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AN ACTIONABLE FRAMEWORK FOR COLLABORATION IN TEMPORAL SUPPLY CHAIN CONTEXTS

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ABSTRACT (IN ENGLISH)

Successful collaborative initiatives between supply chains members can lead to sustained differentiated performance. However, inter-firm collaboration often fails due to misalignment of incentives and strategies. Prior research tackles this issue in the Relational View theoretical perspective, however, usually in contexts where supply chains are well-established networks overlooking a long-term time horizon. For this reason, it becomes interesting to investigate the co-generation of competitive advantages through supply chain collaboration in temporal contexts. This work investigates supply chain relationships, strategies and performance through a multiple case study in the Italian industrial projects-based supply chain supplying products for O&G sector projects. The sample of firms is composed by first tier small-medium suppliers, and the study mainly focuses on horizontal and lateral collaborations between these manufacturers. The final aim of this multiple case study is to evaluate the feasibility of implementing supply chain collaboration in temporal contexts, reflecting on the appropriateness of relational view in such contexts.

Keywords: Supply Chain, Supply Chain Management, Supply Chain Collaboration, Horizontal Collaboration, Relational View, Relational Rent, Competitive Advantage, Project-Based, O&G, SMEs, Integration, Partner, Partnership, Local Content, Temporal Contexts, Case Study, Italy.

ABSTRACT (IN ITALIANO)

Le iniziative di collaborazione fra i membri della supply chain possono portare a prestazioni distintive e sostenibili. Tuttavia, la collaborazione interaziendale spesso fallisce a causa del disallineamento di incentivi e strategie. Le ricerche condotte finora affrontano questo problema sotto il punto di vista della teoria Relational View, tuttavia, di solito in contesti in cui le supply chain sono ben consolidate e si affacciano su orizzonti temporali a lungo termine. Per questo motivo, diventa interessante indagare la cogenerazione di vantaggi competitivi attraverso la collaborazione a livello di supply chain in contesti temporali. Questo lavoro analizza i rapporti, le strategie e le prestazioni della supply chain attraverso un caso studio multiplo nella supply chain industriale italiana basata su progetti che fornisce prodotti per i progetti del settore O&G. Il campione di aziende è composto da fornitori medio-piccoli di primo livello e lo studio si concentra principalmente sulle collaborazioni orizzontali e laterali tra questi produttori. L'obiettivo finale di questo caso studio multiplo è valutare la fattibilità di implementare la collaborazione a livello di supply chain in contesti temporali, riflettendo sull'adeguatezza della Relational View in tali contesti.

Parole Chiave: Supply Chain, Supply Chain Management, Supply Chain Collaboration, Collaborazione Orizzontale, Relational View, Relational Rent, Vantaggio Competitivo, Project-Based, O&G, PMI, Integrazione, Partner, Partnership, Contenuto Locale, Contesti Temporali, Caso Studio, Italia.

1. INTRODUCTION

Supply Chain Collaboration is "*the ability to work across organizational boundaries to build and manage unique value-adding processes to better meet customer needs*" (Fawcett et al., 2008, p.93). Successful collaborative initiatives between supply chains members could lead to sustained differentiated performance, but inter-firm collaboration often fails due to misalignment of incentives and strategies. According to **Relational View theory**, firms willing to partner can establish idiosyncratic inter-firm linkages, making relation-specific investments and combining resources in unique ways; thus, establishing sources of relational rents and co-generating competitive advantage through inter-firm collaboration (Dyer, 1996b; Dyer and Singh, 1998). Usually, relational view theory is applied to tackle this issue in contexts where the supply chain is a well-established network which overlooks a long-term time horizon. Therefore, it becomes pertinent to investigate the co-generation of competitive advantages in **temporal contexts** to expand the Relational View literature. In these contexts, it's difficult to establish lasting collaborations or partnerships, because supply chain participants mostly interact occasionally, just for project purposes. This thesis enriches the literature investigating supply chain relationships, strategies and performance with a multiple case study in **industrial projects-based supply chains**. The aim is confirming, rejecting, contrasting and complementing previous research outcomes, applying the theory in an unexplored context. According to Relational view theory, the study analyzes most important **enablers (mechanisms)** and **barriers (challenges)** for collaborations development in temporal contexts. Identifying them, it's possible to have a starting point to properly define (or redefine) a collaborative strategy effective in temporal contexts.

To achieve this objective, it has been conducted a **qualitative literature review** under Relational View theoretical lens, to investigate the co-generation of competitive advantages in temporal contexts. Literature review played a fundamental role in identifying most important topics and factors to address for preparing a suitable **questionnaire**, conducting proper interviews and developing a complete and reliable content analysis on the findings. The questionnaire has been presented, during one-to-one **semi-structured interviews**, to managers and owners of 14 firms. The **sample of firms** considered for this multiple case

study is composed mainly by Italian SMEs working in industrial projects-based supply chains supplying industrial products (e.g. valves and boilers) for projects related to the O&G sector (e.g. platforms and pipelines). These firms operate in temporal contexts and represent an industrial sector strategically important for Italy, that is composed of hundreds of SMEs. Interviews have been conducted face-to-face with managers and owners, to figure out their point of view, needs and concerns. **Findings** have been presented dividing them according to the type of actor (i.e. suppliers, competitors, customers, agents and service providers) with whom firms entertain relationships. This giving an overview of relationships, independently from collaboration level. A **qualitative analysis** has been developed following Relational View theory principles, analyzing and discussing the different enablers (mechanisms) and barriers (challenges) influencing the success of supply chain collaborations. In **conclusions** there are comments and critiques about Relational View theory applicability in temporal contexts, then insights for future researches.

2. LITERATURE REVIEW

2.1. REVIEW METHODOLOGY

This **qualitative literature review** investigates the co-generation of competitive advantages in temporal contexts, analyzing collaboration state of art under **Relational View** theoretical lens.

Most of papers has been taken from web sources as Scopus, Science Direct, Emerald, Web of Knowledge and Google Scholar; using keywords pertaining to the expected outcome of the study. Keywords used are composed by one or more of the following words: "supply chain*", "SC*", "project*", "collaborati*", "relation*", "partner*", "tempora*", "TMO", "integration", "coordination", "engineering*", "ETO", "horizontal", "lateral", "inter-organizational", "SME" "industrial", "strategy", "cogeneration", "competitive advantage". These papers have been integrated with some additional papers kindly recommended by the Management Engineering Department of Politecnico di Milano. The whole group of papers considered has been further reduced through a qualitative content analysis of abstracts and eventually of papers' structure/content. Papers' contents have then been analyzed and classified to find common topics and properly write the literature review.

2.2. STATE OF ART PRESENTATION AND DISCUSSION

2.2.1. THEORETICAL BACKGROUND

Supply Chain Collaboration (SCC) is "*the ability to work across organizational boundaries to build and manage unique value-adding processes to better meet customer needs*" (Fawcett et al., 2008; p.93). Collaborative efforts in inter-firm relationships give opportunities to generate competitive advantage that couldn't be alternatively created by individual firms (Touboulic and Walker, 2015). SCC entails a situation of openness and trust

where firms can develop sustainable advantages achieving scale economies, process improvements, sharing information, reducing wastes in procurement and allowing risk sharing (Soosay et al., 2008; Walker et al., 2013). However, there is still lack of real procedures in aligning operational and corporate strategies for SCC practices, especially in industrial projects-based supply chains. In this study, we'll examine how cooperation, coordination and integration practices relate in a collaborative context, and which elements foster or hinder a successful SCC.

Supply Chain (SC) is a system encompassing all the firms involved in design, production and delivery of a product to market. These actors are linked together by materials and information flows (Stevens, 1989). Considering actors involved as a single entity, **Supply Chain Management (SCM)** consists in coordination of production, inventory, location, transportation and information sharing among SC participants, to achieve common objectives and improve the overall business. Most of SCM available research neglects needs of ETO (Hicks et al., 2000) and ETS SCs. To bridge this gap, this research is grounded on **Industrial Project-Based Supply Chain (IPBSC):** system where firms participate in temporary networked organizations dealing with non-repetitive mega-projects (Turner and Muller, 2003). **Projects** require multiple resources and entail many activities carried out by temporary firms' coalitions (Hicks et al., 2000). In particular, project procurement process needs an articulated tendering procedure to ensure the best trade-off between price, quality and latency. IPBSC presents high complexity and uncertainty (Fearne and Fowler, 2006), due to SC fragmentation, scarce SCC and frequent disputes among suppliers and EPCs (Aloini et al., 2015). Hence, SCM initiatives still show partial success of implementation in project environments (Gadde and Dubois, 2010; O'Brien et al., 2002).

SCM can be an important tool to break SMEs isolation in the value chain, to overcome dynamic market challenges, pursue technological innovation and face global competition. (Gnyawali and Park, 2009; Kumar and Singh, 2017). In developed countries, SMEs adopt customer-oriented strategies to meet customers' needs like quality improvements, on-time delivery and cost reduction (Syed and Kamel, 2014; Kumar et al., 2014). Nevertheless, SMEs are usually in an unfavorable position against big competitors due to many sources of vulnerability. They suffer many market pressures, deal with resources and organizational constraints, are strongly exposed to market risks (Kumar and Singh, 2017) and may face difficulties in getting certified and appear on customers' vendors lists. In this scenario

horizontal SCC could be beneficial, leading to a regional development of SMEs (Bjornfot and Torjussen, 2012; Simatupang and Sridharan, 2002). **Coopetition** occurs when there is horizontal collaboration between competitors, because the relationship includes both collaboration (e.g. R&D or project completion) and competition (e.g. marketing or tendering phase). "Sleeping with the enemies" is important to acquire knowledge and skills, develop new capabilities, achieve scale economies, mitigate risks and leverage resources together (Morris et al., 2007; Gnywali and Park, 2009). However, paradox of trust persists, since knowledge shared while cooperating can be used in competition (Gnyawali and Park, 2009).

There are some main features that can characterize and influence relationships between actors. These are influenced by network participants' strategies, resulting critical features to shape successful collaborative relationships. The seven **Supply Chain Relationships Features** identified are: collaboration orientation (vertical, horizontal, lateral), collaboration dimensions (joint planning, coordination mechanisms, communication and joint conflict resolution), collaboration duration (short-term, long-term), scope of integration (internal, external), degree of integration (width, depth), integration dimensions (mutual commitment and trust, common strategic goals, common exploitation of strategic resources, risks and rewards sharing, incentives alignment, joint decision making), relationship strength (arm's length relationships, partnerships, joint ventures, vertical integrations) (Lambert et al., 1996; Spekman et al., 1998; Frohlich and Westbrook, 2001; Eriksson and Pesamaa, 2013; Winkler and Schemitsch, 2010; Walker et al., 2013; Aloini et al., 2015; Eriksson, 2015; Sariola and Martinsuo, 2015; Touboulic and Walker, 2015).

2.2.2. CHARACTERISTICS FOR PARTNERS SELECTION

In IPBSCs it's possible to establish both long-term partnerships and temporarily short-term relationships (Winkler and Schemitsch, 2010). Logically, firms shouldn't partner with every actor, because partnerships are costly in terms of time, efforts and money. It's necessary to achieve a project milieu with best partners to discontinue and recreate a suitable project network for latter projects (Sariola and Martinsuo, 2015). To determine if a relationship should stay as is or is worthy of the time and resources needed to fully develop into a partnership, it's advisable to rely on a structured multi-criteria **Partner Selection** (Eriksson,

2015). Hence, it's important to carefully select the type of relationship we need to establish with each single actor, considering criteria based on:

- **Project Features**, like: monetary size; duration and time pressure; complexity and customization level; uncertainty (de Araùjo et al., 2017; Eriksson, 2015; Sariola and Martinsuo, 2015). Because there isn't a general model adequate for each project type (Eriksson and Pesamaa, 2013; de Araùjo et al., 2017).
- **Potential Partner Characteristics**, like: actor role and relative salience in the network; actor size; type and quality of traded goods; performance in terms of staff features and problem-solving capabilities; resources and skills complementarity; relational capabilities; collaboration experience and motivation; financial stability and solvency (Dyer and Singh, 1998; Gnyawali and Park; 2009; Winkler and Schemitsch, 2010; Eriksson and Pesamaa, 2013; Fawcett et al., 2015; Sariola and Martinsuo, 2015; de Araùjo et al., 2017; Chen et al., 2018). Because considering only bid price can lead to shortcomings, causing cost and time overruns (Eriksson and Pesamaa, 2013).

Concluding, the decision to partner and collaborate, rather than compete or maintain arm's length relationship with someone, needs to be taken basing on a wide set of criteria, without forgetting that the decisions taken will affect the overall network.

2.2.3. RELATIONAL VIEW ELEMENTS

Resource Based View (RBV), historically employed to investigate sources of relational advantage, considers the single firm as the main unit of analysis, and firms' heterogeneity as primary reason of differential performances (Dyer and Singh, 1998). In reality, firms' critical resources and capabilities may go far beyond their boundaries. Indeed, individual firm's (dis)advantages are often related to its SC's (dis)advantages (Dyer and Singh, 1998). Basing on this, Dyer and Singh developed in 1998 the **Relational View (RV)**, focusing on dyad/network routines and processes as important unit of analysis for understanding competitive advantage. According to RV, firms can establish idiosyncratic inter-firm linkages, making relation-specific investments and combining resources in unique ways, co-generating competitive advantage through inter-firm collaboration (Dyer, 1996a; Dyer and

Singh, 1998). **Relational Rent** is "*a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners*" (Dyer and Singh,1998, p.662). Relational rents are a property of a network of interconnected firms (Dyer and Singh, 1998), hence beyond the control of single firms, and can't be duplicated by firms alone. In recent years, RV has been applied in several contexts (Walker et al., 2013) to find enablers and barriers to relational rents. However, little is known about SCs operating within short temporal contexts. Therefore, we want to understand which are the main enablers and barriers to co-generate competitive advantages in IPBSCs.

2.2.3.1. ENABLERS (MECHANISMS)

Enablers are mechanisms that, if conveniently joint-leveraged by partners, can lead to sustainable competitive advantages. According to the RV, the enablers are:

EXCHANGE AND INVESTMENT IN PARTNERSHIP-EXCLUSIVE ASSETS

Specialized assets represent a conjunction between partners' assets that is fundamental for collaboration purposes (Amit and Shoemaker, 1993). It's possible to achieve productivity gains undergoing three types of relation-specific investments:

- **Site Specificity** concerns the localization or geographical approximation of assets to run successive production stages in order to considerably reduce inventory, transportation and coordination costs (Dyer, 1996b).
- **Physical Asset Specificity** refers to capital investments in equipment and tools able to tailor processes to exchange partners (Dyer and Singh, 1998), putting the premises for product differentiation and quality improvements.
- **Human Asset Specificity** refers to know-how transfer through human resources. Several mechanisms can be put in place to improve communication between partners (Dyer and Singh, 1998).

"*The greater the alliance partners' investment is in relation-specific assets, the greater the potential will be in relational rents*" (Dyer and Singh, 1998, p.664). **Length of Safeguards** and **Volume of Transactions** influence partners' ability to generate relational rents. The

first refers to the length of arrangements designed to defend actors against opportunistic behaviors of other partners; the second refers to the volume of inter-firm transactions (Dyer and Singh, 1998). Several authors stress also the influence of self-reinforcing factors such as **Relationship History, Commitment and Trust** between members (Walker et al., 2013; Touboulic and Walker, 2015).

KNOWLEDGE AND INFORMATION SHARING THAT BOOSTS JOINT-LEARNING

A network fostering joint-learning among actors has means to out-innovate other networks. Partners are often a source for **Cogeneration of New Ideas and Innovation** (Dyer and Singh, 1998). Establishing **Inter-Firm Knowledge-Sharing Routines** facilitates to transfer, recombine or create specialized knowledge (Grant, 1996), regardless from its nature. Knowledge can be divided into: **Information,** easily codifiable without loss of integrity, and **Know-How**, sticky and difficult to codify (Walker et al., 2013).

To exploit external resources of knowledge firms needs the adequate **Absorptive Capacity**, which is "*the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends*" (Cohen and Levinthal, 1990, p.128). This is function of the extent to which partners have developed overlapping knowledge bases and interaction routines, through inter-firm routines and informal interactions over time (Dyer and Singh, 1998). On the other hand, it's necessary to discourage free-riding behaviors and to foster transparent knowledge sharing between partners, encouraging them through an **Alignment of Incentives** (Dyer and Singh, 1998).

COMBINING OF SCARCE RESOURCES AND CAPABILITIES

Combining scarce resources and capabilities results in the joint creation of unique new products, services and technologies, but also in economies of scale/scope thanks to inter-firm procurement procedures or reduced bureaucracy (Walker et al, 2013). Generally, firms can share **Equipment**, **Facilities**, **Warehouse** and **Know-How Resources**.

A major challenge is to recognize the potential **Resources Strategic Complementarity** of partners, since none has perfect information and firms differ in terms of: prior alliance experiences, internal search and evaluation methods and capabilities, ability to acquire

information (Dyer and Singh, 1998). The greater is resources complementary, the greater are the synergistic effects coming from their combination and hence the possibility they turn into shared VRIN (valuable, rare, inimitable, non-substitutable) resources (Dyer and Singh, 1998). Even firms' **Organizational Complementarity** can be a prominent challenge to face (Dyer and Singh, 1998), since processes, culture, information and control systems must compatible enough to allow coordination (Dyer and Singh, 1998).

GOVERNANCE MECHANISMS YIELDING TO LOWER TRANSACTIONAL COSTS

Effective governance structure generates relational rents by minimizing transaction costs, improving efficiency and influencing the willingness to engage in value-creation initiatives, but also trust is fundamental (Dyer and Singh, 1998; Walker et al., 2013).

According to Dyer and Singh (1998), there are three governance classes:

- **Third-Party Enforced Agreements:** presence of legal contracts involving legitimate third-party authorities providing for dispute resolution issues.
- **Self-Enforcing Formal Agreements:** presence of formal safeguards as financial or specialized-investment hostages to penalize opportunism and reward value-increasing activities, but no third-party intervenes in case of violations.
- **Self-Enforcing Informal Agreements:** presence of informal safeguards as goodwill trust or embeddedness and reputation based on direct/indirect experiences, but no third-party intervenes in case of violations. These are the most effective and least costly safeguards but require time to be established and are subject to the paradox of trust.

Transaction and governance structures alignment is crucial to generate relational rents (Dyer and Singh, 1998), but misalignments occur frequently due to uncertainty, information asymmetry and bounded rationality (Williamson, 1991).

2.2.3.2. BARRIERS (CHALLENGES)

Barriers can be intended as challenges towards relational rents development, or isolating mechanisms preserving rents generated by partners. According to the RV, the barriers are:

ASSET INTERCONNECTEDNESS

Inter-firm asset interconnectedness is based on **Cumulative Bundles of Joint Investment Decisions**, where initial partnership-specific investments put premises for future ones that wouldn't be profitable alone (Dyer and Singh, 1998). To realize the full potential of any single investment and leverage synergies, the cumulative "snowball" effect makes the ball (bundle) bigger and bigger interconnecting current and previous investments (Dyer and Singh, 1998). Bundles creation represent a barrier because requires much time and money, and growing interdependence is difficult to manage (Touboulic and Walker, 2015); but, once created, can be a source of competitive advantage and a barrier for newcomers.

PARTNER SCARCITY

Firms' ability to find a suitable partner limits relational rents generation (Dyer and Singh, 1998). Lack of suitable partners may lie in the **Easiness of Finding a Partner, Partner Willingness** or **Collaboration Experiences**. For example, it's necessary to find partners having local market knowledge, contacts and a widespread distribution network to entry foreign markets (Dyer and Singh, 1998). Usually the suitable partners are rare, especially for latecomers operating in sectors with great diffusion of collaborative initiatives (Dyer and Singh, 1998).

RESOURCE INDIVISIBILITY

Idiosyncratic combination and coevolution of resources and capabilities lead over time to resource indivisibility; making resources and capabilities increasingly hard to imitate (Dyer and Singh, 1998). But this leads to **loss of flexibility**, **difficulty in redeploying resources** and **loss of control over resources and capabilities** (Dyer and Singh, 1998). Concerns about these problems induce strong resistance to change (Touboulic and Walker, 2015).

INSTITUTIONAL ENVIRONMENT

Institutional environment may obstruct cooperation and raise transaction costs, but it can also lower them fostering trust and relational rents creation (Walker et al., 2013). Matters influencing relational rents go far beyond firm boundaries, expanding to a broader, country

level (Dyer and Singh, 1998). Main barriers in an institutional environment can be **legal, organizational** and **country-specific (cultural) restrictions**, since geographically dispersed firms may have different legislations, cultures, conflicting local politics and different priorities (Walker et al., 2013).

3. RESEARCH METHODOLOGY

This research adopted a **multiple case study methodology** to investigate SC relationships, strategies and performance in IPBSCs. Past and current collaborations, and expectations and concerns about possible future collaborations, have been examined under RV lens, contextualizing the whole according to industry and firms features.

A **questionnaire** with 36 mixed queries (open, closed, Likert scale) has been developed to gather information. The information of interest has been defined developing a **reverse engineering map** that allowed macro-topics identification. Questions have been devised to cover all the RV concepts, firms' characteristics and their approach to the market. Questions have been structured in 5 sections:

1. **General Company Information**: Firms' history, dimension, products, competitive advantages and main target markets.
2. **Understanding the Type of Relationship and Collaboration**: Investigation on relationships in place with different SC members (EPCs, end-users, suppliers, competitors, service providers and consultants).
3. **Understanding Partner Selection**: Respondents evaluated the importance of the different characteristics for partner selection.
4. **Understanding the Nature of the Collaboration**: Focus on RV concepts and elements, to investigate most recurrent enablers and barriers.
5. **What About Tomorrow**: Recap of firms' collaboration experiences, expectations and ideas for future collaborations.

This multiple case study is based on a sample of 14 Lombard manufacturers operating in IPBSCs, mainly SMEs focused on production of valves and boilers for the O&G sector. The questionnaire was administered to managers/owners during face-to-face semi-structured interviews. Respondents are at the forefront of relations with external stakeholders, have decision-making power and great market knowledge. Data collected have been filtered, aggregated and reorganized in order to obtain significant information to develop a qualitative analysis able to explain the overall collaborative phenomena, considering trends, discrepancies and correlations.

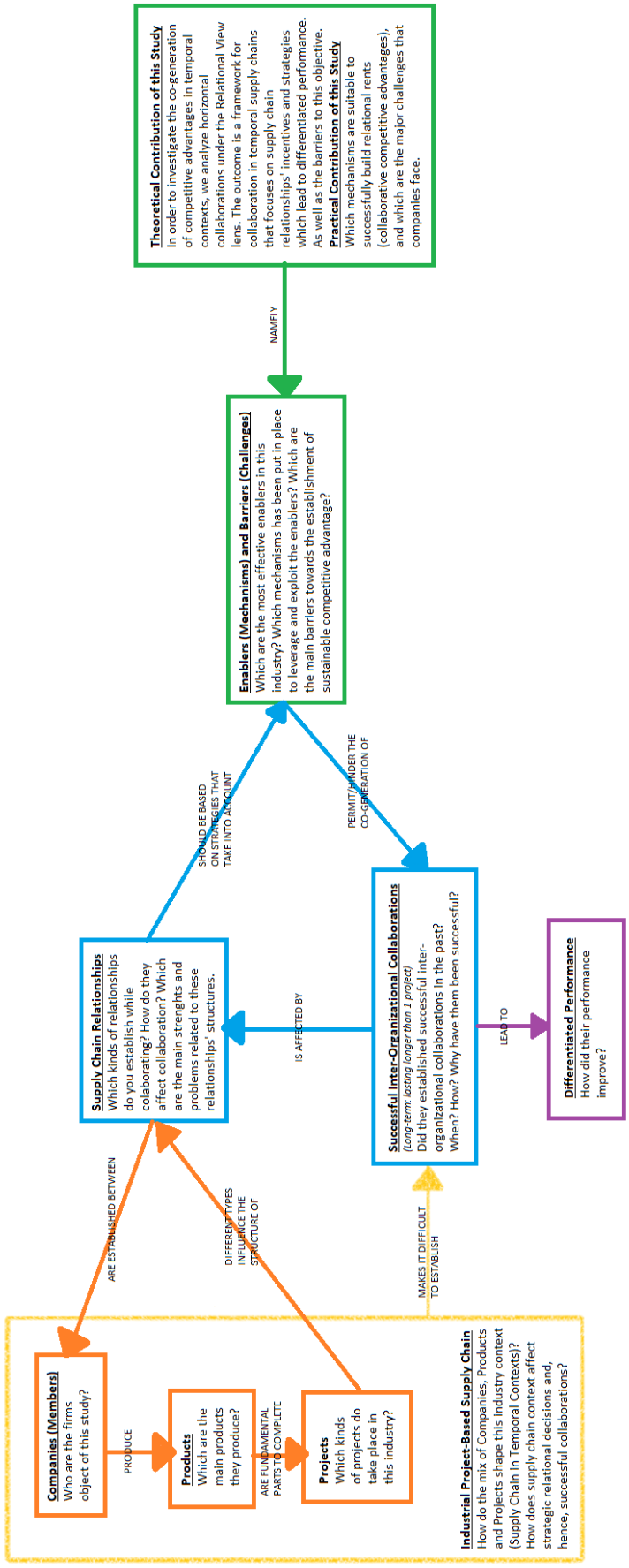

Figure 1 - Reverse Engineering Map is a representation of the logical process that, starting from the final study contribution, has led to define the topics and information of interest on which to develop a suitable questionnaire and achieve the given objective.

Firms	Employees (n)	Turnover (M€)	Turnover from O&G (%)	Production Facilities (n)	Core Business	Project Kinds	Part of Group	Interviewee Role
F1	1200	400	80%	10	Valves and Actuators Fittings and Flanges Skid Systems Firefighting Systems	Extraction (on-shore/off-shore) Pipelines (in-land/subsea) Chemical LNG Terminals Power Plants Shipbuilding Railway, Tube, Airport City Gates and Infrastructures Water Desalinization	No	Vice President Sales & Marketing
F2	105	50	95%	1	Ball Valves (on/off mainly) Skid Systems	Extraction (mainly off-shore) Pipelines (mainly off-shore) Petrochemical Power Plants Water Treatment	Yes	Commercial Operation Director
F3	72	16	90%	1	Heat Exchangers Pressure Vessels Pipes and Fittings (standard)	Petrochemical (off-shore mainly) Chemical Mining and Mineral Extraction Water Treatment	Yes	Sales Director, Operations Director
F4	90	20	20%	1	Ball Valves Actuators (industrial sector only) Brass Valves (industrial sector only)	Extraction Pipelines Petrochemical (Refinery) Cryogenic Food Chemical Pharmaceutical	No	Plant Manager
F5	69	19	75%	3	Heat Exchangers Pressure Vessels	Extraction (on-shore/off-shore) Petrochemical (refinery) Energy & Power Fertilizers Chemical Food Pharmaceutical Textile	No	Sales Department, Business Development Manager
F6	280	100	95%	5	Gate Valves Ball Valves (recently introduced)	Extraction (on-shore) Petrochemical (refinery, etc.) Power Chemical Paper	Yes	CEO Italy
F7	76	20	93%	1	Ball Valves (floating, trunnion)	Exploration and Research Extraction Pipelines (hubs, no primary lines) Nuclear Power Food & Beverage	Yes	President and CEO

Table 1 - List of interviewed firms with main data about size and business (first part).

Firms	Employees (n)	Turnover (M€)	Turnover from O&G (%)	Production Facilities (n)	Core Business	Project Kinds	Part of Group	Interviewee Role
F8	280	120	92%	4	Valves (ball, gate, check, globe, throttle) Pressure Seals	Extraction (on-shore/off-shore) Pipelines (hubs, ...) Petrochemical (refinery, ...) Power	No	CEO
F9	59	10	100%	1	Pressure Vessels' Internals Marine Loading Arms	Extraction Petrochemical (refinery, ...) Chemical	No	Sales Director
F10-A	129	32	65%	2	Industrial Boilers Thermal Oil Heaters	Extraction (on-shore) Pipelines (hubs, stock ...) Petrochemical (Refinery) Chemical Pharmaceutical Textile Food & Beverage Paper Rubber & Plastic Energy District Heating	Yes	Corporate Sales & Marketing
F10-B	102	20	80%	1	Water Treatment Plants Wastewater Treatment Plants	Extraction (on-shore/off-shore) Petrochemical (Refinery, ...) Pharmaceutical Textile Food & Beverage Power Generation Steel Mining Building and Construction Tourism and Recreation	Yes	Corporate Marketing Manager
F11	210	70	50%	3	Heat Exchangers Boilers and Burners Air Heaters and Coolers	Extraction Petrochemical (Refinery, ...) Power	Yes	Manager Business Development Unit AirHex
F12	106	21	55%	1	Industrial gaskets (valves, pumps, flanges)	Extraction Pipelines Petrochemical (Refinery, ...) Energy	No	Chief Technical Officier
F13	20	12	85%	0	Supply of Equipment	Extraction (on-shore) Petrochemical (Refinery, ...) Chemical Industrial sector	Yes	Country Manager Italy, Key Account Manager
F14	41	9	100%	1	Valves (on/off)	Extraction (on-shore/off-shore) Pipelines	Yes	QA & HSE Manager

Table 2 - List of interviewed firms with main data about size and business (second part). (F10 is split in A and B because two firms of the same group have been analyzed during a single interview)

4. FINDINGS

4.1. THE O&G INDUSTRIAL SECTOR: CHARACTERISTICS AND CHALLENGES

Italian manufacturers are leaders in supply of high-quality components and products for the construction of extraction platforms, pipelines, refineries, and others. "By **products types**, the market share is very fragmented", but "manufacturers try to expand their portfolio". "O&G world comes from the standardization of API" occurred at the beginning of 20th century, so, products' "production type and philosophy are about 130-140 years-old". "Competitive factors have substantially a commercial nature" since technology is mature, so the few **innovations** occur mostly on materials. "Italy is a great country for infrastructures of O&G industry" and know-how. Particularly in the **Valve Area** has "developed a network of firms specialized in different O&G sector activities" (e.g. painting, welding, heat treatment). Over time, manufacturers helped them obtaining certifications required by EPCs. These firms are essential for manufacturers who need to outsource critical processes. Manufacturers **horizontal collaborations** in this IPBSC are almost inexistent, because the market and "EPCs put manufacturers against each other". Moreover, "most of the industry is composed by SMEs very jealous of their know-how". Respondents perceive "today there is more openness towards collaboration; once there was total closure", but neither abroad there is horizontal SCC.

