 5.90 Financial Capability – SES

Just two companies indicated Financial Capability, which are firms offering a wide product portfolio of products that requires continuous financial support in order to withstand this huge load.

Internal Integration

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
G Human Resource Management Practices												
J Production System Practices												

K Network												

Table 5.91 Internal Integration – SES

Internal Integration has been selected three times, using different configurations. Information Sharing and Technology plus Network can help increasing the flow of information inside the group, strengthening the union inside different branches belonging to one corporation.

Human Resource Management Practices are used to develop skilled personnel, able to maintain a high level of coordination of the different processes inside the firm. These practices are particularly required by firms that develop highly technological products.

Finally, companies who offer different categories of products decide to internally integrate almost all the production cycle stages in order to improve and control all the different production processes.

External Integration

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
E Long-term Relationships with Suppliers												
F Long-term Relationships with Customers												
J Production System Practices												

Table 5.92 External Integration – SES

Just one company indicated External Integration. This capability is developed through practices that embrace the internal and external sides of the company. This capability is not too used because these suppliers prefer to manage their supply chain through the establishment of partnerships or strengthening already existing relationships.

Project Management Capability

Company	SES-1	SES-2	SES-3	SES-4	SES-5	SES-6	SES-7	SES-8	SES-9	SES-10	SES-11	SES-12
<i>Supplied products</i>	A, B, J, K, R, I, T	A-Q, R, S	A-Q, R, S	S, U, V	R-V	Z	A, B, E, F, J, K, N, O, R-U, AA	A-Q, AA, R-U	R-U	A-Q, R-U, AA	A, B, E, F, R, S, V, AA	A-U, Z
<i>Group Belonging</i>	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	Yes
<i>Turnover [Mln€]</i>	20-100	20-100	/	20-100	100-200	20-100	20-100	100-200	100-200	20-100	20-100	20-100
A IT- Information Technology												
B IS - Information Sharing												
E Long-term Relationships with Suppliers												
F Long-term Relationships with Customers												
G Human Resource Management Practices												
H Project Management Practices												
J Production System Practices												

						A15						
B IS - Information Sharing	B3	B2		B3		B3	B6	B6	B3	B3	B3	B3
	B8	B3		B5		B6		B8	B5	B5		
	B9	B6		B6		B7						
		B8		B8		B8						
				B10		B9						
						B10						
C IS - Customer to Firm						C3	C1		C1			
						C4			C5			
						C5						
D IS - Firm to Customer		D1				D1			D2			
		D2										
		D3										
E Long-term Relationships with Suppliers	E1		E2	E1		E1		E1	E1	E1	E1	E1
	E6		E7	E2		E9		E2	E7	E6		
	E8			E6		E10						
F Long-term Relationships with Customers	F1	F1		F1	F1	F1	F1	F1	F4	F1	F2	
	F6	F2		F2	F4	F4	F2	F4		F4		
		F6		F3	F6	F6	F4	F6				
				F4								
				F5								
				F6								
G Human Resource Management Practices	G1	G1		G2		G3	G3		G8	G3	G2	G3
	G2	G2		G3		G5						G6
	G3			G4		G7						
				G6		G8						
				G8								
H Project Management Practices	H1		H1	H1		H2	H1	H1		H1		
	H2		H2	H2		H3	H3	H2		H3		
			H3	H3		H4		H3				
				H4				H4				
J Production System Practices	J3	J1	J1	J18	J3	J15	J1	J1	J1	J1	J4	
	J4	J2	J4		J9		J3	J3				
	J10	J3	J10		J10		J5	J5				
	J15	J4					J9					
	J20	J10					J10					
		J17					J11					
							J17					
K Network	K1	K2									K1	
		K5									K5	
											K10	
L Strategic Behavior	L2											
	L8											

M Financial								M1				M1
								M2				M2

Table 5.95 Configuration actions overview – SES



Figure 5.22 Relative frequency of selection of actions respect to the practices

Long-term Relationships with Suppliers, Production System Practices and Information Technology are the most selected practices, while Network, Financial Practices and Strategic Behavior prove a very low strategic value respect to competitive advantage creation.

Respondents have been very precise during the interviews, assessing for each practice one or more specific actions, without considering the practice in general.

The analysis the actions related to each single practice is now presented.

IT (Information Technology)

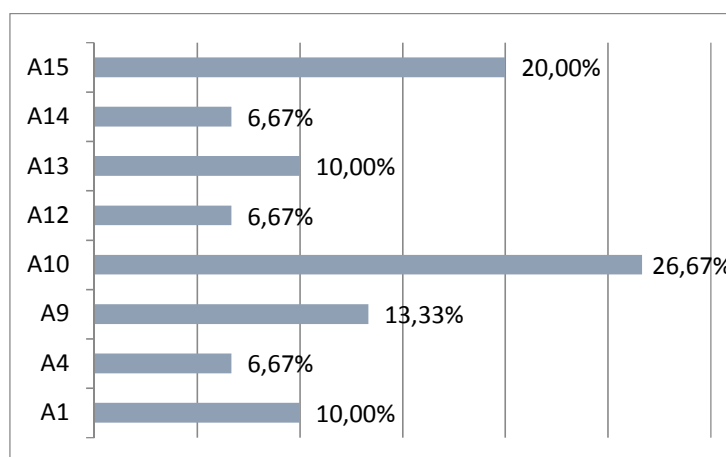


Figure 5.23 Actions related to Information Technology – SES

Primary actions	
A10	Production Planning
Secondary actions	

A15	Monitoring order processing status, Manufacturing Execution System (MES)

Table 5.96 Primary and secondary actions for Information Technology – SES

IS (Information Sharing)

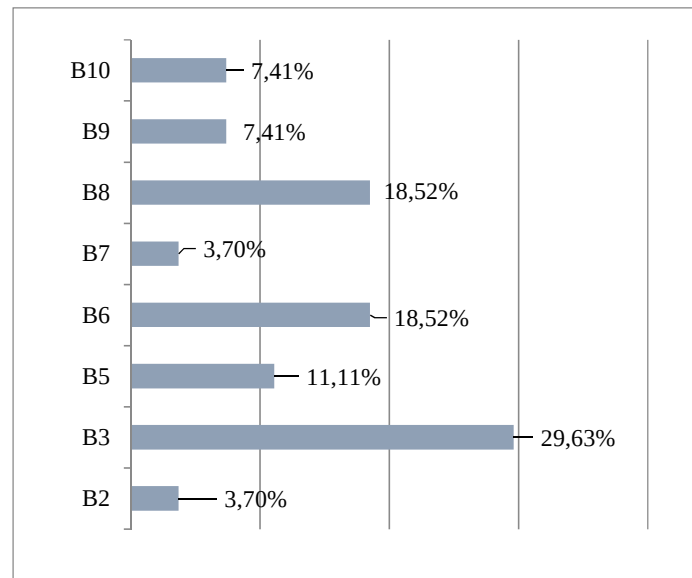


Figure 5.24 Actions related to Information Sharing – SES

Primary actions	
B3	Frequent, informal, timely information exchange
Secondary actions	
B6	Information exchange for improving supplier/client performance
B8	Mutual feedback

Table 5.97 Primary and secondary actions for Information Sharing – SES

IS – Customer to Firm

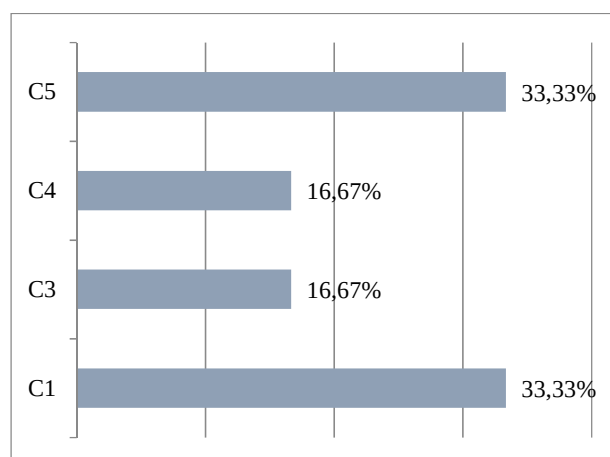


Figure 5.25 Actions related to IS – Customer to Firm – SES

Secondary actions
None, only a few companies selected this practice, so there is no significative action.

Table 5.98 Primary and secondary actions for IS – Customer to Firm – SES

IS – Firm to Customer

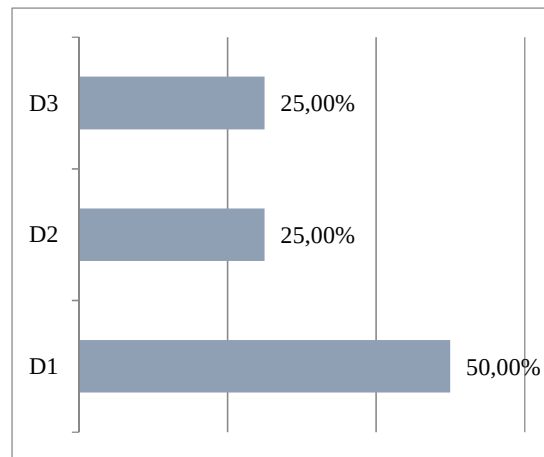


Figure 5.26 Actions related to IS – Firm to Customer – SES

Secondary actions
None, only a few companies selected this practice, so there is no significative action.

Table 5.99 Primary and secondary actions for IS – Firm to Customer – SES

Long-term Relationships with Suppliers

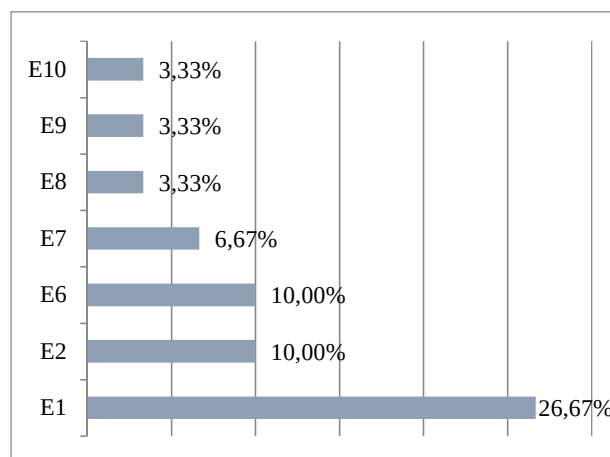


Figure 5.27 Actions related to Long-term Relationships with Suppliers – SES

Primary actions	
E1	Close relationships with strategic suppliers, commercial agreements
Secondary actions	
E2	Helping suppliers to improve their product quality (Top Management Support)
E6	Solid and durable relationships with key suppliers

	(considered as a part of the firm)

Table 5.100 Primary and secondary actions for Long-term Relationships with Suppliers – SES

Long-term Relationships with Customers

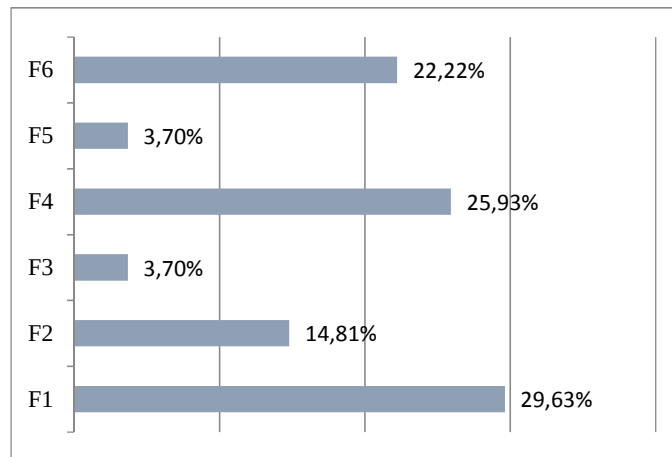


Figure 5.28 Actions related to Long-term Relationships with Customers – SES

Primary actions	
F1	Close partnership with customers
F4	Collaboration in new product development
F6	Investments for evaluating customer's future needs
Secondary actions	
F2	Resources investment to keep a well-performing supply chain (Commitment)

Table 5.101 Primary and secondary actions for Long-term Relationships with Customers – SES

Human Resource Management Practices

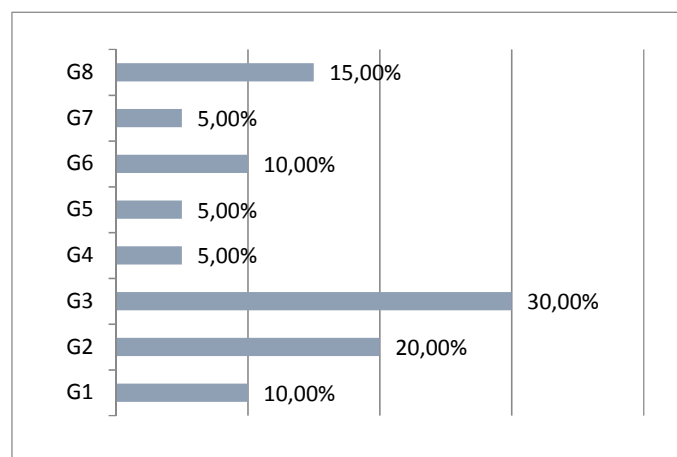


Figure 5.29 Actions related to Human Resource Management Practices – SES

Primary actions	
G3	Staff training
Secondary actions	
G2	Multi-skilled human resource selection
G8	Interdisciplinary workgroups

Table 5.102 Primary and secondary actions for Human Resource Management Practices – SES

Project Management Practices

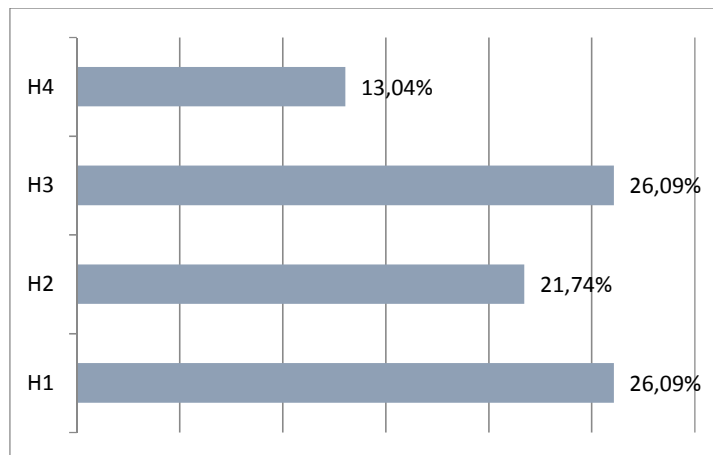


Figure 5.30 Actions related to Project Management Practices – SES

Primary actions	
H1	Risk and opportunities identification analysis methods
H2	Advanced methods for supplier selection
H3	Cost Breakdown Structure

Table 5.103 Primary and secondary actions for Project Management Practices– SES

Production System Practices

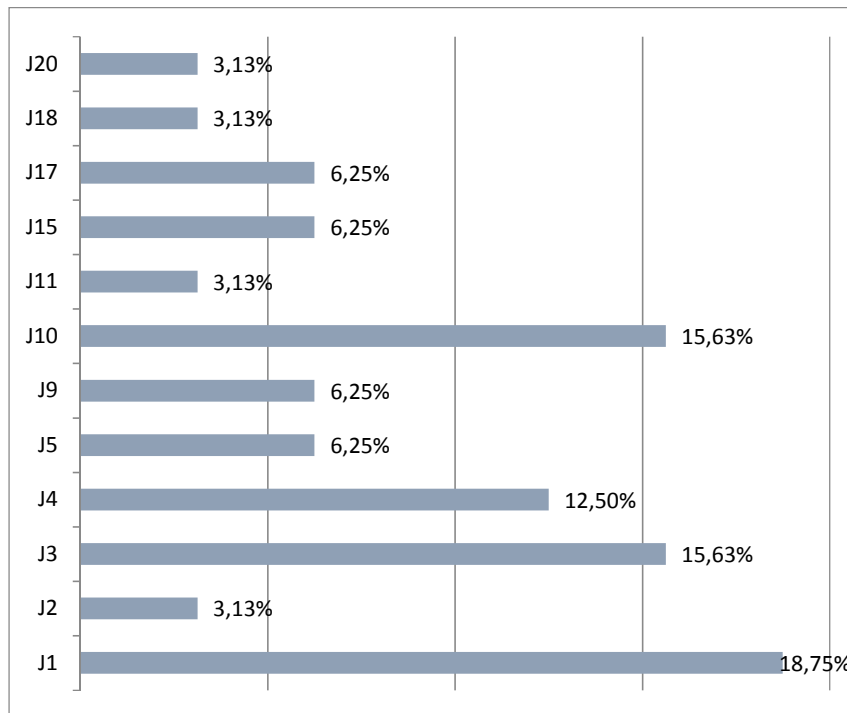


Figure 5.31 Actions related to Production System Practices – SES

Primary actions	
J1	Investments in R&D and Engineering functions
J3	Plants and machines upgrade/replacement
J4	External knowhow/technology acquisition
J10	Cycle time reduction

Table 5.104 Primary and secondary actions for Production System Practices – SES

Network

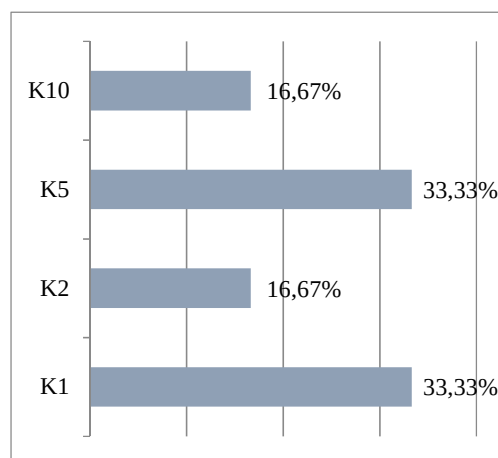


Figure 5.32 Actions related to Network – SES

Secondary actions
None, only a few companies selected this practice, so there is no significative action.

Table 5.105 Primary and secondary actions for Network – SES

Strategic Behavior

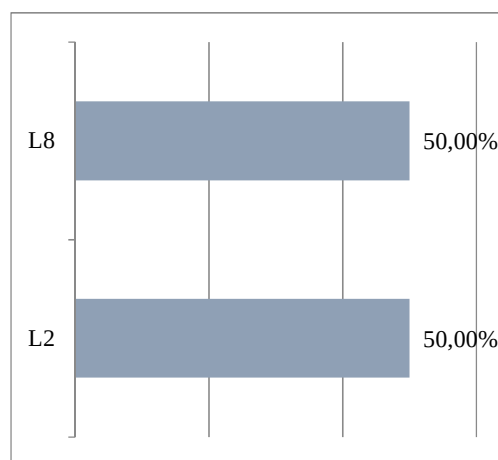


Figure 5.33 Actions related to Strategic Behavior – SES

Secondary actions
None, only a few companies selected this practice, so there is no significative action.

Table 5.106 Primary and secondary actions for Strategic Behavior – SES

Financial Practices

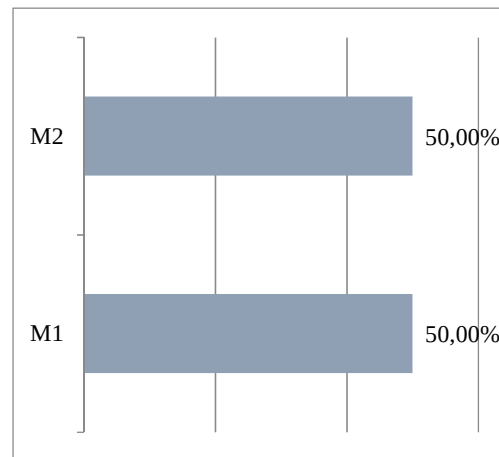


Figure 5.34 Actions related to Financial Practices – SES

Secondary actions
None, only a few companies selected this practice, so there is no significative action.

Table 5.107 Primary and secondary actions for Financial Practices– SES

5.3.2.5 Summary of the results - SES

The scope of this final section of the multi-case study is to summarize the different results that have been obtained during the previous analysis of the linkages of the elements related to the framework, in the static equipment industry.

It is possible to combine the different sets, containing the groups of elements of the framework, altogether, starting from the most targeted performance, which have been defined through the multi-case study.

The most targeted performance, for the static equipment sector, have been Price, Quality and On-time Delivery.

Before moving to the capabilities, it can be seen that this sector is aligned with the performance requested by the EPC contractors. This was an expected result, since the status of Best was attributed to the companies in the sample by the contractors themselves.

For each of those performance, one or more set of capabilities have been identified, that, if developed, could enable the performance with which they were connected. Considering all the capabilities, it becomes possible to identify the following set: Supply Chain Management Inbound, Product/Process Development Capability, Supply Chain Management Outbound, Capacity and Flexibility and Project Management Capability.

Finally, for each capability different sets of practices, common and peculiar, have been identified. The final union of these connections between performance, capabilities and practices, allows the identification of a configuration that can act as a guideline for other suppliers of the sector.

In the following tables, the different sets, coming from the previous analysis, are presented:

Performance	Capabilities	Common practices	Peculiar practices
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
			+ Production System Practices (J)
			+ No further practices to (E)

	Supply Chain Management Outbound	Long-term Relationships with Customers (F)	+ Long-term Relationships with Suppliers (E) and Production System Practices (J)
			+ Information Technology (A) and Information Sharing (B)
			+ No further practices to (F)
	Product/Process Development Capability	Long-term Relationships with Suppliers (E)	+ No further practices to (E)
		Long-term Relationships with Customers (F) and Production System Practices (J)	
		Information Sharing (B) and Human Resource Management Practices (G)	

Table 5.108 Price suggested configuration – 1 – SES

Performance	Capabilities	Common practices	Peculiar practices
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
			+ Production System Practices (J)
			+ No further practices to (E)
	Capacity and Flexibility	Production System Practices (J)	+ No further practices to (J)
			+ Information Technology (A) and Information Sharing (B)
		Long-term Relationships with Suppliers (E)	+ No further practices to (E)
	Product/Process Development Capability	Long-term Relationships with Customers (F) and Production System Practices (J)	
		Information Sharing (B) and Human Resource Management Practices (G)	

Table 5.109 Price suggested configuration – 2 – SES

Performance	Capabilities	Common practices	Peculiar practices

Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
			+ Production System Practices (J)
			+ No further practices to (E)
	Project Management Capability	Project Management Practices (J)	+ Information Technology (A), Information Sharing (B) and Long-term Relationships with Suppliers (E)
			+ Human Resource Management Capability (G)
			+ No further practices to (H)
	Product/Process Development Capability	Information Technology (A), Information Sharing (B) and Production System Practices (J)	
		Long-term Relationships with Customers (F) and Production System Practices (J)	
		Information Sharing (B) and Human Resource Management Practices (G)	

Table 5.110 Quality suggested configuration – 1 – SES

Performance	Capabilities	Common practices	Peculiar practices
Quality	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
			+ Production System Practices (J)
			+ No further practices to (E)
	Supply Chain Management Outbound	Long-term Relationships with Customers (F)	+ Long-term Relationships with Suppliers (E) and Production System Practices (J)
			+ Information Technology (A) and Information Sharing (B)

			+ No further practices to (F)
		Long-term Relationships with Suppliers (E)	+ No further practices to (E)
	Product/Process Development Capability	Long-term Relationships with Customers (F) and Production System Practices (J)	
		Information Sharing (B) and Human Resource Management Practices (G)	

Table 5.111 Quality suggested configuration – 2 – SES

Performance	Capabilities	Common practices	Peculiar practices
On-time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
			+ Production System Practices (J)
			+ No further practices to (E)
	Product/Process Development Capability	Long-term Relationships with Customers (F) and Production System Practices (J)	
		Information Sharing (B) and Human Resource Management Practices (G)	
	Project Management Capability	Project Management Practices (J)	+ Information Technology (A), Information Sharing (B) and Long-term Relationships with Suppliers (E)
			+ Human Resource Management Capability (G)
			+ No further practices to (H)
		Information Technology (A), Information Sharing (B) and Production System Practices (J)	

Table 5.112 On-time Delivery suggested configuration – 1 – SES

Performance	Capabilities	Common practices	Peculiar practices
On-time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
			+ Production System Practices (J)
			+ No further practices to (E)
	Capacity and Flexibility	Production System Practices (J)	+ No further practices to (J)
			+ Information Technology (A) and Information Sharing (B)
	Product/Process Development Capability	Long-term Relationships with Suppliers (E)	+ No further practices to (E)
		Long-term Relationships with Customers (F) and Production System Practices (J)	
		Information Sharing (B) and Human Resource Management Practices (G)	

Table 5.113 On-time Delivery suggested configuration – 2 – SES

Performance	Capabilities	Common practices	Peculiar practices
On-time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E)	+ Information Technology (A) and Information Sharing (B)
			+ Production System Practices (J)
			+ No further practices to (E)
	Supply Chain Management Outbound	Long-term Relationships with Customers (F)	+ Long-term Relationships with Suppliers (E) and Production System Practices (J)
			+ Information Technology (A) and Information Sharing (B)
			+ No further practices to (F)
	Product/Process Development Capability	Long-term Relationships with Suppliers (E)	+ No further practices to (E)
		Long-term Relationships with Customers (F) and Production System Practices (J)	

		Information Sharing (B) and Human Resource Management Practices (G)	

Table 5.114 On-time Delivery suggested configuration – 3 – SES

5.3.3 Switchgears sector

5.3.3.1 Performance – SWS

In the following table, the performance selected will be listed, allowing us to see which competitive elements each company uses to survive in each product/market scenario.