"O&G market at the moment is downturned" and fluctuating, **global financial crisis** and **oil price drop** changed global economic/geopolitical relationships, with strong repercussions on O&G sector. Even "projects already in advanced state were frozen", while others disappeared since no more profitable. Profit margins along the SC reduced, facilitating the entry of foreign low-quality manufacturers. Moreover, a new big challenge for Italian manufacturers is the local content, namely the added value that a firm can bring to the socio-economic system of a country. Many governments, especially in Middle East, want that customers buy locally rather than importing from outside. "Local content will be the strategic discriminating factor for O&G supplies over the next 15-20 years". Manufacturers are

starting collaborations with local partners, both suppliers and agents, but they "cannot open their own facilities everywhere".

4.2. Supply Chain Management to Deliver a Project

Whenever an end-user decides to develop a new project, it "contacts several EPCs organizing a call for tenders", and EPC offering the best solution/price trade-off wins. Then, EPC "begins to fragment project into products or services to buy", aggregating product categories if necessary. Together with end-user, EPC defines **vendor lists** for each product category to select qualified manufacturers. "**Qualification** is a very complex process" for manufacturers, but fundamental to participate in tenders. Qualified manufacturers can participate tendering to access the **short vendor list**. If product categories have been aggregated, manufacturers are forced to collaborate for project delivery. They receive a list of items to provide in accordance with specifications. Call for bids starts, and manufacturers that better meet criteria win. In this phase it's impossible to collaborate because customers "put manufacturers against each other". Main discriminant is price, but local content presence and other factors contribute in defining manufacturers' tendering score. If winning manufacturer supply products fulfilling agreed terms, its job is done. Rarely end-user bypasses EPCs relating directly to manufacturers, but these are occasions for Italian manufacturers, since end-users give more value to quality.

4.3. Suppliers of Materials and Outsourced Processes

Italian industrial sector linked to O&G market has a centennial history, which over time allowed solid and lasting relationships establishment between different tiers suppliers. Manufacturers are "rather loyal to suppliers ensuring good performances", having "tacit collaborations with them" and following procedures facilitating procurement process,

without written rules. “Habits consolidated over time because they got along in previous experiences”, but usually there are no common strategies or goals. Stable relationships with suppliers can lead to performance improvement, “reducing lead time, improving order cycles, warehouse or suppliers’ management”. With few suppliers there are “consultations regarding specifications and technical problems”, but there are no structured mechanisms for collaboration in R&D, it happens occasionally. Anyway, it’s impossible to rely exclusively on historical suppliers, since often customers force “manufacturers to buy from someone specific”. Hence, it’s fundamental to “keep doors open to everyone”. This leads to many one-time collaborations limited to individual projects.

“Majority of Italian valves and boilers manufacturers” are clustered in Valve Area. Around them there is a network of **suppliers of outsourced processes** specialized in various mechanical processes for O&G sector (i.e. painting, welding, heat treatments). Over time, manufacturers helped them in certification processes. Outsourcing critical/discontinuous processes is a “winning strategy to face peak demand periods” lightening manufacturers, “optimizing also costs for suppliers”. However, few manufacturers would invest in these mechanical workshops; they are worried that suppliers may “learn, grow up and become competitors”.

4.4. COMPETITORS AND SUPPLIERS OF COMPLEMENTARY PRODUCTS

“Horizontal expansion of multinational groups through acquisition pushes Italian manufacturers towards collaboration with adjacent manufacturers, but the phenomenon is very limited”.

Horizontal SCCs between competitors are very rare “because you cannot fight every day your competitors and then make the agreement”, but sometimes customers impose them to work together to deliver a bundle when supply completion is required. Customers “check carefully and understand if there are set-ups”, because collaborations and mergers threaten competitiveness within vendor lists. Many SMEs don’t collaborate “because are very jealous of their know-how” and because of the risk that only one of the partners wins tendering

phase for a project. Since Italian manufacturers use the same mechanical workshops, could be interesting "making investments addressed in the interests of several manufacturers", to develop "products that can be used by all manufacturers". Anyway, several manufacturers tried horizontal collaborations with **competitors**, but rarely with success. The major obstacle is probably the cultural barrier.

Collaborations with **complementary products manufacturers** may occur "to offer packages technically and commercially competitive for customers". Respondents think collaboration with complementary products manufacturers may be interesting to broaden the product portfolio or to approach markets requiring local content. The risks are to cultivate a competitor and "strongly reduce the market" inhibiting collaborations with others. Anyway, few long-term horizontal collaborations between complementary products manufacturers diffused over time.

There are also several **associations** that gather similar manufacturers, together with their customers and suppliers sometimes, but few manufacturers actively participate in associations, since they aren't considered really equal and useful.

This IPBSC "doesn't present yet a formalized form of horizontal SCC, but there are informal agreements between manufacturers' management".

4.5. CUSTOMERS: EPCS, END-USERS AND OTHERS

Manufacturers operating in this sector usually supply products to: EPC contractors, O&G/industrial sector end-users, OEMs and higher-tiers suppliers.

Respondents agree that having long-term relationships with **EPCs** isn't possible, because their priority is to have competition in vendor lists to lower prices and maximize profit. Even, some EPCs "pass manufacturers' technical solutions to shabbiest manufacturers" to later buy products at lower prices. Manufacturers are defensive against EPCs to protect know-how, but sometimes cooperate with them to engineer alternative solutions and solve technical problems, giving manufacturers opportunities for additional profits.

With few historical **end-users** it's possible to establish long-term relationships, because they may want "to standardize what they have on their plants". Tailor-made strategies are necessary to establish exclusive long-term relationships, but it's difficult to have written contracts where end-users commit to buy a certain amount". Some manufacturers have regular meetings with end-users, larger ones may also have dedicated staff "to few trusted end-users", they may also decide to invest abroad for local content or to be more responsive towards important end-users. Manufacturers small, making complex products, or oriented towards industrial sector are more attentive to end-users needs and tend to share more know-how. Indeed, with industrial sector end-users it's easier to establish long-term relationships, since there's no such structured tendering phase and "is possible to work continuously". Overall, tendency to have informal approaches, making themselves flexible and available, isn't collaboration but marketing strategy, because there aren't joint objectives.

With **OEMs and higher-tiers suppliers** it's easier to establish frame agreements and share knowledge, but they represent a revenues small fraction.

4.6. AGENTS AND SERVICE PROVIDERS

Everyone has **agents** providing commercial services abroad working on commissions, but it's hard to find suitable **local commercial partners** in every country. They care about managing relationships with customers and PA, monitoring project status and tendering phase, but "aren't able to make technical clarifications". They can represent many different manufacturers, but not competitors. **Industrial distributors** serve a territory with various products, as spare parts. Sometimes distributor buys and resells, other times it distributes on behalf of the manufacturer. This role can be covered by agents, agencies or service providers committed to logistics services like storage, shipping and delivery. Some distributors sell single brand products, others manage different products of non-competing firms. Local agents and distributors often provide **technical support, assistance, installation and maintenance** in reference countries. It's impossible to have facilities everywhere, so manufacturers tend to use existing local agents/partners' structures without major

investments. Collaborations with firms providing **assembly, testing and packaging** are rarer and occur mainly abroad to meet local content requirements. Several manufacturers collaborate in R&D with **universities**, but meetings between manufacturers' engineering functions and academic world, "are punctual, aren't ongoing collaborations".

5. Analysis and Discussion

Findings will be analyzed under RV theoretical lens, to understand which concepts (enablers and barriers) are valid in temporary contexts and which not. This **qualitative analysis** is supported by few quantitative data to give words a magnitude.

The 14 firms considered were classified into two groups based on **dimension**, and in two groups based on **business**. Each manufacturer will appear in one group identifying its size and in one group identifying its business. This to highlight trends and differences.

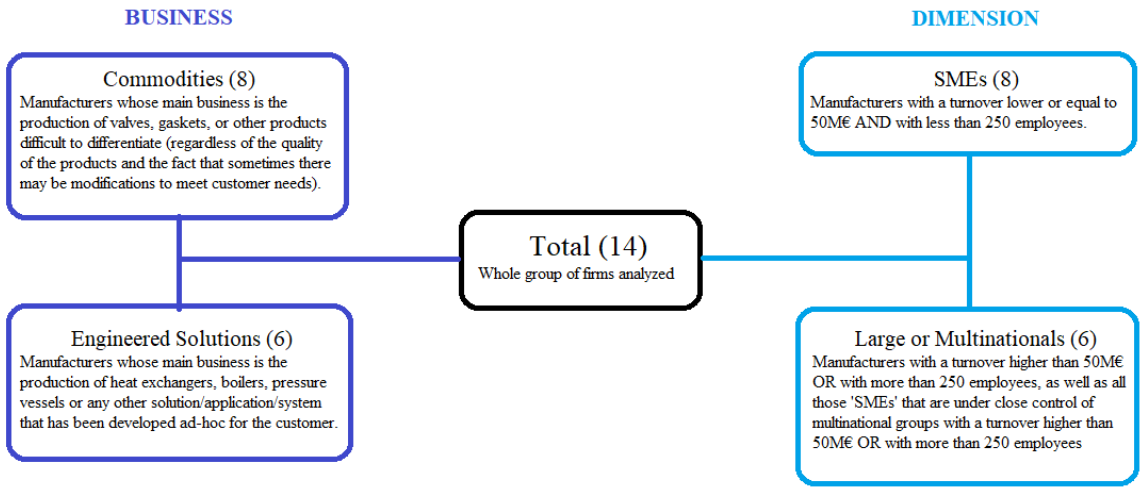

Figure 2 - Groups with classification criteria and number of firms belonging to each group.

5.1. Enablers (Mechanisms)

In this section we try to summarize the answers to the following questions: What are the most widespread and used mechanisms to foster collaborations? Why these? Which mechanisms, instead, are not used? Why? Which mechanisms, not yet present, could be considered? Are there any new mechanisms not previously considered and discussed in the literature?

EXCHANGE AND INVESTMENT IN PARTNERSHIP-EXCLUSIVE ASSETS

This probably represents the most important mechanism to implement to cogenerate competitive advantage necessary to compete in foreign areas.

To **geographically approximate assets** abroad, Italian manufacturers preferably look for local partners who can devote facilities to the collaboration. If a market seems promising, and if manufacturers already have commercial agents on site, usually the first step is co-investing with them to open local commercial branches. Often there is need for warehouses to locally stock spare parts and guarantee prompt and efficient assistance and maintenance services. If a country requires local content production, but guarantees large future business volumes in return, manufacturers can consider co-investing in local production facilities. Usually Italian manufacturers co-invest together with local agents and firms, which are entrusted with processes that don't require skilled labor: assembly, testing and similar. Core production remains in Italy to avoid sharing of sensitive know-how. Furthermore, some manufacturers would delocalize production of low-added-value items in countries with low labor cost. This, in order to reduce production costs and offer a more competitive product in terms of price. So far, few companies have gone beyond investments in commercial branches, but "local content will be the strategic discriminating factor of supplies over the next 15-20 years", and manufacturers acknowledge "that the competitive scenario in which they operate will require in future to expand" this collaboration tool.

Exchange and investments in **partnership-exclusive equipment and tools** occurs mainly to complement the geographical approximation of assets (not in case of pure commercial branches). Little has been done so far with the suppliers of lower tiers, in order to reduce the costs of certain processes, but few managers think that, since they "are using the same suppliers of outsourced processes, it could be nice to think about investments that may be addressed to the interests of many manufacturers".

Generally, manufacturers didn't co-invest to create **human asset specificity**, but this consolidated over time with most recurrent actors, even if manufacturers are always very careful in sharing the minimum. Anyway, someone co-invested to train employees through ValveCampus, to innovate products, or to train staff and agents in foreign facilities. Concluding, there are no main trends or motivations pushing manufacturers to invest in the

transfer of know-how through human resources, it's more a matter of necessity and opportunity. Actually, there is a lot of jealously, and almost none would like to do it in future.

Relationship history, commitment and trust have proved to be the most important factors to consider while evaluating the possibility of co-investing together with another firm, while **length of safeguards** turned out to be the least influential factor. It also emerged that it's not so much **volume of transactions** between firms that weighs on investment decisions, but **revenue prospects**.

KNOWLEDGE AND INFORMATION SHARING THAT BOOSTS JOINT-LEARNING

There are no real routines or structured procedures to share information and know-how or cogenerate new ideas and innovations. Concrete examples are very few, but in case of positive long-term inter-firm relations, there are occasional opportunities involving know-how exchanges and temporary collaborations to develop new products. Occasional **cogeneration of new ideas and innovation** mainly takes place with suppliers or universities. **Know-how transfer mechanisms**, however, can be established occasionally for short periods, to train foreign facilities' employees. Manufacturers don't consider **information sharing mechanisms** particularly useful, since, being global and public, O&G market is transparent and has constant information flows. Indeed, vast majority of respondents neither feel the need to actively participate in existing trade associations. Lack of knowledge sharing mechanisms is mainly rooted in firms' desire to jealously protect know-how.

Incentives alignment is based primarily on trust and binding contracts, but "binding contracts are binding up to 3 seconds later" according to respondents. Contents of contracts, as non-disclosure agreements, "are always quite vague, and in reality manufacturers are never guaranteed against certain things". "The legal framework of agreements is not sufficient unless there is a personal relationship of trust and esteem among the partners".

Generally, **absorptive capacity** of firms operating in this sector is very high; not because they have developed interaction routines, but because product differentiation level is very low and therefore manufacturers have developed overlapping knowledge bases. Absorptive capacity is particularly high among Valve Area's suppliers and manufacturers which interact

for many years; while manufacturers and suppliers operating abroad are at a lower level, despite being very good in taking possession of information and know-how to emulate the Italians.

COMBINING OF SCARCE RESOURCES AND CAPABILITIES

Italian firms prefer to keep strategic resources for themselves, trying to improve scarce resources on their own without depending on others. **Sharing of commercial branches, warehouses and production facilities** with partners occurs subsequently to exchange or investment in partnership-exclusive assets. Some manufacturers, together with competitors, would invest to **share equipment and tools** within suppliers of outsourced processes, since they use same outsourced processes suppliers; but right now, there are no real cases. Except for ValveCampus, **know-how sharing** almost exclusively occurs in consequence of investments or exchanges in partnership-exclusive assets. Generally, foreign firms share commercial know-how, while Italian firms share technical know-how, always maintaining core processes in Italy to avoid sensitive know-how sharing. "In emerging countries, partners are usually people with a certain influence on decision-makers, but who haven't technical knowledge". Resources are occasionally shared if bottlenecks occur due to work peaks, but "if it's something that you think is lasting, at that point you grow up". Concluding, most respondents think combining scarce resources and capabilities couldn't lead to generate competitive advantages, but sometimes it's necessary.

Italian manufacturers don't look for particular **strategic complementary resources** to co-develop special synergies. Usually, they simply look for someone that has good relationships with local decision makers and customers, and who can be trusted especially. In **organizational complementarity** terms, "merging of firms is always an obstacle". Maybe partners have much different businesses, different market approaches or different cultures. In particular, SMEs would struggle in collaborating with multinationals, due to their rigidity and bureaucracy. However, respondents think these are generally surmountable problems which don't preclude collaborations.

GOVERNANCE MECHANISMS YIELDING TO LOWER TRANSACTIONAL COSTS

Type of agreement governing collaboration turned out being not particularly relevant. When "you start collaborating, there may be informal agreements based on trust, but when you start opening your wallet" written agreements are needed. Contracts can be **formal self-enforcing agreements** or even **third-party enforcing agreements**, that usually contain basic non-invasive terms and clauses. Several respondents expressed skepticism about agreements, as "contracts' legal clauses are valid up to a certain point", and it's actually impossible to really protect yourself. "It's full-fledged risk activity, since law protects you with its times and defects". This is valid especially for collaborations abroad. Regarding relationships between manufacturers and different tiers suppliers, instead, relations are mainly managed with **informal self-enforcing agreements**. This is possible only within the Italian context, particularly in Valve Area, because actors are connected for decades. Therefore, it's possible to avoid many bureaucratic nuisances and time wastes, facilitating information sharing and leading manufacturers to occasionally undertake R&D activities with suppliers.

5.2. BARRIERS (CHALLENGES)

In this section we try to summarize the answers to the following questions: Which are the barriers that mainly limit the formation of collaborations? Why these? Which barriers, instead, don't represent a real problem? Why? Which new barriers, not previously considered and discussed in the literature, should be evaluated while approaching collaboration?

ASSET INTERCONNECTEDNESS

Respondents, given low number of joint investments and asset sharing cases, don't consider **cumulative bundles of joint investment decisions** a significant barrier. Moreover, while collaborating with foreign firms and agents, manufacturers usually contribute in terms of

know-how, relying on partners who already have necessary physical assets on-site. Know-how interconnection isn't particularly problematic, but "information segregation is surely an important thing to implement" to preserve sensitive know-how from spillovers. Anyway, identification and evaluation of real opportunities to develop such bundles are difficult, and their development can be hindered by: multinationals bureaucracy, family businesses entrepreneurial spirit, know-how jealously.

PARTNER SCARCITY

Partner scarcity differs "from country to country". Regarding raw materials and outsourced processes suppliers, "in Italy everything is well established and developed for many years, so finding new partners is very difficult". Abroad there are more opportunities, but often partners come from "totally distant and different market sectors". "They have influence on decision makers" but can be hard to collaborate since they haven't necessary technical competences.

	Difficulty in finding a partner (AVG)	Why is it Difficult to Find a Partner?				
		Appropriate Actors Lacking in the Network	Poor Selection and Evaluation Capabilities	Partner's Unwillingness	Firm's Unwillingness	Lack of Collaboration Experiences
Total (14)	3,75	10	3	1	2	1
SMEs (8)	3,71	6	0	1	2	0
Large or Multinationals (6)	3,80	4	3	0	0	1
Commodities (8)	4,00	5	2	0	1	0
Engineered Solutions (6)	3,50	5	1	1	1	1

Table 3 - On the left: Average difficulty that manufacturers, for each category, have in finding a partner (perception, on a Likert scale from 1 to 5). On the right: Main reasons why manufacturers, for each category, have such difficulty in finding a partner (perception, some interviewees pointed more than one reason).

Main partner scarcity reason is linked to **easiness of finding a partner**. Although abroad there are many possible partners, lack of trust and technical capabilities lead to a lack of appropriate actors in the network. Indeed, interviewees consider **product/service type and quality** and **business climate and leadership nature** the most significant characteristics while choosing a partner; coherently with high-quality standards of Italian firms. These characteristics are essential to understand level of partner's **problem-solving capabilities**. Furthermore, business climate and leadership nature are basically the only trust determinant. Indeed, collaboration idea "always starts from two people, who, if trust each other by

instinct, can put premises for subsequent analysis". If a candidate partner has lacks under these aspects, collaboration possibilities are strongly compromised from beginning.

Important Characteristics in Partner Selection (average results on a Likert scale from 1 to 5)					
	Total (14) (AVG)	SMEs (8) (AVG)	Large and Multinationals (6) (AVG)	Commodities (8) (AVG)	Engineered Solutions (6) (AVG)
Potential Partner Characteristics					
Actor Size (Turnover)	3,21	3,50	2,83	3,17	3,00
Product/Service Type and Quality	4,15	4,38	3,80	4,09	3,94
Problem-Solving Capabilities	4,43	4,13	4,83	4,48	4,66
Resources and Skills Complementarity	3,93	3,63	4,33	3,98	4,16
Collaboration Experience and Motivation	3,86	3,75	4,00	3,88	3,94
Financial Stability and Solvency	4,00	4,13	3,83	3,98	3,91
Project Features					
Duration	2,55	2,57	2,50	2,54	2,52
Complexity	3,18	3,00	3,50	3,25	3,38

Table 4 - For each manufacturers category, is shown the average importance of the different potential partner characteristics and project features (perception, on a Likert scale from 1 to 5).

A problem of Italian family-owned SMEs, actually, is **firms' willingness**, not so much **partners' willingness**. Not only because of know-how jealousy, but also because usually in SMEs "owner is used to decide and command", without accounting to anyone for what he does.

RESOURCE INDIVISIBILITY

Manufacturers share few resources, hence, issues like **loss of control over the firm's capabilities and resources** or **difficulty in redeploying resources due to collaboration restrictions** don't appear particularly problematic. Indeed, Italian firms mainly collaborate sharing know-how, an intangible resource easily divisible from others, recoverable and re-usable. However, it's important to carefully segregate information and know-how to avoid spillovers. Interviewees, anyway, agree that it's essential to set record straight since the beginning, to guarantee that each company will maintain decision-making power and control over its own resources and capabilities in future. "Better to flush before than fade afterwards". SMEs dispose of few resources and may suffer l**oss of flexibility due to long-term collaboration**, because there are "risks to restrict certain practices". While making JVs

in countries requiring that majority share is owned by local actor, it may become difficult to maintain control over resources.

INSTITUTIONAL ENVIRONMENT

Often institutional environment is a barrier, as there are many restrictions of different nature hindering successful long-term partnerships formation.

	Main Institutional Environment Restrictions Perceived by Italian Firms			
	Legal Restrictions	Organizational Restrictions	Political Restrictions	Cultural Restrictions
Total (14)	11	8	8	8
SMEs (8)	5	5	4	6
Large or Multinationals (6)	6	3	4	2
Commodities (8)	7	4	3	3
Engineered Solutions (6)	4	4	5	5

Table 5 - Number of manufacturers, for each category, that perceive the presence of the different kinds of restrictions (perception, each interviewee has expressed its concerns about none, one, some or all kinds of restrictions).

Concrete **legal restrictions** are few, but customers don't appreciate horizontal collaborations between competitors. Indeed, vendor lists' purpose is ensuring competition during tendering phase. If two competitors decide to partner, or one acquires the other, customers are used to oppose to this situation, no longer accepting their offers and putting them in black list. Therefore, even if antitrust laws are not applied, there are mechanisms to guarantee competition and avoid certain horizontal collaborations.

Organizational restrictions may occur when SMEs try to collaborate with multinationals. Indeed, bureaucracy rigidity and lack of long-term interpersonal relationships are a problem for SMEs. If multinationals "would like to partner with any firm, times would be biblical, there is no flexibility", and SMEs live in flexibility. Between SMEs "often it's enough a hand shake without even having a contract". Sometimes even cultural differences lead to organizational restrictions. "Because you base yourself on your culture, on your way of working and conceiving work, but others can have a totally different work conception, which floors you at operative moment".

Global geopolitical context evolves very fast, and O&G market is inevitably subject to **political restrictions**. Some countries may have political instability, there can be embargos (e.g. Iran), governments may impose a percentage of local content production to increase country's GDP... However, manufacturers analyzed always managed these problems, learning to adapt according to market evolution. Manufacturers "go in function of what the market offers", both in geographic and temporal terms. Anyway, before investing in a country, it's essential to carefully evaluate all geopolitical factors that may influence collaboration.

This sector connects firms, people and cultures very far apart on a global scale. Sometimes cultural differences can reserve unpleasant surprises, but they don't constitute cultural restriction usually, since manufacturers operating in this sector should relate to most disparate cultures maintaining an open mind. Cultural differences sometimes can have repercussions at organizational level. However, main **cultural restrictions** towards collaboration are in Italy, because of know-how jealousy and individualism characterizing SMEs in this sector. "It's a question of our Italian history that is evolving, but we still face more difficult than other cultures in proactively collaborating". Even if collaboration culture doesn't seem widespread neither abroad.

6. CONCLUSIONS

Since RV theoretical perspective has usually been adopted in long-term time horizon SC contexts, it was interesting to investigate co-generation of competitive advantages in temporal SC contexts. This multiple case study has focused on IPBSCs composed by firms providing industrial O&G sector projects, since most of firms considered have more than 75% of turnover coming from O&G sector. It's important to point out this, because O&G projects follow very rigid tender procedures to guarantee competition and participants' turnover. This because such projects, differently from industrial projects, are of public interest and often have governments' participation. This severely limits possibilities to establish long-term relationships with other SC participants. Industrial sector projects follow less structured procedures, sometimes bypassing tendering. Therefore, it's easier establishing long-term relationships with customers, and consequently with suppliers or competitors.

Italian manufacturers are concerned by many challenges coming from O&G market downturn: less market opportunities, shorter delivery times with penalties for delay, low-price Asian competitors, few differentiation and innovation possibilities, and especially growth of local content requirements abroad. "Local content will be the strategic discriminating factor for supplies over next 15-20 years". In this context, Italian manufacturers show some common **weaknesses**:

- "Business has moved a little further geographically in the last 15 years, in the sense that Asian EPCs have become the most important".
- Italian manufacturers having local production plants abroad are few.
- Italian products' high quality implies high production costs, both for materials, skilled labor and, now, delivery.
- Italian industrial fabric is composed by many SMEs, although multinational groups acquired many firms over time. SMEs are often undersized and it's hard for them to devote resources to collaboration.

- SMEs have narrow product portfolios, while multinationals tend to expand portfolio through acquisitions.
- Italian manufacturers are jealous of their know-how, and in many SMEs there is a strong entrepreneurial spirit that "hinders managerial perspective", hindering SCC.

However, Italy is global leader in quality terms, and the second exporter of such products after China. Italian manufacturers' **strengths** are:

- Products' quality and reliability.
- Experience and engineering skills.
- Customer care and flexibility.
- Historically famous brands, synonymous of quality on the market.
- In Italy, especially in Valve Area, there are many firms with superior know-how on O&G industrial products and processes. This cluster is unique and inimitable, because developed over decades thanks to continuous interactions of hundreds of SMEs.

In this context, considering manufacturers' weaknesses and strengths, Italian SMEs have these **future objectives**:

- To expand product portfolio adding complementary products, to be more competitive and attractive to customers.
- To find local partners in countries representing most important geographic markets, to offer commercial support and satisfy local content requirements.
- To preserve know-how.
- To establish additional exclusive long-term relationships with end-users, to have preferential access on certain projects.
- To reduce costs and lead times for procurement of materials, services and outsourced processes.
- To reduce production costs, delocalizing low-added-value phases in countries with low labor cost.

Considering these observations, let's try to understand how Italian manufacturers can set SCCs, reducing weaknesses and exploiting strengths, to jointly create a shared competitive advantage and achieve common objectives. To do this, we analyzed both current situation

of their collaborations and general interviewees' perception about collaboration topics and opportunities, always under RV theoretical lens.

6.1. RELATIONAL VIEW PERSPECTIVE CONCLUSIONS

We give an overview of most effective **enablers** to co-generate competitive advantages in the IPBSC analyzed.

When manufacturers want to collaborate with a partner (e.g. competitor, complementary products' Italian manufacturer, local supplier or agent) to target a particular **foreign market**, the most effective enabler to gain a competitive advantage against competitors is represented by **exchange and investment in partnership-exclusive assets** for **geographical approximation of assets**. This leads to a competitive advantage, as the habit of requiring a percentage of local content production is spreading in many developing countries; and manufacturers having local production facilities are advantaged in tenders. Although, only low-added-value processes requiring no skilled labor are usually relocated. Italian manufacturers must carefully weigh opportunities to understand which countries are most fertile, where customers can guarantee generous revenues prospects. Usually, if a country or customer is so important for a manufacturer in sales terms, this certainly has already local commercial agents or branches; maybe it can even have warehouses to store spare parts and provide prompt assistance and maintenance services. At this point, the wisest move is to co-invest locally together with current local partners (e.g. commercial agents, suppliers) or complementary products' manufacturers, to offer customers a wider product portfolio. After facilities, it will be necessary to **invest in equipment and tools**. But Italian manufacturers prefer to avoid investments in tangible assets, leasing the burden on local partners and only **sharing know-how strictly necessary** to collaborate. This situation inevitably leads to a **combination of scarce resources and capabilities** needed to collaborate in the given country. In particular, Italian manufacturers share part of technical know-how (of which they are very jealous) to train local employees, while local partners support Italian manufacturers sharing their commercial know-how. This, over time, leads to a **human asset specificity**

increase without monetary investments. Usually, however, no routines are defined for **knowledge and information sharing that boosts joint-learning.** This because Italian manufacturers are justly jealous of their know-how, trying to share only essentials, usually on occasional basis, when opportunities arise. There are no particular **governance mechanisms** that can be used to effectively protect partners against possible opportunistic behaviors. Interviewees perceive that contracts never really protect involved partners, indeed contracts can be formalized fairly, without placing too many constraints on partners.

When manufacturers want to collaborate with a partner in Italy, instead, **exchange and investment in partnership-exclusive assets** don't appear particularly effective. **Co-investment in partnership-specific equipment and tools** with suppliers can reduce outsourced processes' costs, but there aren't many examples of co-investments in such physical assets. With some suppliers there is high **human asset specificity**, which isn't the result of monetary investments, but of a long series of interactions that took place for many years between Italian firms. This led to the development of the precious know-how of Italian manufacturers and firms working closely to them. However, neither in this case there are real structured **mechanisms for knowledge and information sharing that boosts joint-learning**. Rather, there are several examples of occasional know-how sharing among Italian actors of this IPBSC. Whenever an opportunity arises for **cogeneration of new ideas and innovation**, or when there is need to solve any problem to satisfy a customer, Italian manufacturers don't hesitate to consult Italian universities or lower-tiers suppliers of materials, components and outsourced processes. These, however, are occasional technical discussions, which doesn't follow well defined procedures and are possible only between firms having good relationships for a long time. The real enabler that guarantees shared competitive advantages to these Italian SMEs is represented by **governance mechanisms** managing their relationships. Indeed, the high level of trust, respect and mutual esteem present between many Italian firms, as well as the string of inter-firm relationships that characterized their history, have led to an **informal management of relationships** between manufacturers and suppliers of different tiers. This constitutes an enormous competitive advantage which, in addition to a transaction costs reduction, allows continuous improvement, albeit marginal, of Italian firms' know-how. Among Italian competing manufacturers, however, there are still cultural barriers that must be demolished to collaborate, but something is changing with new generations, and ValveCampus proves this.