Company	SWS - 1	SWS – 2	SWS – 3	SWS – 4	SWS - 5	SWS - 6	SWS - 7	SWS - 8	SWS - 9	Frequency
Core after-sales services	high	high	low	high	low	medium	high	high	low	
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high	
Foreign Branches	low	high	low	low	low	high	low	high	high	
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes	
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50	
Price			x			x			x	3
Quality	x	x	x	x		x	x			6
Engineering	x	x	x		x			x	x	6
Flexibility (SC)				x	x		x		x	4
On-time Delivery		x		x		x	x			4
Lead-time					x					1
Commercial Impact								x		1
Service								x		1

Table 5.115 Performance – SWS



Figure 5.35 Performance – SWS

It is possible to notice that there is no company that selected a different supply chain configuration for different products or markets.

The selection of the companies is quite wide and it comprehends five different performance that are chosen as the most important:

- Quality;
- Engineering;
- On-time delivery;
- Flexibility (SC);
- Price.

It can be surprising, given that the EPC contractors always highlights the importance of the performance of Price, to see that it's only the fifth performance indicators, with just half of the frequency of selection of Quality and Engineering. This can be explained considering that companies do not usually use Price as a driver to gain advantage on competitors, but they rather use it to align to the customers' requests, exploiting other factors to win the order. They do not win the orders because they are much cheaper, but because they are better in offering something else, given that they're able to match the economic needs of the EPC.

Usually the customers in the Oil&Gas are very exigent on requiring proven technology with 5-10 years of consolidated use, and this aspect is increased in Switchgear sector, which has products that are very mature and with a low degree of innovation. Thus, the Quality, that can be seen as compliance of the product to technical specifications, becomes extremely important and it represents a cutting performance to access the project vendor list of the end users.

Quality can be penalizing respect to the Italian switchgear suppliers since it forces them to use internal electrical components bought from the multinationals of the factors, thus limiting the impact on the personalization that the company can have on the switchgear.

Since the Italian suppliers usually have to face, during the bidding phase, multinationals, their capability of being flexible on both supply chain and products portfolio becomes critical and this is reflected on the high frequency of selection Flexibility and Engineering.

The Engineering is extremely important because it is used by these companies to adapt the initial structure of the switchgear, that is usually standardized, to the specific requirements of the clients and this is something that the bigger companies are not able to do so easily. All the best performers, except partially one exception, purchase the electrical component, but they own the know-how of their switchgears, thus allowing them to have a much higher degree of personalization of the final product. This product flexibility is spread on all the products belonging to their portfolio.

Another important performance is Flexibility (of the Supply Chain), that is viewed as a typical feature of the Italian small-medium company. This is very important because it helps getting uncertain orders, since the customer will know that he can count on the ability of the company to get the modifications required in a relatively short time and, once again, in a market dominated by huge companies, this is a feature that can give them an edge. Usually flexibility is achieved both internally, creating a system that, along with the relatively small dimension of the company, helps sharing and handling with responsiveness and in the proper way the modifications required, and externally, selecting suppliers close to the firm, where possible, that are able to follow the necessities of the customers. Furthermore, the bulk of these companies produce the switchgear internally and this helps having a more flexible production system and a much higher control on the finished products.

The last main performance is the On-time delivery, whose importance is very high because it helps the company gaining the trust of both the end user and the EPC contractor. In this sector, though, On-time delivery is less important, because the switchgears usually come later in the project, thus leaving the supplier more time for its completion.

Other than those five performances, the respondents identified three other main indicators, that are:

- Commercial Impact;
- Service;
- Lead-time.

These three performances have always been selected only once, and Commercial Impact and Service have been chosen by the same respondent.

Commercial impact has been selected since the company invested a lot in their brand and in customer satisfaction, so that the customer itself could experience an extremely positive service, in both completeness and quality and this helped them in entering end user's project vendor lists. They created commercial branches that could help reducing the distance with customer, fostering the exchange of information, that in this kind of project is fundamental.

The selection of Service goes along with this kind of conversation, given that the services, in particular installation, pre-commissioning, commissioning and eventual modifications, are becoming of increasing importance and they help getting closer to the customers, maintaining long-term relationships with them. Service is growing in importance also in other companies, but it has not become core yet. *It's relevant to notice that the company that selected these two performance considers them two factors that can be used to win orders by customers, but always satisfying the minimum level of quality of the products required and providing prices aligned with the market.*

Finally, one company selected the Lead-time, that is very important especially considering the big companies as primary competitors on the market. In fact, Lead-time can be recollected to it has been said before about the importance of flexibility, that in this case allows the company to supply an order in a much shorter period of time than other competitors.

The following performance haven't been selected:

- Differentiation;
- Variety;
- Innovation;
- Knowledge;
- Financial;
- Communication.

The lack of selection of the first four performance above is characteristic of this sector. Given that, as we said, the product portfolio is steady, and the products have reached a very high level of maturity, it is very difficult to supply to the customer something peculiar. Furthermore, since the EPC contractor are gathering the orders regarding low and medium tension switchgears, it's fundamental for the suppliers to provide the complete portfolio, otherwise they would not be able to compete at all on this market.

It's also difficult to talk about Innovation, since the technological components of the switchgear, the electrical ones, are almost entirely supplied by external companies, thus reducing the possibility of a specific supplier to provide strong innovation or a product much more unique than others. Suppliers are starting to increase the level of automation inside the switchgear, but it is still not enough to consider the Innovation an important factor of competitive advantage.

The Financial indicator is a tricky one, because these companies don't have any problem in satisfying orders that can fit their production capacity or their overall dimension, because they created an adequate economical and insurance support. But being all small-medium companies don't allow them to obtain bigger orders and this is a problem that also the EPC contractors pointed out.

It's noticeable that best performers of the switchgears sector mainly focus on five performances, almost disregarding the others and this indicates that the sector tends to follow a common thread and it is possible to suggest other companies to focus on these elements:

Performance
Quality
Engineering
On-time Delivery
Flexibility (SC)
Price

Table 5.116 Recommended performance – SWS

In order to continue the analysis of the switchgears sector, the focus will be of the other elements, capabilities and practices, related to the five main performance the we selected above, identifying possible competitive supply chain configurations.

5.3.3.2 Performance-Capabilities – SWS

In this section, it is shown how the most important performance are enabled by best performers of switchgears sector, identifying which are the most critical and the most selected capabilities. The analysis will run through the performance, listed in order of frequency of selection.

Quality

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 6	SWS – 7	Frequency

Core after-sales services	high	high	low	high	medium	high	
Direct Interaction with End Users	low	high	low	medium	low	low	
Foreign Branches	low	high	low	low	high	low	
Group Belonging	No	No	No	Yes	Yes	No	
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	
Supply Chain Management Inbound	X						1
Knowledge Management Capability	X	X	X	X	X	X	6
Product/Process Development Capability	X	X	X	X	X	X	6
Customer Service		X		X		X	3
Relationship Capability					X		1
External Integration			X				1

Table 5.117 Quality – SWS

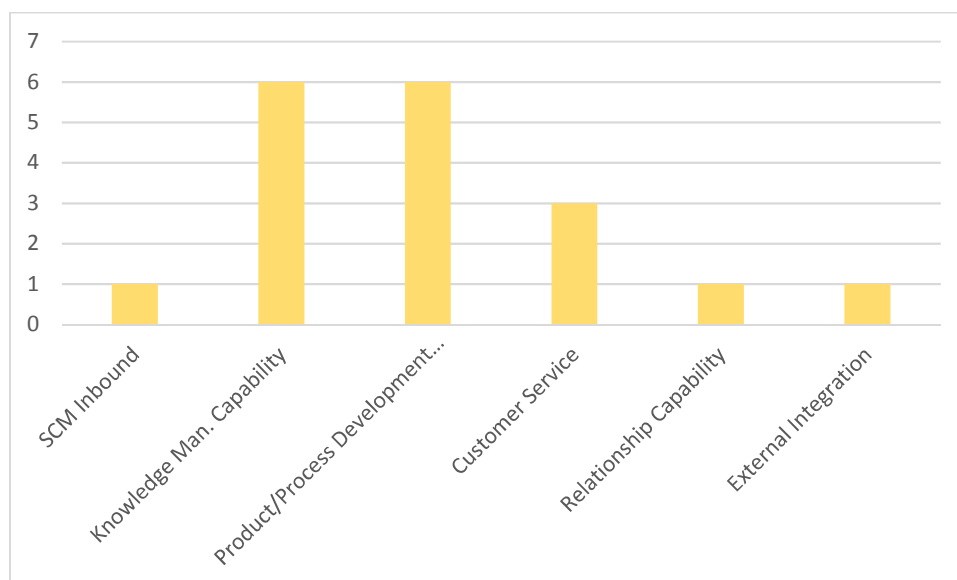


Figure 5.36 Quality overview – SWS

In this sector, the utilization of the capabilities of Knowledge Management and Product/Process Development are of paramount importance and they cannot be overlooked. The first one allows the accumulation and usage of the knowledge that is required for the creation of switchgears that fit customers' requirements, thanks to internal knowledge, certifications and external know-how. Product/Process Development Capability is, instead, considered because it allows the rightful usage of the production processes to effectively create the panelboards, also considering the possible customization required by each customer.

While these performance are always selected, another importance performance is Customer Service, since, it helps providing switchgears whose quality is usually higher than market. Furthermore, this capability is selected by companies that have after-sales services as core activities that are packaged to the switchgears.

Since, on average, switchgears sector is vertically integrated, the performance related to suppliers are less selected. SCM Inbound, External Integration and Relationships Capability are considered just once, since these companies are more focused on internal creation, rather than management of suppliers, or eventual relationships with customers or competitors.

Performance	Set – 1 of capabilities
Quality	Knowledge Management Capability
	Product/Process Development Capability
	Customer Service

Table 5.118 Recommended Quality enabling capabilities – SWS

Engineering

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 5	SWS – 8	SWS – 9	Frequency
Core after-sales services	high	high	low	low	high	low	
Direct Interaction with End Users	low	high	low	low	high	high	
Foreign Branches	low	high	low	low	high	high	
Group Belonging	No	No	No	Yes	No	Yes	
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	

Knowledge Management Capability	X	X	X	X		X	5
Product/Process Development Capability		X	X	X	X		4
Customer Service					X		1
Relationship Capability	X	X	X			X	4
External Integration					X		1

Table 5.119 Engineering – SWS

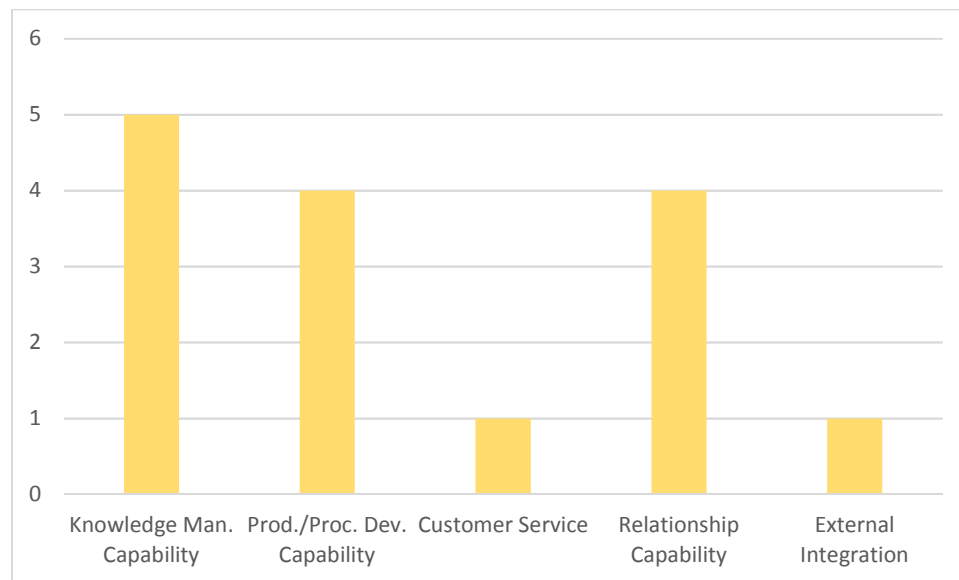


Figure 5.37 Engineering overview – SWS

Engineering performance is mainly enabled, by best performers, through the usage of three capabilities that are Knowledge Management Capability, Product/Process Development Capability and Relationship Capability. This performance is selected by companies without a precise pattern.

Its structure is very similar to the one obtained for the performance of Quality, since also in this case, great importance is attributed to the spread knowledge inside the company and to the ability properly correctly manufacture a switchgear. The technical capacity required is usually developed internally, through a mixture of previous experience and investment on R&D, that allow the company to be flexible to the requests of customization of the end users.

In this sector, it is of paramount importance the Relationship Capability, that is more oriented to establish great relationships with multinationals that are suppliers/competitors, which provide them the electrical components. These alliances have the importance of helping the two companies to increase collaboration on product development, thus increasing the technical ability.

Customer service can favor Engineering if the company succeed in providing support from the projecting and decisional phases, being able to actively contribute to the development of the switchgear.

Performance	Set – 1 of capabilities
Engineering	Knowledge Management Capability
	Product/Process Development Capability
	Relationship Capability

Table 5.120 Recommended Engineering enabling capabilities – SWS

On-time Delivery

Company	SWS – 2	SWS – 4	SWS – 6	SWS – 7	Frequency
Core after-sales services	high	high	medium	high	
Direct Interaction with End Users	high	medium	low	low	
Foreign Branches	high	low	high	low	
Group Belonging	No	Yes	Yes	No	
Turnover [Mln €]	20-50	20-50	20-50	20-50	
Supply Chain Management Inbound	X		X	X	3
Supply Chain Management Outbound			X	X	2
Product/Process Development Capability	X		X		2
Capacity and Flexibility		X		X	2
Relationship Capability		X			1

Table 5.121 On-time Delivery – SWS

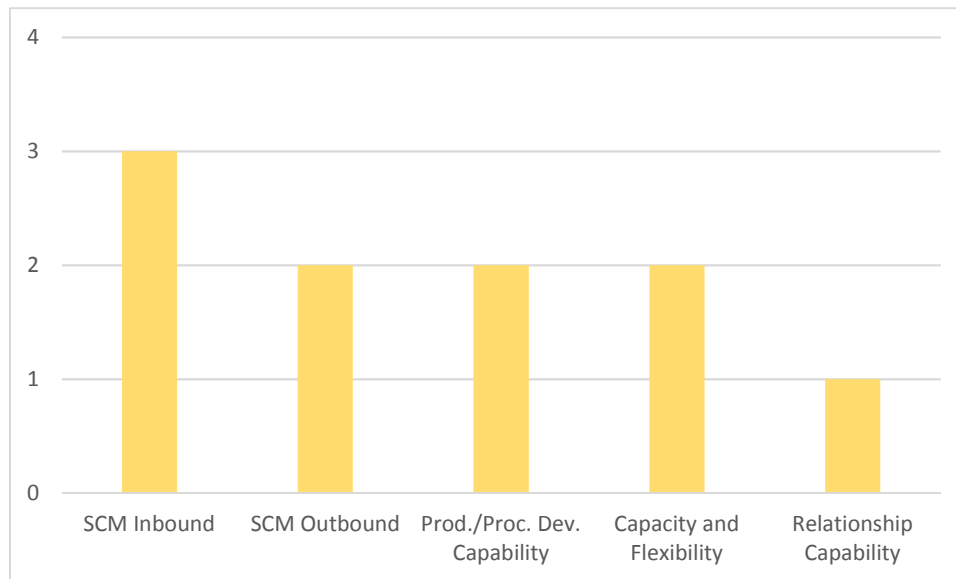


Figure 5.38 On-time Delivery overview – SWS

The enabling of On-time Delivery depends primarily on four different capabilities, that can be combined in two different ways. These capabilities target this performance through the management of both sides of the supply chain, with Supply Chain Management Inbound and Outbound, through an internal capability, related to the development of a more controlled production process, such as Product/Process Development Capability, or thanks to Capacity and Flexibility.

Supply Chain Management Inbound appears to be the most important capability, since it is selected in three cases out of four, since handling a reliable network of suppliers can help satisfying sudden variation in product's requirements, still being able to deliver the product at the right delivery date. Similarly, managing correctly the other side of the supply chain is almost as important, thanks to the proper monitoring of the warehouse and an effective delivery system.

The reduction of uncertainties during of the production process can help in this direction too; vertical integration can also provide a stronger control on work-in-progress. Also, Capacity and Flexibility can help in case there are urgent modifications, being ready with an internal buffer of capacity or relying on its own network of suppliers. In particular, it is very important to develop long-term partnerships with key companies, such as electrical components' suppliers, since it helps reducing the delivery time of these parts.

Performance	Set – 1 of capabilities
On-time Delivery	Supply Chain Management Inbound
	Supply Chain Management Outbound
	Product/Process Development Capability

Table 5.122 Recommended On-time Delivery enabling capabilities – SWS – 1

Performance	Set – 2 of capabilities
On-time Delivery	Supply Chain Management Inbound
	Supply Chain Management Outbound
	Capacity and Flexibility

Table 5.123 Recommended On-time Delivery enabling capabilities – SWS – 2

On-time Delivery can be mainly enabled through two combinations of capabilities; while having full control of the supply chain, through Supply Chain Management Inbound and Outbound, is considered fundamental,

in the other case the company can decide to opt for the improvement of the production system or the increase of flexibility.

Flexibility (SC)

Company	SWS – 4	SWS – 5	SWS – 7	SWS – 9	Frequency
Core after-sales services	high	low	high	low	
Direct Interaction with End Users	medium	low	low	high	
Foreign Branches	low	low	low	high	
Group Belonging	Yes	Yes	No	Yes	
Turnover [Mln €]	20-50	20-50	20-50	20-50	
Supply Chain Management Inbound				X	1
Knowledge Management Capability	X	X			2
Capacity and Flexibility	X	X	X	X	4
Customer Service		X			1
Relationship Capability	X		X		2
Project Management Capability				X	1

Table 5.124 Flexibility (SC) – SWS

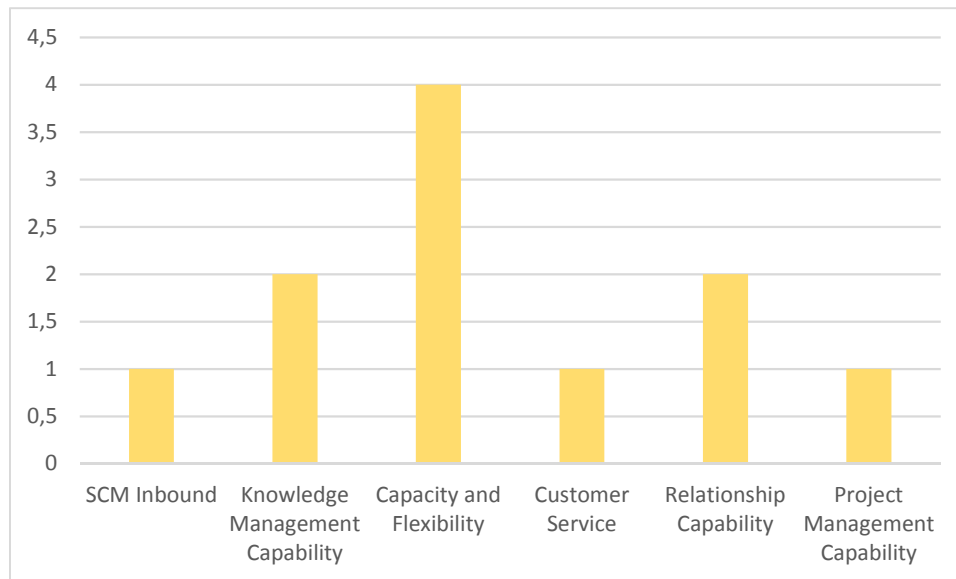


Figure 5.39 Flexibility (SC) overview – SWS

The irreplaceable capability required to gain Flexibility (SC) is Capacity and Flexibility, that is used when the firm decides to focus on managing the production capacity and the network of suppliers in order to be flexible and ready to react to possible modifications of the order. Flexibility (SC) is not only related to modifications in of the order during its development, but it is also related to the capability of adapt volume, production and capacity, thus requiring the development of internal resources that can handle this flexibility, Knowledge Management Capability, and the management of collaborations with suppliers, customers or competitors, that lead to the choice of Relationship Capability.

These three capabilities define the set that it is suggested for the creation and strengthening of this performance. Among the other possibilities there is Customer Service, since the closeness to customers can favor the reaction to possible variations; especially in this sector, where there are suppliers that are used almost entirely to cover peaks of demand, it becomes important to be able to properly handle them, thus requiring the capability of Supply Chain Management Inbound; the last capability that can be used is Project Management Capability, which has been selected by the only company that belongs to a big group, mainly related to large engineering projects environment. This capability can be necessary because in larger project it is requested the capability of being flexible on different elements and the use of a proper Project Manager can be of paramount importance to control these different aspects.

Performance	Set – 1 of capabilities
Flexibility (SC)	Capacity and Flexibility
	Knowledge Management Capability
	Relationship Capability

Table 5.125 Recommended Flexibility (SC) enabling capabilities – SWS

Price

Company	SWS – 3	SWS – 6	SWS – 9	Frequency
Core after-sales services	low	medium	high	

Direct Interaction with End Users	low	low	low	
Foreign Branches	low	high	low	
Group Belonging	No	Yes	No	
Turnover [Mln €]	20-50	20-50	20-50	
Supply Chain Management Inbound	X	X		2
Product/Process Development Capability		X	X	2
Capacity and Flexibility		X		1
Relationship Capability	X			1
Project Management Capability			X	1

Table 5.126 Price – SWS

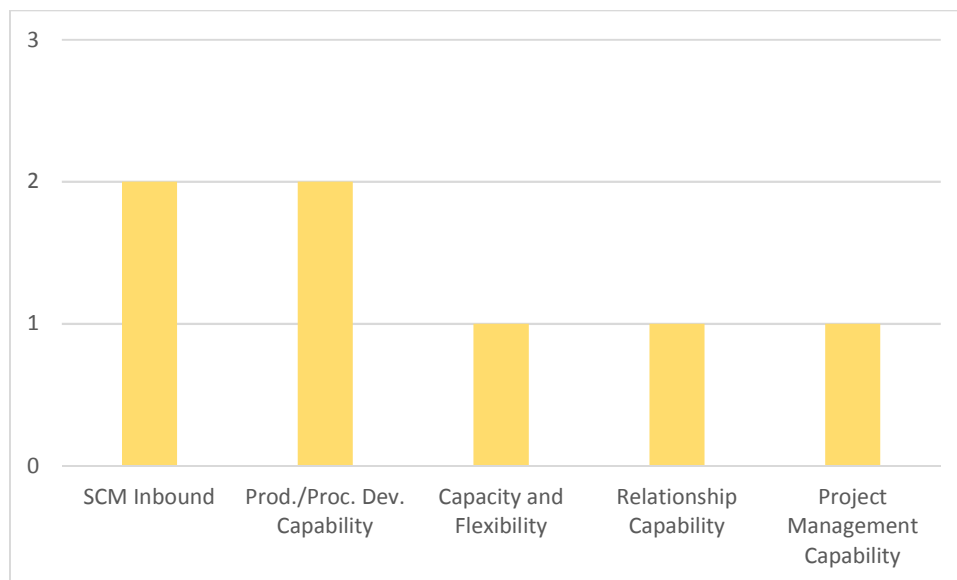


Figure 5.40 Price overview – SWS

Price has been heterogeneously selected and there are 5 capabilities that have a frequency of selection of at least one. This performance is mainly obtained through the utilization of Supply Chain Management Inbound and Product/Process Development Capability.

SCM Inbound is required to handle the network of suppliers, paying attention on purchasing activities, especially when talking about electrical component suppliers. This is highlighted by the only company which does not consider Product/Process Development as a necessary capability, strengthening the SCM Inbound

capability with the Relationship Capability, confirming the importance of the management of the network of the whole supply chain, spending in control in order not to lose later in the development of the order, because of mismanagement of purchasing or delivery.

Product/Process Development Capability is required to reduce costs due to scraps during workings or to missed production, that can happen when there is a strong manual component in the assembly line, thus increasing the uncertainty, or the machines are old unreliable. Similarly, Capacity and Flexibility can be used to reduce the risk of losing margin on the order because the firm has not been able to anticipate or adapt to possible modifications, that can lead, for example, to delays in the delivery.

PM Capability can be used to optimize the interface with customers, reducing costs due to compliance and providing the image of a company that is not claim-oriented. Furthermore, being able to use Project Management allows company to reduce contingency costs, that are related to the risk of the order.

Performance	Set – 1 of capabilities
Price	Supply Chain Management Inbound
	Product/Process Development Capability
	Capacity and Flexibility

Table 5.127 Recommended Price enabling capabilities – SWS – 1

Performance	Set – 2 of capabilities
Price	Supply Chain Management Inbound
	Product/Process Development Capability
	Relationship Capability

Table 5.128 Recommended Price enabling capabilities – SWS – 2

Performance	Set – 3 of capabilities
Price	Supply Chain Management Inbound
	Product/Process Development Capability
	Project Management Capability

Table 5.129 Recommended Price enabling capabilities – SWS – 3

Lead-time

Company	SWS – 5	Frequency
Core after-sales services	low	
Direct Interaction with End Users	low	
Foreign Branches	low	
Group Belonging	Yes	

Turnover [Mln €]	20-50	
Supply Chain Management Inbound	X	1
Capacity and Flexibility	X	1

Table 5.130 Lead-time – SWS

This performance has only been selected once. Managing a local network of suppliers is useful since it allows to be able to react quickly to order and to provide products is less time than competitors. Also, along with continuous interaction with suppliers, it is important to be internally flexible, through a cautious usage and monitoring of the production capacity, to be always ready to accept an order and to complete it as fast as possible.

Commercial Impact

Company	SWS – 8	Frequency
Core after-sales services	high	
Direct Interaction with End Users	high	
Foreign Branches	high	
Group Belonging	No	
Turnover [Mln €]	20-50	
Knowledge Management Capability	X	1
Customer Service	X	1
Market Capability	X	1

Table 5.131 Commercial Impact – SWS

This performance has been selected, along with Service, by a company that invests a lot in customer satisfaction, in order to provide the most complete and efficient to its clients. These capabilities are oriented toward this concept; Knowledge Management Capability is the base with which it is possible to continuously have knowledge about the clients' and acquiring the necessary information and technologies related to certifications. While KM Capability is more related to the technical side, Market Development Capability

concerns with an effective side of identification of customers, identifying new markets and assessing strategic positions to be able, in the future, to seize an opportunity. Finally, Customer Service is used to monitor the development of the order and to adapt it, whenever the client requires modifications, or, moreover, it needs help during the design phase.

Service

Company	SWS – 8	Frequency
Core after-sales services	high	
Direct Interaction with End Users	high	
Foreign Branches	high	
Group Belonging	No	
Turnover [Mln €]	20-50	
Supply Chain Management Outbound	X	1
Customer Service	X	1
External Integration	X	1

Table 5.132 Service – SWS

As previously anticipated, this performance goes together with Commercial Impact. Service deals with the attempt of the company to maintain under strict control the experience and the delivery of the order, thus, it becomes necessary to utilize capabilities, such as Supply Chain Management Outbound, Customer Service, and External Integration. The first one is used because it helps to improve the management of the warehouse of finished products, optimizing the phase that precedes the shipping; Customer Service allows the supplier to be closer, through local companies, to the customer, improving not only the delivery, but also the installation and the after-sales services; External Integration is needed to better coordinate the elements in the supply chain and to maintain updated the status of the order.

In the following table, the capabilities, that are required and suggested to enable the five most important performance of the sector, are listed:

Capabilities
Production/Process Development Capability

Knowledge Management Capability
Capacity and Flexibility
Relationship Capability
Supply Chain Management Inbound
Customer Service
Supply Chain Management Outbound
Project Management Capability

Table 5.133 Recommended capabilities – SWS

5.3.2.3 Capability-Practices – SWS

The multi-case analysis is going to conclude with the relationships between each capability and the practices that can be used to enable and enhance it. After a table in which, for each capability, the practices selected by each company are shown and described, another table will provide which are the suggested combinations of practices that should be used, according to the indication suggested during the interview; in particular, it is possible to distinguish common and peculiar practices, with the first kind being selected by the majority of firms, while the latter used in addition of common ones because of their synergic effect.

The number of selected actions of a practice for each single company is shown thanks to a chromatic reference, explained below:

Legend	
Color	Explanation
	In order to enable the capability, the company indicates more than three actions
	In order to enable the capability, the company indicates three actions
	In order to enable the capability, the company indicates two actions
	In order to enable the capability, the company indicates a single action

Table 5.134 Number of actions selected for practice

Supply Chain Management Inbound

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high

Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
A IT- Information Technology									
B IS - Information Sharing									
E Long-term Relationships with Suppliers									
G Human Resource Management Practices									
J Production System Practices									
K Network									

Table 5.135 Supply Chain Management Inbound – SWS

Supply Chain Management Inbound is a very important capability that, in switchgears industry, presents different possible combinations of practices.

The most important practice is Long-term Relationship with Suppliers, since it is the one that allows the company to generate strong alliances with suppliers, enhancing the control and synchronization with them. Network is very used especially when local suppliers are involved, and it often happens in this sector, and can be used with Long-term Relationships with Suppliers to improve its effects. These two practices can be used alone or they can be used plugging other ones, such as Information Technology alone, that helps the communication, or along with Production System Practices, which can help with the management of the warehouse, thus providing a better control on downstream supply chain.

Two companies, extremely different, selected a combination of three different practices to access Supply Chain Management Inbound, that are Information Technology, Information Sharing and Network, meaning that it is not mandatory to have long relationships with suppliers, but, if they are close, a strong communication system is enough to synchronize flows.

Capability	Common practices	Peculiar Practices
Supply Chain Management Inbound	Long-term Relationships with Suppliers (E), Network (K)	+ Information Technology (A)
		+ Information Technology (A) and Production System Practices (J)
		+ No further practices for (E), (K)

	Information Technology (A), Information Sharing (B), Network (K)	

Table 5.136 Recommended practices for Supply Chain Management Inbound – SWS

Supply Chain Management Outbound

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
A IT - Information Technology									
H Project Management Practices									
J Production System Practices									
K Network									

Table 5.137 Supply Chain Management Outbound – SWS

This capability has been selected by three companies, using similar combination of practices. Supply Chain Management Outbound can be enabled just using Production System Practices, since an updated assembly line and automatic warehouse can strongly enhance the control of finite products. Yet, this practice can benefit of synergic effects given by the combination with Information Technology, that improves internal coordination and the management of the warehouse and Network, since it improves the delivery of the product in the right conditions to the clients. Network is, in fact, selected by a company with a strong presence on foreign market, that allows a better coordination of the delivery phase.

Furthermore, one company selected the Project Management Practices, since they help monitoring all the phases of the order, anticipating risks and controlling the timing and synchronization of the activities.

Capability	Common practices	Peculiar Practices
Supply Chain Management Outbound	Production System Practices (J)	+ Information Technology (A), Project Management Practices (H), Network (K)
		+ Information Technology (A)
		+ No further practices to (J)

Table 5.138 Recommended practices for Supply Chain Management Outbound – SWS

Knowledge Management Capability

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50

A IT- Information Technology									
B IS - Information Sharing									
C IS - Customer to Firm									
E Long-term Relationships with Suppliers									
G Human Resource Management Practices									
J Production System Practices									
K Network									

Table 5.139 Knowledge Management Capability – SWS

Knowledge Management Capability is extremely powerful and it is selected by 8 companies out of 9. These suppliers insisted on the importance of being able to provide a system of spread knowledge inside the company related to the products and the certifications required for the end users, in order to be able to face any customization requested by the clients, other than supply high quality products.

Other than a few exceptions, the capability is achieved through continuous investments in acquisition of certifications and external know-how, thus Production System Practices, and training of skilled personnel, provided by Human Resource Management Practices. Given the specificity of the sector, it is necessary to train internally the operators, since it is very difficult to acquire them from outside the boundaries of the firm.

Capability	Common practices
Knowledge Management Capability	Human Resource Management Practices (G) and Production System Practices (J)

Table 5.140 Recommended practices for Knowledge Management Capability – SWS

Product/Process Development Capability

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low

Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
A IT - Information Technology									
C IS - Customer to Firm									
E Long-term Relationships with Suppliers									
F Long-term Relationships with Customers									
G Human Resource Management Practices									
H Project Management Practices									
J Production System Practices									

Table 5.141 Production/Process Development Capability – SWS

Along with Knowledge Management Capability, this is another extremely important capability, testified by the fact that it has been selected by all the respondents, since this sector has a quite high level of vertical integration. Other than one company, the ability of producing products of quality and tailored to customers' needs is provided by an updated assembly line, that must be able to provide all the variations that the firm desire to implement to its product.

Furthermore, the capability of producing customized products for the clients, other than the possession of a technologic and automated production line, can be fostered by a continuous information exchange with customers and by mean of Information Technology.

Capability	Common practices	Peculiar practices

Product/Process Development Capability	Production System Practices (J)	+ Information Sharing – Customer to Firm (C)
		+ Information Technology (A)
		+ No further practices to (J)

Table 5.142 Recommended practices for Production/Process Development Capability – SWS

Capacity and Flexibility

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
A IT- Information Technology									
B IS - Information Sharing									
C IS - Customer to Firm									
E Long-term Relationships with Suppliers									

G Human Resource Management Practices									
J Production System Practices									
K Network									

Table 5.143 Capacity and Flexibility – SWS

Capacity and Flexibility is quite important in the switchgears sector. Its main foundation lies on the practices of Long-term Relationships with suppliers and Production System Practices, creating flexibility both internally than externally, thanks to a reliable network of suppliers, which are often used, in this sector, in order to cover secondary operations during peaks of demand.

The high level of vertical integration contributes to the necessity of having strong internal control of the process. There are several combinations of practices that can have an positive synergic impact on Capacity and Flexibility, along with relationships with suppliers and productions system: Network means having close suppliers that can be easily contacted for sudden modifications of the order or damages inside the plant; Human Resource Management Practices are required to have skilled operators, able to adjust their schedule in case of unforeseen modifications; Information Sharing and Information Technology contribute in improving the internal flow of information and to increase the level of control n the activities, thus being able to react more quickly to possible perturbations.

Capability	Common practices	Peculiar Practices
Capacity and Flexibility	Long-term Relationships with Suppliers (E) and Production System Practices (J)	+ Human Resource Management Practices (G) and Network (K)
		+ Information Technology (A)
		+ Information Sharing (B)
		+ No further practices to (E) and (J)

Table 5.144 Recommended practices for Capacity and Flexibility – SWS

Relationship Capability

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high

Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
A IT- Information Technology									
B IS - Information Sharing									
C IS - Customer to Firm									
E Long-term Relationships with Suppliers									
F Long-term Relationships with Customers									
H Project Management Practices									
J Production System Practices									
K Network									

Table 5.145 Relationship Capability – SWS

The Relationship Capability is quite used in this sector since, other than the usual relationships with customers and suppliers, typical of an ETO company, these firms have also to interact with possible competitors/suppliers, in order to buy electrical components.

The possible guidelines for this capability are quite complex and intertwined, since there are several different practices that can be used for its unlocking. Other than the usual long-term relationships with both customers and suppliers, it is also useful to use Network, in order to be close to them and favor communication. Also the information sharing is strictly necessary, since it is required to favor the coordination with the three entities of the supply chain, competitors, customers and clients, and having an higher number of entities, it is of paramount importance of being able to communicate appropriately.

Project Management Practices can be quite useful, since they allow a better communication with customers and a proper identification of its needs, that positively reflect on what to ask to suppliers.

Capability	Common practices	Peculiar Practices
Relationship Capability	Information Sharing – Firm to Customer (C), Long-term Relationships with Customers (F)	+ Project Management Practices (H)
		+ Production System Practices (J)
		+ Project Management Practices (H) and Network (K)
	Long-term Relationships with Suppliers (E), Long-term Relationships with Customers (F) and Network (K)	+ Information Sharing (B) and Information Sharing – Firm to Customer (C) + No further practices to (E), (F) and (K)

Table 5.146 Recommended practices for Relationship Capability – SWS

Customer Service

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
B IS - Information Sharing									

E Long-term Relationships with Suppliers									
F Long-term Relationships with Customers									
G Human Resource Management Practices									
K Network									

Table 5.147 Customer Service – SWS

The main practice selected for the Customer Service is the Long-term Relationships with Customers, that is required to quickly identify and respond to possible modifications of the orders. Three out of four companies that selected the practice of Network possess branches close to the most important end users, since they know that the proximity to the customer favors both the delivery timing and the capability of accessing to certifications, thus providing high quality and customized products.

Only one company did not select the Long-term Relationships with Customers since, in order to provide high quality products to the clients, it is just necessary to be close to the suppliers and having a continuous information exchange, that enable the company to provide high standard items.

Capability	Common practices	Peculiar Practices
Customer Service	Long-term Relationships with Customers (F), Network (K)	+ Information Sharing (B)
		+ Long-term Relationships with Suppliers (E)
		+ No further practices for (F), (K)
	Information Sharing (B), Long-term Relationships with Suppliers (E) and Human Resource Management Practices (G)	

Table 5.148 Recommended practices for Customer Service – SWS

Project Management Capability

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high

Foreign Branches	low	high	low	low	low	high	low	high	high
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
B IS - Information Sharing									
F Long-term Relationships with Customers									
H Project Management Practices									

Table 5.149 Project Management Capability – SWS

Even if Project Management Capability has been selected just once, it has been noticed how it can positively impact on the reduction of costs. The only company that selected this performance is also the only firm with a big, international group behind them, meaning that it can also face big orders, thus requiring this capability to properly handle the load. Furthermore, even if not selected, the Project Management started being considered more and more by the other suppliers, thus the decision of including it among the important capabilities. Other than, of course, Project Management Practices, this capability can be favored by the selection of Information sharing with clients and Long-term Relationships with Customers, which strengthen the approach with which project requirements are discussed with contractors or end users.

Capability	Common practices
Project Management Capability	IS – Customer to Firm (C), Long-term Relationships with Customers (F), Project Management Practices (H)

Table 5.150 Recommended practices for Project Management Capability – SWS

Market Development Capability

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low

Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high
Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
L Strategic Behaviour									

Table 5.151 Market Development Capability – SWS

Market Development Capability has been selected only once by a firm that has as a core strategy, its own brand and the capability of fully satisfying all customers' requirements. In order to enable this capability, the only necessary practice has been Strategic Behavior.

External Integration

Company	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9
After-sales services – core	high	high	low	high	low	medium	high	high	low
Direct Interaction with End Users	low	high	low	medium	low	low	low	high	high
Foreign Branches	low	high	low	low	low	high	low	high	high

Group Belonging	No	No	No	Yes	Yes	Yes	No	No	Yes
Turnover [Mln €]	< 20	20-50	20-50	20-50	20-50	20-50	20-50	20-50	20-50
B IS - Information Sharing									
C IS - Customer to Firm									
E Long-term Relationships with Suppliers									
F Long-term Relationships with Customers									

Table 5.152 External Integration – SWS

External integration is selected by two companies, which provide two completely different views of it. The first one is related on focusing on upstream side, through Information sharing and Long-term Relationships with Customers, while the other mainly privileges the relationships with suppliers.

5.3.3.4 Actions overview – SWS

In this section, an analysis on the last links will be provided. The interest of this research is to see which are the configuration actions that are used the most to obtain practices in switchgears sectors. Firstly, an overall view of the actions and their distribution among the practices is provided and, later, a deeper evaluation of which are the primary and secondary actions for each practice is carried on.

Company	SWS - 1	SWS - 2	SWS - 3	SWS - 4	SWS - 5	SWS - 6	SWS - 7	SWS - 8	SWS - 9
A IT - Information Technology	A15	A1			A1	A9	A9		A15
		A2			A13	A14	A10		
		A3			A14	A15	A14		
		A10					A15		
		A15					A16		
B IS - Information Sharing		B3	B3	B5	B5		B5	B4	B3
		B8	B7	B7	B7		B3	B5	B5
							B		
C IS - Customer to Firm	C3	C3	C1	C3		C3	C1	C1	C1
								C3	C3
D IS - Firm to Customer									
E Long-term Relationships with Suppliers	E1	E1	E3	E1	E1	E1	E2	E1	E1
	E9	E9	E6	E3	E3	E6	E3	E3	E6
				E6	E6		E6	E6	
				E8	E7		E7	E8	

							E8		
F Long-term Relationships with Customers	F4	F1	F4	F1	F2			F2	F1
	F6	F4		F2	F4			F6	F4
		F6		F4	F6				
				F6					
G Human Resource Management Practices	G3	G2	G2	G2	G1	G1	G1		G1
	G4		G3	G3	G3	G3	G2		G3
				G4			G3		
							G6		
H Project Management Practices	H	H				H	H		H1
									H2
									H
J Production System Practices	J1	J1	J1	J1	J1	J3	J1		J1
	J3	J4	J2	J3	J2	J5	J2		J4
	J4	J5	J3	J5	J8	J8	J3		J8
	J5	J8	J17	J11		J10	J4		J
	J11	J11		J17			J6		
	J17	J17					J9		
							J11		
							J17		
K Network	K3	K1	K3	K1	K3	K1	K3	K1	K1
	K4	K3		K3	K6	K3	K6	K5	K3
	K5	K5		K4		K5		K6	K5
		K6		K5					
L Strategic Behaviour								L5	
								L7	
M Financial Practices									

Table 5.153 Configuration actions overview – SWS

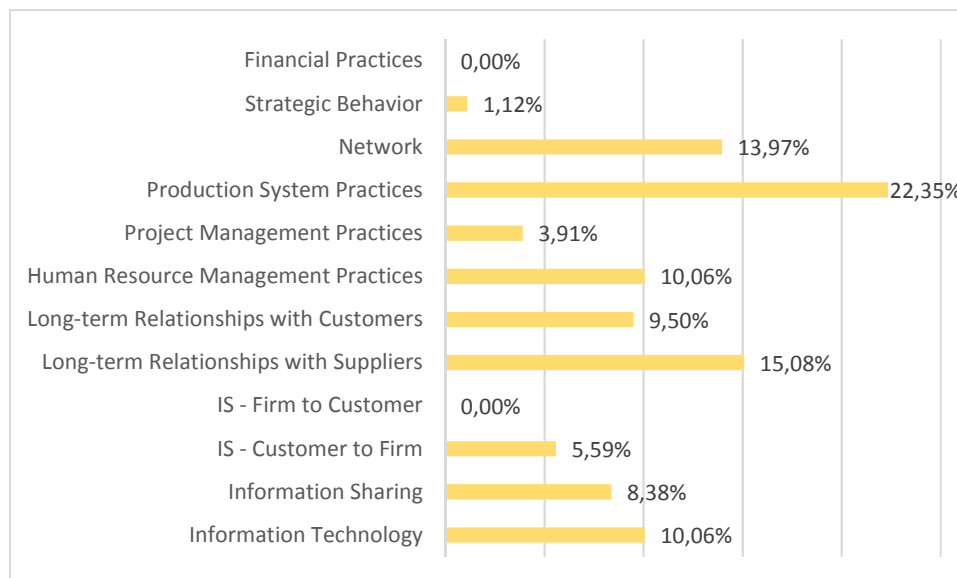


Figure 5.41 Relative frequency of selection of actions respect to the practices – SWS

It is noticeable that the actions associated with Production System Practices are the most selected among all the possibilities, trailed by the actions of Long-term Relationships suppliers and Network. A curiosity is that usually Project Management Practices are selected in reference to the overall concept of application of those methods, with a seldom definition of the specific actions. This does not allow identifying precisely which actions are the most successful for that practice.

There are other, even if rare, cases in which the practice has been selected as a general concept, without specifying which were the reference actions.

Finally, IS – Firm to Customer, Strategic Behavior and Financial Practices do not provide any competitive advantage to this sector’s suppliers, since their selection frequency is very low.

Also Project Management Practices, at the moment, are not very strategic, but, during the interviews, there are respondents who stated that their development is part of a future strategy.

A focus on each single practice and the most relevant actions is now provided.

IT (Information Technology)

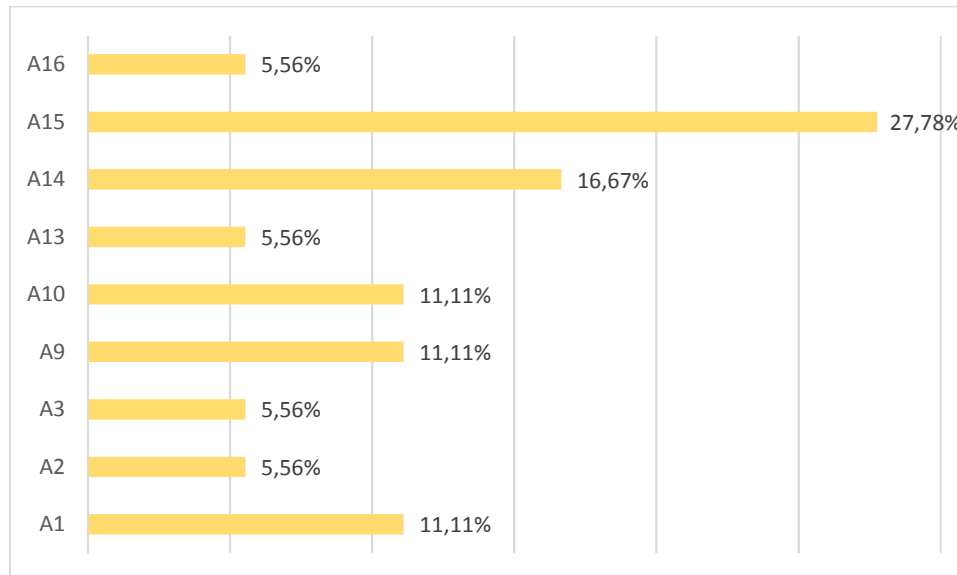


Figure 5.42 Actions related to Information Technology – SWS

Primary actions	
A15	Monitoring order processing status, Manufacturing Execution System (MES)
Secondary actions	
A14	

Table 5.154 Primary and secondary actions for Information Sharing – SWS

IS (Information Sharing)

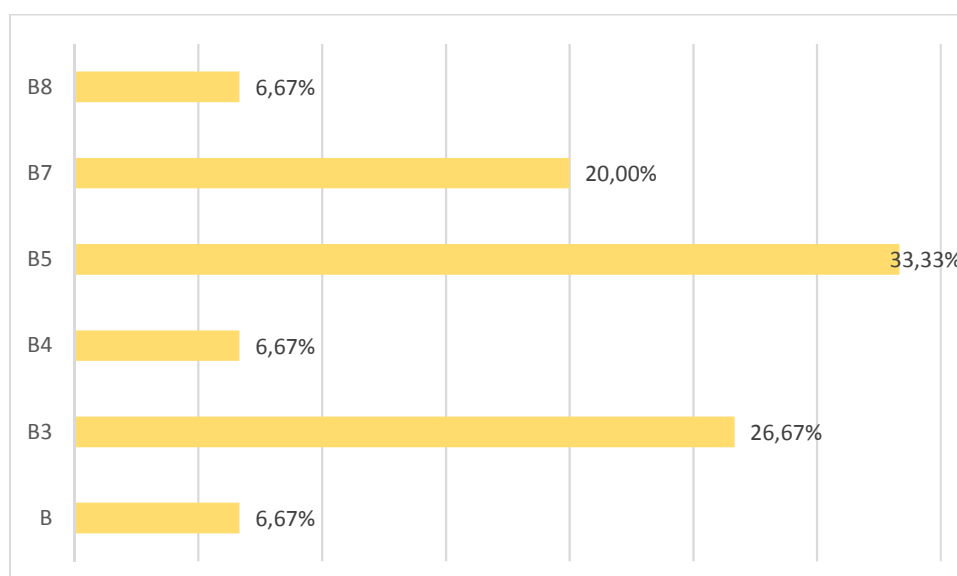


Figure 5.43 Actions related to Information Sharing – SWS

Primary actions	
B5	Frequent, face-to-face planning/communication with suppliers/clients
B3	Frequent, informal, timely information exchange

Table 5.155 Primary and secondary actions for Information Sharing – SWS

IS – Customer to Firm

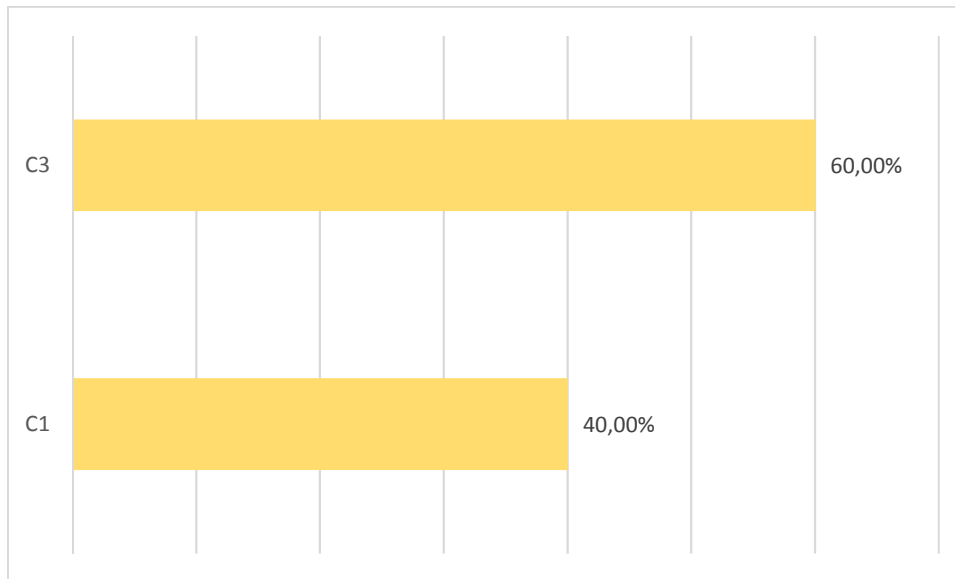


Figure 5.44 Actions related to IS – Customer to Firm – SWS

Secondary actions	
C3	Product design specification

Table 5.156 Primary and secondary actions for IS – Customer to Firm – SWS

IS – Firm to Customer

Secondary actions	
No companies selected this practice, so there are no significative actions.	