Now, we also give an overview of most concerning **barriers** that may hinder co-generation of competitive advantages in the IPBSC analyzed.

Respondents weren't particularly concerned about barriers like **asset interconnectedness** or **resource indivisibility**. Certainly, creating **cumulative bundles of joint investment decisions** in some countries may be difficult for legal or bureaucratic issues, while sharing resources may result in **loss of flexibility due to long-term collaboration**; but Italian manufacturers think these are situations still manageable and not really problematic. **Partner scarcity** has instead turned out being a real barrier. In Italy, basically, seems there are no possibilities to find new partners, because Italian firms have known each other for decades, relationships are well established, and newcomers are rare. Abroad, instead, candidate partners abound, but candidates really valid are scarce; and main reasons are:

- **Low Products' Quality**: Foreign manufacturers usually make low-quality products; to partner with them, for Italian manufacturers making high-quality products, would entail the high risk of putting their brand in a bad light.
- **Leadership Nature and Business Climate**: Collaboration idea usually comes from 2 people, who, if trust each other and agree, can lay the foundations for future collaboration development. Perhaps also due to cultural differences, however, it's often difficult to trust foreign actors. These often show little intellectual honesty, and valuable know-how that Italian manufacturers should share, is often threatened by risks of embezzlement and spillovers.
- **Unwillingness of SMEs**: especially SMEs that still have a family approach, prefer to remain small and flexible, without ceding part of their decision-making power.

Another great barrier is represented by restrictions imposed by **institutional environment**. There are **legal restrictions** mainly linked to the presence of local content requirements and embargoes in some countries, which are however induced by **political restrictions**. There are legal restrictions from competition point of view, not so much because of possible antitrust authorities' interventions, but because of contrast actions that customers can undertake to punish and hinder horizontal SCC between competitors. Furthermore, there may be patent issues, or various specific restrictions in different countries. In **organizational restrictions** terms, it's very difficult for SMEs, which are extremely flexible, to collaborate with multinationals, which are extremely rigid and bureaucratic. Moreover, there may also

be organizational restrictions induced by cultural differences existing between Italians and foreigners, precisely at the level of conception of the way of working itself. Finally, in a global market like O&G one, it's assumed that firms shall deal daily with various political and **cultural restrictions**. So, no matter how much obstructing they could be, Italian manufacturers have learned to live with them, sometimes trying to avoid them, sometimes countering them. However, respondents perceive significant cultural restrictions also in Italy. These are mainly given by Italian SMEs' strong entrepreneurial spirit. Many Italian SMEs still have a family ownership managing the business in emotional way, avoiding collaborations. This to avoid sharing their know-how and leaving part of decision-making power they have on their firm. On the contrary, managers usually manage firms in a more detached and impartial way.

In conclusion, we can say that **Relational View theory**, yes, is applicable in temporal contexts, such as in IPBSCs, but within certain limits. Indeed, RV theory was born to be applied in contexts where SC is a well-established network and overlooks a long-term time horizon. The fundamental problem is that this theory doesn't consider some aspects determinant to contextualize the SCs, such as:

- **Business Type** (What kind of products are produced? What marketing approach do we need to successfully market these products? What geographical scope does the business have?)
- **Reference Market Type** (Is it a free or regulated market? Does this market follow particular dynamics that characterize and differentiate it from classic types?)
- **Opportunities and Necessities** (Are there any real opportunities that require SCC to be exploited? Are there any real needs that require SCC to be met?)

Thus, RV theory can highlight which are most effective enablers (mechanisms) to establish solid and lasting SCCs; it can also analyze main barriers hindering the formation of such collaborations; but it can't consider many important factors characterizing SC and reference market. Therefore, application of RV theory alone, without appropriate context analysis, may be of little significance. This because, often, the importance (high or low) of a particular enabler (or barrier) is highlighted by RV theory, but the reasons for its importance (high or low) are not detected if rooted in contextual issues. Hence, we can conclude that RV theory becomes as less effective as we move away from the ideal context for which it was designed.

The more we move away from the ideal context for which RV theory was designed, the more it's necessary to support its application with an appropriate context analysis in terms of SC characteristics, market characteristics, and business opportunities/needs.

6.2. INSIGHTS FOR FUTURE RESEARCH

In light of what emerged analyzing the case studies with RV theory lenses, in future it would be desirable to deepen the research as proposed below:

An IPBSCs composed by firms supplying industrial products for O&G sector projects have particular dynamics and follow very rigid, public tender procedures. Moreover, there are many geopolitical and cultural issues that can affect businesses and collaboration opportunities. For this reason, it would be **interesting to analyze also IPBSCs composed by firms supplying industrial products for private industrial sector projects**. In industrial sector there are "very different customer-supplier relationships, knowing that is possible to work continuously". While in O&G sector, there is always need "to restart from scratch, offers are redone and the best one takes the job". Peculiar characteristics of the reference market can potentially influence SCC possibilities, therefore, in industrial sector collaboration strategies could find more breeding ground.

Subsequently, it would be **interesting to make a comparison** between the scenario of IPBSCs composed by firms supplying industrial products for O&G sector projects, and that of IPBSCs composed by firms supplying industrial products for private industrial sector projects. Such analysis would be useful to analyze which enablers and barriers occur in one context rather than another. In this way it could be possible to understand how peculiar characteristics of reference market, and which characteristics, can affect or not effectiveness of certain enablers and barriers.

It would be **interesting to analyze an IPBSC that presents a different situation from the suppliers' relations point of view**. The Valve Area represents one in a million industrial cluster, in which participants managed to establish long-term informal relationships over time. These relationships have ensured that valuable local know-how was cultivated,

developing an industrial cluster of international relevance. But, what if manufacturers didn't have such a solid and valuable cluster behind them? How would relations with sub-suppliers be managed in that case?

Finally, it would be **interesting to analyze this case study also under Resource Based View lens, to make a comparison** between the results of two analyses. By doing so, it would be possible to understand if there is a correlation between private resources of partners and their ability to collaborate sharing such resources to co-generate value. In this way it would be possible to identify most important resources to be owned or researched in partners, to successfully take on collaboration.

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Table of Contents

Abstract

Successful collaborative initiatives between supply chains members can lead to sustained differentiated performance. However, inter-firm collaboration often fails due to misalignment of incentives and strategies. Prior research tackles this issue in the Relational View theoretical perspective, however, usually in contexts where supply chains are well-established networks overlooking a long-term time horizon. For this reason, it becomes interesting to investigate the co-generation of competitive advantages through supply chain collaboration in temporal contexts. This work investigates supply chain relationships, strategies and performance through a multiple case study in the Italian industrial projects-based supply chain supplying products for O&G sector projects. The sample of firms is composed by first tier small-medium suppliers, and the study mainly focuses on horizontal and lateral collaborations between these manufacturers. The final aim of this multiple case study is to evaluate the feasibility of implementing supply chain collaboration in temporal contexts, reflecting on the appropriateness of relational view in such contexts.

Keywords: Supply Chain, Supply Chain Management, Supply Chain Collaboration, Horizontal Collaboration, Relational View, Relational Rent, Competitive Advantage, Project-Based, O&G, SMEs, Integration, Partner, Partnership, Local Content, Temporal Contexts, Case Study, Italy.

Chapter 1

Introduction

Supply Chain Collaboration is defined as "*the ability to work across organizational boundaries to build and manage unique value-adding processes to better meet customer needs*" (Fawcett et al., 2008, p.93). Successful collaborative initiatives between supply chains members could lead to sustained differentiated performance, but inter-firm collaboration often fails due to misalignment of incentives and strategies.

According to **Relational View theory**, firms willing to partner can establish idiosyncratic inter-firm linkages, making relation-specific investments and combining resources in unique ways; thus, establishing sources of relational rents and co-generating competitive advantage through inter-firm collaboration (Dyer, 1996b; Dyer and Singh, 1998). The **Relational Rent** is defined as "*a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners*" (Dyer and Singh, 1998, p.662).

Whilst management research tackles this issue in the Relational View theoretical perspective, however, usually in contexts where the supply chain is a well-established network and overlooks a long-term time horizon. Considering the recent technological advancements and the rapid digital transformation of supply chains, it becomes pertinent to investigate the co-generation of competitive advantages in **temporal contexts**. The main difference in these contexts is linked to the fact that supply chain participants mostly interact

occasionally, just for project purposes, making it difficult to establish lasting collaborations or partnerships which go beyond the single project.

In order to contribute in expanding knowledge, this thesis project investigates the supply chain relationships, strategies and performance in a multiple case study in the **industrial projects-based supply chains**. In line with the Relational View theory, this multiple case study was conducted to analyze which are the most effective and widespread **enablers (mechanisms)** that foster development of collaborations in temporal contexts, but also to analyze which are the most obstructive and recurrent **barriers (challenges)** towards collaboration in temporal contexts. By identifying the main enablers and barriers, it is possible to have a starting point to appropriately define a collaborative strategy that is effective, or to improve an existing one.

It is particularly important to study this topic in a temporal context for two reasons:

- To contribute in expanding the state of art knowledge on the Relational View theory, applying it in the industrial project-based supply chains environment, where it has not yet been fully applied. The aim is confirming, rejecting, contrasting and complementing previous research outcomes, in order to consolidate and develop theory in a research area where knowledge is still missing. Furthermore, it will be interesting to highlight the differences between temporal contexts and long-term time horizon contexts.
- In order to tackle the expansion of multinational groups and the increase in competitiveness of foreign competitors (especially low-cost countries), collaboration can be a winning strategy that helps Italian SMEs to become more competitive on the market. In fact, horizontal collaboration could allow firms to face together projects that alone could not be approached, due to a lack of capacity, resources, and so on. Thus, the second objective of this study is to provide some concrete suggestions that can help SMEs in gaining competitive advantage through collaborative strategies, so that they can be more competitive globally.

In order to achieve these objectives, first of all, it has been conducted a **qualitative literature review**, focusing on successful collaborative strategies in industrial projects-based supply chains. The literature review analyzes the state of art of collaboration under the Relational

View theoretical lens to investigate the co-generation of competitive advantages in temporal contexts.

The literature review played a fundamental role in understanding which were the most important topics and factors to address in order to prepare a suitable **questionnaire**, to conduct proper interviews and to develop a complete and reliable content analysis on the findings.

Therefore, starting from the literature review results, a questionnaire with 36 mixed questions (i.e. open questions, closed questions, Likert scale questions) has been developed. The questionnaire has then been presented, during one-on-one **semi-structured interviews**, to managers and owners of a group of 14 firms.

The **firms** considered for this multiple case study are manufacturers working in industrial projects-based supply chains supplying industrial products (e.g. valves, heat exchangers, boilers, gaskets, ...) for projects related to the O&G sector. The firms interviewed are mainly SMEs located in Lombardy. It was considered of interest to analyze these firms because they operate in temporal contexts and they represent an industrial sector strategically very important for Italy, that is composed of hundreds of SMEs. Moreover, addressing mainly the O&G sector, which is a public interest sector, these industrial project-based supply chains have been found having peculiar characteristics that somehow differentiate them from any industrial projects-based supply chain that provides products for private projects (e.g. chemical plants, textile plants, Food & Beverage plants, paper plants, ...).

Once agreements were made with managers and owners via e-mail, the interviews were conducted face-to-face at the premises of the various firms, in order to figure out their point of view, their needs and their concerns. The information collected were then presented by dividing them according to the type of actor (i.e. suppliers, competitors, customers, agents and service providers) with whom the firms entertain relationships. Later on, a qualitative analysis has been carried out following the principles of Relational View theory, analyzing and discussing the different enablers (mechanisms) and barriers (challenges) that can influence the success of collaborations within a supply chain.

The paper is structured as follows:

- **Chapter 2, Literature Review**: After an introduction about the research method, selection and classification of the papers necessary to conduct the literature review,

there is a theoretical background overview needed to fix some key concepts and definitions. After that, the partner selection characteristics and the supply chain relationships features are presented. After these initial parts that help us in understanding the context of collaborations and partnerships, we enter the Relational View theory, where the 4 enablers and the 4 barriers are explained, concluding with the presentation of some research gaps.

- **Chapter 3, Research Methodology**: This chapter explains in detail the procedure followed to define the questionnaire, and to choose, to contact and to interview firms. Then there is a description of such firms, including their core businesses, always preserving their privacy.
- **Chapter 4, Findings**: At the beginning of this chapter some forewords regarding the O&G sector are made, also describing the mechanisms and the related tender procedures leading to the assignment of projects to eligible manufacturers. Then, the information regarding the current state of relationships maintained by manufacturers are presented by dividing them according to the actors in the supply chain:
    - Suppliers of Materials, Components and Outsourced Processes;
    - Competitors and Suppliers of Complementary Products;
    - Customers;
    - Agents and Service Providers;
    - Multinational Groups.
- **Chapter 5, Analysis and Discussion**: The qualitative analysis of the findings is carried out according to the Relational View theory, analyzing one by one the enablers (mechanisms) and the barriers (challenges).
- **Chapter 6, Conclusions**: Here are conclusions about the Relational View theory, to understand up to which extent the theory is effectively applicable in temporal-contexts. In the end there are also some insights for future researches and some practical tips for the interviewed firms.

Chapter 2

Literature Review

1. REVIEW METHODOLOGY

This is a **concept-centric qualitative literature review** which focuses on collaborative strategies in industrial projects-based supply chains. To investigate the co-generation of competitive advantages in temporal contexts, we analyze the state of art of collaboration under the **Relational View** theoretical lens.

1.1. LITERATURE SEARCH, COLLECTION AND CLASSIFICATION

Most of papers has been taken from Scopus; secondarily from Science Direct, Emerald, Web of Knowledge or Google Scholar; and only few from Taylor and Francis or Wiley.

According to the expected outcome of this study, the keywords used for this study are composed by one or more of the following words: “supply chain*”, “SC*”, “project*”, “collaborati*”, “relation*”, “partner*”, “tempora*”, “TMO”, “integration”, “coordination”, “engineering*”, “ETO”, “horizontal”, “lateral”, “inter-organizational”, “SME” “industrial”, “strategy”, “cogeneration”, “competitive advantage”.

The results found in a first moment with these keywords have been skimmed with a title judgment, or abstract analysis if needed. These has been integrated with some additional

papers kindly recommended by the Management Engineering Department of Politecnico di Milano.

The whole group of 216 papers considered has been further reduced after a deeper analysis of abstracts and eventually of the paper structure or content.

This qualitative analysis considered mainly journal articles or generic articles, excluding conference proceedings. Some main topics and features has been identified to classify the kind (K) of paper and its content (C):

- Temporary project contexts vs traditional supply chain context and construction industry (K / good vs bad);
- The paper refers to one-time collaborations in projects, without long-lasting relationships (K / bad);
- Comparison between supply chain management and project management, or between temporal and permanent contexts (K);
- Relationships and partnering in temporary contexts, key processes and strategies (e.g. coordination, integration, …) (C);
- Focus is not on relationships (e.g. logistics, procurement, innovation, knowledge sharing, risk management, sustainability, production, flexibility) (C / bad);
- Effects of partnering and coordination on performances (C);
- Key principles, resources and analysis of factors towards successful collaboration (C);
- Identification of drivers and enablers of competitive advantage (C);
- Analysis of barriers, concerns and problems towards partnering and supply chain management (C);
- Underlying conceptual theory or framework (K / mathematical models has been excluded);
- Literature reviews (K);
- Containing empirical studies, interviews and surveys (C);
- Small and medium enterprises as object of the study (C);

The remaining papers included in the study after this qualitative classification were 132; even if some additional papers identified among their bibliographic can be considered. Keeping track of these topics and features was strongly useful to evaluate papers' content

and to structure the literature review analysis. Furthermore, it was helpful to easily classify and to later recover the concepts prominent to write the literature review.

1.2. Structure of the Literature Review

To comply with the goal of our study we identified some main elements which interactions can be illustrated as presented in Figure 1.

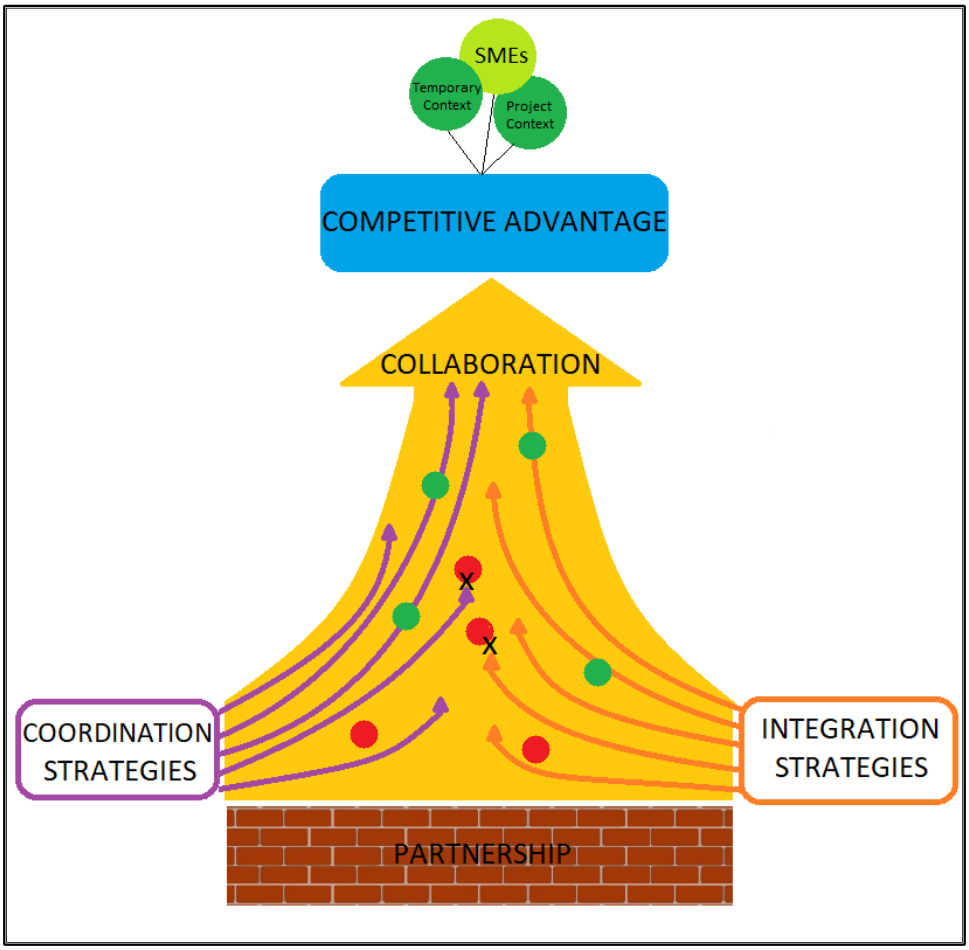

Figure 1 - The model illustrates how partnering, integration and coordination strategies, leveraging the right enablers, can sustain and boost successful collaboration towards the achievement of competitive advantage.

Partnership is represented as a brick wall because its structure and organization must be strong and flexible enough to sustain evolution of collaboration in time, without limiting it for any reason. Coordination and integration in their various forms help the strengthening of collaboration towards the achievement of sustainable competitive advantage. Hence, effective collaborative and integrative strategies should intertwine leveraging enablers (green dots) and escaping barriers (red dots), in order to well-establish a network

overlooking a long-term time horizon. The objective of reaching a competitive advantage is further complicated by context-specific characteristics such as dimension of firms, one-of-a-kind nature of projects, as well as their temporary nature.

According to this main model idea, in following sections of the literature analysis we will present and discuss:

- Theoretical Background:
    - Terminology overview;
    - Supply Chains in Projects Environment (i.e. Temporary/Project Context);
    - SMEs in the Italian Context;
- Characteristics for Partner Selection;
- Supply Chain Relationship Features (i.e. Collaboration, Partnership, Coordination Strategies and Integration Strategies):
    - Collaboration Orientation;
    - Collaboration Dimensions;
    - Collaboration Duration;
    - Scope of Integration;
    - Degree of Integration;
    - Integration Dimensions;
    - Relationship Strength;
- Relational View Elements:
    - Enablers (Mechanisms):
        - Exchange and Investment in Partnership-Exclusive Assets;
        - Knowledge and Information Sharing that Boosts Joint-Learning;
        - Combining of Scarce Resources and Capabilities;
        - Governance Mechanisms Yielding to Lower Transactional Costs;
    - Barriers (Challenges):
        - Asset Interconnectedness;
        - Partner Scarcity;
        - Resource Indivisibility;
        - Institutional Environment.

After this evaluation and discussion, coherently with our initial objectives, we will provide some comments and insights about state of art lacks and gaps.

The structure proposed, together with the connections between its elements, has been extremely beneficial also to shape the framework for defining questions and conducting interviews.

2. STATE OF ART PRESENTATION AND DISCUSSION

2.1. THEORETICAL BACKGROUND

TERMINOLOGY OVERVIEW

Competitive advantage doesn't mainly develop within a firm's boundaries, but also from inter-firm relationships; in fact, collaborative efforts give opportunities to generate value that couldn't be alternatively created by individual firms (Touboulic and Walker, 2015).

Supply Chain Collaboration (SCC) is defined as "*the ability to work across organizational boundaries to build and manage unique value-adding processes to better meet customer needs*" (Fawcett et al., 2008; p.93). Inter-firm collaboration is often employed as a strategy which provide means to survive the market competition; allowing two or more firms to leverage resources belonging to other network parties, forming long-term relationships and working together to plan and execute operations (Sabri et al., 2017; Cao et al. 2010). SCC can lead to a situation of openness and trust where firms can develop sustainable advantage through the achievement of scale economies, improved process, quality and variety of information, reduction of waste in procurement systems, better outcomes and allowing risk sharing (Soosay et al., 2008; Walker et al., 2013). Even if it may be challenging for participants to quantify the added value that collaborations can bring (Walker et al., 2013). However, there is still lack of real procedures in aligning operational and corporate strategies to the SCC practices (Sabri et al., 2017), at least in industrial projects-based supply chains.

Because in literature there is overlapping of terminologies, collaboration mustn't be confused with:

- **Cooperation,** in which mission and goals are not considered and firms interact as needed, without significant joint planning and maintaining separate resources and authority (Mattessich et al., 2001). For example, two firms may cooperate on few activities such as logistics and transportation in order to reduce costs, even if they are competitors or have unrelated businesses.
- **Coordination**, that is a managerial function about efficiency, responsible for aligning decisions and efforts of firms working together towards mutually defined goals (Malone and Crowston, 1994; Mello et al., 2015). This has become increasingly important recently, as firms increase their focus on ensuring short and reliable lead times; particularly in project contexts (Mello et al, 2015).
- **Integration**, that according to Stevens (1989; p.6) is "*how everyone in the company and its trading partners work in sync to achieve the same business objectives via integrated business processes and information sharing*". It's a process helping to attain seamless coordination between several departments and/or firms and can involve both forward physical flows or backward information flows (Frohlich and Westbrook, 2001). Central elements of supply chain integration are joint action, partner selection and incentive structure (Eriksson and Pesamaa, 2013), but the remarkable level of fragmentation and short relationships characterizing industrial project-based supply chain put constraints on the adoption of such integrating practices (Gosling and Naim, 2009; Eriksson, 2015), that need long periods to bear fruits.

Following, we'll examine how these concepts relate in a collaborative context, and which elements foster or hinder a successful SCC towards the generation of sustainable competitive advantages.

SUPPLY CHAINS IN PROJECTS ENVIRONMENT

Supply Chain (SC) is a system encompassing all the companies involved in design, production and delivery of a product to market, thus a firm may belong to one or more SCs (Hugos, 2011). These actors are linked together, directly or indirectly, by feedforward flows of materials and feedback flows of information (Stevens, 1989). Firms able to collaborate

establishing strong SCs have the opportunity to gain a competitive advantage over competitors (Sabri et al., 2017).

Considering the actors involved as a single entity, **Supply Chain Management (SCM)** consists in the coordination of production, inventory, location and transportation, as well as information sharing among the participants (Hugos, 2011). Through the best mix of responsiveness and efficiency in the 5 areas cited above, SCM seeks the goal of increasing sales, while simultaneously reducing inventory and operating expense (Hugos, 2011).

The majority of available research on SCM neglects the needs of the engineer-to-order sector (Hicks et al., 2000). The **Engineer-To-Order (ETO) Supply Chain** is characterized by the location of decoupling point at the design stage, and usually refers to large and complex project environments characterized by iterative flows in transitory networks where main actors are customers, consultants, EPCs and suppliers (Gosling and Naim, 2009; Pryke, 2009). Given that literature considers different sides of the ETO definition, to disambiguate we can say that its dimension ranges from ETO, when a new product is designed, to engineer-to-stock (ETS), when a design is already in stock (Gosling and Naim, 2009). Between them it's possible to find different degrees of modification. We can give advance notice that firms operating in the industry objective of this study, are closer to the ETS side. In particular, our research is grounded on **Industrial Project-Based Supply Chain (IPBSC):** a system where firms participate in temporary networked organizations which deal with non-repetitive infrastructure mega-projects such as cross-continental pipelines and power plants (Turner and Muller, 2003; Turner, 2014).

Projects require multiple resources and are composed of many activities carried out by a temporary coalition of firms each one with a well-defined role (design, engineering, procurement, manufacturing, assembling, commissioning) (Hicks et al., 2000). In addition, projects are characterized by non-repetitiveness and limited time extension, reasons for a strong focus on time and costs. According to Pryke (2009)**,** project management evolved under several approaches:

- Traditional: production or assembly orientation focused upon efficiency;
- Functional: strategic, front end management of projects sustained by different task-driven agendas;
- Information Processing: technocratic input-output model of managing projects;

- Relationship: management of the range of relationships between people and/or firms.

In particular, project procurement process needs an articulated tendering procedure to ensure the best trade-off between price, quality and latency (Sabri et al., 2017), while customers usually select EPC basing on lowest competitive tender (Winch, 2000). Thus, effective SCC and stakeholders' management within the SC are of paramount importance to successfully deliver the project (Sabri et al., 2017).

IPBSC has emerged as a major SC structure, increasing in importance in recent years (Gosling and Naim, 2009). Nevertheless, SCM initiatives, traditionally developed for process-centric contexts, still show partial success of implementation in project environments (Gadde and Dubois, 2010; O'Brien et al., 2002). Indeed, IPBSC presents really high complexity and uncertainty (Fearne and Fowler, 2006), due to SC fragmentation, scarce SCC and frequent disputes among networks of suppliers and EPCs (Aloini et al., 2015).

SCM exists at a high level of abstraction and to study its behavior and characteristics we'll explore the network relationships composing the SC under a relational perspective, which considers SC network as a unique entity.

SMEs IN THE ITALIAN CONTEXT

SCM can be an important tool to break SMEs isolation in the value chain, in order to overcome dynamic market challenges, pursue technological innovation and face global competition. (Gnyawali and Park, 2009; Kumar and Singh, 2017). In developed countries such as Italy, SMEs adopt innovative and customer-oriented strategies to pursue customers' major priorities such as quality improvements, delivery on time and cost reduction (Syed and Kamel, 2014; Kumar et al., 2014).

Though, SMEs are usually in an unfavorable position against big competitors due to many sources of vulnerability; indeed they face many pressures (e.g. price reduction, improvement in product quality and features) and challenges (e.g. upgradation of technology, human resource development, new product development and managing collaboration with other actors), they deal with several constraints (e.g. scarcity of resources, flat organization structure, lack of technical expertise, paucity of innovation, occurrence of knowledge loss

and financing obstacles) and are strongly exposed to market risks (e.g. seasonality, volatility of fads, new product adoptions and short product life cycles) (Kumar and Singh, 2017). Moreover, SMEs working as suppliers in this industry, face difficulties in getting certified and appear on project owner (end-user) verified vendors list, forcing manufacturers to partner with other SMEs in order to contrast EPC bargaining power and avoid its potential opportunistic behaviors (Sabri et al., 2017).

In this scenario could be particularly beneficial horizontal SCC, which consists in two or more unrelated/competing firms cooperating to share information or resources, putting the premises for a regional development of SMEs (Bjornfot and Torjussen, 2012; Simatupang and Sridharan, 2002). Horizontal collaboration can reduce SC costs, improve real time decision-making and foster innovation (Prakash and Deshmukh, 2010). When the collaboration takes place between competitors we talk about **Coopetition**, because the relationship includes both collaboration (e.g. R&D and innovation or project completion) and competition (e.g. marketing and sales or bid phase) at separate times, within the same or different competitors (Gnyawali and Park, 2009). These two contrasting approaches can be separated according to the degree of proximity of activities to the customer or upon business units, but also basing on competitors' access to critical resources (Bengtsson and Kock, 2000).

Coy (2006) argues that "sleeping with the enemies" is important not only to acquire new technological knowledge and skills, but also in creating new capabilities and achieve in the end economies of scale, mitigate risks and leverage resources together (Morris et al., 2007; Gnywali and Park, 2009). However, persists the paradox that information and knowledge shared while cooperating can be used in competition (Gnyawali and Park, 2009). Concluding, coopetition's advantage lies in the combination of a pressure to develop within new areas provided by competition, and the access to resources available thanks to cooperation (Bengtsson and Kock, 2000). Next sections discuss where and how cooperation can be established in order to allow SMEs belonging to IPBSC to gain shared and sustainable competitive advantages against competitors.

2.2. CHARACTERISTICS FOR PARTNERS SELECTION

Many researchers argue that is important to move beyond a dyadic view of SCM towards a network perspective (van der Vaart and van Donk, 2008; Schoenherr et al., 2014; Miemczyk et al. 2012), but till now literature has mainly focused on dyadic level between a focal firm and its customers and suppliers (Giunipero et al., 2008; Vallet-Bellmunt et al., 2011, Sariola and Martinsuo, 2015). A **Network** is a complex structure formed by the aggregation of many different kinds of dyadic relationships within which interactions take place, but it's also the result of such interactions (Hakansson, 1987; Hakansson and Snehota, 1995). **Dyads** are all linked in the same social structure, thus resulting in a high level of interdependence between the actors (Bengtsson and Kock, 2000), so variations in dyads are strategically fundamental for each single firm's position in the network (Bengtsson and Kock, 2000).