Table 5.157 Primary and secondary actions for IS – Firm to Customer – SWS

Long-term Relationships with Suppliers

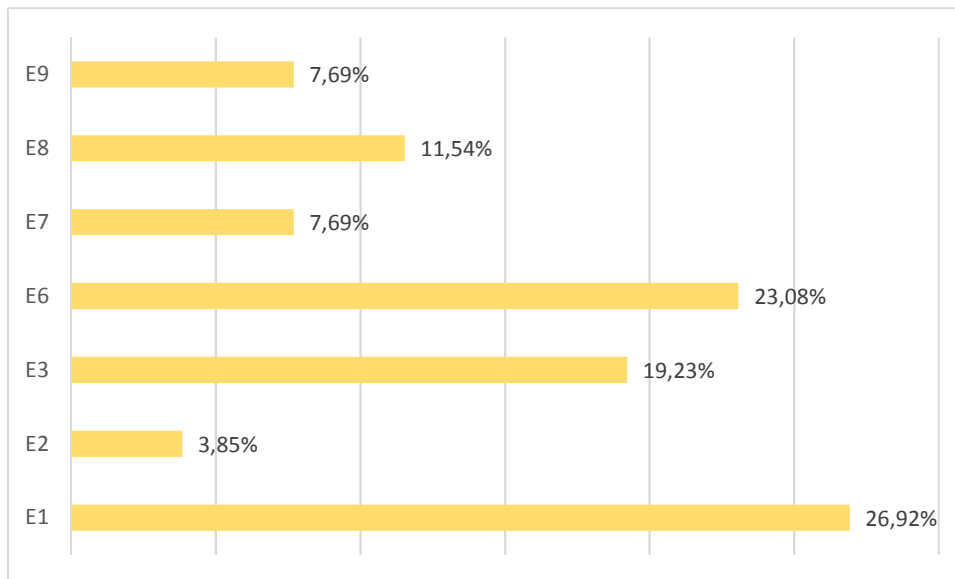


Figure 5.45 Actions related to Long-term Relationships with Suppliers – SWS

Primary actions	
E1	Close relationships with strategic suppliers, commercial agreements
E6	Solid and durable relationships with key suppliers (considered as a part of the firm)
Secondary actions	
E3	Involving suppliers in new product design

Table 5.158 Primary and secondary actions for Long-term Relationships with Suppliers – SWS

Long-term Relationships with Customers

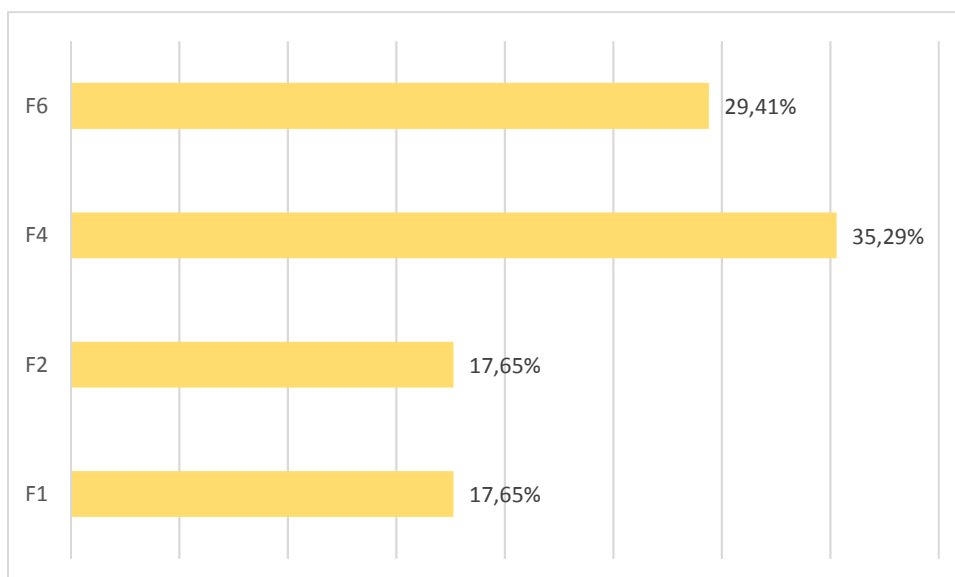


Figure 5.46 Actions related to Long-term Relationships with Customers – SWS

Primary actions	
F4	Collaboration in new product development

Secondary actions	
F6	Investments for evaluating customer's future needs

Table 5.159 Primary and secondary actions for Long-term Relationships with Customers – SWS

Human Resource Management Practices

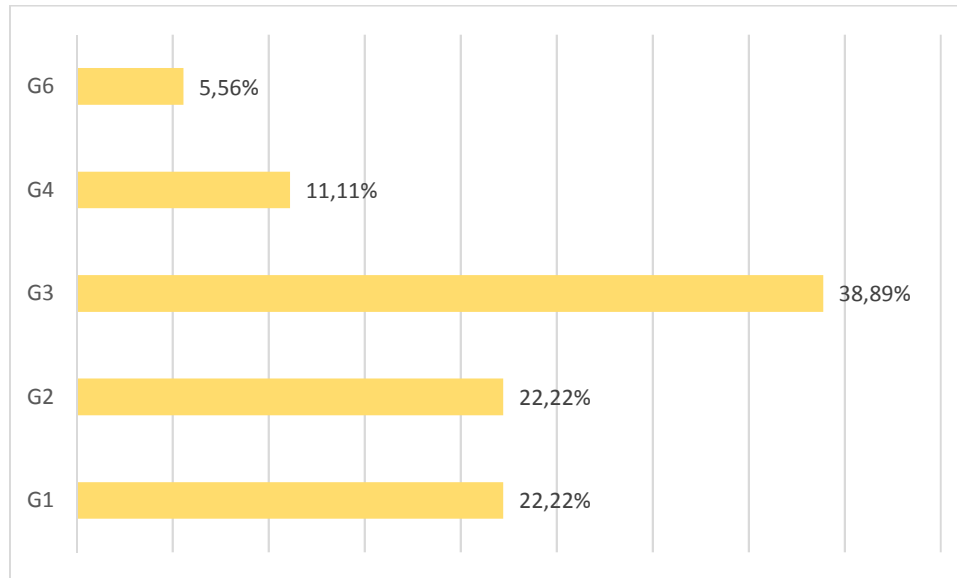


Figure 5.47 Actions related to Human Resource Management Practices– SWS

Primary actions	
G3	Staff training
Secondary actions	
G2	Multi-skilled human resource selection
G1	Advanced methods for employee selection

Table 5.160 Primary and secondary actions for Human Resource Management Practices– SWS

Project Management Practices

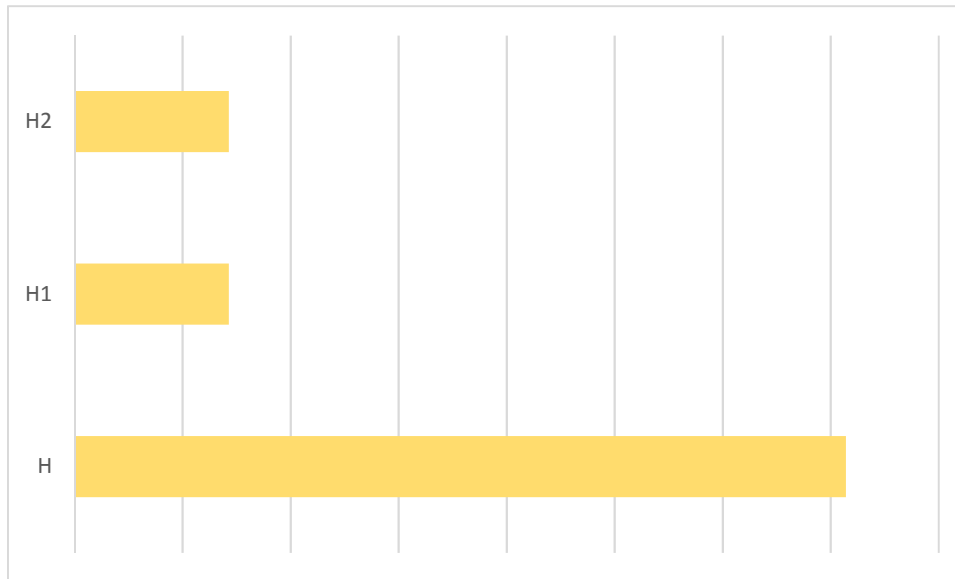


Figure 5.48 Actions related to Project Management Practices – SWS

Secondary actions
There are no particular actions, since this practice has been selected as an overall for most of the time

Table 5.161 Primary and secondary actions for Project Management Practices – SWS

Production System Practices

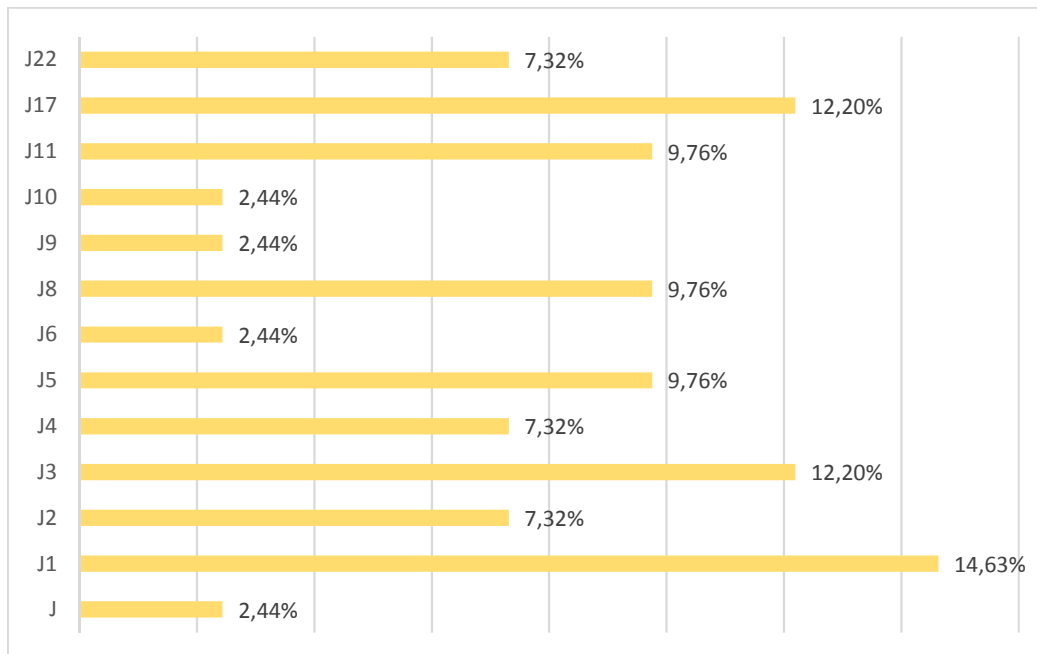


Figure 5.49 Actions related to Production System Practices – SWS

Primary actions	
J1	Investments in R&D and Engineering functions
J17	Use of top quality material
J3	Plants and machines upgrade/replacement

Secondary actions	
J5	Quality data availability
J8	Slack Capacity
J11	Bottleneck controlling

Table 5.162 Primary and secondary actions for Production System Practices – SWS

Network

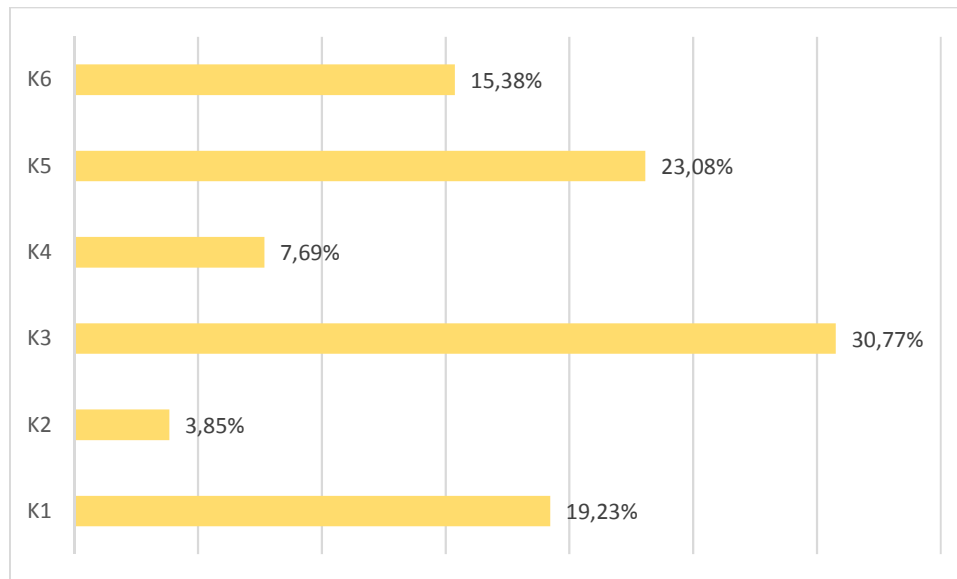


Figure 5.50 Actions related to Network – SWS

Primary actions	
K3	Preference for local suppliers
K1	Sections-network development (for commercialization, contracting and assurance)
K5	Close-to-customer (reference markets) locations
Secondary actions	
K6	On-time delivery directly to customer's points of use

Table 5.163 Primary and secondary actions for Network – SWS

Strategic Behavior

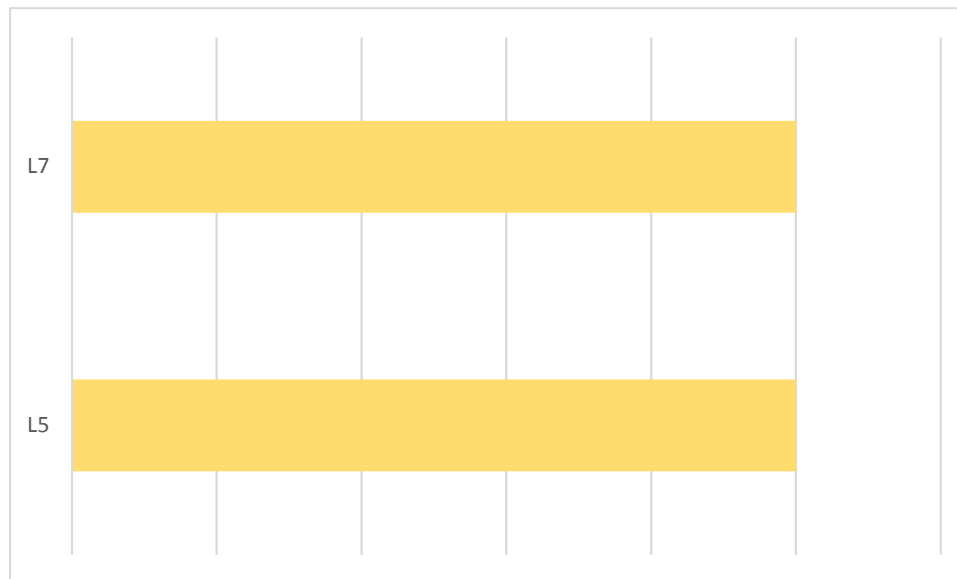


Figure 5.51 Actions related to Strategic Behavior – SWS

Secondary actions
Only a few companies selected this practice, so there are no significative actions

Table 5.164 Primary and secondary actions for Strategic Behavior – SWS

Financial Practices

Secondary actions
No companies selected this practice, so there are no significative actions.

Table 5.165 Primary and secondary actions for Financial Practices – SWS

5.3.3.5 Summary of the results – SWS

The final paragraph of multi-case study means to resume the results obtained from each analysis provided in previous parts, analyzing altogether the links among performance, capabilities and practices in switchgears industry.

It is possible to combine the different sets, containing the groups of elements of the framework, altogether, starting from the most targeted performance.

For the switchgears sector, the most targeted performance have been Quality, Engineering, On-time Delivery, Flexibility (SC) and Price. Respect to the other sectors there are more significant performance and it is present a performance, the Flexibility (SC), that EPC contractors have not proposed as primarily important.

The other performance match the ones provided the main contractors, resulting in a sector aligned with the requirements of the market. This has been an expected result, since the status of Best Performer of the interviewed companies has been attributed by those clients.

For each of the performance previously listed, one or more set of capabilities have been identified whose development leads to the improvement of the related performance. Considering all the capabilities, it becomes possible to identify the following set: Product/Process Development Capability, Knowledge

Management Capability, Capacity and Flexibility, Relationship Capability, Supply Chain Management Inbound, Customer Service, Supply Chain Management Outbound and Project Management Capability.

The identification of a relatively higher number of important performance led to a longer list of capabilities.

Finally, for each capability different sets of practices, common and peculiar, have been identified. The final union of these connections between performance, capabilities and practices, allows the identification of a configuration that can act as a guideline for other suppliers of the sector.

In the following tables, the different sets, coming from the previous analysis, are presented:

Performance	Capabilities	Common practices	Peculiar practices
Quality	Knowledge Management Capability	Human Resource Management Practices (G) and Production System Practices (J)	
	Product/Process Development Capability	Production System Practices (J)	+ Information Sharing – Customer to Firm (C)
			+ Information Technology (A)
			+ No further practices to (J)
	Customer Service	Long-term Relationships with Customers (F), Network (K)	+ Information Sharing (B)
			+ Long-term Relationships with Suppliers (E)
			+ No further practices for (F), (K)
		Information Sharing (B), Long-term Relationships with Suppliers (E) and Human Resource Management Practices (G)	

Table 5.166 Quality suggested configuration – 1 – SWS

Performance	Capabilities	Common practices	Peculiar practices
Engineering	Knowledge Management Capability	Human Resource Management Practices (G) and Production System Practices (J)	
	Product/Process Development Capability	Production System Practices (J)	+ Information Sharing – Customer to Firm (C)
			+ Information Technology (A)
			+ No further practices to (J)
	Relationship Capability	Information Sharing – Firm to Customer (C),	+ Project Management Practices (H)

		Long-term Relationships with Customers (F)	+ Production System Practices (J)
			+ Project Management Practices (H) and Network (K)
		Long-term Relationships with Suppliers (E), Long-term Relationships with Customers (F) and Network (K)	+ Information Sharing (B) and Information Sharing – Firm to Customer (C)
			+ No further practices to (E), (F) and (K)

Table 5.167 Engineering suggested configuration – 1 – SWS

Performance	Capabilities	Common practices	Peculiar practices
On-time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E), Network (K)	+ Information Technology (A)
			+ Information Technology (A) and Production System Practices (J)
			+ No further practices for (E), (K)
	Supply Chain Management Outbound	Information Technology (A), Information Sharing (B), Network (K)	
		Production System Practices (J)	+ Information Technology (A), Project Management Practices (H), Network (K)
			+ Information Technology (A)
			+ No further practices to (J)
	Product/Process Development Capability	Production System Practices (J)	+ Information Sharing – Customer to Firm (C)
			+ Information Technology (A)
			+ No further practices to (J)

Table 5.168 On-time Delivery suggested configuration – 1 – SWS

Performance	Capabilities	Common practices	Peculiar practices
On-time Delivery	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E), Network (K)	+ Information Technology (A)
			+ Information Technology (A) and

			Production System Practices (J)
			+ No further practices for (E), (K)
		Information Technology (A), Information Sharing (B), Network (K)	
	Supply Chain Management Outbound	Production System Practices (J)	+ Information Technology (A), Project Management Practices (H), Network (K)
			+ Information Technology (A)
			+ No further practices to (J)
	Capacity and Flexibility	Long-term Relationships with Suppliers (E) and Production System Practices (J)	+ Human Resource Management Practices (G) and Network (K)
			+ Information Technology (A)
			+ Information Sharing (B)
			+ No further practices to (E) and (J)

Table 5.169 On-time Delivery suggested configuration – 2 – SWS

Performance	Capabilities	Common practices	Peculiar practices
Flexibility (SC)	Capacity and Flexibility	Long-term Relationships with Suppliers (E) and Production System Practices (J)	+ Human Resource Management Practices (G) and Network (K)
			+ Information Technology (A)
			+ Information Sharing (B)
			+ No further practices to (E) and (J)
	Knowledge Management Capability	Human Resource Management Practices (G) and Production System Practices (J)	
	Relationship Capability	Information Sharing – Firm to Customer (C), Long-term Relationships with Customers (F)	+ Project Management Practices (H)
			+ Production System Practices (J)
			+ Project Management Practices (H) and Network (K)

		Long-term Relationships with Suppliers (E), Long-term Relationships with Customers (F) and Network (K)	+ Information Sharing (B) and Information Sharing – Firm to Customer (C) + No further practices to (E), (F) and (K)

Table 5.170 Flexibility (SC) suggested configuration – 1 – SWS

Performance	Capabilities	Common practices	Peculiar practices
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E), Network (K)	+ Information Technology (A)
			+ Information Technology (A) and Production System Practices (J)
			+ No further practices for (E), (K)
		Information Technology (A), Information Sharing (B), Network (K)	
	Product/Process Development Capability	Production System Practices (J)	+ Information Sharing – Customer to Firm (C)
			+ Information Technology (A)
			+ No further practices to (J)
	Capacity and Flexibility	Long-term Relationships with Suppliers (E) and Production System Practices (J)	+ Human Resource Management Practices (G) and Network (K)
			+ Information Technology (A)
			+ Information Sharing (B)
			+ No further practices to (E) and (J)

Table 5.171 Price suggested configuration – 1 – SWS

Performance	Capabilities	Common practices	Peculiar practices
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E), Network (K)	+ Information Technology (A)
			+ Information Technology (A) and Production System Practices (J)

			+ No further practices for (E), (K)
		Information Technology (A), Information Sharing (B), Network (K)	
	Product/Process Development Capability	Production System Practices (J)	+ Information Sharing – Customer to Firm (C)
			+ Information Technology (A)
			+ No further practices to (J)
	Relationship Capability	Information Sharing – Firm to Customer (C), Long-term Relationships with Customers (F)	+ Project Management Practices (H)
			+ Production System Practices (J)
			+ Project Management Practices (H) and Network (K)
		Long-term Relationships with Suppliers (E), Long-term Relationships with Customers (F) and Network (K)	+ Information Sharing (B) and Information Sharing – Firm to Customer (C)
			+ No further practices to (E), (F) and (K)

Table 5.172 Price suggested configuration – 2 – SWS

Performance	Capabilities	Common practices	Peculiar practices
Price	Supply Chain Management Inbound	Long-term Relationships with Suppliers (E), Network (K)	+ Information Technology (A)
			+ Information Technology (A) and Production System Practices (J)
			+ No further practices for (E), (K)
	Product/Process Development Capability	Production System Practices (J)	
			+ Information Sharing – Customer to Firm (C)
			+ Information Technology (A)
			+ No further practices to (J)
	Project Management Capability	IS – Customer to Firm (C), Long-term Relationships with Customers (F), Project	Project Management Capability

		Management Practices (H)	

Table 5.173 Price suggested configuration – 3 – SWS

6.1 Introduction to outliers' analysis

Through a thorough literature review, it has been shown how the framework, that has been used to describe the supply chain configuration of the suppliers, can be supported by a resource-based view, that states how companies acquire and organize resources in order to achieve competitive advantage con competitors.

Thus, the framework is a perfectly fitting tool, that can be used to identify and assess the resources and capabilities that are used by the companies, and to understand which competitive advantages, identified through the performance, these elements can enable. Through the multi-case approach, it has been possible to understand, for each sector, which are the most important performances, capabilities and practices, and how are they combined.

The supply chain configuration of each supplier can be described through the RBT, for each of the three different sectors, which provide critical key-items for EPC contractors in the Oil&Gas market.

Each sector, even considering that clients are in common, presents different characteristics, thus, considering the sector as a contextual factor, the contingent resource-based theory hints that companies providing valves should set up their supply chains differently than switchgears and static equipment's suppliers.

Given different companies embedded in sectors that present dissimilar features, it becomes interesting to study if there are differences between suppliers belonging to the same sector and, in case there are, what originates the diversity. This analysis is done by evaluating an average supply chain configuration for each sector and using the results to show possible "outliers", that are identified as firms whose behavior is significantly different respect to the others.

It is important to clearly define how outliers are identified from the pool of companies. The problem, for this kind of analysis, is the scarcity of literature, that is mainly due to the innovativeness that has been introduced in this research by the framework, that does not allow to identify such a process from previous researches.

Since the outlier is a firm that significantly differs from the others, it is required to identify an average supply chain configuration for each sector, and a numerical variable that can assess how far the supply chain of the company is respect to the mean of the sample under consideration, that is going to be called *similarity index*.

Since this research considers the research-based theory as its theoretical foundation, the analysis of outliers could help understanding if that theory can provide a clear view and description of the phenomenon, or, otherwise, it can help understanding if it required to address, or add, different theories because, for example, the RBT cannot explain how a company with a significantly different SCC is still able to compete on the same market of other firms.

Furthermore, all these suppliers operate in the Oil&Gas market and provide ETO (engineer-to-order) products, even if they have very different characteristics, to their customers. It is possible to consider the ETO as a contextual factor, and accruing the firms from the three sectors, it is possible to perform the same outliers' analysis, identifying which are the companies the behave in the most different way, respect to their similar.

In literature, an ETO supply chain is defined as a supply chain where the 'decoupling point' is located at the design stage, so each customer order penetrates the design phase of a product (Gosling, 2009).

Combining the outliers' analysis from both the single sector and the ETO sample, could show, for example, that a company is aligned to the ETO, while it is an outlier inside its sector, that is a potentially dangerous situation, because it would mean that the firm has not aligned with the specificity of that sector, thus risking being out-of-market.

In the next sections the approaches for the identification of the average SCC, for both the three sectors and the overall ETO sample, and the similarity index will be described accurately and, later, the outliers will be analyzed and discussed.

6.1.1 Average supply chain configuration

The average supply chain configuration is one of the two tools, along with the similarity index, that is going to be used to identify the outliers within each sector or the ETO.

In order to maintain the coherence, it has been defined that each average SCC must be composed in the same way, that is as follows: 3 performances, 3 capabilities for each performance and 3 practices for each capability. This model has been decided because it relates to the indication that has been provided to the respondents during the interview, which has been asked to describe their own supply chains using that scheme. Anyway, being it a suggestion more than a mandatory guideline, if it was not respected completely, especially for capabilities and practices, having, hence, SCC with more or less of these elements.

The selection of the elements to include in the average has been done partially relying on the data derived by the multi-case approach, choosing the three most selected performances, the three most selected capabilities for each of the three performances and the three practices of each of the nine capabilities. In the figure below, this model is shown for one of the three performances. Yet, in some cases, there were the necessity to define one additional rule, that could help whether there were two, or more, elements with the same frequency of selection.

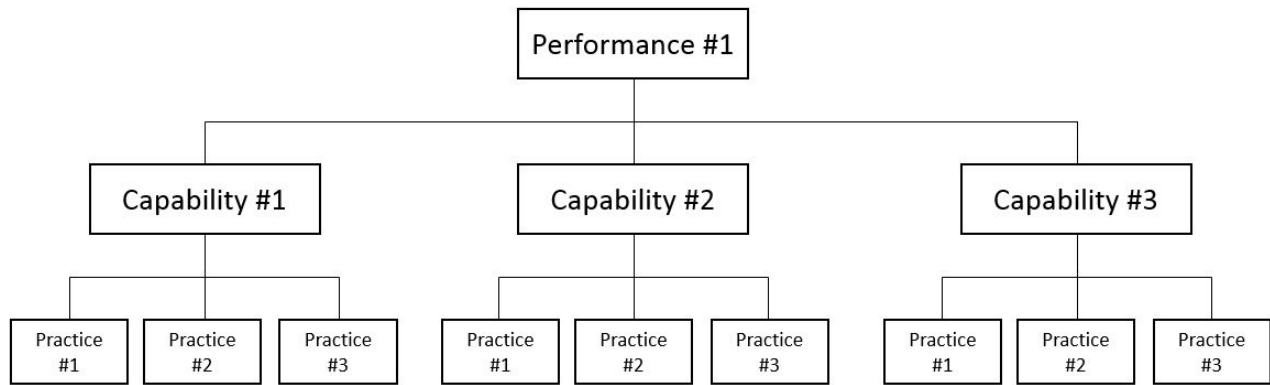


Figure 6.1 Model of average SCC for one of the three most selected performance

For example, considering the selection of the three performances for the switchgears sector, it is possible to notice that the two most chosen are Quality and Engineering while, for the third spot, Flexibility (SC) and On-time Delivery share equal overall selection.

Always considering that the scope of this process is the identification of the SCC that describes in the most appropriate way the average behavior of the sample of firms in consideration, in order to select the third performance, the criteria was the following: in case of equal absolute frequency, it should be designated the performance that has been used the most with the other performances already taken. For the switchgear sector, On-time Delivery is the performance that has been selected the most with Quality and Engineering by the suppliers, thus leading to its inclusion in the average SCC.

The additional rule for capabilities and practices is easier. Since the model considers the frequency of capabilities referred to each most selected performance and practices for each capability, in case of parity between two elements, the discriminating factor is going to be their absolute frequency of selection.

6.1.2 Similarity Index

Once the average SCC have been identified, in order to identify which are outliers, it is necessary to define a coefficient expressing the distance between the SCC of a company and the average of its sector. Again, the literature cannot provide a helpful solution because of the newness of the framework previously introduced, thus it has been introduced the similarity index.

The idea behind this coefficient is to measure the degree of overlapping between two different supply chain configurations, expressed through the framework, attributing a different value depending on which elements of the frameworks are equal.

The comparison is made between the supply chain configuration of a company and the one describing the average behavior of its sector, in order to express the alignment of the firm respect to the others. Through the comparison of each linkage performance-capability-practice of a firm's framework with the average supply chain configuration of the sector, identifying its most fitting branch to the linkage under consideration, it is possible to assess a score, from 0 to 1, depending on the degree of overlapping. The similarity index is the average of these values.

There are four significant matchings that can provide a non-zero score; the image represents the linkage of the firm's SCC, whose value is under assessment, and the linkage, that is the closest, among the average sector SCC:

- If there is a total match performance-capability-practice: 1;

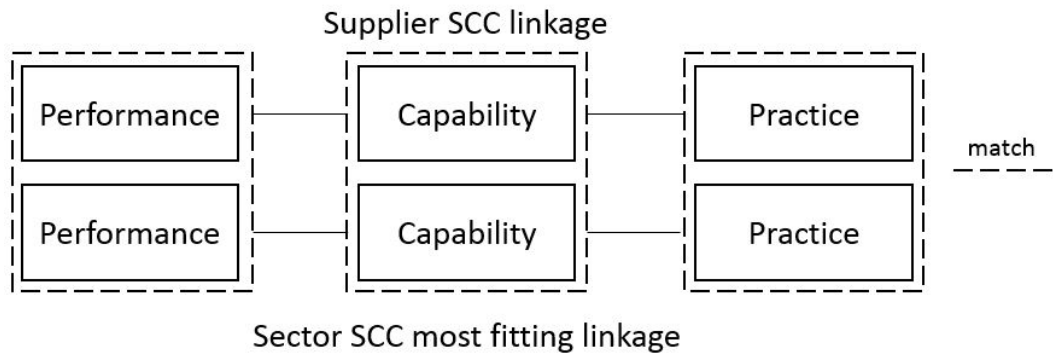


Figure 6.2 Match performance-capability-practice

- If there is match among performance-capability: 0.6;

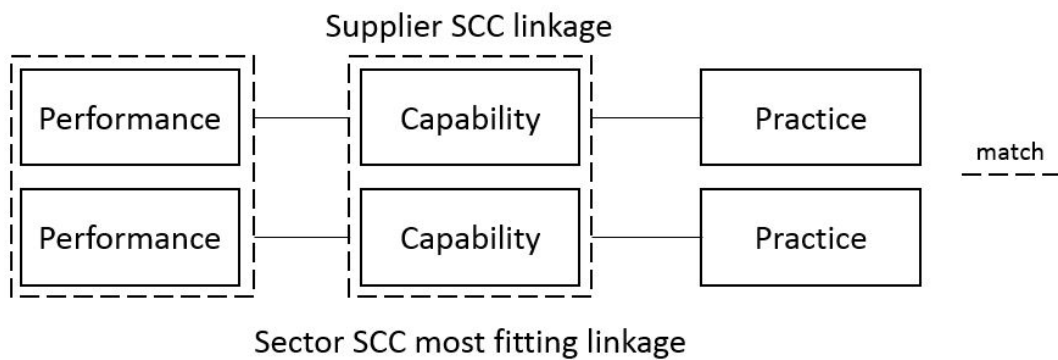


Figure 6.3 Match performance-capability

- If the match is between capability-practice: 0.4;

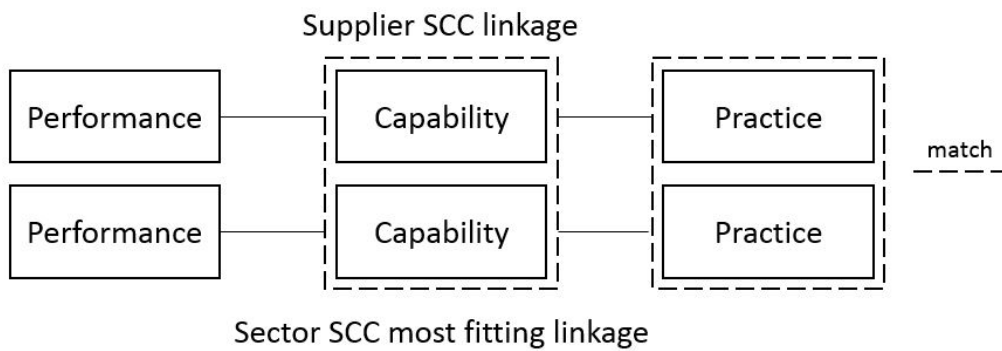


Figure 6.4 Match capability-practice

- If there is match only with performance: 0.2.

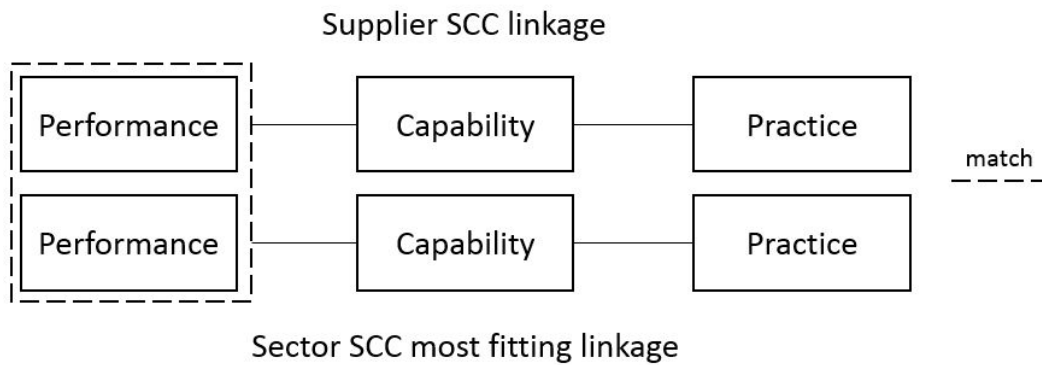


Figure 6.5 Match performance

The other possible matchings do not give any value, since they are not considered significant. In particular, having only capability or practice in common with the average SCC of the sector, has been decided to provide zero value, because, using the RBT as it has been defined, the focus is mainly on the combinations between resources, or practices in this case, and capabilities. Even if the pure possession of resources can provide some advantage, the real positive effect is obtained when these are combined to give capabilities, indeed the matching of capability-practice provides a value of 0,4.

Instead, since the performances are important for a company, because they are what allows them to win orders, having one of the performance belonging to the supply chain configuration of the sector yields 0,2. This reasoning leads the combination of performance-capability to get a value that is 0,6. It is important to distinguish two companies that achieve the same performance, with two different configurations.

An intermediate score is provided in case of matching the capability-practice of the sector. Since the RBT focuses on resources (practices) and capabilities, matching that duo yields a higher score that having identical performance, but a lower one than a company that has a correspondence of both performance and capability.

Once the average supply chain configurations of the three sectors and the similarity index have been clearly defined, it becomes possible to calculate it for all the companies.

It is important to notice that this index has not an absolute meaning and it does not tell anything about how the supply chain of a certain company is structured; this value is only used to assess how close, or how far, a supplier is structured respect to an average configuration. Even if two firms have identical similarity index, it does not imply that they have similar configurations, it only means that they are close, in the same manner, to an average configuration obtained considering the whole sample.

In addition, comparing the similarity indexes of two companies belonging to different sectors is meaningless, since they are calculated starting from different average supply chain configurations.

6.2 Intra-sector outliers' identification

Once the processes for obtaining the average supply chain configuration and similarity indexes have been fully described, it becomes possible to identify which are the outliers for both the three sectors and the ETO. In this paragraph, the only analysis of the three sectors is carried on, since for the ETO there are considerations that have to be made before.

The average supply chain configurations each sector is listed below:

Performance 1	Capabilities	Practices
Quality	Supply Chain Management Inbound	IT (Information Technology)
		Long-term Relationships with Suppliers
		Network
	Customer Service	Long-term Relationships with Customers
		Production System Practices
		Network
	Supply Chain Management Outbound	IT (Information Technology)
		Long-term Relationships with Suppliers
		Long-term Relationships with Customers
Performance 2	Capabilities	Practices
On-time Delivery	Supply Chain Management Inbound	IT (Information Technology)
		Long-term Relationships with Suppliers
		Network
	Customer Service	Long-term Relationships with Customers
		Network
		Production System Practices
	Project Management Capability	IT (Information Technology)
		Project Management Practices
		Production System Practices
Performance 3	Capabilities	Practices
Engineering	Product/Process Development Capability	Long-term Relationships with Customers
		Human Resource Management Practices
		Production System Practices
	Knowledge Management Capability	IT (Information Technology)
		IS (Information Sharing)
		Human Resource Management Practices
	Capacity and Flexibility	IT (Information Technology)
		Long-term Relationships with Suppliers

		Production System Practices

Table 6.1 Average supply chain configuration – SVS

Performance 1	Capabilities	Practices
Quality	Supply Chain Management Inbound	IT (Information Technology)
		IS (Information Sharing)
		Long-term Relationships with Suppliers
	Product/Process Development Capability	IS (Information Sharing)
		Long-term Relationships with Customers
		Production System Practices
	Project Management Capability	IT (Information Technology)
		Project Management Practices
		Production System Practices
Performance 2	Capabilities	Practices
On-time Delivery	Supply Chain Management Inbound	IT (Information Technology)
		IS (Information Sharing)
		Long-term Relationships with Suppliers
	Product/Process Development Capability	IS (Information Sharing)
		Long-term Relationships with Customers
		Production System Practices
	Project Management Capability	IT (Information Technology)
		Project Management Practices
		Production System Practices
Performance 3	Capabilities	Practices
Price	Supply Chain Management Inbound	IT (Information Technology)
		IS (Information Sharing)
		Long-term Relationships with Suppliers
	Product/Process Development Capability	IS (Information Sharing)
		Long-term Relationships with Customers
		Production System Practices

	Capacity and Flexibility	IT (Information Technology)
		IS (Information Sharing)
		Production System Practices

Table 6.2 Average supply chain configuration – SES

Performance 1	Capabilities	Practices
Quality	Knowledge Management Capability	Human Resource Management Practices
		Production System Practices
		Network
	Product/Process Development Capability	IT (Information Technology)
		IS – Customer to Firm
		Production System Practices
	Customer Service	IS (Information Sharing)
		Long-term Relationships with Customers
		Network
Performance 2	Capabilities	Practices
On-time Delivery	Supply Chain Management Inbound	IT (Information Technology)
		Long-term Relationships with Suppliers
		Network
	Product/Process Development Capability	IT (Information Technology)
		IS – Customer to Firm
		Production System Practices
	Capacity and Flexibility	Long-term Relationships with Suppliers
		Network
		Production System Practices
Performance 3	Capabilities	Practices
Engineering	Knowledge Management Capability	Production System Practices
		Human Resource Management Practices
		Network
	Product/Process Development Capability	IT (Information Technology)
		IS – Customer to Firm

	Relationship Capability	Production System Practices
		Long-term Relationships with Suppliers
		Long-term Relationships with Customers
		Network

Table 6.3 Average supply chain configuration – SWS

In case a firm has more than one configuration, the similarity index is calculated for all its supply chain configurations, because it could be useful to understand, in case one of these is very different from the others, what causes the company to structure itself in such a heterogenous manner.

The similarity indexes of the companies are listed below:

SVS - 1	SVS - 2	SVS - 3	SVS - 4A	SVS - 4B	SVS - 5	SVS - 6	SVS - 7
0,337	0,600	0,528	0,589	0,800	0,294	0,391	0,367
SVS - 8A	SVS - 8B	SVS - 8C	SVS - 9	SVS - 10	SVS - 11	SVS - 12A	SVS - 12B
0,560	0,556	0,760	0,459	0,424	0,567	0,640	0,238
SV - 12C	SVS - 13	SVS - 14A	SVS - 14C	SVS - 15	SVS - 16	SVS - 17	SVS - 18
0,711	0,523	0,600	0,725	0,371	0,558	0,689	0,771

Table 6.4 – Similarity Index – SVS

SES - 1	SES - 2	SES - 3	SES - 4	SES - 5	SES - 6	SES - 7
0,471	0,400	0,667	0,530	0,600	0,369	0,783
SES - 8A	SES - 8B	SES - 8C	SES - 9	SES - 10	SES - 11	SES - 12
0,518	0,518	0,463	0,733	0,450	0,311	0,815

Table 6.5 – Similarity Index - SES

SWS - 1	SWS - 2	SWS - 3	SWS - 4	SWS - 5	SWS - 6	SWS - 7	SWS - 8	SWS - 9
0,727	0,868	0,625	0,658	0,417	0,545	0,609	0,278	0,469

Table 6.6 – Similarity Index - SWS

With the similarity indexes calculated, the target of the analysis becomes the identification of those companies that, in each sector, configure in the most diverse way respect to the others, namely the ones with the lowest similarity index. Since every sector has a pool of companies of different dimension, it becomes necessary to understand a common criterion that allows the identification of a proper number of outliers accordingly with the size of each sample.

At the end, the outliers have been identified considering a cut-off value for each sector, which is the tenth percentile of the three distributions of similarity indexes. Every company owning an index lower than the threshold is considered an outlier of its sector and it will be later analyzed. The selection of the tenth percentile as the limit value considers the interest in understanding which are the most diverse companies, thus focusing on a reduced number of companies, that are the ones that could provide the most interesting results.

Sector	Cut-off value
Special Valves	0,347
Static Equipment	0,378
Switchgears	0,364

Table 6.7 Cut-off values for each sector

Applying the previous criterion, it is possible to identify 6 overall outliers, 3 for the special valves (SVS – 1, SVS – 5, SVS – 12B), 2 for static equipment (SES – 6, SES – 11) and 1 for switchgears (SWS – 8). The number of outliers is kind of proportional to the number of companies for each sector, confirming one of the reason for the selection of that criterion. Furthermore, there are no companies that have a similarity index that is higher, but very close to its cut-off value, so no other firms have been included in the outliers' sample, other than the ones that have already been listed.

Special Valves	SVS – 1	0,337	SVS – 5	0,294	SVS – 12B	0,238
Static Equipment	SES – 6		0,369	SES – 11		0,311
Switchgears	SWS – 8			0,311		

Table 6.8 Outliers of each sector

Before starting the analysis of each outlier, to understand what lead the firm to configure in such a different manner respect to the sector, it becomes important to perform the outliers' identification also on ETO sample, so that there will be more information and the final examination will provide a more complete explanation.

6.3 ETO outliers' identification

As previously mentioned, the first part of the final analysis will concern a comparison between the outliers from each single sector and the ETO, thus it is necessary to identify which firms are going to be gathered to create the pool of companies to study under the contextual factors of engineer-to-order products.

EPC suppliers can be considered as a subset of a more generic definition, such as ETO, that identifies companies that supply low volume and highly customized products, such as special valves, static equipment and switchgears. Given this description, it should be possible to accrue these companies and identify the outliers, as previously executed of the same firms, but under different contextual factors.

Before aggregating the companies altogether, it is important to notice that firms that are parts of special valves and static equipment sectors have a significantly different dimension, spanning from 20 to more than 200 in the first case, and from 20 to more than 100 in the second sector. Thus, collecting these firms under one single contextual factor could be risky, because, without the necessary research, the effect of the firm's dimension could be hidden.

Among the elements present in the framework, there are some of them that could be more easily accessed by companies with a certain dimension, thus, before aggregating these firms altogether, it is necessary to show that the influence of the dimension on how close the company is to the average configuration, is very low. In case this effect is significant, the companies inserted in the pool for the ETO analysis will have similar dimension.

In order to assess this dependence, the similarity index of companies related to special valves and static equipment sectors will expressed in function of the firm's dimension, expressed in turnover. It has to be

noticed that this analysis does not take into account the switchgears' suppliers since their dimension is much closer as they almost completely belong to 20-50 Million range.