Prior research has focused on relationships between actors central to the project network (i.e. EPC-customer and EPC-direct suppliers), namely the dyads managing high value adding functions that can be considered the project's contractual core (Sariola and Martinsuo, 2015). Instead, relationships between suppliers are often neglected despite stronger ties between them may increase their centrality, visibility and salience in a EPC's project network (Emmitt, 1997; Larsson et al., 2006; Pauget and Wald, 2013). In particular, it is noticeable how the rigid power structure of SC in exams allows stronger relationships and better SCC on the upstream side (e.g. high-tier suppliers), in respect to the downstream (e.g. EPC-customer) (Sabri et al., 2017).

In an IPBSC network it's possible to establish both long-term partnerships and temporarily short-term relationships, according to the importance of the participating firms (Winkler and Schemitsch, 2010). It's easily understood that a firm shouldn't partner with every actor, because partnerships are costly in terms of time, efforts and money. Thus, it's necessary to establish a strategic partner pool for the selection of best partners in each project (Winkler et al., 2007), in order to achieve a project milieu suitable to discontinue and recreate project network for latter projects (Sariola and Martinsuo, 2015).

So, how can managers determine if a potential relationship should stay as is, or is worthy of the time and resources needed to fully develop into a partnership? Exploiting a structured multi-criteria supplier selection, or more broadly **Partner Selection**, which is critical for successful integration (Eriksson, 2015).

Indeed, given that many scholars value procurement and innovation as fundamental activities in this kind of industry, defining appropriate partner/supplier selection criteria and weigh factors is really beneficial to support relationships' planning, as well as ensuring good project outcome (de Araùjo et al., 2017). In this context, a selection managed horizontally by small and medium manufacturers may result hard; hence a platform for partner selection is usually more effectively managed by EPCs, which better know type of project and customers' needs (Touboulic and Walker, 2015; de Araùjo et al., 2017).

In a structure where each dyad may have such an impact on the overall network, it's necessary to careful select the type of relationship we need to establish with each single actor, considering criteria based both on:

- **Project Features**, because there is not a general model adequate for each project type (Eriksson and Pesamaa, 2013; de Araùjo et al., 2017). In particular, the literature suggests:
    - Monetary size (i.e. cost/price) (de Araùjo et al., 2017; Eriksson, 2015; Sariola and Martinsuo, 2015);
    - Duration and time pressure (de Araùjo et al., 2017; Eriksson, 2015);
    - Complexity and customization level (Eriksson, 2015; Sariola and Martinsuo, 2015);
    - Uncertainty (Eriksson, 2015; Sariola and Martinsuo, 2015);
- **Potential Partner Characteristics**, because considering only bid price can lead to ineffective planning, poor site management and other shortcomings, causing cost and time overruns (Eriksson and Pesamaa, 2013). In particular, the literature suggests:
    - Actor role and relative salience in the network (Winkler and Schemitsch, 2010; Hugos, 2011; Sariola and Martinsuo, 2015):
        - EPC;
        - Supplier;
        - Competitor;
        - Customer;
        - Service providers and consultants.
    - Actor size: collaboration is more intense between two firms of the same size, while the littler may fear loss of control and opportunistic behaviors if the counterpart has higher bargaining power (Gnyawali and Park; 2009);

- Goods traded in terms of type and quality (i.e. bulk materials or ad hoc items) (Winkler and Schemitsch, 2010; Chen et al., 2018);
- Performance in terms of staff features and problem-solving capabilities (Sariola and Martinsuo, 2015; de Araùjo et al., 2017);
- Resources and skills complementarity (Dyer and Singh, 1998; Eriksson and Pesamaa, 2013);
- Relational capabilities, collaboration experience and motivation (Dyer and Singh, 1998; Eriksson and Pesamaa, 2013; Fawcett et al., 2015; Sariola and Martinsuo, 2015; de Araùjo et al., 2017);
- Financial stability and solvency (de Araùjo et al., 2017);

In conclusion, the decision to partner to collaborate, rather than compete or maintain arm's length relationship with a particular actor, needs to be taken basing on a wide set of criteria, without forgetting that our decisions will affect the overall network.

2.3. SUPPLY CHAIN RELATIONSHIPS FEATURES

In this section we are going to present the main determinants that, according to the literature, characterize a relationship between two actors, or between multiple actors which ultimately may represent a network in broader sense. These characteristics strongly influence, and are influenced by, the strategies undertook by network participants, resulting in the end critical features in order to shape the network environment for successful collaborative relationships.

The seven **Supply Chain Relationships Features** proposed below are: collaboration orientation, collaboration dimensions, collaboration duration, scope of integration, degree of integration (i.e. width and depth), integration dimensions and relationship strength.

COLLABORATION ORIENTATION

In IPBSC networks there are possibilities for vertical, horizontal and lateral collaboration practices. **Vertical Collaboration** may occur between customers, EPC and suppliers of different tiers (Winkler and Schemitsch, 2010). Integrating vertically helps in the maximization of efficiency through scale economies, but today's fast evolving markets ask for more flexibility and responsiveness in SCs (Hugos, 2011).

Horizontal Collaboration appears when two or more competing suppliers decide to cooperate in R&D, procurement, production or other activities; sharing resources and capabilities in order to reach objectives impossible to achieve by firms alone (Winkler and Schemitsch, 2010). As discussed earlier in this chapter, horizontal collaboration puts the basis for coopetition which is particularly beneficial for SMEs innovation purposes (McAdam et al., 2014).

Lateral Collaboration takes place whenever horizontal and vertical occur simultaneously in the network, and it entails also contingent relationships with third parties such as service providers or consultants (Winkler and Schemitsch, 2010).

For further information, Hugos (2011) argues that the emerging practice of **Virtual Integration** easily allows each firm to focus on its core competencies and partner with other firms to access their complementary capabilities. In this way it would be possible to manage a multi-directional (i.e. lateral) SCC with higher degrees of flexibility and responsiveness.

COLLABORATION DIMENSIONS

Anytime that SCC is employed as a strategy, firms have the possibility to jointly exploit resources, plan and execute operations and improve the overall relationship (Fawcett et al., 2008; Cao et al., 2010). Relationships and integration can sustain the growth of a fruitful SCC over its three main dimensions, that should be equally considered while dealing both with short-term project decisions or long term strategic decisions. The collaboration dimensions defined by Spekman et al. (1998) are:

- **Joint Planning:** developing joint objectives for the project and rely on an effective joint planning for executing schedules result fundamental in order to carry out successfully whatever project (Lambert et al., 1996; Eriksson and Pesamaa, 2013). However, there may be joint long-term planning activities such as material procurement, budgeting and shared investments, which plans extend far beyond the single project timespan, assuming a more strategic nuance (Eriksson and Pesamaa, 2013; Kumar et al., 2016).
- **Coordination Mechanisms:** during a one-time project collaboration, coordination mechanisms are directed mainly to the functions needed to complete the project;

activities such as process monitoring or staff training and teambuilding, with a limited degree of operational resource sharing (Eriksson and Pesamaa, 2013; Touboulic and Walker; 2015; Kumar et al., 2016). In longer term collaborations, instead, firms share more resources and skills cooperating also outside projects, for example managing stocks jointly, integrating logistics or developing innovative products together (Winkler and Schemitsch, 2010; Eriksson and Pesamaa, 2013; Sariola and Martinsuo, 2015).

- **Communication and Joint Conflict Resolution:** while networking the cultural involvement assumes strong importance; it is linked to the relationship history, which thanks to ongoing enforcement of interpersonal relations, openness and communication helps in reinforcing trust and commitment day by day (Lambert et al., 1996; Sariola and Martinsuo, 2015; Touboulic and Walker; 2015; Kumar et al., 2016). This dimension may involve standards for communication and joint conflict resolution systems, but if leveraged is fundamental to drive joint organizational learning, know-how and information sharing (Eriksson and Pesamaa, 2013; Sariola and Marinsuo, 2015; Touboulic and Walker, 2015; Kumar and Singh, 2017). At a higher level, this dimension is also beneficial to ensure mutuality of risks and rewards as well as the definition of shared values and goals (Touboulic and Walker, 2015; Kumar and Singh, 2017).

Later we will analyze in depth the main Integration Dimensions and how, spanning across collaboration dimensions, they can improve the overall degree of SCC.

COLLABORATION DURATION

Low frequency and separation of many different stages between actors, make duration dimension really critical in project-industry contexts IPBSCs (Crespin-Mazet and Portier, 2010; Martinsuo and Ahola, 2010). Key actors should be involved as earlier as possible in such collaborative projects, in order to socialize and establish the right spirit (Eriksson, 2015). From this moment on, we can observe **Short**, **Medium** and **Long-Term** collaborations.

These collaborations can be limited to a single project or may extend over many projects in time, in the latter situation it's not uncommon to assist to integration activities between

parties, rare otherwise. Of course, integration strengthens SCC over time, building mutual trust and preparedness against future challenges (Kaufman and Carter, 2006; Zheng et al., 2008); but is actually unusual to find long strategic partnerships which spans over a series of different projects (Bygballe et al., 2010) sustaining a deep integration.

SCOPE OF INTEGRATION

The simplest scope taxonomy in literature involves internal and external integration**,** emphasizing the distinction of integrative activities towards different actors' typologies (i.e. internal functions, customers and suppliers) (Leuschner et al., 2013).

Internal Integration implies that a focal firm's departments and functions (e.g. marketing, purchasing and R&D) should run as an integrated process to speed up decision-making and to foster SCC, too (Vickery et al., 2003; Flynn et al., 2010).

External Integration refers to the strengthening of relationships with other firms, in order to have higher closeness and interactivity (Vickery et al., 2003; Flynn et al., 2010).

However, Eriksson (2015) found that many scholars consider this simple distinction not relevant enough. For this reason, there is a need to implement a new dimension: the degree of integration.

DEGREE OF INTEGRATION

Maybe it's not a gospel (see e.g. Caniels et al., 2012; Houman Andersen and Drejer, 2009), but it's common that sharing more of each firm's economic activities strengthens relationships (Lambert et al., 1996). Indeed, Fabbe-Costes and Jahre (2007) adopted a perspective which associates the number and nature of SC partners with their relative interdependencies; while Leuschner et al. (2013) states that the overall degree of integration basically depends on the extent of information integration, operational integration and relational integration.

The "Arcs of Integration" model proposed by Frohlich and Westbrook (2001) introduces the concept of **Width** as the extension of integration along the SC, upstream and downstream. According to this model, the arcs of integration can be narrow (i.e. if we integrate only with

direct customers and suppliers) or broad (i.e. if we integrate till raw material suppliers and final customers).

Depth, instead, refers to how many people at different hierarchical levels (e.g. managers, specialists, engineers, production staff) and from different internal functions are committed to integrating activities (Eriksson, 2015). Indeed, close interaction between employees at lower and lower hierarchical levels improves collaboration (Zheng et al., 2008) by enhancing behavioral transparency and limiting information asymmetry (Dyer, 1996a).

It's opportune to point out that while depth captures also the internal integration aspect, width results meaningless if the scope of integration isn't external.

INTEGRATION DIMENSIONS

The strength of linkages between firms certainly depends on the extent of integration between their activities (Leuschner et al., 2013). Indeed, SCC strongly benefits from integration under information, operational and relational scopes (Leuschner et al., 2013). The main dimensions to which we may refer while adopting integration strategies are:

- **Mutual Commitment and Trust (Top Management):** to establish successful and durable collaborations, an increasing strong integration based on loyalty is fundamental, but the whole has to be promoted by top management support and commitment (Lambert et al., 1996; Walker et al., 2013; Aloini et al., 2015; Touboulic and Walker, 2015; Kumar et al., 2016). The resistance to change can arise tensions, so to foster interactions is suggested to enhance interpersonal relations through periodic interdepartmental meetings (Walker et al., 2013; Sariola and Martinsuo, 2015; Kumar and Singh, 2017). Willingness and competence to integrate are good starting points that can be strengthen reducing information asymmetries in favor of behavioral transparency, but trust remains a fundamental value that requires time to be strengthened (Lambert et al., 1996; Eriksson, 2015; Kumar et al., 2016).
- **Common Strategic Goals:** a deep integration should extend beyond the establishment of joint objectives of project coordination (Eriksson and Pesamaa, 2013; Sariola and Martinsuo, 2015). Setting common strategic goals means to agree with partners on vision and values, converging and setting long-term objectives (Eriksson and Pesamaa, 2013; Aloini et al., 2015; Eriksson, 2015; Touboulic and

Walker, 2015; Kumar and Singh, 2017). Of course, to monitor the progress towards goals is necessary to jointly develop a performance measurement system (Walker et al., 2013; Aloini et al., 2015).

- **Common Exploitation of Strategic Resources:** a firm can decide if and how to share different resources and capabilities for integrative purposes, sometimes putting its know-how at risk in an attempt to benefit from complementary or otherwise scarce resources within the firm. Tangible and financial resources can be shared at operational level, for example integrating inventory management, logistics and transports (e.g. common logistical equipment or common use of third party logistics), components production and site management, rather than R&D or design and engineering (Lambert et al., 1996; Frohlich and Westbrook, 2001; Prkye, 2009; Winkler and Schemitsch, 2010; Eriksson and Pesamaa, 2013; Aloini et al., 2015; Kumar et al., 2016; Kumar and Singh, 2017). Indeed, the firms can decide to transfer existing assets instead of investing in new ones. Equally, it is important to integrate intangible resources aligning standards and IT equipment for successful information sharing (e.g. market-based information, delivery schedules, feedbacks from clients, inventory levels, production plans) (Frohlich and Westbrook, 2001; Aloini et al., 2015; Eriksson, 2015; Sariola and Martinsuo, 2015; Kumar et al., 2016; Kumar and Singh, 2017). However, the most arduous resources to share remain knowledge and skills, especially in SMEs, not only due to the fear of opportunism, but also because of the difficulty to teach such complex unwritten concepts and techniques (Eriksson, 2015; Kumar et al., 2016).
- **Risks and Rewards sharing:** there is need for mechanisms ensuring that not only benefits and rewards are shared, but also costs and risks (Lambert et al., 1996). We have a "balance situation" when risks such as relationship-specific investments and adaptation efforts are equally shared, while benefits must be ensured by an incentive system working fairly (Aloini et al., 2015; Touboulic and Walker, 2015). When a partner is willing to bear a short-term hit in favor of the partnership long-term prosperity, we can say to have a strong integration and commitment towards shared risk (Lambert et al., 1996).
- **Incentives Alignment:** the incentive structure is usually considered in terms of hostages and relation-specific investments, which a firm may lose if something goes

wrong (Stump and Heide, 1996; Wathne and Heide, 2004). Indeed, partners have both disincentives for opportunism and incentives for maintaining relationship over the long-term (Stump and Heide, 1996). Anyway, in IPBSC these hostages are not widespread due to discontinuity of relationships (Eriksson and Pesamaa, 2013). On the contrary, incentive-based payment is strongly recognized as a major incentive structure in this industry, since it distributes benefits evenly while signaling if collaboration continues to be legitimate and desired, or its stability is threatened by the drop of estimated benefits (Eriksson, 2015). Incentive-based payments often involve open book accounting linked with risk and reward sharing arrangements to an ex ante negotiated target price (Eriksson and Pesamaa, 2013). Summing up, the network management has to provide partners with adequate incentives exceeding participants arrogated contributions (Simon, 1981).

- **Joint Decision Making:** decision making occurs at different levels within firms, from single project and organizational decisions, up to strategic and corporate levels. Indeed, many decisions can be taken together with partners, starting from inter-organizational planning, selection of goods and services, staff training and teambuilding activities rather than joint replenishment and forecasting decisions; to generally solve problems jointly (Winkler and Schemitsch, 2010; Eriksson and Pesamaa, 2013; Walker et al., 2013; Eriksson, 2015; Kumar and Singh, 2017). Anyway, a durable integration should permit also long-term decision making, that can be fostered by implementing appropriate structures, standardizing procedures and processes, and defining appropriate joint controlling systems (Lambert et al., 1996; Winkler and Schemitsch, 2010; Eriksson and Pesamaa, 2013; Walker et al., 2013; Aloini et al., 2015; Eriksson, 2015). In such well-integrated networks, joint decision-making regards also strategic planning among SC participants, to develop and launch new activities or business units, as well as for the management of relationships and the selection of new partners (Aloini et al., 2015; Eriksson, 2015).

These SC integration dimensions support and improve each other, so it is important not to neglect any of these aspects when trying to develop a high level of integration able to foster inter-firm collaboration. Ignoring one of these aspects can severely limit the growth and stability of integration as a whole.

RELATIONSHIP STRENGTH

According to Lambert et al. (1996), relationships between network actors can range between several types of increasing strength:

- **Arm's Length Relationships**: the supplier typically offers standard products to a wide range of customers either at one-time or multiple transactions, in an environment without sense of joint commitment or collaboration between actors.
- **Partnership:** is a "*tailored business relationship based on mutual trust, openness, shared risk and shared rewards that yields a competitive advantage, resulting in business performance greater than would be achieved by the firms individually*" (Lambert et al., 1996, p.2). Even if partnerships share many common elements, there isn't a particular typology appropriate in every situation. Lambert et al. (1996) individuated 3 main types of partnerships:
    - **Type 1:** partners coordinate activities and planning on a limited basis, usually involving one functional area over a short period;
    - **Type 2:** partners progress beyond coordination to integration of activities, usually involving multiple divisions over a long period;
    - **Type 3:** partners have a high degree of operational integration in many divisions, typically without an end date.
- **Joint Venture (JV):** its peculiarity lies in the presence of a certain degree of shared ownership between the partners.
- **Vertical Integration:** is an extreme situation in which the entire SC of a focal firm is owned by that firm.

Generally, a firm maintains many different kinds of continuously evolving relationships spanning the entire spectrum, but partnerships should be reserved for actors critical for the firm's long-term success (Lambert et al., 1996; Sariola and Martinsuo, 2015). It isn't wise to partner with everyone because it's a consuming process in terms of effort, money and time.

2.4. RELATIONAL VIEW ELEMENTS

According to Dyer and Singh (1998), scholars have historically investigated sources of competitive advantage, hence supernormal returns, mainly according to the Resource Based View (RBV). This perspective states that firms able to accumulate valuable, rare, inimitable and non-substitutable (VRIN) resources and capabilities can achieve a competitive advantage over competitors (Barney, 1991; Dierickx and Cool, 1989; Rumelt, 1984). This theory considers the single firm as the main unit of analysis and the firms' heterogeneity as a primary reason of differential performances (Dyer and Singh, 1998).

In reality, firms' critical resources and capabilities may go far beyond their boundaries. In fact, individual firm's (dis)advantages are often related to its SC's (dis)advantages; in particular, to the network of relationships maintained by the firm (Dyer and Singh, 1998). Building on this fact, Dyer and Singh developed in 1998 the **Relational View (RV)**, focusing on dyad/network routines and processes as an important unit of analysis for understanding competitive advantage. According to this theory, firms willing to partner can establish idiosyncratic inter-firm linkages, making relation-specific investments and combining resources in unique ways; thus, establishing sources of relational rents and co-generating competitive advantage through inter-firm collaboration (Dyer, 1996; Dyer and Singh, 1998). Dyer and Singh (1998, p.662) define a **Relational Rent** as "*a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners*".

The sources of competitive advantage arising from effective partnerships and SCC are usually beyond the control of a single firm, because relational rents are a property of a network of interconnected firms (Dyer and Singh, 1998). Instead, arm's length market relationships can't generate such relational rents because there is nothing idiosyncratic in their relationships; they are not rare or difficult to replicate. In this case, sources of competitive advantage are housed within the firms or lie in their bargaining power (Dyer and Singh, 1998).

Hence, there is a remarkable difference between RBV and RV theory that often results in contrasting strategies and ideas (e.g. sharing or protecting know-how and resources), but the latter can be considered as an extension of RBV with a focus on inter-firm relationships and

routines (Dyer and Singh, 1998; Somsuk et al., 2013). To better understand, at most the RBV classifies the ability to work with other firms as a firm-specific capability, while the RV offers a distinct and complementary view on how firms generate rents, considering a different unit of analysis: the dyad/network.

Thanks to Dyer and Singh, a growing body of literature embracing RV emerged in recent years, applying their theory to different kinds of relationships (e.g. customer-customer, customer-supplier, supplier-supplier) (Walker et al., 2013) in several contexts, such as collaborative procurement in public administration (see Walker et al., 2013) or green and sustainable SCM (see e.g. Somsuk et al., 2013; Touboulic and Walker, 2015); with the aim of finding drivers, enablers or barriers to relational rents. However, most of the papers based on RV analyze inter-firm relationships in long-term collaborations, while little is known about SC operating within short temporal contexts, namely IPBSC. So, according to RV, we want to understand which are the main enablers and barriers to co-generate competitive advantages in temporal contexts. Several scholars argue that lack of enablers could be even more hindering towards collaboration than barriers (Walker et al., 2013; Touboulic and Walker, 2015). Anyway, for our study we'll focus on the four enablers and four barriers identified by Dyer and Singh (1998), neglecting issues related to lack of enablers.

2.4.1. ENABLERS (MECHANISMS)

Enablers are mechanisms that, if conveniently joint-leveraged by partners, can lead to sustainable competitive advantages. According to the RV, the enablers are:

EXCHANGE AND INVESTMENT IN PARTNERSHIP-EXCLUSIVE ASSETS

Firms have to develop unique capabilities to gain relational rents, hence specialized assets represent a conjunction between partners' assets that, by its nature, is strategically fundamental for collaboration purposes (Amit and Shoemaker, 1993). Williamson (1985) argues that is possible to achieve productivity gains along the SC when firms are willing to undergo three types of relation-specific investments:

- **Site Specificity** concerns the localization or geographical approximation of assets to run successive production stages in order to considerably reduce inventory,

transportation and coordination activities costs (Dyer, 1996b; Sabri et al., 2017). Physical proximity sustains inter-firm cooperation and coordination, especially in complex and fast-changing high-tech industries. (Nishiguchi, 1994; Enright, 1995; Dyer, 1996b; Dyer and Singh, 1998). For SMEs especially, it's hard to penetrate international markets without physical branches on-site, so long-term investments to relocate facilities closer to end-users become of paramount importance (Sabri et al., 2017).

- **Physical Asset Specificity** refers to capital investments in equipment and tools able to tailor processes to particular exchange partners (Dyer and Singh, 1998; Sabri et al., 2017). This kind of specialization increases product integrity putting the premises for product differentiation and quality improvements (Clark and Fujimoto, 1991; Nishiguchi, 1994).
- **Human Asset Specificity** refers to know-how transfer through human resources (Sabri et al., 2017). The know-how and information accumulated over long-term relationships increase as alliance partners develop experience working together (Dyer and Singh, 1998). Several mechanisms can be put in place, starting from staff co-appointment for example, allowing partners to communicate efficiently and effectively, which reduces communication errors, enhancing quality and increasing speed to market (Dyer and Singh, 1998; Walker et al., 2013).

According to Dyer and Singh (1998, p.664), "*the greater the alliance partners' investment is in relation-specific assets, the greater the potential will be in relational rents*", reaching lower total value chain costs, greater product differentiation, fewer defects and faster product development cycles. Anyway, there are two key sub-processes influencing partners' ability to generate such relational rents: **Length of Safeguards** and **Volume of Transactions**.

The first refers to the length of arrangements designed to defend each actor against opportunistic behaviors of other partners; this is needed to face uncertainty and risks generated by the fixed-cost based structure of some investments (Dyer and Singh, 1998).

The second refers to the fact that investment decisions are influenced by the total breadth and volume of inter-firm transactions (Dyer and Singh, 1998). The greater the volume of exchanges, the greater the appropriateness of launching more specialized and complex relational-specific investments (Williamson, 1985; Dyer and Singh, 1998).

Usually relationships go on for many years or decades, giving firms the possibility to substantially joint-invest (Touboulic and Walker, 2015). Indeed, several authors stress also the influence that self-reinforcing factors such as **Relationship History, Commitment and Trust** between members can have over inter-firm specific-investments (Williamson, 1985; Walker et al., 2013; Touboulic and Walker, 2015).

KNOWLEDGE AND INFORMATION SHARING THAT BOOSTS JOINT-LEARNING

Joint-Learning is critical to gain a competitive advantage unlikely replicable by competitors (March and Simon, 1958; Levinson and Asahi, 1996; Powell et al., 1996). Indeed, partners (e.g. suppliers and customers) are often a source for **Cogeneration of New Ideas and Innovation** (Dyer and Singh, 1998, Sabri et al., 2017). A network with better knowledge-transfer mechanisms among actors have means to out-innovate other networks (von Hippel, 1988). A mechanism to build relational rents may consist in establishing **Inter-Firm Knowledge-Sharing Routines,** which facilitate to transfer, recombine or create specialized knowledge (Grant, 1996). To its greater extent, it means to know each other really well, not only to know who knows what and where critical expertise is within partners, but also to provide useful knowledge contacting employees who retains absorptive capacity (Dyer and Singh, 1998). Knowledge, regardless from its nature, can be divided into two types (Nelson and Winter, 1982; Ryle, 1984; Kogut and Zander, 1992; Grant, 1996; Szulanski, 1996, Walker et al., 2013): **Information,** easily codifiable without loss of integrity, and **Know-How**, sticky and difficult to codify; indeed, the latter results in more sustainable advantages that outperform competitors. Knowledge sharing routines draw attention to the presence of cooperation and communication aimed for collective learning, however Walker et al. (2013) point out that sometimes there may be lack of clear methods for partner's benefits calculation and communication.

Anyway, to exploit external resources of knowledge a firm needs the adequate **Absorptive Capacity**, which is "*the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends*" (Cohen and Levinthal, 1990, p.128). Partner specific absorptive capacity, in the end, is function of the extent to which partners have developed overlapping knowledge bases and interaction routines (Dyer and Singh, 1998). Thus, it is a skill that can be developed over time through informal interactions (i.e. intimate,

extensive and face-to-face) and designing inter-firm routines that facilitate information sharing (Arrow, 1974; Daft and Lengel, 1986; Marsden, 1990; Badaraco, 1991; Dyer and Singh, 1998).

On the other hand, it's necessary to discourage free-riding behaviors and to foster transparent knowledge sharing between partners, encouraging them through an **Alignment of Incentives** (Dyer and Singh, 1998). To incentivize firms in devoting the needed resources to knowledge transfer, it's possible to define formal financial incentives as equity arrangements, but also informal norms of reciprocity (Kogut, 1988; Mowery et al., 1996; Szulanski, 1996; Dyer and Singh, 1998).

Summing up, Dyer and Singh (1998) argue that the knowledge sharing potential in generating relational rents is strongly related to the greatness of partner-specific absorptive capacity and alignment of incentives.

COMBINING OF SCARCE RESOURCES AND CAPABILITIES

Complementarity of scarce resources and capabilities is a strong foundation for collaboration, indeed, it shows how much importance each partner has in brining valuable assets and knowledge to the table in order to grant a successful SCC (Blome et al., 2014; Touboulic and Walker, 2015). Combining such resources and capabilities results in the joint creation of unique new products, services and technologies, but also in economies of scale/scope thanks to inter-firm procurement procedures or reduced bureaucracy, for example (Walker et al, 2013). Generally, we can divide shared resources and capabilities in four groups (Sabri et al., 2017):

- **Shared Equipment** (e.g. Nestlé has been able to exploit Coca-Cola's international distribution and vending machine network) (Hamel and Prahalad, 1994);
- **Shared Facilities (**e.g. an Italian firm could exploit the stores or production plants of a partner in Japan);
- **Shared Warehouse** (e.g. an Italian firm could exploit warehouses and logistic capabilities of a partner in overseas markets) (Shan and Hamilton, 1991; Hamel and Prahalad, 1994);
- **Shared Know-How Resources** (e.g. sharing innovation capabilities with a firm that has complementary or overlapping competences, but also to access unique local

knowledge and later intangible assets such as reputation or brand) (Shan and Hamilton, 1991; Oliver, 1997; Walker et al., 2013, Touboulic and Walker, 2015).

Leveraging the complementary resource endowments of partners is considered a key factor driving returns from alliances and generating relational rents (Harrigan, 1985; Teece et al., 1987; Hamel, 1991; Hill and Herrigel, 1994; Shan et al, 1994). The greater are the synergistic effects coming from the combination of such resources, the greater are their complementary and hence their ability to turn them into shared VRIN (Valuable, Rare, Inimitable, Non-substitutable) resources (Dyer and Singh, 1998).

A major challenge is to find suitable partners and recognize the potential of their **Resources Strategic Complementarity**, since isn't possible to have perfect information (Dyer and Singh, 1998). This is hard especially because of three main differences occurring between firms, in terms of: prior alliance experiences, internal search and evaluation methods and capabilities, and ability to acquire information (Dyer and Singh, 1998). Therefore, firms' ability in combining resources is supported by: positive relationship history, occupation of an information-rich position in the network (i.e. many strong linkages with other parties), but also investments in strategic alliance functions which, enjoying dedicated staff and resources, can collect and evaluate information more and more efficiently (Gulati, 1995a; Mitchell and Singh, 1996; Walker et al., 1997; Dyer and Singh, 1998).

Once resources strategic complementarity has been ascertained, firms' **Organizational Complementarity** becomes a prominent second challenge to face (Dyer and Singh, 1998). Indeed, we can generate rents only if processes, culture, information and control systems are compatible enough to facilitate coordination (Kanter, 1994; Doz, 1996; Dyer and Singh, 1998). Of course, this kind of complementarity can be easier developed with the right commitment of partners.

GOVERNANCE MECHANISMS YIELDING TO LOWER TRANSACTIONAL COSTS

Effective governance generates relational rents by lowering transaction costs and influencing the willingness to engage in value-creation initiatives, such as relation-specific investments, knowledge sharing mechanisms or strategic resources combination (see previous paragraphs) (Williamson, 1985; Dyer and Singh, 1998; Walker et al., 2013). The more a resource is specialized, the lower its value for different purposes, so trust is fundamental as

well as a governance structure that minimizes transaction costs improving efficiency (Williamson, 1985; North, 1990, Dyer and Singh, 1998).

According to the RV theory (Dyer and Singh, 1998), we classify three increasingly effective classes of governance adaptable between different kinds of relationships:

- **Third-Party Enforcement of Agreements:** presence of legal contracts involving third-parties, which are legitimate authorities providing for dispute resolution issues (Telser, 1980; Williamson, 1991).
- **Self-Enforcing Formal Agreements:** presence of formal safeguards as financial or specialized-investment hostages, but no third-party intervenes in case of violations (Klein, 1980; Telser, 1980; Williamson, 1983). Economic hostages align economic incentives of partners thanks to safeguards able to penalize opportunism and reward credits to value-increasing activities (Pisano, 1989; Dyer and Ouchi; 1993); indeed, they are intentionally established to avoid the appearance of opportunistic behaviors (Klein, 1980; Williamson, 1983).
- **Self-Enforcing Informal Agreements:** presence of informal safeguards as goodwill trust or embeddedness and reputation, but no third-party intervenes in case of violations (Telser, 1980; Weigelt and Camerer, 1988; Powell, 1990; Sako, 1991; Larson, 1992; Gulati, 1995b; Uzzi, 1997). Basing on experiences that may be direct or indirect, these mechanisms rely on personal trust relations or reputation, that are the most effective and least costly safeguards for specialized investments (Dyer and Singh, 1998). Indeed, trust improves performance while reducing monitoring and bargaining transaction costs (Sako, 1991; Barney and Hansen, 1994).

Misalignments occur frequently due to uncertainty, information asymmetry and bounded rationality (Williamson, 1991). Hence, the ability to effectively align transaction and governance structures in a discriminating way is crucial for the generation of relational rents (Dyer and Singh, 1998).

Following, there is a list of characteristics further explaining why informal self-enforcing agreements are the best mechanisms, while third-party agreements the worst ones (Dyer and Singh, 1998):

- No expenditures in terms of time and money to specify every detail of the agreement in a contract;

- Self-monitoring reduces costs;
- High degree of flexibility allows partners to adjust the agreement "on the fly" to face uncertainty and respond to unforeseen market changes (Uzzi, 1997);
- No time limitation to the contracts avoids the cost of re-contracting;
- It's hard to explicitly contract for value-creation initiatives;
- Contractual arrangements and formal safeguards are easily imitable, while informal ones (trust and reputation) are difficult to imitate.

On the other hand, informal safeguards require a lot of time to be established and are subject to the paradox of trust (Dyer and Sigh, 1998). Paradox of trust consists in the fact that, while trust reduces the perception of risk forging appropriate behavior expectations, it also gives possibilities for opportunistic behaviors, especially between partners (Granovetter, 1985). This can be linked to the concept of coopetition previously introduced.

Concluding, alliances usually adopt different governance mechanisms simultaneously, but should tend to move from third-party formal agreements to self-enforcing safeguards. This because self-enforcing agreements reduces contracting, monitoring and adaptation costs, while giving superior incentives for value creation initiatives; and, if informal, further reduce marginal costs and increase difficulty of imitation for competitors (Dyer and Singh, 1998; Walker et al., 2013).

2.4.2. BARRIERS (CHALLENGES)

Barriers can be intended both as challenges for partners willing to develop relational rents, as well as isolating mechanisms preserving the rents generated by collaborating partners. According to the RV, the barriers are:

ASSET INTERCONNECTEDNESS

Inter-firm asset interconnectedness is based on the accumulation of shared resources and occurs in **Cumulative Bundles of Joint Investment Decisions**, which may refer to assets belonging to any partner or dyad (Dyer and Singh, 1998; Walker et al., 2013). Initial investments in partnership-specific assets put premises for future, further specialized

investments, that wouldn't otherwise be profitable if partners hadn't invested previously (Dyer and Singh, 1998). There is a cumulative "snowball" effect that makes the ball (bundle) bigger and bigger interconnecting current and previous relation-specific investments (Dyer and Singh, 1998). These bundles of related specific investments are needed to realize the full potential of such single investments, leveraging synergies arising from their mutual adoption (Dyer and Singh, 1998). The creation of these bundles may represent a barrier because it requires a lot of time and money, in a context that may additionally be affected by low inter-firm trust and high uncertainty. For this reason, managing the growing interdependence is difficult and may result in tensions (Touboulic and Walker, 2015), moreover, dedicating resources to a collaboration can lead to neglect needs of other business units or firms' areas (Walker et al., 2013).

In conclusion, cumulating bundles represents a big challenge for firms that start exposing themselves to collaborative environments; but, once achieved, bundles can be the secret for a sustainable competitive advantage, as well as an effective barrier for newcomers.

PARTNER SCARCITY

Relational rents generation is limited by a firms' ability to find a partner with necessary complementary resources and relational capability (Dyer and Singh, 1998; Walker et al., 2013). This can be due to an actual lack of network actors able to match a specific firm's needs, but it can be also cause of the poor partner selection and evaluation capabilities of that specific firm. For this reason, we can sort critical issues responsible of partner scarcity as follows (Sabri et al., 2017):

- **Easiness of Finding a Partner;**
- **Willingness of the Partner;**
- **Experience in Collaboration.**

For example, while looking for SCCs beneficial to entry foreign markets, it's necessary to find firms having local market knowledge, contacts and a widespread distribution network (Dyer and Singh, 1998). Usually the suitable partners are rare, moreover, they could show lacks in terms of relational capability, governance mechanisms building skills, financial resources for relation-specific investments or other issues hindering the development of transparent knowledge-sharing routines (Larson, 1992; Eisenhardt and Schoonhoven, 1996).

Similarly, Touboulic and Walker (2015) found that is arduous for multinational customer companies (food sector) to find suppliers (agricultural firms) with a befitting awareness level regarding the environmental and social management, simultaneously matching (crop) quality standards.

This barrier comes out limiting especially for latecomers operating in sectors with a great diffusion of collaborative initiatives; indeed, who quickly developed capabilities to identify and ally with partners has a strong first mover advantage (Dyer and Singh, 1998).

RESOURCE INDIVISIBILITY

Resource indivisibility forms over time due to the idiosyncratic combination and coevolution of resources and capabilities (Dyer and Singh, 1998; Walker et al., 2013). Obviously, firms that invested in collaboration (and integration) activities are concerned about the fate that shared staff, resources and capabilities will face in case of collaboration breakages (Walker et al., 2013). Coevolving over time, resources and capabilities are increasingly hard to imitate, because of path dependence and resource indivisibility (Dyer and Singh, 1998). On the other hand, indivisibility and idiosyncrasy reduce flexibility, as well as firms' ability to control and redeploy resources (Dyer and Singh, 1998). Here we list the three main challenges that collaborations may face over time (Dyer and Singh, 1998; Sabri et al., 2017), making waver partners while taking decisions:

- **Loss of Control over the Firm's Capabilities and Resources;**
- **Difficulty in Redeploying Resources due to Collaboration Restrictions;**
- **Loss of Flexibility due to Long-Term Collaborations.**

The occurrence of these concerns induces a strong resistance to change, especially because people firstly perceive hard facts and data regarding their own efforts, barely capturing the tacit know-how that emerges during long-lasting relationships (Touboulic and Walker, 2015). According to some scholars, this situation may further lead to the perception of inequities in sharing pains and gains (Walker et al., 2013; Touboulic and Walker, 2015).

INSTITUTIONAL ENVIRONMENT

Institutional environment may not lend itself to cooperation and can raise transaction costs, but it can also lower them fostering trust and relational rents creation (North, 1990; Walker et al., 2013). According to Dyer and Singh (1998), matters influencing relational rents go far beyond the firm boundaries, expanding to a broader, country level. Indeed, it may be necessary to locate operations in a particular institutional environment, in order to enjoy formal (legal controls) and informal rules (social controls) able to stem opportunism and encourage cooperation (Dyer and Singh, 1998). The main barriers we can find in an institutional environment are (Sabri et al., 2017):

- **Legal Restrictions:** for example, SEU (Sistema Efficiente d'Utenza) could be a winning solution to have energy at a lower price exploiting 100% of energy produced by a joint-owned solar plant. Though, in Italy there are limitations to its diffusion because the plant owner is allowed to sell energy to a single user only. Instead, Germany allows 1-n arrangements that are interesting for condominiums, airports, ports, hospitals, shops and industrial districts.
- **Organizational Restrictions:** basically, geographically dispersed and isolated SMEs have conflicting local politics and different priorities (Walker et al., 2013). This heterogeneity results in differences in their way of working and obstacles the management of such stakeholders' relationships (Walker et al., 2013; Touboulic and Walker, 2015).
- **Country-Specific (Cultural) Restrictions:** for example, several authors noticed that Japanese firms appear abler than US firms in generating relational rents because of a country-specific socially complex extra-hybrid institutional environment that fosters trust and cooperation (Dore, 1983; Sako, 1991; Smitka, 1991; Hill, 1995). Other countries couldn't easily replicate low transaction costs of Japanese collaborations (Dyer and Singh, 1998). Similarly, in South-East Asia firms have different time scales for the implementation of green solutions, because their culture requires relationship building, while rejecting the initiatives when perceived as duties (Rao, 2002; Ramanathan et al., 2014).

3. RESEARCH GAPS

Studying the literature in the attempt to identify good collaborative practices leading to sustainable competitive advantages, it's easy to bump into a marked inconsistency of terminology and overlapping of concepts, due to the variety of perspectives and scenarios. This is a first hurdle to face while approaching collaboration and relational theories.

With humility, our study enriches the state of art in three particular interest areas which are traditionally scarce in the literature body, because often neglected by scholars:

- Management of IPBSCs;
- Application of RV theory;
- Focus on SMEs and low-tier suppliers in IPBSCs.

Hence, our study is focusing on a niche of the market quite unexplored, in order to expand knowledge on many concepts and issues presented till now. In this particular field there are four research gaps that we'll try to reduce interviewing industry experts:

- Horizontal and lateral SCCs are much less explored than vertical ones;
- Lack of analysis of barriers hindering generation of relational rents, while several papers deal with enablers or lack of enablers;
- Lack of studies to understand reasons to partner and to establish a collaborative environment (which is the triggering event that induces willingness to partner?);
- Lack of studies about how industry-specific complexity and uncertainty may affect the choice to collaborate or threat existing collaborations;

In the literature there are other gaps and interest areas that our study doesn't investigate, but could be interesting to deepen in future analyses:

- Complementarity of RBV and RV could be a starting point to analyze and understand how value of single resources housed inside firms relates with relational sources of competitive advantage;
- Lack of case studies, theoretical and real procedures to quantify the added value brought by different participants; that is important for risk and reward sharing as well as to study incentives aligning mechanisms;

- Lack of case studies exploring status, problems, benefits and features of existing horizontal collaborations and coopetition environments;
- Lack of studies about the reasons and patterns leading to the depletion of existing SCCs.

Chapter 3

Research Methodology

According to the literature, successful collaborative initiatives between SCs members can lead to sustained differentiated performance; for this reason, we want to understand how suppliers can actually co-generate value through horizontal and lateral SCC. Hence, in this research we used the **multiple case study methodology** to investigate the SC relationships, strategies and performance in the IPBSCs. Past and current collaborations, as well as expectations and concerns about possible future collaborations, has been examined under relational view lens, contextualizing the whole according to industry and firms features.

In order to gather this information a **questionnaire** with 36 mixed queries (open, closed and Likert scale questions) has been developed. The information of interest has been defined developing a **reverse engineering map** that, starting from the final purpose of the study, has allowed to precisely identify some macro-topics. Hence, the questions have been devised to cover all the RV concepts, enablers and barriers, as well as firms' characteristics and their approach to the market. In particular, the questions have been structured in 5 sections:

- **General Company Information**: The questions in this section are essential to attribute an identity to firms. First of all, to know the history of the firms and give them a dimension in terms of turnover, number of employees, and facilities. As well as to understand which products constitutes their core business, what are the competitive advantages they can boast, and to which markets they mainly target. This

section also includes general considerations regarding the industrial sector and the general diffusion of collaborations and partnerships.

- **Understanding the Type of Relationship and Collaboration**: With this set of questions we want to understand which kinds of relationships are in place between the different SC members (EPCs, end-users, suppliers, competitors, service providers and consultants). In particular, are of interest the length and depth of their relationships, as well as objectives and motivations, challenges and eventual results on performance. If collaborative relations are not present, similarly, it's of interest to understand why.
- **Understanding Partner Selection**: In this section the respondents evaluated (on a Likert scale ranging from 1 to 5) the different characteristics presented in *Chapter 2 – 2.2. Characteristics for Partner Selection*, in order to understand which are the most important factors they consider while choosing a partner. Furthermore, it was considered important to investigate possible structured mechanisms that firms follow to select their partners or suppliers.
- **Understanding the Nature of the Collaboration**: The questions belonging to this group are focused on the concepts and elements that characterize the RV, in the attempt to deeply explore SCCs. There are queries to understand which co-investments have been undertaken or which resources and capabilities have been shared; as well as which are the underlying strategies, features, motivations, objectives, challenges and results. There are questions to understand how difficult it is to find a suitable partner for a specific collaboration, which are the reasons behind this difficulty, but also the limitations (legal, organizational, cultural, political) and problems that can undermine the success of collaboration. In the end, there are also queries that investigate governance mechanisms and agreements in place to safeguard partners and preserve collaboration.
- **What About Tomorrow**: The aim of this final section is to make a recap of the collaboration experiences the firms had or have, trying to understand if there are, and which are, expectations and ideas for future collaborations. In addition, in this section is explicitly asked to respondents which are, in their opinion, the main pillars and most important features to focus on to have a successful and durable collaboration.

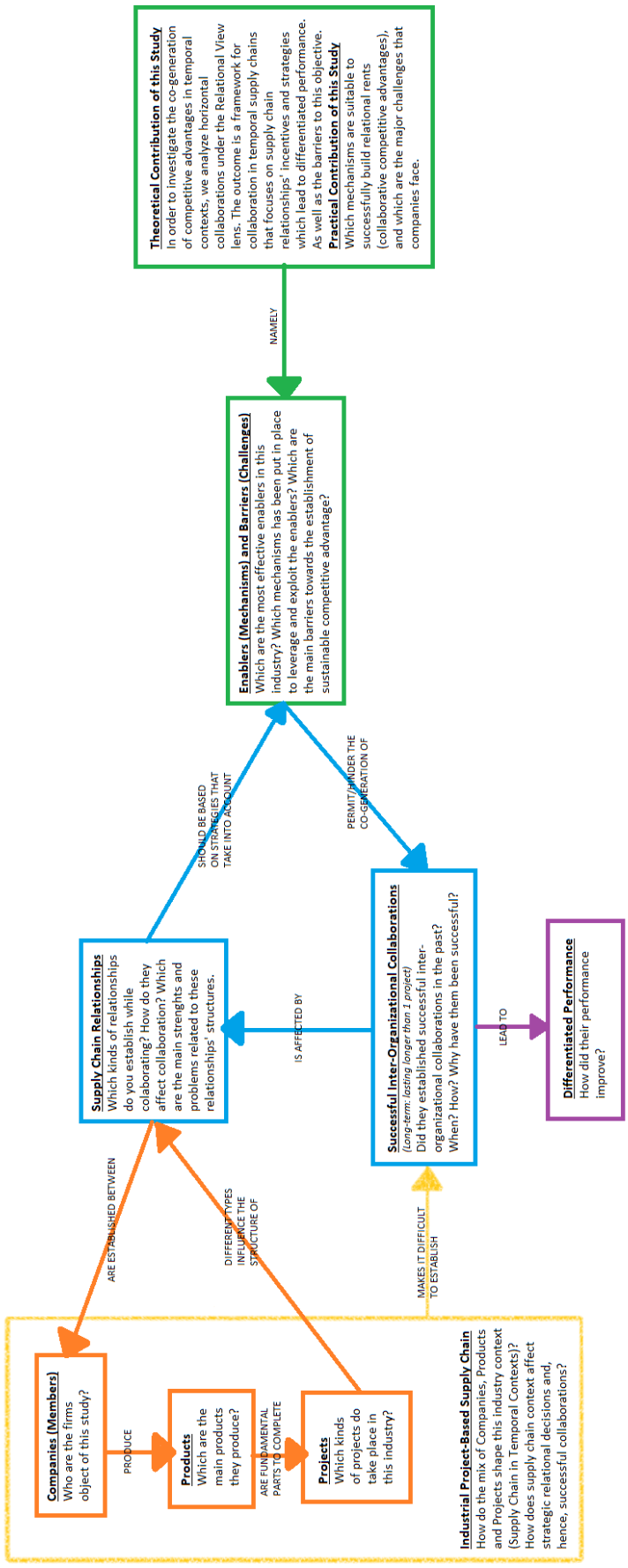

Figure 2 - Reverse Engineering Map is a representation of the logical process that, starting from the final study contribution, has led to define the topics and information of interest on which to develop a suitable questionnaire and achieve the given objective.

In order to collect the data necessary for the study, the above questionnaire was administered to 14 Italian firms, mainly SMEs, operating in the O&G, power and energy sectors. The firms of interest for our study are mainly focused on the production of valves, pressure vessels, heat exchangers and similar; but also complementary products such as gaskets, actuators, fittings, pipes or flanges. The e-mail contacts of managers and owners of the various firms have been kindly provided by the management engineering department (DIG) of the Politecnico di Milano, which had already worked together with these firms in the past. All firms invited to participate in the study are Italian firms belonging or not to multinational groups. All firms that have accepted to participate in the study are Lombard manufacturers, therefore represent one of the most important manufacturing clusters of Italian industrial sector.

The contents of the project, and the relative questionnaire on which data collection was based, have been electronically advanced to the firms. After that, agreements were made with the managers of interested firms, in order to schedule a meeting at their premises and interview them to personally discuss about SCC. Such **semi-structured interviews**, with an average duration of 1:30h, were completely recorded and then transcribed. The transcriptions were indispensable not only to extract qualitative data necessary to complete the notes taken during the interviews, but also to extrapolate quotes particularly fitting in explaining certain phenomena. The data were then collected, filtered, aggregated and reorganized in order to obtain significant information. This information was the starting point to develop a qualitative analysis able to explain the collaborative phenomena as a whole, taking into account trends, discrepancies and correlations between different situations.

This multiple case study is based on a sample of manufacturers that mainly consists of SMEs manufacturing industrial products for O&G sector applications, then operating in project environments. All the manufacturers interviewed are located in Lombardy, the vast majority in the industrial cluster called Valve Area, which extends in the area between Milano, Como, Bergamo and Brescia. The products offered by these manufacturers are mainly valves, pressure vessels, boilers and heat exchangers, but also actuators, pipes, flanges, fittings, gaskets, columns and many others. We have selected these manufacturers as they operate in an IPBSC and are mainly SMEs, some independent and some become part of multinational groups. Therefore, they were considered particularly suitable for the reference context of the

study. The anonymous list of firms, reporting important data identifying their size and core business, is shown at the end of this chapter.

The respondents of the study were mainly managers, owners or CEOs, who in most of the cases have strong decision-making power and/or usually deal with relations with external stakeholders (e.g. suppliers, agents and customers). It was fundamental to interview people who were at the forefront of relations with external stakeholders, and who had a good view of the market outside the firm. Sometimes the semi-structured interviews have been conducted discussing jointly with two managers of the same firm.

In the following chapter, after an overview of the industrial sector, the information related to the collaborations in progress will be presented. In particular, an overview of the relationships maintained by the manufacturers will be presented, dividing according to the SC actors with whom they entertain them. In the case of suppliers, for example, the ways in which manufacturers relate to them for procurement, R&D or any other firm function that is subject to coordination, integration or collaboration will be exposed and discussed. There will also be some examples that facilitate the understanding of the trends that manufacturers in the sector have in approaching these various subjects. Furthermore, expressing the concerns and expectations of the interviewed managers will be crucial to explain what motivated them to collaborate rather than to avoid doing so; in order to understand what could be done to ensure these manufacturers an increasingly prosperous future.

Firms	Employees (n)	Turnover (M€)	Turnover from O&G (%)	Production Facilities (n)	Core Business	Project Kinds	Part of Group	Interviewee Role
F1	1200	400	80%	10	Valves and Actuators Fittings and Flanges Skid Systems Firefighting Systems	Extraction (on-shore/off-shore) Pipelines (in-land/subsea) Chemical LNG Terminals Power Plants Shipbuilding Railway, Tube, Airport City Gates and Infrastructures Water Desalinization	No	Vice President Sales & Marketing
F2	105	50	95%	1	Ball Valves (on/off mainly) Skid Systems	Extraction (mainly off-shore) Pipelines (mainly off-shore) Petrochemical Power Plants Water Treatment	Yes	Commercial Operation Director
F3	72	16	90%	1	Heat Exchangers Pressure Vessels Pipes and Fittings (standard)	Petrochemical (off-shore mainly) Chemical Mining and Mineral Extraction Water Treatment	Yes	Sales Director, Operations Director
F4	90	20	20%	1	Ball Valves Actuators (industrial sector only) Brass Valves (industrial sector only)	Extraction Pipelines Petrochemical (Refinery) Cryogenic Food Chemical Pharmaceutical	No	Plant Manager
F5	69	19	75%	3	Heat Exchangers Pressure Vessels	Extraction (on-shore/off-shore) Petrochemical (refinery) Energy & Power Fertilizers Chemical Food Pharmaceutical Textile	No	Sales Department, Business Development Manager
F6	280	100	95%	5	Gate Valves Ball Valves (recently introduced)	Extraction (on-shore) Petrochemical (refinery, etc.) Power Chemical Paper	Yes	CEO Italy
F7	76	20	93%	1	Ball Valves (floating, trunnion)	Exploration and Research Extraction Pipelines (hubs, no primary lines) Nuclear Power Food & Beverage	Yes	President and CEO

Table 3 - List of interviewed firms with main data about size and business (first part).

Firms	Employees (n)	Turnover (M€)	Turnover from O&G (%)	Production Facilities (n)	Core Business	Project Kinds	Part of Group	Interviewee Role
F8	280	120	92%	4	Valves (ball, gate, check, globe, throttle) Pressure Seals	Extraction (on-shore/off-shore) Pipelines (hubs, ...) Petrochemical (refinery, ...) Power	No	CEO
F9	59	10	100%	1	Pressure Vessels' Internals Marine Loading Arms	Extraction Petrochemical (refinery, ...) Chemical	No	Sales Director
F10-A	129	32	65%	2	Industrial Boilers Thermal Oil Heaters	Extraction (on-shore) Pipelines (hubs, stock ...) Petrochemical (Refinery) Chemical Pharmaceutical Textile Food & Beverage Paper Rubber & Plastic Energy District Heating	Yes	Corporate Sales & Marketing
F10-B	102	20	80%	1	Water Treatment Plants Wastewater Treatment Plants	Extraction (on-shore/off-shore) Petrochemical (Refinery, ...) Pharmaceutical Textile Food & Beverage Power Generation Steel Mining Building and Construction Tourism and Recreation	Yes	Corporate Marketing Manager
F11	210	70	50%	3	Heat Exchangers Boilers and Burners Air Heaters and Coolers	Extraction Petrochemical (Refinery, ...) Power	Yes	Manager Business Development Unit AirHex
F12	106	21	55%	1	Industrial gaskets (valves, pumps, flanges)	Extraction Pipelines Petrochemical (Refinery, ...) Energy	No	Chief Technical Officier
F13	20	12	85%	0	Supply of Equipment	Extraction (on-shore) Petrochemical (Refinery, ...) Chemical Industrial sector	Yes	Country Manager Italy, Key Account Manager
F14	41	9	100%	1	Valves (on/off)	Extraction (on-shore/off-shore) Pipelines	Yes	QA & HSE Manager

Table 4 - List of interviewed firms with main data about size and business (second part). (F10 is split in A and B because two firms of the same group have been analyzed during a single interview)

Chapter 4

Findings

1. THE O&G INDUSTRIAL SECTOR: CHARACTERISTICS AND CHALLENGES

The manufacturers considered in this study make products or engineered solutions and applications for the O&G sector, working on projects. In particular, they are usually engaged in the supply of components and products for the construction of on-shore and off-shore extraction platforms, in-land and submarine pipelines, refineries, hubs and terminals for compression, liquefaction or regasification; but also shipbuilding (FPSO, submarines, ...), power, chemical and industrial plants. In terms of quality, "Italy is the world leader in this industrial segment", also winning the merit of being the second exporter of these products right after China.

"By **products types**, the market share is very different and is very fragmented", and especially "the world of valves is moving towards solutions where manufacturers try to expand their portfolio" products; even if, in principle, larger manufacturers are specialized on large products suitable for critical applications (e.g. primary and submarine pipelines), while the smaller ones mainly focus on smaller diameters or special products. In fact, if we consider "the downstream, there are certain constructions, in the upstream there are other constructions and even completely different pressures". Italian manufacturers have mainly "positioned on the upstream and midstream segments, where the technical requirements are

higher" and where Asian manufacturers can't arrive, as they have "a history on the molten and in certain critical applications the molten is not acceptable".

"Most of these items, however, have an over a century history, in fact the whole O&G world comes from the standardization of the American Petroleum Institute (API)" occurred at the beginning of the 20th century. "So, from the dimensional and typological point of view, these products are as old as petroleum, they are about 130-140 years-old in terms of production type and philosophy". They are essentially mature products, where "all the competitive factors have substantially a commercial nature, hence the ability to supply with a certain lead time, with a market price, but the products are those". The technology is mature, "but manufacturers have to always stay with eyes open and antennas well straight, because it's a market very volatile under this point of view, there are periods when very special materials are used, materials that cost a lot, and there are periods when customers still buy the iron". So, the few **innovations** that occur "concern mostly the materials, because the product design is the same for at least 40 years". The world of heat exchangers, pressure vessels and boilers deals with products having greater complexity than valves, gaskets and similar; for these reason, these products have always had a greater margin of innovation and improvement (even from the point of mere ad-hoc engineering), although quite limited.

"Italy is a great country for the infrastructures of O&G industry, so you know there are overall suppliers of materials, cuttings, forges, pipes, plates, all available". In general, the necessary quality materials "are almost all in Europe", therefore "normally there are no problems for Italian manufacturers, while on some projects the use of Indian and Chinese materials is prohibited". In particular, in the Brescia-Bergamo-Milan triangle, has developed the so-called **Valve Area**. "Within these 100km radius there are almost all the Italian high pressure boilers manufacturers", as well as the most important valves manufacturers of the sector. Around these manufacturers "it developed a whole network of firms specialized in different activities such as painting and welding, only for the O&G sector". "They possess a whole range of qualifications and certifications required by EPCs", and the manufacturers themselves helped them in being approved over the years, "even if it has not been planned, structured or formalized". In fact, these firms are essential for manufacturers who need to outsource some critical processes by dividing the workload efficiently among the various mechanical workshops. It was necessary to help them in the certification process because the customers "allow manufacturers to outsource critical activities, but they must

demonstrate to have a control as if they were their processes, substantially". The know-how level in the Valve Area is so high that even some "Spanish and French valves manufacturers send their products here to do these mechanical processes rather than painting, but they have a huge economic impact", if compared to Italians.

The majority of the managers and owners interviewed believe that the **horizontal collaborations** between the manufacturers of this IPBSC are almost totally inexistent. "Maybe EPCs tend to do JVs between EPCs to collaborate", "but not at the level of manufacturers, everyone cares about its backyard". "It is the market that does not lead manufacturers to collaborate, or to collaborate only in limited and manageable cases", "maybe on some specific project" among manufacturers of complementary products, also because "are the EPCs themselves, however, who put manufacturers against each other". Especially "from the commercial point of view it is very difficult", "it is always dangerous, because to match someone else implies the risk of losing the tender because the other one is out while you are in". But the truth is that in many cases "the main barriers are linked to the operational mandate of the ownership of the respective manufacturers", which are based on different cultures and values, that if are not shared by both parties, "there can not be a lasting marriage". "Let's not forget that the Italian structure of SMEs is familiar, this in Italy hinders the managerial perspective of the whole, so inevitably these types of relationships are managed in an emotional way by the owners". "Most of the industry is composed by SMEs that are very jealous of their know-how"; so, many prefer "to be small rather than lose flexibility by binding to particular collaborations, which sooner or later inevitably inhibit some procedures". Some managers think it's a pity that this scenario actually limits the formation of horizontal SCCs that could basically bring advantages, "which are those of facing more strongly, together, projects that individually would be difficult to approach". But some managers see a glimmer of light, "there is more openness today on these issues; once there was total closures, even if the competitor was playing on the intercom, it was not even allowed to enter the gate". So, certain achievements that some manufacturers have managed to achieve from the point of view of collaboration, would not have been possible in the past, because the owners of the previous generations "were much more individualistic and much more aggressive, in a very different industrial and economic world". In any case, with the exception of South Korea, neither abroad there is horizontal SCC, "so it's not an Italian problem while the others collaborate"; "so much that the only thing happening is

multinational groups that are acquiring or buying manufacturers", sometimes just "to kill them and remove competition".

The 2008 **global financial crisis**, and the subsequent 2015 **oil price drop**, have changed the economic and geopolitical relationships of the entire world, with strong repercussions on the O&G sector, especially in Western countries. "In 2008 there was an interruption of orders and investments, for 12 months the world stopped", "because who commands is the finance, not so much the industry". So, from the finance came the order to "put in 'hold' projects; which doesn't mean to cancel, sometimes it is 'delay', but very often it is 'hold'". "It happened that this world stopped and for the next 2 years only the plants that were beyond a certain progress stage have been managed; so, small jobs and at an incredible speed, with unusual delivery requirements". "When the market recovered, these habits remained and became a discriminating factor", "in fact, today EPCs have found a new way to automatically get a discount, which is that of the delivery penalty". For this reason, in recent years many manufacturers have employed their resources to reduce the lead time for management of order passive cycle. A very similar scenario came back in 2015, when, with the oil price drop, "projects already in an advanced state have been frozen"; some projects "have disappeared overnight, because the oil price drop has made them no more profitable". As if this were not enough, these events have reduced the profit margins of many actors along the SC, facilitating "the entry on the market of manufacturers that previously had less credibility, coming from the Far East (e.g. Chinese, Indians, ...), and that obviously the only weapon they had was to enter with very low prices". "O&G market at the moment is downturned", it has also become "very, very fluctuating", for this reason manufacturers "need that their suppliers or firms keep collaborating and following them". "It's no more like before when there was a fixed yearly base of 80%-85%, and then those holes of 15% could be filled with small, fast orders". The managers and owners interviewed, despite they expressed many concerns, gave the impression of being positive and hopeful towards the future. It also seems that a certain turnaround is taking place in the way end-users manage their projects: "for example, Total, who has always worked through EPCs, is starting to think of cutting them off at least on certain projects, in order to try to directly manage items purchase and avoid all mark-ups ".