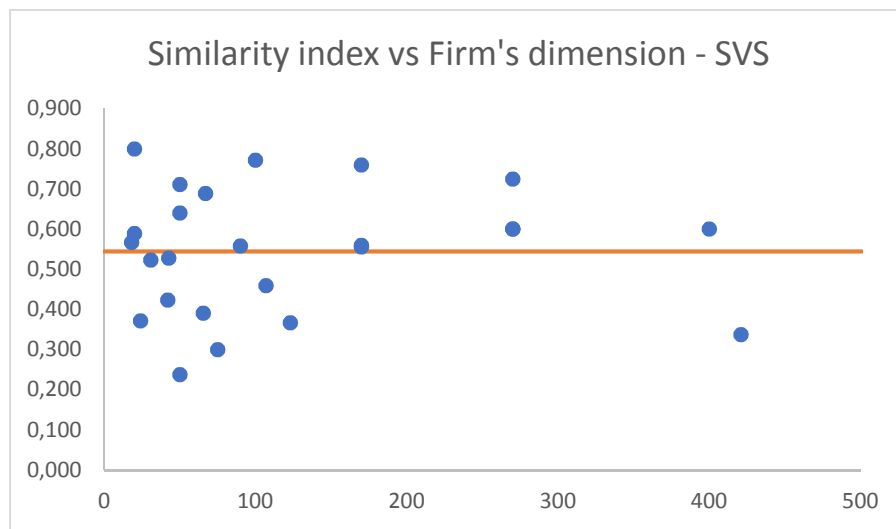


Figure 6.6 Similarity index vs Firm's dimension – SVS

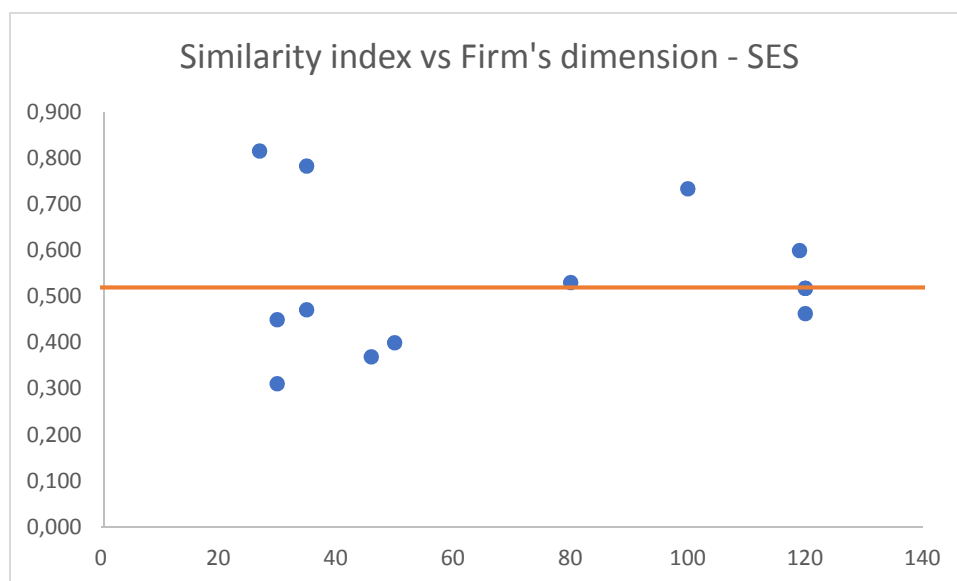


Figure 6.7 Similarity index vs Firm's dimension – SES

It is possible to notice that the two distributions are pretty symmetric respect to the average value (orange line). This is an interesting result, because it shows that, even if in the framework there are performances, capabilities or practices that are more likely accessible by firms with a certain dimension, companies have a certain freedom in their configuration choices and the similarity does not strongly relate to the dimension.

Given these conclusions, it is possible to unite all the companies under the ETO contextual factor and to analyze them altogether, comparing the results with those occurred studying the single sectors.

The first step is the identification of the average supply chain configuration. While for the three sectors the selection of performances, capabilities and practices relied on the absolute frequency of selection, this method would lead a strong bias toward the special valves, since there are much more configurations than the other two sectors. Because of that, the definition of the average supply chain configuration for the ETO is based on the average between the relative frequencies for the three sectors, thus removing the effects of the difference of the number of firms among special valves, static equipment and switchgears sectors.

Applying this method, it is possible to obtain the following average supply chain configuration:

Performance 1	Capabilities	Practices
Quality	Supply Chain Management Inbound	IT (Information Technology)
		Long-term Relationships with Suppliers
		Network
	Product/Process Development Capability	Long-term Relationships with Customers
		Human Resource Management Practices
		Production System Practices
	Knowledge Management Capability	IT (Information Technology)
		Human Resource Management Practice
		Production System Practices
Performance 2	Capabilities	Practices
OTD	Supply Chain Management Inbound	IT (Information Technology)
		Long-term Relationships with Suppliers
		Network
	Capacity and Flexibility	IT (Information Technology)
		Long-term Relationships with Suppliers
		Production System Practices
	Product/Process Development Capability	Long-term Relationships with Customers
		Human Resource Management Practices
		Production System Practices
Performance 3	Capabilities	Practices
Price	Supply Chain Management Inbound	IT (Information Technology)
		Long-term Relationships with Suppliers

	Product/Process Development Capability	Network
		Long-term Relationships with Customers
		Human Resource Management Practices
	Capacity and Flexibility	Production System Practices
		IT (Information Technology)
		Long-term Relationships with Suppliers
		Production System Practices

Table 6.9 Average supply chain configuration – ETO

Once the average supply chain configuration is obtained, it becomes possible to calculate the similarity index of the whole pool of companies. The method, that is going to be used, is the same applied, singularly, on the three sectors and the similarity index obtained are:

SVS – 1	SVS – 2	SVS – 3	SVS – 4A	SVS – 4B	SVS – 5	SVS – 6	SVS – 7
0,326	0,318	0,632	0,579	0,475	0,353	0,336	0,400
SVS – 8A	SVS – 8B	SVS – 8C	SVS – 9	SVS – 10	SVS – 11	SVS – 12A	SVS – 12B
0,420	0,578	0,620	0,365	0,365	0,360	0,540	0,238
SVS – 12C	SVS – 13	SVS – 14A	SVS – 14C	SVS – 15	SVS – 16	SVS – 17	SVS – 18
0,378	0,185	0,371	0,350	0,271	0,425	0,667	0,386
SES – 1	SES – 2	SES – 3	SES – 4	SES – 5	SES – 6	SES – 7	SES – 8A
0,357	0,308	0,467	0,370	0,630	0,323	0,748	0,435
SES – 8C	SES – 9	SES – 10	SES – 11	SES – 12	SWS – 1	SWS – 2	SWS – 3
0,411	0,776	0,410	0,341	0,754	0,582	0,474	0,463
SWS – 4	SWS – 5	SWS – 6	SWS – 7	SWS – 8	SWS – 9		
0,474	0,244	0,709	0,487	0,000	0,275		

Table 6.10 Similarity Index - ETO

Once calculated the similarity indexes, it is possible to evaluate which of these companies are the outliers respect to the ETO category, always using the tenth percentile, that is 0,273, as a cut-off value. In this case, since the firm EPS – 9 has a similarity index that is barely higher than the threshold, 0,275, it is included in the sample of outliers.

There are 6 outliers respect to ETO supply chain configuration, 3 from special valves and 3 from switchgears sectors, while there are no companies from the static equipment one.

Special Valves	SVS – 12B	0,238	SVS – 13	0,185	SVS – 15	0,271
Switchgears	SWS – 5	0,244	SWS – 8	0,000	SWS – 9	0,275

Table 6.11 Outliers of ETO

In the following paragraph, these firms will be analyzed and compared to the outliers for each single sector.

6.4 Outliers' analysis

This best-suppliers have been investigated under the lens of the research-based theory, which considers that companies achieve competitive advantage over competitors through the acquirement and bundling of different resources. Thanks to the framework previously introduced, it has been possible to describe how these best-suppliers combine their resources to enable different performance, that allow them to win orders over competitors. Once the supply configurations of these firms have been identified, the aim of the study became to understand why there are companies that structure themselves in such different way and how do these organizations survive on the market, while their competitors are set in a different way.

Furthermore, it could be possible that the resource-based theory does not allow to appreciate the real competitive source of these outliers, thus requiring a deeper investigation. The results that will come from this analysis will answer to the third research question.

In order to increase the level of completeness of the research, as previously introduced in chapter 3, these companies are also accrued and studied as suppliers of engineer-to-order products, allowing, through a different point of view, to provide a wider description of the phenomenon.

It is possible to classify the companies under study in four categories, considering, as classification factors, being an outlier or not for ETO and for the single sector; since this part of the analysis focuses on the analysis of outliers, to understand if resource-based theory is able to describe companies with a much different configuration than the average, there is no interest in studying suppliers which are not outliers in their own sector.

The classification is therefore presented:

ETO\Own sector	Outlier – YES	Outlier – NO
Outlier – YES	SVS – 12B, SWS – 8	SVS – 13, SVS – 15, SWS – 5, SWS – 9
Outlier – NO	SVS – 1, SVS – 5, SES – 6, SES – 11	–

Table 6.12 Outliers' classification

There are four companies that are outliers for ETO and not in their own sector and four for the opposite; two companies have configurations that appear as outliers in both ETO and their own sector, while the remaining are not outliers at all.

Each outlier related to the column on the left will be following described and analyzed. After this part, a more holistic description and comparison of the three sectors, also respect to the ETO, is provided.

6.4.1 SVS – 12B

This outlier is not related to a company, but it is a configuration that a firm presented in order to more properly configure on Far East markets. The other two firm's configurations are much more aligned with average behavior of valves and ETO sector (similarity index of 0.65, 0.548 and 0.711, 0.378 for 12A and 12C

respectively), but the characteristics of this configuration are outliers in both the sectors. This difference is mainly given by the selection of the Service, that has been rarely selected (two other times in special valves and one in switchgears) and Price as performance, plus capabilities with low frequency of selection, such as external integration, relationship capability and customer service, that show how the company is trying to strictly relate with both sides of supply chain.

This difference in configuration could be explained using the contingent resource-based view: a different market, such as Far East, can lead the company to identify and enable performance factors that are strongly diverse than the ones required for other markets. Only considering the market could be, though, incomplete, since two other companies, that do not figure among the outliers, have identified a distinguished configuration for Far East, SVS – 14C and 8C, and have chosen Engineering, On-time Delivery and Quality as performance. A further consideration to be made is related to the size of the three companies; the firm under investigation is the smallest among the three (even if it belongs to the same turnover range of firm 8, they are almost at the opposite extremes) and this could mean that, due to its dimension, the firm has to focus more on obtaining competitive price and the performance of Service, while bigger companies can achieve them more easily, thus focusing more on Quality and On-time Delivery aspects.

Since all these companies provides ball valves on this particular market, it should not play a big role in the configuration in this specific case.

The specificity of the market requires this company to configure in a very particular way, that is way different than more average configuration in both ETO and special valve sectors. This case seems to sustain the necessity of coupling the resource-based theory with the contingency theory; without the latter, it would have been more difficult to understand the meaning behind a configuration that different.

6.4.2 SWS – 8

This company identifies a supply chain configuration that involves the smallest similarity indexes of all the outliers. While it is the only outlier from switchgears' suppliers, it is also the sole company with a configuration with a null similarity index respect to the ETO, meaning that there are no elements in common with that average supply chain configuration.

Other than Engineering, that, however, does not appear in ETO average supply chain configuration, this supplier has selected two performance with a very low frequency of selection, that are Service, that as shown above (Table 5.2, Table 5.115) it has been selected only four times overall, and Commercial Impact, that has been selected only by this firm.

This company strongly invested in customer satisfaction, applying a strategy that is almost entirely oriented towards effectiveness, through the acquisition or creation of international branches, that are required to increase the closeness with end users and to strengthen their after-sales services. Also the capabilities reflect this choice, since they are enabled through practices that focus on information sharing or long-term relationships with customers and suppliers. This firm does not neglect other performance, considered fundamental by other suppliers, such as Price and Quality, but the firm just considers them as cutting performance, whose continuous improvement does not allow the increase of possibility of winning order, but they are just required to access markets. Engineering is required to manage and expand the archive in which the firm keeps all the thousands of different alternatives of standardized switchgears, whose production process stages are mainly outsourced and tested internally.

This company is one of the two suppliers of switchgears, that works almost entirely in Oil&Gas market. While the other belongs to an international group that allows it to be known internationally, this company has to provide the connection by itself. Yet, the advantage of being purely focused on Oil&Gas could favor it, since

they can invest entirely in end users and main contractors' needs, without having to focus on the requirements from other industries.

Furthermore, switchgears, as opposed to special valves and static equipment, are more standardized items, whose electrical components are bought, by Italian companies, from international suppliers that are, often, also competitors in Oil&Gas, thus limiting the possible technological innovation impact that Italian suppliers can offer. Thus, this company is focused less on the production of the switchgear, even if maintaining standard of excellence for the products, and more on effectiveness side, providing the most complete overall possible package to the customers.

While this almost pure effectiveness-oriented strategy seems to be more difficult on the other sectors, thus making the lowest similarity index, it feels as a possible future strategy for the Italian switchgears industry. Doubling down on customers' satisfaction seems like a viable strategy to overcome difficulty imposed by the Oil&Gas switchgears sector, always maintaining the focus on the performance of the Engineering, that enables them to dialogue directly with end users' in order to access their specifications.

Furthermore, this is the company, among switchgears suppliers, that has the lowest vertical integration level, opposing the idea that is almost homogeneously spread in the sector, of investing to improve assembly line in order to produce internally, preferring to use money to get closer to customers.

This outlier can still be described by the extended resource-based theory. A firm identifies resources, that are mostly outside the boundary of its firm, to anticipate its competitors and obtain a competitive advantage that will last over time.

6.4.3 SVS – 1

This is the first, out of four, supplier that behaves as an outlier if compared with its sector, while it is not for ETO. The main difference is given by the selection of the performance of Flexibility (SC) and Differentiation, which have a very low selection frequency, especially the latter, which has been selected just twice over the whole ETO sample.

This supplier is the only that, in special valves sector, focuses in the provision of all the categories of valves and which has as main business the wide portfolio. The strategy above mentioned is favored by the dimension of the firm, since that is one of the two biggest companies of the whole sample, that allows it the selection of the Differentiation performance, helping the company in achieving a competitive advantage through the implementation of a business that has not been implemented by other competitors. This is also confirmed by the selection of Financial capability for the Differentiation performance, while the same capability is enabled by network action "maintaining large dimension".

Thus, firm's dimension can be, for sure, considered as a contextual factor that allows the supplier to build a wide portfolio of high engineered valve, but at the same time, it is also related to a choice of strategy of the company, that favors this uncommon business strategy.

The Flexibility (SC) is another extremely important characteristic, since it allows the company, in spite of its dimension, to be able to adapt to clients' requirements and modifications, while maintaining this complete products portfolio; flexibility is obtained both internally, thanks to local multi-skilled divisions and different plants, but also externally, through continuous interaction with customers and reliability of suppliers' network. Furthermore, the company is able to maintain a great internal organization, that allows the interaction with clients and the quick definition of the required documentation, that are often mismanaged, especially in firm with such a dimension. Thus, Flexibility (SC) is a fundamental element that this supplier requires to be able to balance wide portfolio and its dimension.

The risk is that the supplier, being an outlier in his sector, could be too aligned with ETO, thus meaning that the company would act as an ETO company without, yet, possessing the required specialization to operate and compete long-term on special valves market; this seems quite difficult since, thanks to its huge dimension and investment in maintaining the proper level of Quality and Flexibility (SC), the company should be able to maintain long-term advantage.

Another possibility, that will be later explored, is that the RBT is not perfectly fitting to describe this very specific company inside a much wider contextual factor as it is the ETO.

6.4.4 SVS – 5

This supplier is the only one that has selected the Financial performance, considered as very important to maintain the product portfolio and to win orders, especially in a market with companies with higher turnover or operating in a group. Quality is considered as a cutting skill; once the firm is able to certificate its products, it becomes equal to its competitors and this lead this supplier to indicate Engineering and Price as the other two main performance, thus preferring to compete on the market with lower price.

The particular configuration of this supplier is probably the combination of different factors; this is the only company which tries to approach the market with an almost complete portfolio of products (it only does not produce plug valves) without being part of a bigger group or being a firm with a significant size. It also focuses on the production of both “engineered valves” and standard valves, which are produced in another firms with a much higher production capacity.

In order to be able to compete, considering the width of portfolio, with bigger or with more specialized competitors, the company needs a continuous external financial support. This also leads to select a smaller number of suppliers for the whole different products, that could lead, long-term, to lose specificity, or increasing costs.

The tendering phase becomes extremely important, because the firm has to prove to EPC that they are able to compete on quality against other competitors. Collaborations with end users become extremely important to provide the highest level of services and product development.

This configuration is the result of a sequence of contextual factors, that is helping the company surviving against bigger competitors (or at least part of a group), or with firms more specialized in the items that it also provides.

Yet, its position on the market seems quite precarious in the long-term, being surrounded by much bigger or more specialized companies; at the moment, its position seems quite stable, but in case of sudden modification of the market external conditions, this company could be a hybrid between big companies with wide portfolio and small firms extremely specialized on a narrow set of valves, that could endanger its future.

The result above describes one of the possible problem that was intended to be identified by this study; a company, aligned with the ETO, that is an outlier in its sector, could be in a dangerous position for maintaining its competitive advantage over the future.

6.4.5 SES – 6

The main difference of this company with its competitors in static equipment sector is given by a different selection of performance; while this firm is fairly aligned in terms of practices and capabilities, yet those are combined to enable performance that are not much used in its sector, such as Flexibility (SC) and Engineering.

This supplier is completely focused on the production of Trays & Internals, that are products rarely produced by the companies in this sample; this difference leads the company to mainly sell its products to licensors,

instead of EPC companies. Since this is a very niche market, the company is able to have a worldwide leadership.

In this case, the contextual factor that leads the company to configure its supply chain in such a different manner is given by a difference in terms of clients, that in this case are licensors, whose strong relationships help providing much more particular technologies. These partnerships, that the company always tries to obtain and implement, foster the performance of Engineering, that is, in turn, improved thanks to an internal and specialized R&D department, required to communicate with the same customers. This leads the company to enable Knowledge Management Capability, that is a peculiarity of the firm, since it has not a high frequency of selection in this sector.

Other than licensors, this company also works with column suppliers and it probably has a smaller necessity to invest in price reduction, since it belongs in a market which a competition level that is much lower. Offering quality products with a high level of engineering allows the company not to worry too much about the final price that will be offered to its customers.

For the foreseeable future, the company should be able to survive, maintaining the advantage in a market in which there are not a lot of competitors yet, its alignment in the ETO could result in two different outcomes: the first one is that, being a very particular supplier of Static Equipment, which operates under a contextual factor, Trays & Internals, that is considered only by this Best Performer in the whole sample, the RBT applied to the ETO is not able to perceive its singularity, meaning that it cannot describe properly the behavior of this company in the ETO sector; the other one, that is quite likely since, as it will be shown later, the RBT well describes Static Equipment industry in ETO sector, meaning that this company could be on an unstable position on the market. For example, considering that companies in Static Equipment are quite big, they could start a process of vertical integration respect to Trays&Internals, increasing the competition around these specific products. Being SES – 6 only focused on Trays&Internals, its survival could be strongly stressed.

6.4.6 SES – 11

Unlikely its competitors, this company is not part of an international group, but it is the headquarter of national group, which prefers to acquire other companies to enhance its dimension, allowing it to maintain the same managerial independence.

Its smaller dimension, respect to competitors, makes the firm configuring its own supply chain in a different manner; while the performance, except Engineering, are in common with sector, the capabilities required to enable them are significantly different. The company focuses almost completely on external capabilities related to the control of both sides of the supply chain.

Furthermore, its relative small dimension did not allow the firm to achieve the production capacity required to decrease costs, through economy of scale, during crisis, thus the Engineering became extremely important because the firm was no more able to compete on markets ruled mainly by low-cost criteria, so it had to search niche markets on which it could get competitive advantage providing highly technological equipment. In the meanwhile, the company invested a lot for the enhancement of its Price performance, in order to compete with Italian and European competitors, for example, forging alliances with foreign suppliers able to produce standard components close to customer, reducing shipment costs.

Engineering has later become a main pillar of the company, which usually creates strong local partnership with customers. This performance is also fostered through continuous research of possible M&A, in order to acquire know-how and licenses.

Another difference with other sectors' suppliers is given by the absence of utilization of Project Management, that can be explained through the combination of two effects: the overall turnover is lower than the ones of its competitors, especially considering that many belongs to groups, and the low percentage of turnover that

the company obtains from Oil&Gas. This probably leads the company to the unnecessary of developing specific knowledge about Project Management, that is more used by other firms, because the lower load of projects allows the supplier to handle it without a Project Manager figure.

The company seems to be too aligned with ETO, while being an outlier in its sector and, as happened for the previous supplier, there are two possible explanations; the fact that the RBT is not able to translate this peculiar firm in a more general sector as the ETO or the company relying on a supply chain configuration that is too distant from the other competitors. Once, again the second solution appears the more likely, since this supplier could be too small to compete in a far future if, for example, the market shrinks again and the competitors increase much more their dimension. Furthermore, this company does not have, at the moment, the Project Management skills to manage an increase of number and dimension of the orders, thus hindering its potential growth.

6.4.7 SVS – 13, SVS – 15, SWS – 5, SWS – 9

Even if the target of this specific part of the research is to analyze the outliers in each sector, in order to understand how accurate is the resource-based view in the description of how these firms obtain and maintain over time competitive advantage, these four companies could provide useful information.

In the next part of this chapter, the focus of the research will deal with the precision with which the resource-based view can be used to describe the same companies, previously examined, in the ETO sector.

These are the suppliers that are outliers in the ETO, but they are not in their own sector, meaning that these firm do not behave as ETO companies, but they are able, in some way, to be competitive in the EPC industry. The result of the above conclusion would be that there are suppliers, whose products belong to EPC, that do not have the characteristics of the engineer-to-order companies. This means that these sectors are borderline across the ETO and that there are firms, that are aligned with their sector, that fall outside the boundaries of ETO.

Anyway, there is also another possibility that will be thoroughly inspected in the next section, which is that the extended resource-based view, even if united with contingency and dynamic capability theory, is not able to describe accurately these Best Performers in relation to ETO sector, meaning that those companies appear as ETO outliers because of a bias in theory used for their description.

These companies will not be analyzed singularly, but they will be kept under consideration during the next analysis and in writing conclusions of the research.

6.5 Comparative analysis of single sectors with ETO

It has been previously introduced, along with the three sectors related to the EPC, the more general contextual factor of ETO, whose average supply chain has been evaluated starting from the aggregated data of all the companies under study.

Thanks to this framework, it has been possible to define an average supply chain configuration of this new sector, considering the most used elements of these Best Performers, that have been gathered altogether. This contextual factor can be used to join these suppliers under one single lens, to provide a different view of their configurations and to understand if it is possible to use their configurations in order to say something about the ETO.

Yet, this study relies on the concept that these companies can be investigated through the usage of an extended resource-based view, that keeps under consideration also the effects of the different contextual factors.

Thus, it becomes interesting to see how close each sector is respect to the ETO, to see if there is some gap in theory that could be exposed through this comparison. The results that are obtained from this analysis will provide an answer for the fourth research question.

In order to do that, the similarity indexes, previously evaluated (Table 6.4, Table 6.5, Table 6.6, Table 6.10), are considered and, for each company, the percentage of variation of the similarity index is calculated from its own sector to the ETO.

Considering, then, the average variation of each company for each sector, it is possible to see which is the one that is the closest to the ETO and to evaluate if it is required to provide more theory to describe the discrepancies.

In other words, through this study, it is possible to evaluate if the resource-based view of the company in its sector can be extended to ETO.

The list of similarity indexes for each supplier is listed below, along with the percentage variation:

Company	SVS – 1	SVS – 2	SVS – 3	SVS – 4A	SVS – 4B	SVS – 5	SVS – 6
Sector	0,337	0,600	0,528	0,589	0,800	0,300	0,391
ETO	0,326	0,318	0,632	0,579	0,475	0,353	0,336
% Variat.	-3,12%	-47,06%	19,70%	-1,79%	-40,63%	17,65%	-13,95%
Company	SVS – 7	SVS – 8A	SVS – 8B	SVS – 8C	SVS – 9	SVS – 10	SVS – 11
Sector	0,367	0,560	0,556	0,760	0,459	0,424	0,567
ETO	0,400	0,420	0,578	0,620	0,365	0,365	0,360
% Variat.	9,09%	-25,00%	4,00%	-18,42%	-20,51%	-13,89%	-36,47%
Company	SVS – 12A	SVS – 12B	SVS – 12C	SVS – 13	SVS – 14A	SVS – 14C	SVS – 15
Sector	0,640	0,238	0,711	0,523	0,600	0,725	0,371
ETO	0,540	0,238	0,378	0,185	0,371	0,350	0,271
% Variat.	-15,63%	0,00%	-46,88%	-64,71%	-38,10%	-51,72%	-26,92%
Company	SVS – 16	SVS – 17	SVS – 18	SES – 1	SES – 2	SES – 3	SES – 4
Sector	0,558	0,689	0,771	0,471	0,400	0,667	0,530
ETO	0,425	0,667	0,386	0,357	0,308	0,467	0,370
% Variat.	-23,88%	-3,23%	-50,00%	-24,24%	-23,08%	-30,00%	-30,19%
Company	SES – 5	SES – 6	SES – 7	SES – 8A	SES – 8C	SES – 9	SES – 10
Sector	0,600	0,369	0,783	0,518	0,463	0,733	0,450
ETO	0,630	0,323	0,748	0,435	0,411	0,776	0,410
% Variat.	4,94%	-12,50%	-4,44%	-15,91%	-11,36%	5,79%	-8,89%
Company	SES – 11	SES – 12	SWS – 1	SWS – 2	SWS – 3	SWS – 4	SWS – 5
Sector	0,311	0,815	0,745	0,895	0,650	0,653	0,378
ETO	0,348	0,815	0,364	0,463	0,288	0,337	0,156
% Variat.	9,52%	-7,55%	-21,95%	-47,06%	-28,85%	-27,42%	-35,29%
Company	SWS – 6	SWS – 7	SWS – 8	SWS – 9			
Sector	0,545	0,626	0,311	0,450			
ETO	0,627	0,417	0,133	0,238			

% Variat.	30,00%	-22,22%	-100,00%	-38,89%	

Table 6.13 List of similarity indexes – Single sector/ETO

	Average variation
Special Valves	-20,48%
Static Equipment	-11,38%
Switchgears	-32,41%

Table 6.14 Average similarity index variation for each sector

From this analysis, it is possible to see that the sector whose companies are the most heterogeneous, respect to the ETO, is the switchgears one, whose suppliers see a decrease of the similarity index, on average, of 32%. This reduction, that also verifies, even if with a smaller amplitude, for the other sectors, could be just related to the fact that the pool of companies from which the similarity index is calculated is much wider.