In addition to the problems described above, there is a new challenge that is putting a strain on Italian and European manufacturers: "this **local content**, which is the nightmare of all

manufacturers". The so-called local content is the added value that a firm can bring, in terms of GDP, to the socio-economic system of the country in which it's operating. "The local content will be the strategic discriminating factor for supplies in this field over the next 15-20 years, in the sense that each actor has a political interest in giving labor in the area where the plant is built, or in any case to involve actors interesting for him, which may be those of his country". "Everything related to oil has had raids, at least until the end of the 70s", of Western oil companies such as "Shell, Total and Esso, who have plundered the world". The countries victims of these depredations "now have said: <<That's enough!>>". Thus, "the business has moved a little further geographically, and issues that were previously unknown began to arise". "There is a push in this direction in many parts of the world", especially in the Middle East, first of all in Saudi Arabia; because "they are among the biggest buyers and investors of this sector, so they would like to ensure that EPCs and end-users start buying locally as well, rather than importing everything from outside". For example, "the Saudi Arabia government's program plans to be able to purchase 70% of products locally by 2021", and the percentage is intended to increase in the following years, "so it's surely a very aggressive program". Actually, these are often "local content a little 'embellished, in the sense that maybe there is a little presence of production, the product is just painted or assembled and presented with a local content that, frankly does not exist, but this serves and satisfies the end-user because in any case the order is conveyed on a legal entity of the country that it wants". The local content question, therefore, "is taking on a noteworthy importance, which greatly limits manufacturers in the future, who will have to find a strategy to survive". In this regard, the main strategy that is emerging on the market is to undertake collaborations with local partners, both suppliers of materials and components, manufacturers of complementary products or local agents. Unfortunately, "in these emerging countries the partners are usually actors who have a certain influence on the decision makers, but who do not have the necessary skills at all". Another problem is that "countries that require local content must still grow a lot in terms of mentality", in fact "a critical part of the development of new partners in these countries, is certainly their intellectual honesty, in the sense that at a certain point it will be necessary to share the drawings of the components, and after that it is difficult to know where those drawings will end up". Of course, "manufacturers cannot open their own facilities everywhere in the world", but many manufacturers, at least, have already considered the possibility of starting JVs with local partners, sometimes trying

more or less successfully in this venture. Multinational groups, logically, having many production subsidiaries scattered around the world, are encountering less difficulty in addressing the growing demand for local content. Below there is an overview of the actions taken by the manufacturers analyzed to meet the demand for local content:

- **F1** has production facilities in China, UK and Canada, as well as many commercial branches around the world. In Nigeria they have a JV with local suppliers and their agents, "together forming a Nigerian firm". F1 has "a partner in Russia who is buying their finished products and offering a Russian product to an O&G public company or whatever in Russia". Similarly, "in Il Cairo they did it in the beginning, F1 had a service center in Il Cairo, but it was not a separate manufacturing or possibly competing companies".
- **F2** is part of a group and in foreign countries as India can exploit "resources shared as engineers rather than commercial agents, which are therefore not paid directly by F2". The company has also a JV "under way with its agent in Saudi Arabia, to make a fairly large plant in which to do assembly and testing locally".
- **F5** has evaluated the possibility of starting JVs with local partners in Russia and Saudi Arabia, but in the end there weren't the necessary premises to ensure the success of the collaboration.
- **F7** has not invested abroad yet to meet local content requests. The idea, however, would be to do so with other manufacturers of the group, or at least with manufacturers of complementary products, so as to have "a production complex where it would be possible make all the products, or at least some".
- **F8** is involved in 2 JVs in Saudi Arabia, both aimed at "producing products with local content to serve an O&G public company". The first one has local partners, the second one has local partners and another Italian manufacturer as partner, that offers industrial products complementary to F8 valves. The experience that F8 has had until now (2 closed JVs, 1 with limited success and one with very good results both for the JV and for F8, plus the commercial agreements with customers and suppliers that continue to be positive) is positive and F8 recognizes that "the competitive landscape in which it operates will require in the future to expand this tool".
- **F9** has two commercial firms, one in Brazil and one in France. The Brazilian firm "was created specifically for the Brazilian market that is dominated by an O&G

public company, and it is necessary to have a local firm to access the systems". "While in France it is a company that deals with international spare parts". In these two firms there is no local content. F9 has previously assessed the possibility of opening a JV in Saudi Arabia, but it was then discarded because the partners' objectives were different. The idea of making a JV in Iran was also assessed, but then between embargo and various restrictions the thing did not go on. At the moment F9 is considering the possibility of moving abroad the production of products that do not require skilled labor, in order to have savings on labor costs "by collaborating with firms that are there".

- **F10-A** and **F10-B** belong to the same multinational group, which has plants in several countries of the world. So they have the possibility to rely on the different manufacturers of the group, as well as their partners and contacts, in order to take advantage of commercial services, engineering, assistance, spare parts, packaging and assembly. The only idea that F10-A is evaluating at the moment, is to relocate the production of some equipment in Central America, in order to serve better that geographical area, reduce the cost of labor and shipping.
- **F11** has few formal collaborations at group level with foreign partners, for example in the Middle East, Iran, India and Russia; these in order to meet local content requirements and reduce labor costs. Regarding **F11** as individual manufacturer, "engineering and some parts that need know-how on pressure are made in Italy, then a constructive completion may be done locally". These collaborations are still at an early stage, but the idea is to start new ones.
- **F12** is about to start a start-up in Algeria, which given the size and capacity of the manufacturer "is already an important magnitude". An inconvenient factor is that the African country "is under a legal-regulatory framework for which, by law, the Algerian has the majority share, hence it's not so easy to get the money out from Algeria, you can let them in, but getting them out is not easy", and this involves high risks.
- **F13**, at least for the flow control business line, has no JVs. However, the multinational group has very solid foundations and is present in more than 50 countries worldwide. This means that the various manufacturers of the group can help each other by sharing the resources they have in the different areas of the world.

- **F14** has left behind a negative experience of horizontal collaboration with a Malaysian competitor, which will be explored later. F14, burned by this past experience, has no interest in trying something similar at the moment.

The manufacturers that were not mentioned in the list above simply rely on local agents, purely for the provision of commercial services abroad.

2. THE SUPPLY BASE CREATION IN PROJECTS-BASED SUPPLY CHAINS

Now that main characteristics and issues related to this industry have been introduced, before describing the current state of relations between the different supply chain actors, we clarify the phases and procedures that come in succession from the moment in which the end-user decides to develop a project, to the time when the construction of the plant begins.

Whenever an end-user (e.g. oil companies or any actor that has to build a refinery) decides to develop a new project, it must first acquire the **license** necessary to implement certain processes and technologies, which are normally covered by a patent. The license to use these patents is granted by licensees, which are firms that develop new technologies aimed at new production processes or their optimization. Once in possession of the license, the end-user contacts several EPCs, which act as intermediaries between a end-user and manufacturers. "The EPCs must organize a call for tenders", which will be won by the EPC able to offer the best solution at the best price.

Once the EPC and the end-user have defined their own relationships, the EPC "begins to fragment its project into products or services that it has to buy", making merit assessments to understand if it is necessary to aggregate certain product categories. In case of projects particularly small, the EPC "has no interest in going to every single manufacturer to get an offer", but it will prefer to go to a single distributor or big manufacturer and entrust him with the whole supply. At this point the project **vendor lists** are defined in order to identify "which manufacturers are qualified to supply each product category". There can be 3 scenarios:

- The end-user imposes its own vendor list to the EPC, even if the EPC "generally doesn't want anything to be imposed on him";
- The end-user allows the EPC to define the vendor list at will;
- There is a mediation that leads to the insertion in vendor list of some manufacturers preferred by the EPC and others preferred by the end-user (most common situation).

Therefore, for every product category a vendor list is defined, and this "is the first step to receive an invitation to tender".

The commercial work of each manufacturer, therefore, is to be qualified by end-users and/or EPCs, because if you are not part of the vendor list, "there is no possibility to participate in that tender". "The **qualification process** is a very complex process", which means being audited and producing all the documents necessary to demonstrate the value and compliance of the manufacturer. The fact is that to undergo qualification process and access the vendor list manufacturers have to be in waiting list, because the vendor lists are opened cyclically every few years in order to have a turnover of participants. To be able to manage this situation efficiently manufacturers need to work with foreign commercial agents, and then "find country by country where the EPC is located, someone who can help them in the activity of being in the vendor list, and this is a very hard work". When it comes to technical issues, however, "the EPC wants to talk to the manufacturer, it doesn't want anyone in between". "This is a necessary but not sufficient condition to be invited to the specific tender, because the vendor list of the project (short vendor list) clearly cannot accommodate 1000 manufacturers for each category, in general they do not go beyond 6 for each product category". "Obviously the EPCs and the oil companies try to have a vendor list wide enough to have great competition, but not too big to generate an excess of costs or a too long time disruption to take the final choice about who should be the manufacturer". In these vendor lists "it is very difficult to get in, and it takes a second to get out".

So, after qualification, there is a battle "to be invited to participate in the call for tenders" and then access the **short vendor list**. In the event that a product category was previously aggregated to another (or others) category, the two (or more) manufacturers chosen by EPC would be forced to work together to deliver a bundle containing these complementary products to the EPC; but it will be only the manufacturer that provides the most valuable products to interface with the EPC, the other one will only interface with the manufacturer

to which it has been aggregated, that is responsible for the two product categories. Therefore, all the manufacturers participating to the project are imposed by the EPC "at the level of the finished product, while at the SC level for the production process of the single manufacturer, no". In fact, for those non-critical materials, components or processes, the EPC wants to be aware of who are the suppliers, but does not enter into the merits of their selection. Once invited to the tender, manufacturers receive a list of items that must be provided in accordance with specifications; in the case of technical deviations with respect to what is reported in the specifications, a negotiation is opened between the parties, until reaching a signed agreement that precisely defines the content of the supply. "At that point the economic call for bids starts, the listing is made and the EPC, according to criteria that can change from time to time, chooses the manufacturers". In this commercial phase it is very difficult to collaborate between manufacturers, because "EPCs and oil companies control very carefully and understand if there are any tricks", are themselves, in fact, "to put manufacturers against each other".

Although the price is the main discriminant, there are other **factors that contribute in defining the score** of competing manufacturers to win the tender, such as having "a local production facility together with someone local", or the fact of having certifications such as ISO 18000 or ISO 14001. "Little by little, we are moving towards a direction where, on equal terms, it is not only the price that discriminates, because in any case these are relations between firms". But "the rules of the game essentially want 3 things: that manufacturers provide a product that meets the required specifications, that it has a market price, and that they deliver it within the agreed deadline". If manufacturers manage to win the quotation phase by meeting the 3 rules just mentioned, they just have to respect the terms of the contract and deliver the products in accordance with the agreed terms, usually without the need to provide installation services or field assistance.

There is the possibility, albeit rare, that the end-user bypasses the EPC by relating directly to the manufacturers, especially in the case of small projects or revamping, and "there take a whole series of different mechanisms". If, as mentioned above, the tendency of cutting out the EPCs should spread among O&G sector end-users, the Italian industrial sector would probably benefit a lot. This because "the EPCs must lower the CAPEX, because everything they save, is gain for them, while for the end-user it is different, because it must mediate between two things: the CAPEX and the OPEX". In such a situation, the competitiveness of

Italian manufacturers would increase a lot, as they offer the best quality products on the market.

3. SUPPLIERS OF MATERIALS AND OUTSOURCED PROCESSES

We know that "Italy is a great country for the infrastructures of O&G industry, there are overall **Suppliers** of materials, cuttings, forges, pipes and plates, all available". The Italian industrial sector linked to the O&G market has a centennial history, which over time has allowed the establishment of historical, solid and lasting relationships between suppliers of different tiers. This cooperation can arise for several reasons, maybe because they have components that "fit well on the final product, have competitive costs with acceptable levels of quality and performance for a project, are comfortable because they are close and quick to meet, etc.". Usually these relationships can be understood as "tacit collaborations with historical suppliers", in fact often "there is no framework contract, no written rule, but there are procedures in place that facilitate the whole process" of procurement.

"Let's say that suppliers are more or less always the same", in fact manufacturers "tend to be rather loyal to suppliers that ensure good performances". In this way they avoid opening every time a call for bids, "because in the end it is an advantage for both the fact of having a reliable partner on one side, and for the supplier to have a customer who does not question you every time". Therefore, we are talking about "habits and conventions consolidated over time only because they got along in previous experiences", but usually "there aren't common market strategies or common strategic choices". In any case, there are some components and materials' categories where it's more propitious to have repetitive suppliers: there are lasting relationships with foundries because for them "establishing a collaboration that is not limited to a single order is necessary to work on large volumes"; in the case of boilers "they may be the suppliers of fans, they can be burners or certain valves suppliers"; while in the case of valves they can be gaskets suppliers, for example.

But, we must point out that it's not possible to rely solely and exclusively on historical suppliers, in fact some customers trust the manufacturers and consequently the qualified

suppliers that they propose, but "others are forcing manufacturers to buy from someone specific" (e.g. maybe because they explicitly want an Italian quality product, rather than a cheaper Chinese product). For this reason, all the managers interviewed agree that it is of paramount importance to "keep doors open to everyone, because having a single collaboration leads to excluding everyone else, but the manufacturer must always be ready to respond to any customer requirement, even with different suppliers". "Keeping a quite open vendor list on the choice of certain suppliers categories" is therefore essential in order to have no big limitations; in fact the manufacturer surely prefers someone in particular, "but if then it has to do a certain project and this someone isn't in the vendor list, it must go to another one" that, if it's aware of their ongoing collaboration, certainly will not propose favorable contractual conditions to the manufacturer. This situation imposed by customers translates into the recurrence of many one-time collaborations limited to individual projects, especially in case of larger ones; hence, few manufacturers prefer to treat suppliers as "simple suppliers of services and materials". Anyway, the majority of manufacturers tries to establish stable relationships with the most reliable suppliers (for components or critical processes), and this can lead to performance improvement, for example "reducing the lead time, improving order cycles management, rather than warehouse management or the suppliers' management".

If there are few suppliers with whom it's possible to establish solid and lasting relationships that allow "an exchange of opinions at a technical level", or "a consultation regarding specifications and technical problems"; even less are the components and "the equipment on which we can establish a collaboration for the development of the project and the product". Indeed, structured mechanisms for collaboration in R&D aren't diffused at all, at most manufacturers "report to the suppliers some technical innovations to ask them if there are some ways that can be followed", in order to understand together what could be the most suitable material or component for a specific application requested by the customer. Sometimes the suppliers directly contact the manufacturers to propose them new solutions or new materials, but "this is an attempt to sell something new", not collaboration actually.

Now, let's focus a little bit more on **Suppliers of Outsourced Processes**. In the Valve Area are clustered "almost all the Italian valves and boilers manufacturers". Around these manufacturers "it has grown a network of firms specialized in the various mechanical processes dedicated to the O&G sector, such as painting, welding", heat treatments... So,

there are “many small satellites, outside of these manufacturers, where artifacts are created under the supervision of the manufacturers, in line with their quality”. These artisan organizations (actually some welders can also become bigger than valves manufacturers) “are in possession of a whole series of qualifications and certifications required by EPCs”. The manufacturers of valves and boilers helped these suppliers of outsourced processes in the approval process over time, convincing customers (EPCs or end-users) to audit and qualify all these suppliers of critical processes. “So for the customer it's fine, it's as if the operations were done internally substantially”. “This is the process of horizontal collaboration that has took place over time with these firms”.

Given that each manufacturer implements different production strategies (e.g. there is who prefers to outsource assembly or testing, and who the production itself), the practice of outsourcing critical and discontinuous processes “lightens manufacturers, because some processes, if managed internally, would be much more expensive for absurd”. This also leads to a “cost optimization for these mechanical workshops, because they do that thing every day, they also have various orders of competing manufacturers, and therefore amortize the cost of the oven”, for example; or “a single painter who works for 7 manufacturers manages to have a constant business volume that allows it to consume the paint well and to have the people always employed”. In fact, operations such as painting or heat treatment are required only on certain items, it would therefore be nonsensical to invest in personnel, equipment or materials destined to remain unused most of the time. Similarly, other complex processes such as welding can require specialized know-how depending on the material to be welded (e.g. titanium, zirconium, nickel alloys...), therefore outsourcing is once again the wisest choice. Being able to count on such a widespread network of artisans has also turned out to be a “winning strategy to face peak demand periods” that can put production capacity of SMEs through the wringer, creating bottlenecks on some activities.

However, few manufacturers invested, or would like to invest, in these mechanical workshops. For example, F7 contributed investing in the equipment of few mechanical workshops in order to create “masks and tools that fit its pieces (high-specific partnership-exclusive physical assets), so a merely economic collaboration to adapt the workshops’ machines to the details of its valves”. Another possibility could be to create a technical standard through the “development of components that can be used by all manufacturers”

competing in the area. So, given that manufacturers use the same suppliers, could be nice the idea of "making investments that are addressed in the interests of several manufacturers".

There are few, mainly little-sized, manufacturers that have decided to minimize or avoid outsourcing, so as to "not allow suppliers of outsourced processes to see how their designs and valves are made, because they have an intrinsic technological innovation". On the other hand, it is also true that "these suppliers gradually learn more and more, grow up and in some cases become a new competitor". Although the engineering phase always remains within the manufacturer that outsources the process, the workshops develop anyway skills and know-how at production and process level, so "the risk is to raise a competitor".

Concluding, there are few suppliers of materials or outsourced processes with whom is possible to establish long-term relationships and define "frame agreements", rather than "open purchasing contracts" or anyway "purchase programs for large quantities of materials and products". However, it is essential that each critical supplier with whom manufacturers collaborate is qualified, whether it is a historical one or a one-time supplier. Premise that, first of all, manufacturers should "go in search of who offers the product that best suits the customer's needs", usually the procedures for qualifying, validating, accrediting and selecting suppliers are defined by "a quality system in accordance to ISO9001" or even in line with "special licenses concerning the oil sector, namely APIs (American Petrol Institute)". The qualification procedures may include documentary assessments, periodic quality audits, a references check or an investigation on past experiences. Although it's not so common to find situations that deviate from this scenario, there are manufacturers that decide to take one step more and grant free-passes to the best suppliers. "The free-pass means having the supplier audited and agreeing with him to make sure that it does the minimum quality checks on its products, namely dimensional, typological, etc., so that the manufacturer can let the components and materials enter the warehouse without control".

4. COMPETITORS AND SUPPLIERS OF COMPLEMENTARY PRODUCTS

Horizontal SCCs in this industrial sector are very rare. “In the pure order execution field there are no ways, if one has difficulties the other one does everything to let it die, as worst enemies”. In particular, manufacturers avoid horizontal collaborations with competitors “because you cannot fight every day your competitors with knives and then make the agreement”. First, it is difficult to collaborate from the commercial point of view because of the nature of the business in this market, in fact, the vendor lists are imposed by EPCs and end-users, who “check very carefully and understand if there are any set-ups”. It is the case of F6 that about 15 years ago acquired a direct competitor with financial problems, keeping the two brands separate and trying to develop all possible synergies between the two manufacturers; pity that “as the acquisition voice spread in the market, customers no longer accepted offers from both manufacturers, or they accepted the offer of F6, or they accepted the offer of the other manufacturer”. These mergers or collaborations are seen by customers as actions that threaten competitiveness within vendor lists. Quite simply, many SMEs prefer not to collaborate “because they are very jealous of their know-how”, and this “know-how must remain within the firm”; “maybe they do not want to share their price margins, exact costs parameters or the hours they need to do certain operations rather than the usual mark-ups, that they will be forced to share if they would like to collaborate for a big project”. Furthermore, we must always remember that this is a market based on relationships, “the market is difficult, the market must be conquered, a end-user is conquered after 2 or 3 years, and it is easy to lose it in one day, so no one would like this effort to be erased or diluted, giving others the possibility of being present on the market “. “And then it's always risky, because if you match with someone else, maybe you lose an order because you are in the vendor list, but your partner doesn’t; when you associate with someone else you also suffer from your partner’s lacks”.

Hence, generally manufacturers “do not collaborate with competitors, but sometimes they have to work with them”. “Sometimes customers explicitly ask for a certain product that may be of another competitor”; so manufacturers “have to go to them and buy something, or vice versa”, package all together and deliver everything to the customer. Because maybe

you don't produce that product or your competitor's product "meets customer's requirements in an almost mandatory manner". We know the keyword is always "to offer the product that best suits the customer's needs", but manufacturers still reserve the right to refuse orders where the percentage of other manufacturers' products is too high if compared with percentage of their core products. This so-called supply completion is a sporadic request that customers make to manufacturers especially within medium-small projects. We say sporadic because EPCs tend "to optimize the purchasing process, in terms of savings for each product category, keeping all product categories separate" and managing the purchasing process by their own. A manufacturer is responsible for the entire scope of supply that is assigned to it, therefore, "everything that enters the scope of supply, even the materials bought from others and incorporated into the product, falls under the responsibility of the manufacturer". The breadth and content of a manufacturer's scope of supply are defined by the EPC, which, by appropriately aggregating the numerous product categories, is able to reduce the number of manufacturers to contact in order to procure all the products. Thus, it may happen that the lower value-added products are aggregated to others with a higher intrinsic value (e.g. gaskets may enter the scope of supply of tie-rods; pumps, valves and burners may enter the scope of supply of boilers; actuators may enter the scope of supply of valves, ...), and this obliges some manufacturers to "change strategy, because they no longer have a direct relationship with the EPC, but must contact the manufacturer responsible for the scope of supply". In this sense we can say that "there is a daily war, which sometimes results in some opportunity", it could be a temporary collaboration with a competitor rather than a manufacturer of complementary products; but the manufacturers "do not see the reason to prepare themselves because it is a very limited request".

In summary, while the possibility of collaborating on regular business with a competitor is generally excluded and avoided, with some **manufacturers of complementary products** "there could be the possibility to offer a package that is technically and commercially competitive for the EPC or the end-user". After all, "why do I have to collaborate with someone who has the same skills and does the same things I do? I do it well enough by myself. If I've to go with someone, I'll go with someone who does something different and complementary to what I do". Many of the managers interviewed consider it desirable to establish a collaboration with a possible manufacturer of complementary products in order to broaden the product portfolio. For example, F14 collaborated with a manufacturer of

complementary products in order to create a unique catalog for the control valves; the two manufacturers have interfaced deeply at the technical level to develop a new control know-how; unfortunately, the horizontal collaboration was not successful and stopped after few years. Larger manufacturers and multinational groups, however, prefer to expand their portfolio through acquisitions or by leveraging the ideas that some SMEs or individuals present to them from time to time. "Sometimes there are small firms, can be even 2 or 3 people, that have an idea for a product; they go to manufacturers asking if they are interested in developing with them this new product line. There is an opportunity to develop a new product, but they don't have the financial, manufacturing or whatever resources". Others consider that the idea of collaborating horizontally with manufacturers of complementary products could be winning while approaching those markets that have a growing demand for local content. "In emerging countries there is a strong demand for a percentage of GDP" on the final product, so it would make sense "to think about collaborations with manufacturers that produce other items, so maybe a ball valves manufacturer joins an actuators manufacturer and a gate, globe and check valves manufacturer, and they decide together to build the plant in Saudi Arabia", for example. This would be impossible if we considered 3 ball valves manufacturers. Smaller manufacturers, instead, could feel the need for a complementary partner to be less dependent on external suppliers, so as to "be more competitive and instead of outsource certain operations, tend to do everything in house". As for the collaborations with the suppliers of materials and components, whenever, for example, "a valves manufacturer marries an actuators manufacturer, the market is greatly reduced. Because the others valves manufacturers certainly will not go to ask, to commercially support this actuators manufacturer. Because they know about the JV with the valves manufacturer. And, if the valves manufacturer goes to an actuators manufacturer different from its partner, it hardly will receive a technical or commercial support". Moreover, similarly to what has been said for the mechanical workshops, also the manufacturers of complementary products start "building up references, building up their knowledge, their turnover, etc." over time; with the risk of becoming competitors.

Despite the barriers imposed by some market dynamics, proactive horizontal relationships between manufacturers of complementary products have been established over time; going beyond the execution of the mere single order. The **most significant collaborations between manufacturers of complementary products** are presented below:

- Titanium and carbon filters: there are two similar boilers manufacturers, F3 produces titanium filters with a high intrinsic value, while the other manufacturer produces carbon filters with a low intrinsic value. There is an exclusive agreement that allows F3 to supply titanium filters to the other manufacturer, and vice versa. This manufacturer "knows how to dimension the filters from a functional point of view, but from the process point of view it has no idea how titanium filters are made", and there is no know-how sharing.
- Boilers and gas turbines: there is a historic partnership between a F11 and a gas turbines manufacturer. In this collaboration "the know-how of the thermodynamic part is held by the manufacturer that has the know-how of the application on the gas turbine, instead the part of the mechanical construction and of the production is held by F11". After so many years, the technological innovation that can be done is little, there "are more projects of continuous cost reduction, optimization and efficiency". F10-A collaborates "quite good with producers and packers of gas turbines"; up to a certain point however, because as already mentioned, sometimes it is also necessary to work with different manufacturers in order to satisfy the customer's requests.
- Valves and actuators: several valves manufacturers have to go to the actuators manufacturers in order to buy these complementary products and deliver to the customer a complete bundle with the two products. Therefore, several valves manufacturers can rely on a small trusty group of actuators manufacturers "with whom they must necessarily maintain good relations". As above mentioned, it is anyway necessary to maintain a vendor list that is open enough to meet the needs of the market.
- F8 is involved in 2 JV in Saudi Arabia since 2015 (JV1: 25% F8, 75% local partners; JV2: 25% F8, 25% Italian manufacturer of complementary products, 50% local partners), both aimed at producing products with local content to serve a customer, namely the O&G public company. The collaboration with the Italian manufacturer of complementary products satisfies Saudi contractors' need of covering the entire range of products required. Commercial, production and quality activities are carried out in Saudi Arabia, while the engineering phase is still in Italy. The experience so far is positive and F8 acknowledges that "the competitive scenario in which it operates will require in the future to expand this instrument".

From what has emerged so far, we can say that this sector "doesn't present yet a formalized form of horizontal SCC, but there are informal agreements normally linked to personal relationships between management of individual manufacturers". Despite the numerous problems introduced in the previous pages, however, several manufacturers have undertaken, more or less successfully, horizontal collaborations with **competitors**. So, with few competitors "there have been some hints, intentions, beginnings of collaboration", which however revealed to be positive only in some cases. The major obstacle is probably the cultural barrier; in fact, those few companies that are collaborating, do it at corporate/management level mainly, "because at a lower level it would be even more difficult". The CEOs and managers of these manufacturers, in the few hours they meet, "have a common goal, but once left they slaughter each others. It isn't easy to split in two".

With the exception of South Korea, the managers said they have not seen "anything like this neither abroad, so it's not an Italian problem while the others collaborate. The only thing you see are large groups that instead of collaborating acquire other manufacturers". On the one hand, this "horizontal expansion of some multinational groups through acquisition is pushing independent Italian manufacturers to seek forms of collaboration with adjacent manufacturers, but the phenomenon is very limited". Some manufacturers would like to collaborate more. For example, given that all the Italian manufacturers use more or less the same mechanical workshops, could be interesting "making investments that are addressed to the interests of several manufacturers", to develop "products that can be used by all manufacturers". The **most significant experiences of horizontal SCC between competitors** are presented below:

- In 2012 the parent company of F14 created F14 in order to establish a horizontal collaboration with a Malaysian competitor. The initial idea was that F14 would have shared a technical know-how, while the Malaysian manufacturer would have shared a commercial know-how that would have allowed the group to target also the Eastern countries. So there was no real investment, just an exchange of know-how. The goal of F14 was to "exploit also contacts, agents, a commercial network that wasn't present in Italy and use the qualifications that had been able to obtain the Malaysian manufacturer". Unfortunately, the collaboration ends in 2015, when F14 definitively realizes the lack of honesty of the partner, who did not share the commercial know-how in the agreed methods and contents.

- ValveCampus and Industrial Valve Summit (IVS): 5 years ago, 5 Italian manufacturers (4 valves manufacturers and 1 gaskets manufacturer), "together with Confindustria Bergamo, have created a biennial trade fair, hold in Bergamo, which is the IVS", dedicated to the Italian valve sector. At the fair there is always a "part of technical conferences, where a scientific committee defines issues of interest and launches the call for papers". The manufacturers participating in the fair have increased over the years, becoming more than 130, and this year it has also been promoted a survey for international customers. "There is a very ambitious project, which is to create something that gives territorial value". "In parallel, an association called ValveCampus has been built, which aims to provide training to both manufacturers' customers and employees", hence, offering special training not obtainable elsewhere, but also "to give added value to the fair, in fact the fair is a container that must contain something". Concerning the internal training, the basic idea was: "let's get together, our training needs are always the same, and we create training sessions to which each of our employees can participate, but who are basically collegial". While, the basic idea behind the external training was: "since more and more the EPCs have engineers who come young from the school and no one trains, let us take care of them in order to do some training free of charge". "If people and engineers are well trained under a technical perspective, they can also better recognize the difference between a quality Italian product and the others". The hope is also to "increase the specific culture of subjects who write the purchasing specifications and buy industrial products", because "depending on how you write certain things, supply options may be narrower, the tangles of the possibility of infiltration of low quality or high quality manufacturers can be more or less large". In summary, "since Italy is already recognized as the leader on the technical-qualitative part of the valve, the idea of these 2 activities is to maintain this leadership, publicize the know-how, spread it and maintain its level, overcoming the individual interests to look at them in a more collective way". This, in order to "give to the territory visibility through the fair, first of all by bringing here the decision-makers of the purchasing process, so that they can make contact with the Italian territory and understand that here is the quality valve; and in return, to give members

tools for industrial planning ". The hope is to be able to bring benefits to all the actors in this industrial sector, which is really important for Italy.