The creation of ETO contextual factor derives from the union of three pools of companies belonging to similar sectors related to the EPC that, however, present different features, that are mainly related to the different types of product that are under investigation. It is not surprising to see that, on average, all the companies have seen a reduction of the degree of fit, because they are relating with a sector which has additional elements taken from other different industries.

Anyway, it is possible to see that special valves and, above all, switchgears firms have seen a decrease of their compatibility with this new average configuration, that is higher than static equipment one. It becomes interesting to understand if this difference in the percentage variations can tell us something about the hypothesis that have been used to approach this analysis.

Furthermore, it does not seem casual that the four companies, which were ETO outliers and aligned within their industry, come from the same two sectors that have the highest percentage reduction. It seems at least likely that the resource-based theory is not able to fully describe the switchgears and special valves in relationships with a more general ETO sector.

In the following section, the results of the two previous analysis will be presented and, through their comparison, the answers to the third and fourth Research Questions will be provided.

6.6 Discussion of the results

The results of the two analyses previously effectuated seem to provide more than one point in common.

The answer to the *third Research Question* comes from the analysis of the results of the study on the outliers of each sector, which are following: SVS – 12B, SWS – 8, SVS – 1, SVS – 5, SES – 6, SES – 11. These six outliers present supply chain configuration that are far different from the ones of their competitors. A critical examination of the context of these firms helped to understand if the resource-based theory was still able to provide an explanation for this different behavior, or if it was necessary to address further literature review to identify other theories.

The results of the analysis showed that the behavior of these suppliers is aligned with the contingent resource-based view, meaning that each of the six firms has identified a particular supply chain configuration that is required because of the presence of different contextual factors, that force them to bundle their resources in such a different way. While the majority of the other firms tend to align, identifying common performance and pursuing similar combination of capabilities and practices, these outliers not only present

different capabilities and practices, but they have the tendency of moving away from common performance, identifying their competitive advantage through different kind of performance.

The resource-based theory applied to the framework allows, not only to identify differences in terms of capabilities and practices, but also the variances between the performance that are enabled thanks to those elements.

The richness of this part of the study is that, not only it confirms the goodness of the RBT applied to this context, but it also allows to analyze which are the most significant contextual factors. Furthermore, other than a few exceptions, it can be noticed that in order for a company to structure differently its own supply chain, usually it is necessary, for the supplier, to be subjected to a different combination of contextual factors, that act as external forcing.

Except SWS – 8 and SES – 6, whose single contextual factor is strong enough to alter the structure of the company by itself, all the other suppliers are different because of a combination of two or three different factors, that can be taken among size of the firm, product portfolio, partnership to a group and reference market.

Another interesting result, that comes from this analysis, is related to the future of some of these companies; in fact, the comparison with ETO at this level, can be useful because it helps to understand if the different configuration of the company is going to be positive in the future or if the firm will be in danger, if the market suddenly changes.

The latter is the condition that has been noticed for companies SVS – 5, SES – 6 and SES – 11, whose configuration could be very fragile in the future, in case of shock in the market. Usually, this happens because these firms present a supply chain that is a hybrid between extreme configurations of competitors present on the market; while this situation, mixed with actual contextual factors, helps the company maintaining a present position of competitive advantage, possible future changings could negatively impact the company. These conditions have already been discussed in their respective section. What is important to see is something that also came out during literature review about resource-based view, that is the role of the manager, that has to rearrange the resources and capabilities of the company, if the external conditions vary. This is extremely important for the three above mentioned companies, because it could be necessary to change their business and supply chain configuration in the future.

There is also a third result, that can be united with the next discussion of the results, related to single sectors and the ETO. There is one company, SVS – 1, which is an outlier for its sector, but not in ETO. The configuration of this company does not seem to be possibly affected by variations in the market and so, the fact that this company is not perceived as an outlier in ETO, could hint that there is something wrong in the translation from special valve sector to ETO.

This is the topic that will provide the answer to the *fourth Research Question*, that is the application of the resource-based view to describe the suppliers under the common contextual factor of ETO.

From the analysis of the variation of Similarity Index of the suppliers from their sector to the ETO, it is possible to notice that there is an overall reduction of the fit, that is more spread in switchgears and special valves. The scope of that analysis was to understand if resource-based view was specific enough to describe these companies, coming from different sectors, as they were under a single one, ETO sector.

Combining the results of the previous analysis and the outliers' one, it seems that the resource-based theory, as it was defined with the framework in the literature, is not accurate enough to provide a detailed description of these Italian suppliers, coming from different sectors, as they were ETO companies. It is necessary to explain where does these considerations come from.

First of all, it seems that the major effect of this lack of accuracy of the RBT is reflected on special valves and switchgears, leaving undisturbed the static equipment. This initial consideration comes directly from the result of the last analysis, that shows that the two sectors that see the highest reduction of similarity index are valves and switchgears.

Furthermore, there are four outliers of the ETO, that are aligned inside their own sector. From a logical point of view, this would mean that their membership sectors are borderline respect to ETO, thus these outliers are companies that do not have ETO characteristics, but that work in an ETO environment, such as the EPC industry. While this could be an interesting reading of the results, there is another alternative; the four companies belong to special valves and switchgears sectors. No outlier of that type comes from static equipment.

This could validate the previous consideration which states that the resource-based theory applied on the framework is not accurate or complete enough to be used to properly describe companies supplying switchgears and special valves as they were ETO suppliers. Then, those four companies could be outliers in ETO because the framework is warping their supply chain, showing data that are not realistic.

There is one further element that seems to support this statement, that is company SVS – 1. This supplier is an outlier in special valve sector, while it is not respect to ETO, depicting a possible future unstable situation that does not seem realistic, meaning that, once again, the description of the company with the framework is not precise.

The framework that has been used seems to be very useful to describe these Italian suppliers within their sector, while it loses accuracy if it is required to describe these same companies altogether. This could be related to the fact that these sectors possess some features that, when considered altogether, hinder the correct description of the phenomenon. It could be interesting to identify what could be the features that are impede the proper analysis of these companies.

For example, the switchgears' sector presents some features that cannot be found in the other two; almost the totality of Italian best-performers are small-medium sized companies which buy the electrical components from multinationals, thus defining this strong dependence relationships towards these suppliers, that are usually smoothed trying to create partnership and combined products. Since these suppliers have a much higher financial capability, it becomes very difficult for Italian suppliers to be able to invest enough in R&D on these components (switches, for example) with reliability standard sufficient to persuade end users to accept their products.

The development of partnerships, or alliances, with these multinationals, become, though, an extremely important source of competitiveness of Italian suppliers for engineering purposes, better after-sales services, on-time delivery and other strategic advantages. While the framework contains elements that can help describing this situation, given the latter results, it could be possible that they are not enough, especially for the description of the affiliation of this sector with an ETO set, that takes into account also other companies belonging to sectors in which this kind of dependence does not exist. The resource-based view, even in its extended form, in which resources outside the company are considered as fundamental to achieve competitive advantage, could not be enough to describe this transfer of know-how and critical parts.

The advantage of resource-based theory is its extreme flexibility and adaptability, that allows it to be molded and united with other different theories, as it has already been done in this research. Maintaining the RBV as the main theoretical support, it could be possible to further exploit these relationships between switchgears' suppliers and multinationals integrating another theory, in a future research, by analyzing the outsourcing of such a critical set of components (switches and others) to companies, that are, at the same time, competitors on the market.

The literature identifies how RBT has been used in the fields of operation and supply chain management and which are the most associated theories. Among these, there are some that have already been considered in this paper, that allowed the connection with the framework, while others can be used for the analysis of strategic outsourcing: transactional cost economics (TCE) and knowledge-based view (KBV).

In Transaction Cost Economics approach, the properties of the transaction determine what constitute the most efficient governance structure, that can be market, hierarchy or alliance (Williamson, 1975). There is a growing body of literature that is starting to view these theories altogether in order to understand which approaches lie behind outsourcing decisions, leveraging on the fact that, alone, they cannot explain properly this phenomenon, as it seems to happen in this study.

Knowledge-based view is very similar to resource-based view, identifying the knowledge as the most important resource of a company. The primary role of a company is the identification, acquirement, storing and application of knowledge, through different mechanism. Knowledge management among buyer-supplier can be a strategic resource for the company and a source of competitive advantage. Starting from this concept, Bustinza et al. (2010) analyzed the outsourcing under a knowledge-based perspective, assessing how the nature of the knowledge outsourced affects the success of outsourcing.

One of these theories can provide a deeper insight on how do these companies generate competitive advantage while outsourcing the manufacturing of high-value components to suppliers that are, at the same time, their competitors, and how do these companies succeed in creating win-win partnerships, that allow them to survive on the markets.

Since the manufacturing of own set of electrical components is also often opposed by the end users, which prefer the more reliable technology coming from international groups, another analysis on this side of the supply chain could be useful.

The situation of special valves sector is a bit more complicated, since it is not so easy to perceive a feature in this sector that could help, at least, the identification of the field to be investigate through additional theories.

This will later be discussed in the conclusions section.

7. Conclusions and future research

This study started with the prospective of conjugating a framework that was able to provide an accurate description of the supply chain configuration of a company with the resource-based theory, that could act as a theoretical lens, providing the meaning behind a certain combination of practices and capabilities. The union between this framework and the theory has happened after the integration of other theories, complementary with resource-based theory, to provide a wider view of the configuration of a firm.

Once this integration has been completed, the framework has been used to analyze 39 Best Performers companies from 3 different sectors, Special Valves, Static Equipment and Switchgears, that work in the EPC industry.

This study has been made considering four Research Questions: the first two are related to the principal elements selected by the companies and their relationships, while the second two point at understanding if the resource-based theory could be used to study these companies both in their own sector and under the contextual factor of the ETO.

The first two Research Questions have been answered through the application of multi-case study, that allowed to see the alignment between suppliers and EPC Contractors, in terms of performance. Furthermore, through the multi-case study, it has been possible to identify the most selected performance for each sector and then to identify which were the used capabilities to achieve these performance and, for each of these one or more suggested sets of capabilities have been created.

The same happened when the focus moved to the practices, identifying which are the best practices to use to get each capability. For the best capabilities, it was possible to identify combinations of practices that could be used to enable such a capability.

The final consideration wanted to provide a suggested guideline that could be used for other suppliers, to identify how to develop certain performance, starting from the practices. This connection has been made putting together the different sets performance-capabilities and capability-practices, that allowed the identification of more than one combination of practices. This plurality can be useful if, for example, a firm already has some practice, thus it can find the combination in which the practices, that it already has, are present and it can understand which are the missing one that it requires.

In the following table, the references to the results of the first two Research Questions will be listed.

Research Question	Description	Sector	Reference Paragraph	
R.Q.1	Which are the most important performance, capabilities and practices for each sector?	Special Valves	Performance	5.3.1.1
			Capabilities	5.3.1.2
			Practices	5.3.1.4
		Static Equipment	Performance	5.3.2.1
			Capabilities	5.3.2.2
			Practices	5.3.2.4
		Switchgears	Performance	5.3.3.1
			Capabilities	5.3.3.2
			Practices	5.3.3.4
R.Q.2	Which are the suggested configurations for each principal performance of the three sectors	Special Valves	5.3.1.5	
		Static Equipment	5.3.2.5	
		Switchgears	5.3.3.5	

Table .1 Reference answers for R.Q.1 and R.Q.2

Now that the first two Research Questions have been archived, it is necessary to conclude the results obtained from the previous chapter.

It has been proven, thanks to the analysis of the outliers, that the resource-based theory applied to the framework is able to provide in detail the description of the supply chain configuration of each company, if it is referred to the reference sector.

The problem starts when the resource-based theory is applied to a much wider context, such as the ETO, in which the companies related to the three sectors are converged. Even if those companies work in for EPC clients, that is usually characterized by ETO approach by suppliers, on average, the companies of switchgears and special valves sector tend to get far from the average, with a higher magnitude respect to static equipment.

It has been shown in the discussion of the results of the previous chapter, that the extended resource-based theory, combined with contingency and dynamic capability theory, is not able to perceive a characteristic of the sector, that probably warp the configurations of those firms.

Is it possible to identify some higher guideline, not related with the specific sector?

When the three different sectors are combined to create the ETO, we are saying that there are companies, that have been previously well described by resource-based theory, that suddenly are no more describable by the same theory. Static equipment has its own features that are not present inside the other sectors, yet when is coupled with switchgears and special valves, the lost due to the passage in ETO is much smaller.

This could be due to the fact that there are some features and characteristics that are particularly difficult to be described by this framework.

Another possibility is that the switchgear sector presents a difference in terms of relationships with other entities of the supply chain, in this case the multinationals, that is just too specific and that cannot be described by the actual framework and further literature research is required.

This could also imply the higher decrease of the special valves sector. If special valves is closer to switchgears than It is with static equipment, during the evaluation of the average supply chain configuration of the ETO, the data coming from switchgears could affect it negatively, thus warping also the final result for the special valves sector, showing it much farer from the ETO than the real value.

It could be possible to provide a rough demonstration that special valves sector is closer to switchgears than static equipment using the similarity index onto the average supply chains of the sectors. This index is, of course, not symmetric, though results are different depending on which sector is the reference and which has the configuration that is desired to compare with.

This leads to the following results:

Compare to\Reference	Special Valves	Static Equipment	Switchgears
Special Valves	-	0,43	0,533
Static Equipment	0,504	-	0,4
Switchgears	0,519	0,348	-

Table 8.2 Comparison among average supply chain of the theory

This is a result coming from average values, but it shows that special valves are closer to switchgears than to static equipment, while static equipment seems pretty far from switchgears, meaning that it could feel less the effect of warping.

What does it mean for the theory?

It means that the resource-based theory, if it is not perfectly configured for the research, it warps not only the source of mistake, but it also fouls up the other data, hindering the result of the research.

One possible future research is to try the same outliers' analysis and the same comparison with ETO sector just considering the Special Valves and Static Equipment in order to understand if the reduction of the Special Valves is really due to it being different than ETO, or that the previous result was biased by the switchgear.

Another future research is related to the exploration of resource-based view with the framework, of the two possible theories, the knowledge-based view and transaction-cost economics, in order to see which theory is able to better describe the outsourcing of electrical component and their relationships with competitors/suppliers.

After the identification of the right theory it could be possible to implement the framework, if necessary, and to try again the comparison of the sectors with ETO, in order to see that: a) the reduction of the percentage variation of the switchgears sector was caused by missing theory and b) also the reduction of percentage variation of special valve was due to the influence of poor description for the ETO sector.

In case b) was negative, it would mean that the special valves sector is effectively far from ETO or that there is one or more feature of that sector that the resource-based theory is not able to describe. In the latter case, further literature analysis would be suggested, in order to understand which are these characteristics of the special valves that are not perceived by RBT and, eventually, which theory could fill this gap.

Finally, it could be useful to use this framework in a research in a field different than the Oil&Gas.

REFERENCES

- Amit R, Schoemaker PJH. 1993. Strategic assets and organizational rent. *Strategic Management Journal* 14(1): 33–46
- Ansari, A., Modarress, B. (1988). JIT purchasing as a quality and productivity centre. *The International Journal of Production Research*, 26(1), 19-26.
- Azadegan, Arash, Pankaj C. Patel, Abouzar Zangouinezhad, and Kevin Linderman. 2013. "The Effect of Environmental Complexity and Environmental Dynamism on Lean Practices." *Journal of Operations Management* 31 (4): 193–212
- Barney, Jay. "Firm resources and sustained competitive advantage." *Journal of management* 17.1 (1991): 99-120.
- Bayraktar, E., Demirbag, M., Koh, S.C., Lenny, T.E., ZaimH. (2009). A causal analysis of the impact of information systems and supply chain management practices on operational performance: evidence from manufacturing SMEs in Turkey. *International Journal of Production Economics*, 122, 133-149.
- Beamon, Benita M. "Measuring supply chain performance." *International journal of operations & production management* 19.3 (1999): 275-292.
- Bhatnagar, Rohit, and Amrik S. Sohal. "Supply chain competitiveness: measuring the impact of location factors, uncertainty and manufacturing practices." *Technovation* 25.5 (2005): 443-456.
- Biscardini, G., Morrison, R., Branson, D., del Maestro, A. (2017). 2017 Oil and Gas Trends
- Blome, C., Schoenherr, T., Rexhausen, D. (2013). Antecedents and enablers of supply chain agility and its effect on performance: a dynamic capabilities perspective. *International Journal of Production Research*, 51(4), 1295-1318.
- Brancaleoni, M. (2014). Le valvole industriali, un primato tutto italiano. *Impiantistica Italiana*, Vol. 6, 11-13.
- Brush, Thomas H., and Kendall W. Artz. "Toward a contingent resource-based theory: The impact of information asymmetry on the value of capabilities in veterinary medicine." *Strategic Management Journal* (1999): 223-250.
- Bustinza, Oscar F., Luis M. Molina, and LEOPOLDO J. GUTIERREZ-GUTIERREZ. "Outsourcing as seen from the perspective of knowledge management." *Journal of Supply Chain Management* 46.3 (2010): 23-39.
- Chen, Injazz J., and Antony Paulraj. "Towards a theory of supply chain management: the constructs and measurements." *Journal of operations management* 22.2 (2004): 119-150.
- Croom, Simon, Pietro Romano, and Mihalís Giannakis. "Supply chain management: an analytical framework for critical literature review." *European journal of purchasing & supply management* 6.1 (2000): 67-83.
- Day, George S. "Market Driven Strategy." (1990).
- Day, George S. "The capabilities of market-driven organizations." *the Journal of Marketing* (1994): 37-52.
- Dickson, G.W. (1966). An analysis of vendor selection systems and decisions. *Journal of Purchasing*, 2(1), 5-17.
- Dierickx, Ingemar, and Karel Cool. "ASSET STOCK ACCUMULATION AND THE SUSTAINABILITY OF COMPETITIVE ADVANTAGE: REPLY." *Management Science* 35.12 (1989).
- Donaldson, Lex. *The contingency theory of organizations*. Sage, 2001.
- ENI (2016). World Oil and Gas Review 2016

- Flynn, Barbara B., Baofeng Huo, and Xiande Zhao. "The impact of supply chain integration on performance: A contingency and configuration approach." *Journal of operations management* 28.1 (2010): 58-71.
- Franchini, G., Jimenez D.R.V., Rocco, A.G. (2017). Oil&Gas global plant investment outlook, *Impiantistica Italiana*, Vol. 2, pp. 30-35
- Frohlich, Markham T., and Roy Westbrook. "Arcs of integration: an international study of supply chain strategies." *Journal of operations management* 19.2 (2001): 185-200.
- Fynes, Brian, Chris Voss, and Seán de Búrca. "The impact of supply chain relationship quality on quality performance." *International journal of production economics* 96.3 (2005): 339-354.
- Gordon, John, and Amrik S. Sohal. "Assessing manufacturing plant competitiveness-An empirical field study." *International Journal of Operations & Production Management* 21.1/2 (2001): 233-253.
- Gosling, Jonathan, and Mohamed M. Naim. "Engineer-to-order supply chain management: A literature review and research agenda." *International Journal of Production Economics* 122.2 (2009): 741-754.
- Gosling, Denis R. Towill, Mohamed M. Naim & Andrew R. J. Dainty (2015) Principles for the design and operation of engineer-to-order supply chains in the construction sector, *Production Planning & Control*, 26:3, 203-218
- Grötsch, Volker M., Constantin Blome, and Martin C. Schleper. "Antecedents of proactive supply chain risk management—a contingency theory perspective." *International Journal of Production Research* 51.10 (2013): 2842-2867.
- Gunasekaran, Angappa, Christopher Patel, and Ronald E. McGaughey. "A framework for supply chain performance measurement." *International journal of production economics* 87.3 (2004): 333-347.
- Hallgren, Mattias, and Jan Olhager. "Lean and agile manufacturing: external and internal drivers and performance outcomes." *International Journal of Operations & Production Management* 29.10 (2009): 976-999.
- Hansen, Mark H., Lee T. Perry, and C. Shane Reese. "A Bayesian operationalization of the resource-based view." *Strategic Management Journal* 25.13 (2004): 1279-1295.
- Harel, Gedaliahui H., and Shay S. Tzafrir. "The effect of human resource management practices on the perceptions of organizational and market performance of the firm." *Human resource management* 38.3 (1999): 185-199.
- Hitt, Michael A., Kai Xu, and Christina Matz Carnes. "Resource based theory in operations management research." *Journal of Operations Management* 41 (2016): 77-94.
- Holcomb, Mary Collins. "Customer service measurement: a methodology for increasing customer value through utilization of the Taguchi strategy." *Journal of Business Logistics* 15.1 (1994): 29.
- Innis, D.E. and LaLonde, B.J. (1994), "Customer service: the key to customer satisfaction, customer loyalty, and market share", *Journal of Business Logistics*, Vol. 15 No. 1, pp. 1-28.
- Jones, Gary K., Aldor Lanctot, and Hildy J. Teegen. "Determinants and performance impacts of external technology acquisition." *Journal of Business venturing* 16.3 (2001): 255-283.
- Kaleka, Anna. "Resources and capabilities driving competitive advantage in export markets: guidelines for industrial exporters." *Industrial Marketing Management* 31.3 (2002): 273-283.
- Koh, S. C., et al. "The impact of supply chain management practices on performance of SMEs." *Industrial Management & Data Systems* 107.1 (2007): 103-124.
- Koufteros, Xenophon A. "Time-based competition: Developing a nomological network of constructs and instrument development." (1996): 2765-2765.

- Kumar Kar, Arpan, and Ashis K. Pani. "Exploring the importance of different supplier selection criteria." *Management Research Review* 37.1 (2014): 89-105.
- Lado, Augustine A., and Mary C. Wilson. "Human resource systems and sustained competitive advantage: A competency-based perspective." *Academy of management review* 19.4 (1994): 699-727.
- Lambert, Douglas M., James R. Stock, and Lisa M. Ellram. *Fundamentals of logistics management*. McGraw-Hill/Irwin, 1998.
- Laursen, Keld, and Nicolai J. Foss. "New human resource management practices, complementarities and the impact on innovation performance." *Cambridge Journal of economics* 27.2 (2003): 243-263.
- Lavie, D. (2006), "The competitive advantage of interconnected firms: an extension of the resource-based view", *Academy of Management Review*, Vol. 31 No. 3, pp. 638-58.
- Lewis, Michael, et al. "Competing through operations and supply: the role of classic and extended resource-based advantage." *International Journal of Operations & Production Management* 30.10 (2010): 1032-1058.
- Ling-Yee, Li. "Marketing resources and performance of exhibitor firms in trade shows: A contingent resource perspective." *Industrial Marketing Management* 36.3 (2007): 360-370
- Li, Suhong, et al. "The impact of supply chain management practices on competitive advantage and organizational performance." *Omega* 34.2 (2006): 107-124.
- Luzzini, Davide, Federico Caniato, and Gianluca Spina. "Designing vendor evaluation systems: An empirical analysis." *Journal of Purchasing and Supply Management* 20.2 (2014): 113-129.
- Makadok, Richard. "Toward a synthesis of the resource-based and dynamic-capability views of rent creation." *Strategic management journal* 22.5 (2001): 387-401.
- Mason-Jones, R., Naylor, B., Towill, D.R. (1999). Lean, agile or leagile? Matching your supply chain to the marketplace. *International Journal of Production Research*, 38(17), 4061-4070
- Monczka, Robert M., et al. "Success factors in strategic supplier alliances: the buying company perspective." *Decision Sciences* 29.3 (1998): 553-577.
- Moore, D.L., Fearon, H.E. (1973). Computer-assisted decision-making in purchasing. *Journal of Purchasing*, 9(4), 5-25.
- Morgan, Neil A., Douglas W. Vorhies, and Charlotte H. Mason. "Market orientation, marketing capabilities, and firm performance." *Strategic Management Journal* 30.8 (2009): 909-920.
- Murray, J.Y., Yong Gao, G., Kotabe, M. (2011). Market orientation and performance of export ventures: the process through marketing capabilities and competitive advantages. *Journal of the Academy Marketing Science*, 39, 252-269.
- Narasimhan, R. (1983). An analytical approach to supplier selection. *Journal of Purchasing and Materials Management*, 19(4), 27-32.
- Neely, Andy, Mike Gregory, and Ken Platts. "Performance measurement system design: a literature review and research agenda." *International journal of operations & production management* 15.4 (1995): 80-116.
- Pandey, Prachi, Sanghamitra Bhattacharyya, and Arshinder Kaur. "Exploring the role of HR practices in supply chain." *Journal of Advances in Management Research* 9.1 (2012): 113-123.
- Payne, H.L. (1970). Development of a supplier evaluation technique utilizing financial information. *Journal of Purchasing*, 6(4), 21-34.

- Power, Damien J., Amrik S. Sohal, and Shams-Ur Rahman. "Critical success factors in agile supply chain management-An empirical study." *International journal of physical distribution & logistics management* 31.4 (2001): 247-265.
- Prajogo, Daniel, and Jan Olhager. "Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration." *International Journal of Production Economics* 135.1 (2012): 514-522.
- Priem, Richard L., and John E. Butler. "Is the resource-based "view" a useful perspective for strategic management research?" *Academy of management review* 26.1 (2001): 22-40
- Prometeia (2015). Rapporto Analisi dei Settori Industriali. *Report Semestrale con Banca Intesa Sanpaolo*
- Prometeia (2017). Rapporto Analisi dei Settori Industriali. *Report Semestrale con Banca Intesa Sanpaolo*
- Rahman, A., A. Rahim, M. Shariff, and N. Baksh. 2003. "The Need for a New Product Development Framework for Engineer- to-order Products." *European Journal of Innovation Management* 6 (3): 182–196
- Ravichandran, Thiagarajan, Chalerm Sak Lertwongsatien, and CHALERMSAK LERTWONGSATIEN. "Effect of information systems resources and capabilities on firm performance: A resource-based perspective." *Journal of management information systems* 21.4 (2005): 237-276.
- Servizio Centrale Studi Economici di ANIE (2015). L'industria italiana di Quadri elettrici di Media e Bassa Tensione
- Sheth, J.N. (1973). A model of industrial buyer behavior. *The Journal of Marketing*, 50-56.
- Sirmon, David G., Steve Gove, and Michael A. Hitt. "Resource management in dyadic competitive rivalry: The effects of resource bundling and deployment." *Academy of Management Journal* 51.5 (2008): 919-935.
- Sirmon, David G., Michael A. Hitt, and R. Duane Ireland. "Managing firm resources in dynamic environments to create value: Looking inside the black box." *Academy of management review* 32.1 (2007): 273-292.
- Smith, N.J. (2002). *Engineering project management*. Blackwell.
- So, K.C., Zheng, X. (2003). Impact of supplier's lead time and forecast demand updating on retailer's order quantity variability in a two-level supply chain. *International Journal of Production Economics*, 86, 169-179.
- Song, Michael, C. Anthony Di Benedetto, and Robert W. Nason. "Capabilities and financial performance: The moderating effect of strategic type." *Journal of the Academy of Marketing Science* 35.1 (2007): 18-34.
- Sousa, Rui, and Christopher A. Voss. "Contingency research in operations management practices." *Journal of Operations Management* 26.6 (2008): 697-713.
- Spekman, Robert E., Joseph Spear, and John Kamauff. "Supply chain competency: learning as a key component." *Supply chain management: An international journal* 7.1 (2002): 41-55.
- Swafford, P.M., Ghosh, S., Murthy, N. (2008). Achieving supply chain agility through IT integration and flexibility. *International Journal of Production Economics*, 116, 288-297.
- Tan, K.C., Kannan, V.R., Handfield, R.B., Ghosh, S. (1999). Supply Chain Management: an empirical study of its impact on performance. *International Journal of Operations & Production Management*, 19(10), 1034-1052.
- Tan, K.C. (2002). Supply Chain Management: practices, concerns, and performance Issues. *The Journal of Supply Chain Management: A Global Review of Purchasing and Supply*, (2002), 42-53.
- Teece, David J., Gary Pisano, and Amy Shuen. "Dynamic capabilities and strategic management." *Strategic management journal* (1997): 509-533.

- Tracey, Michael, Jeen-Su Lim, and Mark A. Vonderembse. "The impact of supply-chain management capabilities on business performance." *Supply Chain Management: An International Journal* 10.3 (2005): 179-191.
- Tripodo, G. (2016). Andamento del mercato del settore impiantistico nel 2015 e prospettive per il biennio 2016-2017. *Impiantistica Italiana*, 48(4), 40-54.
- Tseng, Shu-Mei, and Pei-Shan Lee. "The effect of knowledge management capability and dynamic capability on organizational performance." *Journal of Enterprise Information Management* 27.2 (2014): 158-179.
- Ufficio studi ANIMA (2015).
- Weber, C., A., Current, J., R., 1993. A multi-objective approach to vendor selection. *EJ Op Res.* 68:173-184.
- Weber, Charles A., John R. Current, and W. C. Benton. "Vendor selection criteria and methods." *European journal of operational research* 50.1 (1991): 2-18.
- Wernerfelt, Birger. "A resource-based view of the firm." *Strategic management journal* 5.2 (1984): 171-180.
- Williamson, O.E., 1975. *Markets and Hierarchies*. Free Press, New York.
- Wook Kim, S. (2006). Effects of supply chain management practices, integration and competition capability on performance. *Supply Chain Management: An International Journal*, 11(3), 241-248.
- Wright, Patrick M., et al. "The relationship between HR practices and firm performance: Examining causal order." *Personnel psychology* 58.2 (2005): 409-446.
- Yin, Robert. "Case study research: Design and methods . Beverly Hills." (1994).
- Zhao, Meng, Cornelia Dröge, and Theodore P. Stank. "The effects of logistics capabilities on firm performance: customer-focused versus information-focused capabilities." *Journal of Business Logistics* 22.2 (2001): 91-107.
- Zhou, Honggeng, and W. C. Benton. "Supply chain practice and information sharing." *Journal of Operations management* 25.6 (2007): 1348-1365.

ANNEX-A

PERFORMANCE

PERFORMANCE ITEMS	Performance measurement	Author
Price	Product pricing	Li (2006)
	Total cost of acquisition	Kumar Kar (2014)
	Production capability	Gunasekaran (2004)
	Maintenance cost	-
	Dismissal cost	-
Quality	Product quality	Monczka (1988), Weber (1991)
	Safety adherence	Weber (1991), Kumar Kar (2014)
	Quality in field	Chen (2004)
	Defect-free deliveries level	Kumar Kar (2014)
On-Time Delivery	Delivery reliability	Kumar Kar (2014)

	Delivery frequency	-
	Average lateness of orders	Beamon (1999), Li (2006)
	Shipping errors	Beamon (1999)
Engineering	Design capabilities	-
	Technical capability	Timmerman (1986), Weber (1991)
	Product development cycle time	Li (2006)
Innovation	Use of new technology	Kumar Kar (2014)
	Innovation investment	Kumar Kar (2014)
	Research & Development	Kumar Kar (2014)
Differentiation	Product uniqueness perception	-
Variety	Supply variety	Fynes (2005)
	Product line diversity	Kumar Kar (2014)
Lead-Time	Lead-time/response time	Beamon (1999)
	Manufacturing lead-time	Beamon (1999)
	Delivery lead-time	Beamon (1999), So (2003), Fynes (2005)
	Customer response time	Beamon (1999)
Flexibility (Supply Chain)	Procedural compliance	Weber (1991), Kumar Kar (2014)
	Availability of parts	Kumar Kar (2014)
	Response flexibility	Beamon (1999)
	Order flexibility	Beamon (1999)
	Frozen time	-
	Production flexibility	Beamon (1999), Chen (2004)
	Volume flexibility	Chen (2004), Fynes (2005)
	Capacity flexibility	Narasimhan (1983)
	Delivery systems flexibility	Moore (1973), Gunasekaran (2004)
Commercial Impact	Supplier's reputation	-
	Performance history	Timmerman (1986), Weber (1991)
	Trade restrictions	Kumar Kar (2014)
	Brand value	Wagner (1989)
Financial	Financial position	Payne (1970)
	Warranties	Weber (1991)
Service	Service quality experience	Sheth (1973), Weber (1991), Kumar Kar (2014)
	Service quality credence	Sheth (1973), Weber (1991), Kumar Kar (2014)
	Custom duties	Li (2006), Kumar Kar (2014)
	Domain experience	Kumar Kar (2014)
	Packaging capability	Ansari (1988), Weber (1991)
	Billing accuracy	Kumar Kar (2014)
	Installation assistance	-
	Maintenance assistance	-
Communication	Close relationships development	Kumar Kar (2014)
	Electronic data interchange	Kumar Kar (2014)
	Communication barriers	Kumar Kar (2014)
	Reciprocal arrangements	Weber (1991)
	Cultural fitment	Kumar Kar (2014)
	Information accuracy	Mason-Jones (1999), Kumar Kar (2014)
	Information availability	Mason-Jones (1999), Kumar Kar (2014)

	Information timeliness	Mason-Jones (1999), Kumar Kar (2014)
	Self-audits	Kumar Kar (2014)
	e-transaction capabilities	Kumar Kar (2014)
	Staff skill level	Kumar Kar (2014)
Knowledge	Intellectual property rights	Kumar Kar (2014)
	Patents and certifications	Kumar Kar (2014)
	Conflict resolution systems	Kumar Kar (2014)
	Forecasting techniques accuracy	So (2003), Kumar Kar (2014)

CAPABILITIES

CAPABILITIES	Ability of	Authors
Supply Chain Management Inbound	Developing and maintaining an effective purchasing function (procurement)	Tracey (2005)
	Contracting with suppliers and correctly estimate supply value (pricing)	Song (2007), Murray (2011)
	Regulating and optimizing raw materials procurement (commercial agreements for supply)	Wook Kim (2006)
	Managing effectively raw materials transport (from supplier to warehouse)	Tracey (2005)
	Adopting effective quality control on raw materials	Tracey (2005)
	Managing effectively raw materials warehousing	Tracey (2005)
	Monitoring effectively and regularly raw materials inventory (availability and quantity)	Tracey (2005)
	Managing effectively raw materials picking up from warehouse and their inclusion in production cycle	Tracey (2005)
Supply Chain Management Outbound	Adopting effective quality control on finished products	Tracey (2005)
	Managing effectively finished product packaging and labelling procedures	Tracey (2005)
	Managing effectively finished products warehousing	Tracey (2005)
	Monitoring effectively and regularly finished products inventory (availability and quantity)	Tracey (2005)
	Managing effectively finished products delivery (to middle distribution centres or to final customer)	Tracey (2005)
	Acquiring external knowhow to create, apply and protect new knowledge	Tseng (2014)

Knowledge Management Capability	Developing current internal knowhow to create, apply and protect new knowledge	Tseng (2014)
	Managing effectively organizational structures, technologies e company culture for knowhow developing	Tseng (2014)
Product/Process Development Capability	Developing customized products for specific clients	Wook Kim (2006)
	Re-designing and improving existing products	Kaleka (2002), Tseng (2014)
	Developing products that are innovative for the market	Kaleka (2002), Wook Kim (2006), Murray (2011), Tseng (2014)
	Reducing production costs and total costs for clients	Wook Kim (2006)
	Installing and managing production lines that are excellent and reliable	Tseng (2014)
	Developing new production lines and improving/optimizing production processes	Kaleka (2002), Murray (2011), Tseng (2014)
Capacity and Flexibility	Benefiting from economies of scale	Kaleka (2002)
	Extending production capacity	Blome (2013)
	Satisfying large demands in short times (big production lots)	Blome (2013)
	Responding quickly to changes in requested product volumes (order size)	Wook Kim (2006), Swafford (2008)
	Responding quickly to changes in requested product types (portfolio size)	Blome (2013)
	Responding quickly to changes in requested product mixes	Swafford (2008)
Customer Service	Monitoring effectively order processing state	Tracey (2005)
	Processing orders quickly (fast delivery)	Wook Kim (2006)
	Respecting regularly order delivery time (on-time delivery)	Wook Kim (2006)
	Responding effectively to urgent requests or order / delivery time changes	Swafford (2008)
	Selling products of conformed quality	Wook Kim (2006)
	Selling products of superior quality, compared to market standards	Wook Kim (2006)
	Assuring competitive prices, compared to competitors	Wook Kim (2006)
	Supporting clients in decisional and projecting stages	Kaleka (2002)
	Supporting clients during the entire product life cycle	Kaleka (2002), Wook Kim (2006)
Relationship Capability	Creating and managing external collaborations (also with competitors)	Song (2007)
	Creating and managing an excellent and reliable suppliers network	Song (2007)
	Engaging and bargaining with customers	Song (2007), Murray (2011)
	Managing effectively and quickly information acquisition and communication	Tracey (2005)
	Controlling effectively product selling and delivery network	Wook Kim (2006)
	Delivering effectively products in overseas markets	Wook Kim (2006)

Market Development Capability	Managing effectively marketing and communication functions (in product advertisement and promoting)	Wook Kim (2006), Song (2007), Murray (2011)
	Developing and improving firm brand	Wook Kim (2006)
	Identifying new potential clients (sensing)	Kaleka (2002), Song (2007)
	Identifying new potential competitive products	Kaleka (2002), Song (2007)
	Obtaining strategic information about market trend, in order to consider possible developments and opportunities	Kaleka (2002)
	Monitoring developments and opportunities about overseas markets, through external relationships	Kaleka (2002)
Financial Capability	Enabling convenient funding agreements	Kaleka (2002)
	Maintaining constant contribution margins	Kaleka (2002)
Internal Integration	Integrating and coordinating all managing functions, for shared development of firm strategies	Tracey (2005)
	Coordinating all internal logistics activities	Prajogo (2012)
	Integrating internally all firm functions	Wook Kim (2006)
External Integration	Integrating with suppliers	Wook Kim (2006)
	Integrating with customers	Wook Kim (2006)
Project Management Capability	Perceiving and correctly assessing risks	Smith (2002)
	Reducing risk turning out probability or limiting their impact	Smith (2002)
	Planning all different production phases and respecting production timetable	Smith (2002)

PRACTICES

Practices	Configuration actions	Authors	COD
IT (Information Technology)	Inter-organizational coordination through electronic links	Prajogo (2012)	A1
	Information Technology-enabled transaction processing	Prajogo (2012)	A2
	Direct computer-to-computer links with key suppliers	Prajogo (2012)	A3
	Electronic mailing (with key suppliers)	Prajogo (2012)	A4
	Electronic Fund Transfer (EFT)	Prajogo (2012)	A5
	Electronic transfer of purchase orders, invoices, etc.	Prajogo (2012)	A6
	Advanced planning and scheduling software	Zhou (2007)	A7
	E-procurement systems	Zhou (2007)	A8

	Bar coding/automatic identification systems	Zhou (2007)	A9
	Scheduling and planning software (use and/or development)	Zhou (2007)	A10
	Production planning	Zhou (2007)	A11
	Electronic Data Interchange (EDI)	Zhou (2007)	A12
	Enterprise Resource Planning Systems (ERP)	Zhou (2007)	A13
	Warehouse Management Software (WMS)	Zhou (2007)	A14
	Monitoring order processing status, Manufacturing Execution Systems (MES)	Zhou (2007)	A15
	Constant delivery tracking, Radio Frequency Identification (RFID)	Bayraktar (2009), Prajogo (2012)	A16
IS (Information Sharing)	Knowledge sharing about Core Business Processes	Li (2006)	B1
	Quality data availability	Tan (1999)	B2
	Frequent, informal, timely information exchange	Prajogo (2012)	B3
	Giving information about events or changes that may affect the other part	Prajogo (2012)	B4
	Frequent face-to-face planning/communication with suppliers/clients	Prajogo (2012)	B5
	Information exchange for improving supplier/client performance	Prajogo (2012)	B6
	Formal Information Sharing agreements	Tan (2002)	B7
	Mutual feedback	Chen (2004)	B8
	Group coordination activities		B9
	Benchmarking	Bhatnagar (2005), Hallgreen (2009)	B10
IS – Customer to Firm	Information exchange about planned orders or order changes	Zhou (2007)	C1
	Information exchange about inventory level	Zhou (2007)	C2
	Product design specifications (from clients)	Zhou (2007)	C3
	Expected performance specifications (from clients)	Zhou (2007)	C4

	Production planning specifications (from clients)	Zhou (2007)	C5
	Information about market opportunities and demand forecasting (from clients)	Zhou (2007)	C6
IS – Firm to Customer	Information about available production capacity	Zhou (2007)	D1
	Information about order status and expected lead-time	Zhou (2007)	D2
	Information about delivery schedule and/or possible changes in delivery schedule	Zhou (2007)	D3
Long-term Relationships with	Close partnerships with strategic suppliers, commercial agreements	Koh (2007)	E1
	Helping suppliers to improve their product quality (Top Management Support)	Li (2006)	E2
	Involving suppliers in new product design	Li (2006)	E3
	Involving suppliers in new process design	Li (2006)	E4
	Mutual performance measurement (Collaborative Performance Systems)	Prajogo (2012)	E5
	Solid and durable relationships with key suppliers (considered as a part of the firm)	Prajogo (2012)	E6
	Expediting (visiting suppliers' plants)	Tan (1999)	E7
	Enhancement of each other's business (common growth)	Power (2001)	E8
	Quality control and guarantee programs	Tan (1999)	E9
	Use of suppliers' technical support and test machines	Tan (1999)	E10
	Annual price negotiations for key items purchase	Tan (1999)	E11
	Use of hedging contracts in suppliers selection	Tan (1999)	E12
Long-term Relationships with Customers	Close partnerships with customers	Koh (2007)	F1
	Resources investment to keep a well-performing supply chain (Commitment)	Li (2006)	F2
	Sharing market interests, firm policies and business goals	Li (2006)	F3
	Collaboration in new product development	Li (2006)	F4
	Sharing marketing strategic decisions	Li (2006)	F5

	Investments for evaluating customer's future needs	Li (2006)	F6
Human Resource Management Practices	Advanced methods for employee selection	Harel (1999)	G1
	Multi-skilled human resource selection	Hallgren (2009)	G2
	Staff training	Harel (1999), Laursen (2003)	G3
	Job enrichment and job enlargement	Harel (1999), Laursen (2003)	G4
	Performance-related payments (Reward Alignment)	Harel (1999), Laursen (2003), Pandey (2012)	G5
	Participation in decisional stages (delegation of responsibilities, team work)	Harel (1999), Laursen (2003)	G6
	Internal Labor Market	Harel (1999)	G7
	Interdisciplinary workgroups	Chen (2004)	G8
Project Management Practices	Risk and opportunities analyzing methods	Smith (2002)	H1
	Advanced methods for supplier selection	Smith (2002)	H2
	Cost Breakdown Structure (CBS)	Smith (2002)	H3
	Work Breakdown Structure (WBS)	Smith (2002)	H4
Production System Practices	Investments in R&D and Engineering functions	-	J1
	International certifications (ISO 9001)	Bhatnagar (2005)	J2
	Plants and machines upgrade/replacement	Hallgren (2009)	J3
	External knowhow/technology acquisition	Jones (2001)	J4
	Product/process standardization (Postponement)	Li (2006)	J5
	Product modularization	Hallgren (2009)	J6
	Statistical process control	Bhatnagar (2005), Hallgren (2009)	J7
	Slack capacity	Hallgren (2009)	J8
	Setup time reduction	Hallgren (2009)	J9

	Cycle time reduction	Zhou (2007)	J10
	Bottleneck controlling	Hallgren (2009)	J11
	Use of manufacturing cells	Bhatnagar (2005)	J12
	Just In Time practices (JIT)	Bhatnagar (2005)	J13
	Total Quality Management practices (TQM)	Bhatnagar (2005)	J14
	Agile manufacturing strategies	Zhou (2007)	J15
	Pull/push procurement systems	Zhou (2007)	J16
	Use of top quality material	Chen (2004)	J17
	Predictive maintenance	Bhatnagar (2005), Hallgren (2009)	J18
	Preventive maintenance	Bhatnagar (2005)	J19
	Stocking area for urgent orders	Bayraktar (2009)	J20
Network	Sections-network development (for commercialization, contracting and assistance)	-	K1
	Sections-network development (for production)	-	K2
	Preference of local suppliers	Tan (2002)	K3
	Limited number of suppliers	Bayraktar (2009)	K4
	Close-to-customer (reference markets) locations	Tan (2002)	K5
	On-time delivery directly to customer's points of use	Tan (2002)	K6
	On-time reception directly to firm's points of use	Tan (2002)	K7
Strategic Behaviour	Sharing sensitive information (about finance, production, design, research, competing scenarios, etc.)	Prajogo (2012)	L1
	Joint Decision Making	Spekman (2002)	L2
	Designation of a supply chain planning team	Zhou (2007)	L3
	Involving both marketing and manufacturing functions in supply chain planning process	Zhou (2007)	L4

	Communication of firm's strategies	Tan (2002)	L5
	Communication of client's strategies to suppliers	Tan (2002)	L6
	Emphasis on health and environmental safety issues	Tan (2002)	L7
	Industrial group participation	Nava (2014)	L8

ANNEX B

CONTRACTORS INTERVIEWS – OVERVIEW

SECTION A.

Contractor's general information, in order to contextualize its business.

SECTION B.

List of the contractor's reference markets.

SECTION C.

- Subdivision of the overall products range into general, significant macro-categories the contractor might refer during purchasing stages.
- Subdivision of the global Power and Oil&Gas market into significant geo-political macro-areas.
- Limits and peculiarities of Italian suppliers.
- Definition of what is needed to improve with the maximum priority, considering a resource-based view (suppliers are expected to own limited resources).

SECTION D. Performance items, capabilities, assets

- Which are the most important performance requested?
- Are there particular capabilities, internal/external assets, financial/commercial parameters clients assess/request during the vendor evaluation and qualification stage?
- What are always requested, independently from clients, products and markets of reference (cutting assets)? What are grading assets?

ANNEX C

SUPPLIERS INTERVIEWS – OVERVIEW

SECTION A. Company's vital statistics

General firm information gathering, especially in terms of economic results achieved in 2014, in order to contextualize the firm's business.

SECTION A-II. Group's vital statistics (in case the company belongs to a group)

General firm information gathering about the group the firm belongs to, especially in terms of economic results achieved in 2014.

SECTION B. Products and markets

Description of the business sector the firm works in, to contextualize needed performance items and main adopted configurations:

- Quantitative and qualitative details about the core product types that characterize the firm's business, and related geographical reference markets.
- Specifications about possible markets of interest for the future and valve or static equipment demand development forecasts, both in current reference markets and in those the company is aiming to enter.

SECTION C. Belonging to a group or corporation

Analysis of the group-belonging issue, in order to understand the benefits a company could obtain and how they can affect performance improvement. In case the company does not belong to a group, its opinion about possible future collaborations with a larger number of firms or with a leader company is asked.

SECTION D. Synthesis of company's configuration strategies

Synthetic description of the main strategic decisions the firm has made in the last years, contextualized in respect to the specific market situations to face. In addition, the impact of the global economic crisis on company's business strategies is analysed.

SECTION E. Supply chain configurations for the core products

Simplified schematization and description of company's reference supply chains (already stated in section B). In particular, it is interesting to define which stages of the production cycle are realized internally and which ones are outsourced. In case of partial or significant outsourcing, the main performance items, assets and configurations evaluated in the supplier selection stage (in terms of cutting and grading skills) are requested.

SECTION F. Performance – capabilities – practices links

For each of the three most strategically important market-product scenarios (already stated in section B), making use of tables and reference lists specifically supplied in the questionnaire, it is requested to:

- specify the three most relevant performance items the company aims to keep at high levels, according to customers' needs;
- for each one of the three prevalent performance items, select at most three capabilities (set of distinctive abilities and skills, strategically relevant for the company) that enable its generation and conservation;
- for each capability selected at least once, specify the most relevant configuration actions and strategies through which the company enabled it.

SECTION G. Contractor - supplier relationships

Definition of main contractors/end users' peculiarities and limits, analysis of differences between Italian and foreign contractors. It is also asked what the supplier knows about clients' vendor selection criteria and methods they currently use.