To be thorough, we have to say that there are also several **national and international associations**, **organizations or consortia** that bring together groups of similar manufacturers, together with their customers and suppliers sometimes. Among these we can mention:

- **Italian Petrochemical Manufacturers (IPM)**: association between several Italian manufacturers of components for the O&G industry that "offers to international EPCs bundles of Italian products".
- **European Sealing Association (ESA)**: an association that brings together several European gaskets manufacturers with a focus on safety, energy efficiency and environmental protection. The objective is the development of appropriate standards, legislations and sealing technologies.
- **Associazione Italiana Pressure Equipment (AIPE)**: Italian association led by a famous Italian manufacturer, which brings together pressure vessels and heat exchangers manufacturers in order to allow members to "tackle bigger projects together in order to have more strength".
- **American Society of Mechanical Engineers (ASME)**: a US association with more than 130.000 members worldwide; it deals with technical publications, organizes numerous technical conferences and professional development courses, as well as sponsoring educational programs and assigning various annual awards.
- **Associazione Nazionale Impiantistica Industriale (ANIMP)**: it's a network with the aim of connecting people, skills and firms such as: EPCs, suppliers, end-users, universities, experts and scholars, all operating in the industrial plant engineering sector, in order to develop a strategic vision for industry development.
- **Associazione Costruttori Caldareria (UCC)**: it groups Italian manufacturers operating in the vast field of pressure equipment, from design to production. Among the various activities, UCC is involved in the organization of training events with high technical content.
- **Fractionation Research Institute (FRI)**: it's a consortium of EPCs, end-users and manufacturers of interior columns, which seeks to standardize, develop and test these

products to improve them, encouraging an exchange of information between all members.

The reality, however, is that few of the manufacturers interviewed are members of these associations and actively participate in them. The feeling is that "everyone makes his own business", the strongest members can invest more resources in the consortia/associations, and hence benefit more. They are associations that are born with the purpose of sharing information, but "they share up to a certain limit, because any competitor wants to maintain a certain control over its technology know-how". These associations have little success among SMEs because often there is a substantial difference between the size of the members, and the SMEs would end up experiencing the association as spectators. For the same reason, many manufacturers try to avoid participating in the Associazioni Temporanee d'Imprsa (ATI). The ATIs are formed in the case of "very important orders, or for delivery reasons, between large manufacturers that subdivide the type of work among themselves". Many manufacturers have never participated in ATIs "because ATIs are important when the weight or the importance of manufacturers is more or less similar". In any case, if you want to participate in a certain project, sometimes participating in ATIs is mandatory.

5. CUSTOMERS: EPCS, END-USERS AND OTHERS

Manufacturers operating in this sector can basically have 4 types of customers: EPC contractors, O&G sector end-users, industrial sector end-users, OEMs and higher-tiers suppliers.

EPC contractors are intermediaries to whom the end-user relies on for engineering, developing and completing projects. The managers interviewed agree in saying that, with the EPCs, it is not possible to have a continuative relationship that goes beyond the single project. "Because you're always on the rope, because in fact you do a great job to be on the vendor list, a huge job to be in the short vendor list and then you have to do the tender, too".

Once the technical specifications and the relative quality prerequisites are guaranteed, the priority of the EPC is to create a competitive environment in the vendor lists to lower prices

as much as possible (minimum project CAPEX possible), in order to maximize their own profit margin. So much that "EPCs make the technical tabulation, which means passing your technical solution to the shabbiest manufacturer". In this case the technical document "is made a document of the EPC", who then proposes it to end-users as if it was its own solution. Then it "takes the Chinese or Indian manufacturer and tells him to do the technical alignment", namely, providing this manufacturer with the specifications that he EPC acquired and appointing it in order to produce the component to buy it at a lower price. "This global market plays in favor of EPCs". Once these considerations have been made, we can easily understand the defensive attitude that many manufacturers take while approaching EPCs, in order to protect their know-how and engineering capabilities.

There is the possibility of cooperating with EPCs in the context of individual projects. Manufacturers who have their own design and engineering know-how have "the added value of being able to provide their own alternative solutions". "The contents of the specifications are sometimes completely exhaustive and well done, other times the project starts on a preliminary basis from the process data point of view, so the process data are sometimes refined underway, while already working". These are the situations in which it is possible to suggest alternative solutions to the EPC, succeeding in saving time and money for the latter, while at the same time offering a product with a higher intrinsic value and therefore more profitable also for the manufacturer. Technical collaboration contracts with EPCs are more unique than rare, so rather than a collaboration, with the EPCs there is usually a cooperation to solve certain technical problems, to fulfill the contract and to complete the project.

O&G sector End-Users: The O&G sector "certainly is a market also made of relationships, so it is important to have a certain relationship with the customer". "The end-user is the one who uses the system in the end, and therefore it has a greater interest on supply reliability, service and solidity of the manufacturer", since it does not only evaluate the CAPEX, but also the OPEX. Therefore, "mainly with the end-user, in some cases it is possible to have long-term relationships". Usually, it's possible to establish lasting relationships only with a handful of historical end-users, who, preferring some manufacturers, can also decide "at a certain point to standardize what they have on their plants relying on 2 or 3 manufacturers only, rationalizing spare parts and interventions" and then trying to push the EPCs towards these manufacturers for future projects.

"The concept is that going beyond means investing time, people and money, with some end-users it's worth it, with others it's absolutely a waste of time, so you can do it with a small circle of end-users, depends on the relationships in place". In any case, "it is very difficult to have written contracts in which end-users are committed to buy a certain amount, most of the times preferential relations are consequence of what happened over the years". There is therefore a small number of end-users with which manufacturers can establish sales or frame agreements that govern commercial relations, that are "the model business raising the more benefits end-users may get", but this is not collaboration because there are no joint interests, it "is an agreement with which you can reduce competition".

"The market is difficult, the market must be conquered, an end-user is conquered after 2 or 3 years, and it is easy to lose it in a single day"; therefore, in order to establish exclusive and lasting relationships, tailor-made strategies are necessary, because "each end-user must be treated differently". These strategies adopted towards end-users vary basing on the customer, but also according to some characteristics of manufacturers:

- Size: smaller manufacturers tend to pay more attention to end-users' needs, ensuring great flexibility and being able "to produce products that have special requirements, and that other manufacturers wouldn't do, because maybe the quantity required is so low that for them it would be more a burden".
- Product Complexity: the more a product is complex (boilers, pressure vessels, heat exchangers, particular valves, ...), the more are the margins to develop an ad hoc version with special characteristics. Manufacturers that deal with these products therefore tend to enhance their engineering capabilities, proposing alternative solutions that better meet the needs of the end-user.
- Industrial Sector Orientation: "in the O&G sector a lot of orders are managed on projects, while in the industrial sector it is easier to work for everyday life". Manufacturers more oriented towards the industrial sector tend to be more attentive to the needs of the end-user, developing relationships that are as long lasting as possible. This attitude is often maintained even while approaching the O&G sector.

However, there may be different strategies to reinforce relationships with end-users. Manufacturers small or with more complex products tend to share more know-how, differentiating it end-user by end-user. Larger manufacturers may have dedicated technical

or commercial staff "to few very trusted end-users in the world, to some part of the world or areas geographically". Many manufacturers "provide a supervisor on the field, who verifies that the product is properly installed and started", but since these are not difficult operations, there is often no need for them. Some manufacturers, generally SMEs, have lasting relationships that have allowed them to work hard in revamping business field. With historical most loyal end-users, some manufacturers have regular meetings and stay "in contact at a high level, because knowledge and technical know-how is recognized to them". "Hence, when end-users review and rewrite a technical specification, they consult the manufacturers", and "the fact that a manufacturer is called upon to express its opinion on their specifications has a return, because the manufacturers try to set it in such a way to gain a competitive advantage". Some end-users or geographical areas represent such a high turnover share for certain manufacturers, that the latter decide to open new facilities abroad through JVs or private investments. This is not only to comply with local content requirements or to reduce the cost of labor, but also to be more responsive towards important end-users, ensuring them a high level of service. It is very rare that innovations arise as a consequence of the needs expressed by the end-user. Anyway, this innovation "does not lead to a patent that is then deposited as a share between the two firms", rather changes and ad-hoc solutions developed to solve problems on certain applications. "R&D with end-users has a moderate revenue value, but it is strongly propulsive for relations with them". There are also several associations, such as previously presented ValveCampus and FRI, to which end-users can participate to access knowledge and to be closer to the manufacturers, but generally these aren't tailor-made relationships that can lead to business opportunities for the manufacturers.

All the strategies discussed so far are useful for establishing "long-term relationships, but they are not specific to the project, they are marketing actions that can then be transformed into projects".

We must never forget that "firms are formed by people, and many times customers identify in a firm's individual the correspondent with whom to dialogue". Therefore, "the technician isn't only the one who knows the formulas, but the technician is also the one who in addition to the formulas also knows how to behave towards the customer". So, the tendency with end-users is to have a rather informal approach, making themselves as flexible and available

as possible, “but the end-user is always one who is on the other side of the barricade, and if mistakes are made he is ready to to close and to castigate”.

As a rule, manufacturers tend to have little conversations with end-users because often there is an EPC as intermediary. On the market, however, it seems that there is a slight reversal of trend, “for example Total, which has always operated through EPCs, is starting to think about cutting them off at least on certain projects, in order to try to directly manage items purchases and avoid all the mark-ups”. Therefore, “the trend of interfacing directly with the end-user could also bring an advantage” to Italian manufacturers, who combine a high quality product with considerable engineering capabilities.

Industrial sector End-Users: As already mentioned above, with the end-users of the industrial sector it’s easier to establish long lasting relationships; “it is not a real collaboration, but it is a very different customer-supplier relationship, knowing that is possible to work continuously”. In the O&G sector, instead, orders are managed in projects and practically every time “everyone has to restart from scratch, the offers are redone and the best one takes the job”. Therefore, in the industrial sector, strategies for end-user loyalty can be implemented more efficiently.

OEMs and higher-tiers suppliers: This type of customers represents a very small part of the turnover. In the previous paragraph we talked about repetitive suppliers, but logically those manufacturers that have repetitive suppliers, are in turn the regular customers of the aforementioned suppliers. In fact, there are products such as gaskets that are required as a first use supply by manufacturers of industrial products such as valves, pumps, boilers and heat exchangers (whether these are intended for the O&G or industrial sector). Another example: manufacturers of boilers and heat exchangers can be regular customers of fans, burners, valves and many other components manufacturers. “Subcomponents’ suppliers don’t have to be declared, they must be in the manufacturer’s vendor list with all the necessary criteria and requisites”. The issue is that there are particularly critical components on which the end-user has the power to impose a particular supplier to the manufacturer; while there are non-critical components or components destined for the industrial sector, where manufacturers can choose more freely. Regarding these products, it is easier to establish frame agreements with OEMs or higher-tiers suppliers, share a bit more knowledge, and sometimes do some R&D together.

6. AGENTS AND SERVICE PROVIDERS

Agents are typically an external type of personnel who, as a base, provide commercial services. “They are professional figures that everyone has”, and with whom there are “continuous collaboration contracts” and “usually work on commissions”. It is a very hard job to “find, country by country where the EPCs are located, someone who can help manufacturers in the activity of being in the vendor lists”. The agents are **local commercial partners** who “allow manufacturers, on large projects, to know more or less where they are during the quotation/tendering phase”. “It's basically someone who, daily, has to go knocking” at the door of the EPC to convince it to open the vendor lists and to let the represented manufacturer work. Thanks to the agents, “when a project is starting in the study stage, manufacturers know about it, their agents are telling them”. Usually these agents “are not in any case able to make technical clarifications or a technical discussion with the EPC during the feed”, in fact, the EPC prefers to contact the manufacturer directly, “because the level of technical communication is very high and putting intermediaries in between means only creating confusion and errors”. Larger manufacturers may also have more than one agent in each state, because they may have a very large and various portfolio of products that a single agent could not have the skills to manage. These agents can represent many different manufacturers, but only one for each product category, because it is not acceptable to represent the same product for 2 different competitors. “You can not be married with someone and then you go with the girlfriend to see the customer”. In short, agents have an important role “more than anything else from the commercial point of view, lead generation, opportunity generation, as well as local relationships on the project and with the customer”. Basically, they “offer a service as a business intermediary” and help manufacturers “on all the bureaucratic and local politics”. In addition to taking care of “products sales and customer offers”, “in some cases they can also act as distributors, that is, they buy from manufacturers at discounted prices and sell locally, perhaps by providing some additional service”.

“The **industrial distributor** is a reseller of technical items located in a geographical area, which serves that territory with industrial products of various kinds, offering products and

services for the industry". The role of industrial distributor can be covered by agents, agencies or service providers who are purely committed in providing local logistics services such as storage, shipping and delivery. "Typical examples are spare parts that require maximum timeliness of delivery". Some distributors sell products of a single brand, while others manage products of different brands and types, but never different brands for the same product type. In most cases "the purpose of the distributor is to offer a service for maintenance substantially", operating with a day-to-day approach. So, the distributors "put in stock spare parts and products that have been provided on the most important projects, when from the plant end-users need to replace a valve or do some maintenance, they intervene". In some cases, the distributor buys products from the manufacturers "and resells them (limited to its competence area) at a maximum agreed price". Some manufacturers "would not like to give their products, if they have problems because distributor pays them when it sells, they have to have a situation where it buys the product, put it on the shelves and then sell it". Therefore, "on the one hand it can be a customer, in the sense that the distributor activates its action with some customers and buys the spare parts from the manufacturer; while in many cases the manufacturer sends to it an order that has been negotiated with a customer on the basis of agreements, price lists and anything else". These two strategies can also coexist in the same distributor (sometimes it buys and resells, other times it distributes on behalf of the manufacturer), but it is difficult to find "someone who is available to make a warehouse of something that it's not sure to sell the next day". It happens that "some customers or projects want something local"; in this case the local agent can become a valuable candidate with whom to invest locally to meet the needs of the customer. For example, some manufacturers "help the agent/distributor to build (or buy in advance) a spare parts warehouse that it manages independently".

It is not uncommon for local agents or companies that provide stock and distribution services to also provide **technical support, assistance, installation and maintenance** in the reference countries. "In the sense that, if there is need to go on the plant to check or maybe do the maintenance, not only the supply of the parts is needed, but also to make the arrangements; these are people technically trained to go and do the intervention". They are very useful even when "the customer requires an installation, the manufacturer instead of sending an employee from Italy, establishes an agency contract with a servicing company, then sends the servicing company".

It's not possible to open service support facilities everywhere, for this reason manufacturers tend to use structures already in place because is less investment; it would “cost a lot of money to open facilities, hire the people, train, all these things”. Manufacturers “have sometimes their partners, their agents or firms that want to be their service support center and want to join together, so manufacturers obtain that benefit without any major investment, they still get the return and for customers is great”.

A particular case is that of F13, which does not carry out production activities in Italy, but proposes a support service by relying on a local partner. In particular, as it does not have adequate logistics on the Italian territory, F13 collaborates with its historical partner who can act both as a customer (buys and resells) and as a distributor. This partner also complements the service performed to the customer by F13, increasing its timeliness. “Their workforce and operating structure is needed by F13 to maintain, test and verify the valves before they are returned to the customer”. Over the years, F13 has also helped its partner on certain investments, without scheduling or planning them. Although the partnership has been standing for years, there is still a passage of minimal know-how from F13 to its partner. F13 is considering the idea of finding a second partner in Italy, which perhaps could also offer commercial services, to balance a bit the role of the actual partner, so as “not to be totally dependent on certain activities from this entity”.

Collaborations with service providers such as **assembly, testing and packaging** are much less common, if compared with commercial service, distribution and support service providers’ ones. Collaborations for assembly and testing are established mainly abroad, usually to meet local content requirements and better follow the needs of local customers. Companies that offer packaging services, on the other hand, are usually located in Italy, and the service is usually governed by frame agreements. In the end, there are manufacturers that rarely require help of external workforce for production or engineering, just “when there is an overload of work for the technical office”.

Several manufacturers collaborate in R&D with **universities**, there are meetings and exchanges between the engineering functions of manufacturers and the academic world, “but they are punctual, it is not an ongoing collaboration”. It’s not uncommon for manufacturers “to turn to the academic world rather than the industrial world” for the cogeneration of new ideas and innovations; “to develop perhaps applications, governed by specific contracts, or

to validate some results" of the tests. In these cases, at least from the point of view of know-how, the collaboration is of a higher level because at that point there is also an exchange of information and details in both directions". A collaboration similar to the those with universities, even if slightly different, is that one established by F11 with a firm that develops "systems to perform non-destructive examinations". This firm, outside from the IPSC of the O&G sector, has developed for F11 an efficient system for performing non-destructive examinations, maintaining a fairly continuous relationship aimed at continuous improvement.

7. MULTINATIONAL GROUPS

Multinational groups tend to expand their business by expanding production capacity and product portfolio through acquisitions, rather than establishing collaborations. "Before turning to an external supplier, if there is excess capacity in the group, first is used that, obviously". Manufacturers that become part of multinational groups usually succeed in obtaining great solidity and availability of resources. Usually the multinational groups are divided into different business lines, and especially within the same business line "there is cooperation; there are also systems that link and connect the manufacturer to the other firms of the group". Therefore, "there is an effort to try to develop synergies and collaborations" to optimize the use of internal resources, but it is not always easy, especially between different business lines. In these cases, there is usually a good sharing of information and know-how, but it is still useful to have a segregation of information between and within the different business lines, in order to limit the possibilities of information and know-how spillovers.

"Strategic decisions and investments are normally taken at division or business line level, then they must also be approved from the top", while regarding the R&D part made by the manufacturer, only a corporate approval is required. The horizontal collaboration between the manufacturers of the same group can extend to many business areas and functions, also leading to a reduction in transaction costs for many businesses. There may be shared

resources such as production facilities, IT systems, administration and personnel (maybe in share-service, maybe are employees of the group not paid directly by the manufacturer), "engineering exchanges, a bit of project management, and R&D part". But they can also collaborate on procurement and sourcing strategies for materials, as well as on sales and agents, while marketing is usually centralized and managed at corporate level. From the point of view of purchasing strategies, it is important to have an integration and a complementarity among the manufacturers of the group, in order to be able to rely on other members for the purchase of important components or products (e.g. valves manufacturers and actuators manufacturers, generic manufacturer and steel mill of the same group, ...). Concerning sales strategies, it is not only a question of having centralized marketing and shared agents among the companies of the group; but there is also the possibility of offering to customers bundles of complementary products. So, the customers can "have some advantages of discount on the price and still address a unique production site, with a commercial site, with a unique interface". "So, this can also give a greater impact force over the customer".

The multinational groups, being widespread in many different geographical areas, have the possibility to better meet local content requirements, so the group manufacturers are encouraged to rely on foreign branches. "But a multinational can hardly be present everywhere" in a complete way, for this reason in some areas they have "a minor presence that is embellished and presented as a local production content that, frankly does not exist, because maybe they just paint or make only a small assembly". Furthermore, it is a great advantage for manufacturers to be able to invest abroad in jointly with a company of the same group. In addition, there are much less bureaucratic and trust problems. "With one production site it's possible to make all the products" offered by the group, and that can be requested by the customers of that area.

If we talk about the O&G sector, Italian manufacturers that have been acquired by multinational groups usually have a very high importance within the group, both at strategic and know-how level.

Chapter 5

Analysis and Discussion

The information collected and presented in *Chapter 4 – Findings* will be analyzed in this chapter under the lens of the RV, which has been presented in *Chapter 2 – Literature Review*. All the concepts introduced by Dyer and Singh will be explored in order to understand which of these are valid also in the context of the temporary IPBSCs, which are not, and if there are others new to be taken into consideration. The chapter structure is divided into 2 sections, enablers and barriers, according to the RV. Few quantitative data have been added to this **qualitative analysis**, so as to allow readers to give the right weight to the written words and to understand the interviewees orientation in giving the answers to the questionnaire.
The 14 manufacturers considered (F10-A and F10-B have been merged as there was only one interview with 2 persons and the answers were most of the times common) were classified into two groups based on **dimension**, and in two groups based on **business**. Each manufacturer will appear in one group identifying its size and in one group identifying its business. This to highlight trends and differences:

- **Dimension (SMEs - Large or Multinationals)**: 'SMEs' are considered manufacturers with a turnover lower or equal to 50M€ AND with less than 250 employees; 'Large or Multinationals' manufacturers are considered manufacturers with a turnover higher than 50M€ OR with more than 250 employees, as well as all those 'SMEs' that are under close control of multinational groups with a turnover higher than 50M€ OR with more than 250 employees.

- **Business (Commodities - Engineered Solutions)**: 'Commodities' are considered manufacturers whose main business is the production of valves, gaskets, or other products difficult to differentiate (regardless of the quality of the products and the fact that sometimes there may be modifications to meet customer needs); 'Engineered Solutions' are considered manufacturers whose main business is the production of heat exchangers, boilers, pressure vessels or any other solution/application/system that has been developed ad-hoc for the customer.

According to these distinctions, the groups turned out to be the following:
Total (14): F1, F2, F3, F4, F5, F6, F7, F8, F9, F10A/B, F11, F12, F13, F14
SMEs (8): F2, F3, F4, F5, F7, F9, F12, F14
Large and Multinationals (6): F1, F6, F8, F10-A/B, F11, F13
Commodities (8): F1, F2, F4, F6, F7, F8, F12, F14
Engineered Solutions (6): F3, F5, F9, F10A/B, F11, F13

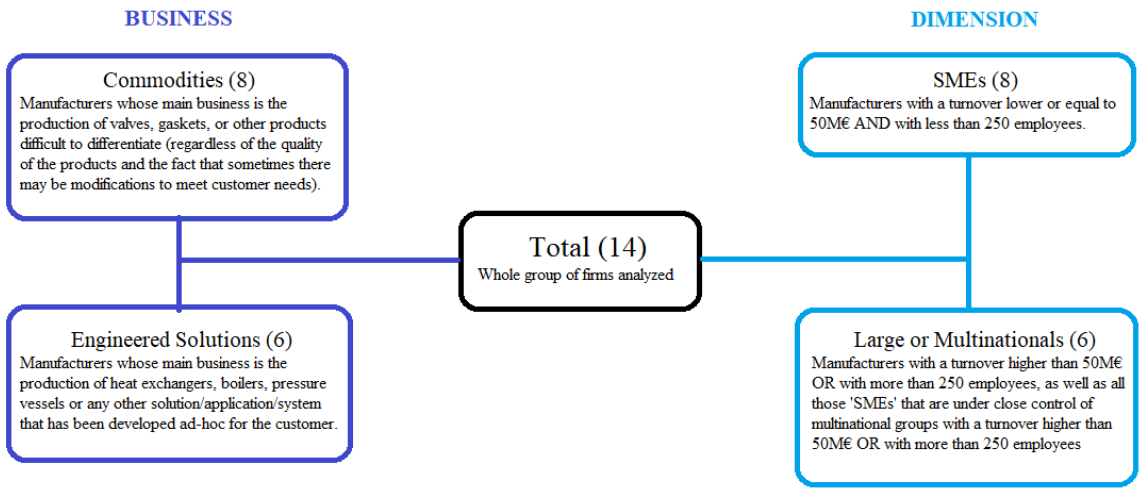

Figure 3 - Groups with classification criteria and number of firms belonging to each group.

1. ENABLERS (MECHANISMS)

1.1. EXCHANGE AND INVESTMENT IN PARTNERSHIP-EXCLUSIVE ASSETS

Among the manufacturers analyzed, 6 have undertaken investments in partnership-exclusive assets.

	Firms that Joint Invested with Partners				Where Firms Would Joint Invest with Partners		
	Total	Site Specificity	Physical Asset Specificity	Human Asset Specificity	Site Specificity	Physical Asset Specificity	Human Asset Specificity
Total (14)	6	3	4	4	5	2	1
SMEs (8)	3	1	1	2	2	1	1
Large or Multinationals (6)	3	2	3	2	3	1	0
Commodities (8)	4	2	2	3	2	0	1
Engineered Solutions (6)	2	1	2	1	3	2	0

Table 5 - On the left: number of manufacturers, for each category, that invested in partnership-exclusive assets (real facts). On the right: number of manufacturers, for each category, that would like to do so (perception).

Only 3 of these manufacturers have significantly co-invested abroad for the construction of production plants with high site specificity. The aim is to **localize and geographically approximate assets** in foreign countries in order to meet the growing demand for local content productions. In this way, manufacturers have the opportunity to better serve the market or a certain end-user in a particular geographical area, having at the same time greater advantages even in tenders, where the presence or absence of local production has a greater and greater weight on the overall bid evaluation. “The proximity of product realization to the final site probably has an advantage in terms of costs”. “The problem of local content is that obviously a manufacturer is nagged to death because it cannot have a local content anywhere, so manufacturers have to start looking from time to time for local partners that help them, but it's not easy because these gentlemen know the role well, once they say yes, then they make the offer today to manufacturer, then it materializes after a year and everything changes”. Among the manufacturers that have not undertaken investments in partnership-exclusive assets, 5 have expressed a growing interest, or need, in investing abroad; mainly to meet local content requirements and/or to take advantage of low-cost workforce for the production of products that do not require qualified personnel, as well as assembly, painting, testing and other simple operations. Even if there is no such marked difference, it seems that large manufacturers or manufacturers belonging to multinational groups, hence with stronger corporate solidity, are more inclined to invest in production plants and warehouses abroad. Although, in many situations, the directive that comes from

the corporate level of multinationals is to find local partners who are already owners of production plants, or who invest at their expense.

Among the manufacturers that have made capital investments in **physical specific assets**, 2 invested for the purchase of equipment and tools relative to the above-mentioned production plants. Similarly, manufacturers that see the possibility of investing in physical assets in the future would do that in conjunction with investments in production plants. Other 2 firms have invested in equipment and tools able to tailor processes to particular suppliers of outsourced processes; or simply to make an economic contribution to help some strategically important suppliers. Co-investing in equipment and tools for suppliers leads to a reduction in costs, because it facilitates certain processes. “Obviously the supplier asks manufacturer to contribute, because if it makes an investment of that type, and starting from tomorrow the manufacturer gives it nothing more to work, because it has no obligations, supplier remains with an investment that cannot be reused with anyone else”. Usually these are not scheduled or planned investments, “if manufacturers want to help this company to make an investment, maybe instead of paying the hourly work X, they can pay it X+1 to help them in making an investment, eventually”.

Investments for the **transfer of know-how through human resources** are avoided where possible, since there is a lot of jealousy of proprietary knowledge. Transaction-specific know-how is usually accumulated by transactors through long-standing relationships that increase human assets specificity. In many cases, this happens with suppliers and sometimes with customers; but it's a natural process that has taken place during the years thanks to firms proximity and cyclic interactions, without the need of investing money. The suppliers with whom the manufacturers collaborate “are more or less always the same”, there is tendency “to be fairly faithful to suppliers who give good performances”, but there is no “bilateral exclusivity with them, let’s say that the relationship is preferential”. In fact, the manufacturer certainly prefers someone in particular, “but if then manufacturer has to do a certain project and this one is not in the vendor list, it must go to another one”. Therefore, we can say that “these are more opportunities arising from projects that allow manufacturers to cooperate with a partner, then the relationship consolidates, but there isn’t a common market strategy or common strategic choices. Let’s say these are more habits consolidated over time only because partners got along in previous experiences”. Partners develop experience working together, accumulating specialized information and know-how; in this way partners can

communicate more efficiently and effectively. So, there are a few opportunities to establish solid and lasting relationships that "allow an exchange of opinions at a technical level", or "a consultation regarding specifications and technical problems". Similarly, "privileged relations are established with historical customers, which also lead to a transfer of know-how" from the manufacturer to them. In the same way, a high degree of human asset specificity can be established through long-standing relationships with commercial agents in foreign countries; agents that are dedicated to market the products of a single manufacturer, but also in this case there are usually no monetary investments. So, in general, there is no need for investments to create the necessary human asset specificity, but this consolidates over time with the most recurrent actors, even if manufacturers are always very careful in sharing the minimum. The motivations that have pushed few manufacturers to invest and exchange this intangible asset are different. Someone did it in the field of professional training through ValveCampus, someone else did it to develop innovative products together with a competitor, someone else to train staff in foreign production plants, and someone more to train important local partners in order to give better assistance to customers. There are therefore no main trends or motivations that push manufacturers to invest in the transfer of know-how through human resources, in fact almost no one would be happy to do it in the future. Usually, investing in know-how transfer is the result of a particular need or market opportunity; and it is still done with caution, trying to share the bare essentials.

	Important Factors for Joint Investment Decisions			
	Length of Safeguards	Voulme of Transactions	Revenues Prospects	Relationship History Commitment and Trust
Total (14)	4	5	5	10
SMEs (8)	1	4	4	5
Large or Multinationals (6)	3	1	1	5
Commodities (8)	1	2	4	6
Engineered Solutions (6)	3	3	1	4

Table 6 - Most important factors that manufacturers, for each category, consider while taking decisions about co-invest or not in partnership-specific assets (perception).

Relationship history, commitment and trust have proved to be the most important factors to take into account when evaluating the possibility of co-investing together with another firm. In particular, a lack of trust in the candidate partner, as well as its bad name, nip any possibility of collaboration in the bud. During the information gathering, it emerged that it is not so much the **volume of transactions** between firms that weighs on investment decisions, but rather the **revenue prospects**. The prerogative of having substantial revenue

prospects is legitimate, and is usually the basis of any investment appraisal, whether in an individual or collaborative context. “Maybe if the volume is important, it’s possible to digest more easily some divergences, some conflicts”. In fact, most of the investments in partnerships-exclusive assets are undertaken in order to meet the needs of a particular customer or market that guarantees a large volume of business as a return. However, we can notice that SMEs and manufacturers of hardly differentiable products give particular weight to the prospects of revenues. For a SME, investing in partnership-exclusive assets is a very onerous challenge that must be well reflected; while for a manufacturer belonging to a multinational group, revenue prospects have less weight, since the same plant in a given geographical area can be shared and exploited by several manufacturers of the group, maybe bringing limited benefits to the single subsidiary, but giving an overall advantage for the entire multinational. Indeed, investment decisions are always taken at corporate level. Moreover, we can notice that the manufacturers that engineer ad hoc solutions tend to give less importance to revenue prospects; in fact, for them the proximity to the customer is advantageous in order to offer tailor-made solutions and services that strengthen more and more relations with the customer. The **length of safeguards** turned out to be the least influential factor in the decision-making process; “it is important when there are previous reasons that cause doubts about trust”.

1.2. KNOWLEDGE AND INFORMATION SHARING THAT BOOSTS JOINT LEARNING

The majority of manufacturers operating in this sector haven’t regular patterns of inter-firm interactions that permits the transfer, recombination or creation of specialized knowledge, namely inter-firm knowledge-sharing routines. In fact, know-how is a very important value, and manufacturers “try to leave as little as possible the know-how generated within their boundaries”. “SMEs stand up also thanks to the preservation of their peculiarities”. “We are selfish, but it’s our survival”. Instead, occasional contacts are more widespread, especially when there are opportunities for the cogeneration of new ideas and innovations or engineered solutions. With the term "occasional", we refer to relationships that haven’t long-term objectives, but are the result of one-off occasions. Companies collaborate or cooperate for a short period of time, and once they reach their goal (e.g. develop a product or engineer an alternative solution) they may even never again entertain relationships in the future.

	Firms that Implement Mechanims to Share Knowledge and Information that Boosts Joint-Learning			
	Total	Cogeneration of New Ideas and Innovation	Inter-firm Information Sharing Routines	Inter-firm Know-How Sharing Routines
Total (14)	5	2	3	2
SMEs (8)	3	1	2	2
Large or Multinationals (6)	2	1	1	0
Commodities (8)	4	1	3	2
Engineered Solutions (6)	1	1	0	0

Table 7 - Number of manufacturers, for each category, that have implemented mechanisms or routines in order to share knowledge with partners (real facts).

	Firms that Only Occasionally Share Knowledge and Information that Boosts Joint-Learning			
	Total	Cogeneration of New Ideas and Innovation	Inter-firm Information Sharing	Inter-firm Know-How Sharing
Total (14)	8	6	3	0
SMEs (8)	4	2	2	0
Large or Multinationals (6)	4	4	1	0
Commodities (8)	3	3	0	0
Engineered Solutions (6)	5	3	3	0

Table 6 - Number of manufacturers, for each category, that occasionally share knowledge with partners, only when there are really interesting opportunities (real facts).

Starting from the **cogeneration of new ideas and innovations**, we have to remember that "R&D is something strongly related to the product sector in which firms operate, and many manufacturers actually sell commodities; the real work they do is to enhance their firm in order to be able to sell the commodity". The fact is that, most of the O&G sector items are "quite standardized products for years, there are no big innovations. The innovations mainly concern the materials, such as gaskets or similar, the design of the product is the same for at least 40 years". Therefore, "R&D must also be done in relation to the way of selling the product according to what manufacturers produce and want to sell, and to the market in which they intend to operate". "It's not just a marketing strategy, it's also organizational strategy, because they have to be able to bring the product from the production plant up to the consumer's hand".

Of course, there have been few firms undertaking the cogeneration of new ideas and innovations, for example F14 has "developed together with another manufacturer a new know-how for control valves, therefore for the regulation of flow, and they have created together a ball that wasn't yet on the market". There is an ongoing collaboration also between F11 and a manufacturer of gas turbines for the production of such products, but the

technology is the same for many years, so "there are more projects of continuous cost reduction, more in terms of optimization, efficiency and cost reductions". However, most of the times collaborations for cogeneration of new ideas and innovations are "occasional things, limited in that aspect, it is not something that then has a continuation for the development of who knows what". There are several occasional collaborations with universities, both for R&D and "to develop some applications, governed by specific contracts, or to validate some test results". It happens also that, "if there is a supplier who developed a new or innovative product, it proposes the product to manufacturers and they consider what to do". More rarely, to large manufacturers mainly, it happens that "there are situations sometimes where small firms have an idea for products, but they do not have the financial or manufacturing resources or whatever to do this; sometimes these firms come to manufacturers asking if they are interested in developing this new product line". Most manufacturers, therefore, prefer to have occasional relationships for the development of the few possible innovations in this sector. Furthermore, "it is more common for manufacturers to turn to the academic world rather than the industrial world". On the other hand, there are very few manufacturers that consider "advisable to have a team dedicated to the co-development of new innovations". In conclusion, the few possible innovations are developed internally, but occasionally they can be traced back to suppliers' (much rarely customers) initial ideas, or there can be manufacturers turning to universities for R&D.

Inter-firm information sharing routines are not diffused and they are not considered so beneficial. This because the O&G sector is by nature rather transparent from the point of view of information, in fact all tenders are public, out in the open, and there is therefore a great flow and exchange of information concerning the market and its actors. Furthermore, there are many associations that bring together manufacturers, EPCs and end-users; but these "associations hardly share know-how because there are competitors, they share information". "One of the main problems of associations is that they are actually a bit fake, because it is not clear the association purpose and the mission there is to do; so we can talk about relationships between friendly competitors and stop, but tighten, tighten, it's not possible to achieve something good ". In the FRI association, for example, there is sharing, "but up to a certain limit, because any competitor wants to maintain a certain control over its technology". "There are tests that the manufacturer pays totally, and therefore totally secret, but it's disclosed only what the manufacturer of the tested product wants, while there

are tests that are sponsored by the FRI and are therefore in the public domain". "Whoever has more money tests at its own expense and divulges what interests to it, whoever has less money to invest in R&D makes less tests, or tests with this association after having already tested the product in a private system", in order to promote its results. There are sometimes routines for sharing sensitive information internally to the groups, but these may be "not accessible to everyone, there is segregation of information". Usually manufacturers have to share bare essential information with suppliers of materials and outsourced processes (e.g. technical drawings, measurements and parameters for processing), but they try to share as little as possible this knowledge, that can be intended halfway between information and know-how, "without even entering into the merits of design". Even, few manufacturers "decided to do internally processes rather than outsourcing them, just to not grant mechanical processes to external suppliers giving them the possibility to see how designs and valves are made, which have their own inherent technological innovation". Others "try to never give the same firm 2 drawings that can lead to an argument, let's say".

As already mentioned, the philosophy of many manufacturers is: "I try to hold onto my knowledge". For this reason, not only **inter-firm know-how sharing routines** are not widespread, but also occasional inter-firm exchanges of know-how are completely inexistent, as manufacturers would feel even less secure to share know-how outside from structured and/or regulated contexts. For example, regarding the collaboration between F11 and the manufacturer of gas turbines, "the know-how of the thermodynamic part is held by the manufacturer that has the know-how of the gas turbine, instead, the part of mechanical construction and production is of F11". Therefore, even in this type of situation, know-how remains basically well separated. Sometimes firms may send personnel on the field during the start-up phase, but there isn't a real exchange of know-how. Instead there could be sharing of know-how with universities or other associations (e.g. ASME, UCC, AIMA), also to create innovations, but there are no routines. ValveCampus is an exception, in fact there are routines for the sharing of know-how among competitors, in order to professionally train staff in Italy. Through ValveCampus, manufacturers organize training sessions to train internal and external staff, everything is organized and managed collectively by the CEOs of the various companies, who meet regularly. "The meetings are used to define the programs and the training needs, from there they create training sessions and some of them alternately, technicians or others, make this technical presentation that also benefits

employees of competitors. Maybe there is a manufacturer technician who explains how a valve is designed in a certain way, and is feeding it to people who are employees of another manufacturer, hence formally competitors".

In order to have an **alignment of incentives** necessary to discourage free-riding behaviors and to foster transparent knowledge sharing, the first important thing is "that there are clear basic rules, as the collaboration is between two parties and the two parties must be honest in having this kind of relationship". So, there should be considered "a synergy with firms that are at the same level, therefore having the same line of thought and going hand in hand", have the same objectives, the same way of working, thinking, and that none of the two aim to prevail over the other. The problem is that partnerships are almost never equal, there is always someone with a greater weight; maybe through licensing agreements "one has the know-how and makes it usable to the other, so the one who makes it available tends to have also greater control". Many of the respondents, in terms of incentives alignment, think that "there is little to do; in the sense that it is very dangerous, it is a very dangerous market in which if one has a good idea it is better to keep it and not to wave it around". Anyway, we can say the alignment of incentives is based primarily on trust and binding agreements, but "binding agreements are binding up to 3 seconds later". For example, "there are agreements for non-disclosure of information that are made with suppliers regarding the design", as well as "documents of intellectual property and shared confidentiality of information". On some innovations developed internally there can be a patent speech, so sometimes it is asked "also to the licensee and others to countersign a non-disclosure agreement for confidentiality of information, because it is an important value". Unfortunately, some of the major licensees are reluctant to sign these agreements, because their know-how is focused on innovation, so "signing these things could potentially preclude them opportunities to develop their ideas". The contents of the protection contracts, as non-disclosure agreements, "are always quite vague things, and in reality manufacturers are never guaranteed against certain things, it is always something generally quite weak and not very protective".

"The legal framework of agreements is not sufficient unless there is a personal relationship of trust and esteem among the partners". "The relationship between firms is a relationship between people, so it also depends on that". It's important to "try to have an open and frequent dialogue, where there is an exchange of information and manufacturers can test each others little by little; but it is difficult to have something that guarantees someone's

honesty". Basically manufacturers have to rely on trust, but that must be supported by the facts, everyone must put something, "but when you're sitting at a table and you begin to realize that this one only takes and does not give you anything, then trust is missing and you begin to understand that it is profiteering". So, it's fundamental to have "frequency of contacts, dialogue, exchange of ideas and information, so it's possible to calibrate each other and also to see if the other one changes its mind, if it is taking a different way, etc.".

Some managers pointed out that "a segregation of information is surely one of the important things that could be implemented", "but this information must be segregated both in terms of physical space and in personal terms".

Finishing, it is good to remember that: "No one imagines that these contexts take place for ethical reasons or for social responsibility reasons, there is always behind the profit principle, in the sense that it must always be clear that the parties gain mutual benefit from collaboration". "When you say 'the business never sleeps', it's true, that is, money has no ethical value, profit is the principle that governs companies". "This must never be forgotten, because in any case a firm, unlike a group that can be: the friends, the football team or the class; must find an element of cohesion to be together". And this element is the profit.

In general, the **absorptive capacity** of firms operating in this sector is very high; not so much because they have developed interaction routines, but because the level of product differentiation is very low and therefore manufacturers have developed overlapping knowledge bases. Absorptive capacity is particularly high among suppliers and manufacturers (but also EPCs) operating in the Valve Area; while manufacturers and suppliers operating abroad are at a lower level, despite being very good in taking possession of information and know-how to emulate the Italians. In fact, especially with Italian suppliers, there have been direct, intimate and complete face-to-face interactions for many years; that have led to the establishment of informal relationships that allow to know well enough who knows what and where critical expertise resides within each firm. Even because we are mainly talking about SMEs (or SMEs that are part of large groups); so if we consider the "problem solving skills and competences of the staff, we discover that all the firms are standing for 4-5 people out of 100, who keep things going".

In summary, the manufacturers operating in this sector try to keep their know-how as secret as possible, sharing only the strictly necessary information. There are rarely opportunities to

collaborate for the development of certain innovations or engineered solutions, but these collaborations usually have a limited duration in time. In general, the sharing of knowledge according to structured mechanisms is not limited by the difficulty of unifying the information sharing system, but by the tendency to not want to leak certain types of information. This inclination doesn't vary a lot between SMEs: "We do not consider it opportune and useful, in our area, to make this information public or to pass it on to other people"; and large or multinational firms: "Ethically, our firm does not want an exchange of information and know-how with other firms". ValveCampus is a pearl in the dirt; in the past the owners of these family owned firms "were much more individualistic and much more aggressive, in a different industrial and economic context probably". The collaborative process that was followed to achieve the current results "wouldn't have been possible in the past, even culturally, there is more openness today on these issues, once there was total closure".

1.3. COMBINATION OF SCARCE RESOURCES AND CAPABILITIES

The majority of respondents don't think that combining scarce resources and capabilities with competitors could lead to generate competitive advantages. "It's impossible, if one goes into difficulty, the other does everything to let competitor die".

	Respondents' Perception on Combining Scarce Resources and Capabilities		Respondents' Perception on Lack of Cultural and Organizational Complementarity	
	It Leads to Value Cogeneration	It Doesn't Lead to Value Cogeneration	They Can Hinder Combination	They Don't Hinder Combination
Total (14)	4	8	7	2
SMEs (8)	1	6	4	1
Large or Multinationals (6)	3	2	3	1
Commodities (8)	2	4	4	1
Engineered Solutions (6)	2	4	3	1

Table 7 - On the left: Number of manufacturers, for each category, that think combination of scarce resources and capabilities can lead or not to value cogeneration (perception, some interviewees didn't give an answer). On the right: Number of manufacturers, for each category, that think cultural and organizational complementarity can hinder or not combination of scarce resources and capabilities (perception, some interviewees didn't give an answer).

It is very rare that there is a long-term combination of scarce or strategic resources, it can happen on demand; when there are peaks in work some resources can become scarce and manufacturers may need external support, for example for: storage, workforce or some processes. For example, the products that F5 can make are subject to "structural limits, in

terms of weight, there is a maximum of 150 tons". For this reason, in the past F5 has collaborated with a Venetian mechanical workshop for the production of large titanium evaporators and separators. This Venetian partner has shared its spacious workshop and equipment with F5. Even in this case, however, the collaboration was limited to a single project. If the situation should recur frequently, it would be preferable to proceed with "an acquisition of facilities to respond to requests for extra-normal dimensions", so there would be "the possibility of extending the items product category" and to be independent. Some processes can become a problem or a bottleneck in case there is a work overload, but in these cases there isn't a real collaboration, they are always necessary professional services that are bought and paid, sometimes facilitating formalities or giving discounts. However, "it is obvious that if a manufacturer has a scarce resource, as it's lacking or it doesn't have enough of it, it must go externally asking help to someone; while if it's clear that the situation is long-term, manufacturer tries to make some investments by its own in order to increase the resources, because if it's something that probably is lasting, at that point there's need to grow up". "If I am scarce, I try to improve, it is a selfish attitude". Then, "if in an optimization path, there's opportunity to create this relationship with others, that's fine"; because maybe it's better to outsource certain processes rather than making them in house, but it's still a performance that is given against remuneration.

Especially while approaching foreign markets, it may become necessary to use resources in combination with those of other local actors. If there is a demand for local content production, combining certain resources with local actors can give a competitive advantage in terms of quotation during the tendering phase, while in some countries it is even mandatory to participate to the tender. More rarely, the manufacturers consider the possibility of investing or sharing a "production site in a given country with a low labor cost". So, we are talking more of necessity than of opportunity. Few manufacturers have **shared facilities** (e.g. for production, assembly or testing) or **shared warehouses** (e.g. for spare parts and assistance) together with local firms, agents or suppliers, while the number of commercial branches is higher. The ownership of these facilities can be Italian or foreign, the casuistry is very varied even if some countries impose a local ownership (e.g. Algeria); but in general the specialized know-how-bearing technicians are Italian, while the unskilled labor and commercial agents are local. Anyway, manufacturers prefer to use "structures already in place, because it's less investment and they still get the return". Presence of

shared know-how resources in these situations are inevitable, even if Italian manufacturers try to reduce it to the bare minimum. There is mainly a sharing of commercial know-how with agents and commercial branches, sometimes a sharing of technical know-how in order to locally manage assistance, maintenance or production, but never a sharing of know-how related to the core production or engineering phases. "So the thinking head, if we can translate it in this way", the critical phases of great added value always remain in Italy. There are no cases of **shared equipment**, but few managers think that, since they "are using the same suppliers of outsourced processes, it could be nice to think about investments that may be addressed to the interests of many manufacturers".

So, complementarity of both firm and country specific resources between Italian and foreign firms should be a key factor in order to develop cross-border collaborations. The technical know-how of Italian manufacturers, combined with the unique local knowledge of partners in overseas markets, in terms of commercial, distribution, legal and bureaucratic capabilities, should result in a synergistic effect. Actually, it looks like Italian manufacturers aren't trying to look for excellent capabilities on which to co-develop who knows what synergies or VRIN combined resources. "Because in these emerging countries, partners are usually people who have a certain influence on decision-makers, but who don't know so much" about the business at a technical level. Therefore, manufacturers usually simply look for someone who is in touch and on good relations with local decision makers and customers, and who can be trusted. "And this is a very hard work". Because "a critical part of the development of new partners in these countries is certainly their intellectual honesty; in the sense that at some point it is necessary to provide drawings of the components, and after that it's difficult to know where those drawings end up"; and in general, agreements and governance mechanisms are not really protective from a legal point of view. This is the sore point of this situation. A significant experience is that of F14, who shared his technical know-how with a Malaysian competitor, which in turn had to share commercial know-how and certifications in order to compete together in Southeast Asia. Unfortunately, the partner has not fully fulfilled the promises made, and the collaboration has dissolved after a few years; now companies are once again competitors. F14 managed to bring their technicians back to Italy, but technical know-how spillovers have been inevitable. The sharing of know-how and information at the base of ValveCampus, on the other hand, allows firms to be able to

procure capabilities and intangible assets not readily available in competitive factor markets, such as reputation.

Most of the managers interviewed believe that absence of **organizational complementarity** between systems, processes and cultures can hinder and prevent the creation of good collaborative relationships. “The merging of firms is always an obstacle”. In fact, manufacturers “may not be complementary in their approach to the market”. Maybe the products and business lines of the two manufacturers are complementary on paper, “but one has a history on chemistry while the other has a history on refinery, so one is a little reluctant to invest on refinery, and the other is a little reluctant to invest on chemistry”. In particular, family owned SMEs would struggle to bargain with multinationals, because from the organizational point of view there is a lot of bureaucracy, they are very rigid and struggle in reaching compromises; while in the SMEs usually “there is the owner who is used to decide and to command”. “Between family owned firms everything would be much easier”, even if, even in these little manufacturers “there is always someone who is used to do always what he wants, and if there are two people with this mentality” it becomes difficult to get along. Therefore, some organizational and cultural differences, even with foreign countries, can hinder the sharing of resources necessary for a fruitful collaboration. “Because you’re basing yourself on your culture, on your way of working, on conceiving work, etc.; but others can have a totally different concept of work, which then floors you while operating together”.

It is very difficult to evaluate ex-ante to which benefits and synergies the sharing of scarce or strategic resources can lead. The projects, whether they are collaborations or not, “show their potential after start-up phase”. Although a subject can have access to accurate and timely information on potential partners, it is possible to have a clear vision of collaboration potential “only when there is a minimum state of progress”, essential to decide whether it is worthwhile to proceed or not.

1.4. GOVERNANCE MECHANISMS YIELDING TO LOWER TRANSACTIONAL COSTS

Regarding the mechanisms that govern the relationships between firms, whether they are occasional or long-term partners, it seems that there isn't a particular type of enforcing agreement preferred by manufacturers. There are several facets.

	Governance Mechanisms Implemented by Manufacturers that Yield to Lowering Transactional Costs		
	Third-Party Enforcement of Agreements	Self-Enforcing Formal Agreements	Self-Enforcing Informal Agreements
Total (14)	4	7	3
SMEs (8)	1	4	3
Large or Multinationals (6)	3	3	0
Commodities (8)	2	4	2
Engineered Solutions (6)	2	3	1

Table 8 - Number of manufacturers, for each category, that are used to (or prefer to) employ the different kinds of agreements. The answers are related to the manufacturers attitudes and to the main kind of actor with whom they are used to (or prefer to) interact and collaborate (real facts).

However, it is true that, despite the fact that often relationships are managed in an informal way, it is almost always essential to have something written and countersigned that can somehow protect both parties. "Because it's ok that manufacturers set some mechanisms, but it's true that from a certain point of view they must also protect themselves". Anyway, third-parties "can always enter in case of disputes", even if there is a relationship governed by a contract between firms. "There is never any agreement that says: <<If things do not go well: *Vino e tarallucci*.>>; if things are not right, they shall be subject to an arbitrary panel that follows certain rules". Because "if two partners decide that they no longer agree and want to stop, but they do not agree on how to stop, then there's need for a third-party". However, many argue that "the legal clauses of contracts are valid only up to a certain point", and that it is therefore impossible to really protect themselves. "This is all risk activity, full-fledged, so the law protects partners with all its times and its defects". Even if a foreign partner improperly takes possession of the technical know-how of an Italian manufacturer, it's not worth "going to sue a Chinese firm in China, because probably the costs are higher than the benefits". How has unfortunately happened to F14 and other manufacturers that ended up growing a competitor. While many interviewees consider the informal approach as "the only possible policy", although always supported by basic contracts, some prefer to have "very structured black-on-white arrangements", then "formal agreements subject to what may be

internationally accepted rules". Agreements made by third-parties that guarantee "all actors involved with severe penalties in case of non-compliance with the agreements".

Most of the time, relationships with **suppliers of materials and outsourced processes** are handled informally. This is possible only within the Valve Area, or at most in the Italian context, because these manufacturers have a great history of interactions and personal ties with suppliers that required substantial time to be developed. These informal safeguards, namely goodwill trust and reputation, are really difficult to imitate and can actually lead to a reduction of transaction costs between manufacturers and their suppliers. Especially in the SMEs, "they rely more on trust and less on contracts, and they try to manage things as serious people, also because there are often agreements made directly between the owners of the two companies, and then it's possible to avoid all the mechanism of the multinationals", which must respect hierarchies, roles and bureaucracy.

In general, informal relationships are established with **customers**, and sometimes there may be frame agreements. But the customer never makes binding connections with a manufacturer, because "the customer is always an actor who is on the other side of the barricade, and if manufacturers make mistakes it's ready to close and punish".

"Unfortunately there is no common rule for everything, the type of agreement depends on the country where partners are, because one thing is making an agreement with a Saudi or one from the Arab Emirates, one thing is going to Central-South America, or doing it in Europe or in Italy". It is a good habit to have "a cautious and incremental approach, so as not to immediately bind hands and feet", in order to be able to develop and adjust the agreement on the fly to respond to unforeseen changes. Maybe when partners "start collaborating there may be informal agreements based on trust, but when they start opening the wallet" there's need for written and clear rules for future reference, without exaggerating of course. In this way, "even a third-party or someone who takes over is able to give continuity to the relationship". In conclusion, the rule that applies basically for everyone is: "Better to flush before than fade afterwards".

2. BARRIERS (CHALLENGES)

2.1. ASSET INTERCONNECTEDNESS

Inter-firm asset interconnectedness occurs when there are cumulative investments and exchanges on an existing stock of assets, that can be in part property of a given firm and in part property of its partner. Partners may need to create such **cumulative bundles of joint investment decisions** in order to conclude the highest potential that might flow from the investments. For example, when a manufacturer decides to co-invest and/or share a production plant abroad, it must also provide for the necessary production equipment and tools. These, in turn, like the facilities, can be the result of an investment or a contribution from one or more partners, who decide to share the necessary machinery and tools.

Many of the managers interviewed believe that the initial phase is particularly critical. To commit to the creation of bundles of relation-specific investments, "clearly, there must be a motivation"; and it's not easy "to identify where this possibility lies", this opportunity that motivates an investment of time and resources. "It is difficult and challenging to evaluate the pros and cons, to take decisions at the beginning", also because it is difficult to foresee collaboration continuity in such a volatile and fluctuating market, "it is a bet on the future". It's fundamental "to understand how much that particular area will generate in the future". "The strategic decisions to have local production presence are made to follow the market in a certain way and to have competitiveness", but logically it is necessary to estimate ex-ante "the volume that a given investment can bring"; even if "making predictions about the future is a very difficult thing". Projects "show their potential after start-up phase", because you can see their real potential "only when you have a minimum state of progress, which is essential to be able to take a final decision". Because "in reality the project starts from a fraction of an idea, it is not a complete thing, then it gradually gets richer and becomes something".

While in Italy there are no significant experiences of interconnection of assets, abroad these usually start with the opening of commercial branches where there is an interconnection of technical and commercial know-how, but there is almost nothing from the point of view of tangible assets (i.e. maybe offices). If the geographical area results promising, there could

be further investments and shares of tangible and intangible assets, for example to have a spare parts warehouse or to offer assistance and maintenance services. As the strategic importance of a given area grows, investments and sharing of production facilities can become economically viable, and consequently there is a need for the equipment and technical know-how necessary for the production phase. The level of interconnection of assets is therefore growing in these situations, and closely related to the potential that the reference market reveals.

Many of the managers interviewed, once the start-up phase is over, consider not a big problem to increase the bundles of relation-specific investments from a purely monetary point of view. Despite this, logically, the manufacturers' hope is to identify local partners who have already existing structures, in order to invest less money. What can hamper the creation of these bundles of relation-specific investments is:

- **Bureaucracy of multinationals**: For manufacturers part of multinational groups, "a type of investment of this kind has an internal approval process that is not so immediate"; actually it's very long. There is "a whole series of projects and therefore approvals, priorities, etc.", moreover they "must involve everyone, the central management, operations development, etc.".
- **Entrepreneurship in family businesses**: "Let's not forget that the structure of Italian SMEs is familiar, this in Italy hinders the outlook for a managerial approach to the thing and therefore inevitably these types of relationships are managed in an emotional way by the owners", who share or cede decision-making power with difficulty.
- **Jealously of know-how**: Italian manufacturers are very jealous of their know-how and in every situation they try to share the bare minimum. The know-how is therefore an asset that is shared reluctantly and sometimes this can block the 'snowball' cumulative effect over the bundle. An appropriate segregation of information and know-how, however, can be very useful to increase the level of interconnection by reducing the risk of know-how spillovers.

The difficulties that may arise from the presence of inter-firm interconnected assets, on the other hand, are mainly linked to the management of the assets themselves. In these contexts,

it can be difficult to "keep the two entities separate" and at the same time co-manage the business in an efficient and linear way, it requires great mutual trust.

2.2. PARTNER SCARCITY

Manufacturers go "in function of what the market offers, and geographically the market offers in disparate geographical locations, and in different times". It's important to never forget that collaborations can take place only if there is a need to be satisfied or an opportunity to be exploited. Therefore, "it is also difficult to understand in which areas it's possible to collaborate, because no one even sit at the table to think about it, there is a little fear to bind and change the equilibria". Then it is difficult to find the appropriate partner, because "however it is not easy to understand, to find, to work, to follow it before deciding, to understand what experiences it has". "If a person looks for a person who is his mirror, he will never conclude anything, but if a person is convinced that in order to take a step forward he needs a partnership, he enters a new dimension from which one gives value to the other one, and this is the first step to explore the opportunities". "An attitude towards this activity must also be developed, so let's say that it would be advisable to have an evolution of the corporate culture in order to develop a sensitivity towards this issue".

	Difficulty in finding a partner (AVG)	Why is it Difficult to Find a Partner?				
		Appropriate Actors Lacking in the Network	Poor Selection and Evaluation Capabilities	Partner's Unwillingness	Firm's Unwillingness	Lack of Collaboration Experiences
Total (14)	3,75	10	3	1	2	1
SMEs (8)	3,71	6	0	1	2	0
Large or Multinationals (6)	3,80	4	3	0	0	1
Commodities (8)	4,00	5	2	0	1	0
Engineered Solutions (6)	3,50	5	1	1	1	1

Table 9 - On the left: Average difficulty that manufacturers, for each category, have in finding a partner (perception, on a Likert scale from 1 to 5). On the right: Main reasons why manufacturers, for each category, have such difficulty in finding a partner (perception, some interviewees pointed more than one reason).

The respondents of this study, on average, believe that's quite difficult to find the right partner for achieving their goals. Logically, the **partner scarcity** is closely related to the objective of the collaboration itself, but it also depends on who is proposing the collaboration. Some candidate partners are less interesting and appealing than others. "Normally when firms see a serious manufacturer, they are always keen to find a partner as this". For example, a firm with whom there are good relationships for many years is a perfect candidate partner, and manufacturers can also "go for the quickness because they know the

people already". On the contrary, practically nobody wants to collaborate with a competitor, because "there is no willingness to go and share any kind of information that can favor one or another".

Family owned SMEs with a high-level know-how are not open to collaborate, as they jealously protect the knowledge that is the source of their success. In addition, a small manufacturer may appear as an unattractive partner in the eyes of larger firms. Some partners, "being much larger, prefer to make an acquisition".

Furthermore, "there are differences from country to country". For example, "on raw materials in Italy everything is well established and developed for many years, so finding new partners is very difficult". Abroad there are more opportunities, at least theoretically, because in reality "maybe they come from a totally distant and different market sector", and even if "they have a certain influence on the decision makers", then it can be difficult to make the collaboration work.

Most of the respondents, in conclusion, complain about a **lack of appropriate actors in the network**. In some situations, "if a partner doesn't want, manufacturers choose another one, if they still aim at achieving that particular goal"; while "if what manufacturers are looking for is not what is currently on the market, in the end they cannot partner". "The research that should be done is always in order to raise the 'bar', so manufacturers have to find people who raise the 'upright elements' in such a way that it's possible to raise the 'bar', because if a manufacturer take people with 'uprights elements' as high as theirs, it's not worth it".

Important Characteristics in Partner Selection (average results on a Likert scale from 1 to 5)					
	Total (14)	SMEs (8)	Large and Multinationals (6)	Commodities (8)	Engineered Solutions (6)
	(AVG)	(AVG)	(AVG)	(AVG)	(AVG)
Potential Partner Characteristics					
Actor Size (Turnover)	3,21	3,50	2,83	3,17	3,00
Product/Service Type and Quality	4,15	4,38	3,80	4,09	3,94
Problem-Solving Capabilities	4,43	4,13	4,83	4,48	4,66
Resources and Skills Complementarity	3,93	3,63	4,33	3,98	4,16
Collaboration Experience and Motivation	3,86	3,75	4,00	3,88	3,94
Financial Stability and Solvency	4,00	4,13	3,83	3,98	3,91
Project Features					
Duration	2,55	2,57	2,50	2,54	2,52
Complexity	3,18	3,00	3,50	3,25	3,38

Table 10 - For each manufacturers category, is shown the average importance of the different potential partner characteristics and project features (perception, on a Likert scale from 1 to 5).

Analyzing the **potential partner characteristics**, we tried to understand which are the most important characteristics, that are crucial for manufacturers when choosing a partner:

- **Actor Size (Turnover)**: The size of the partner company turned out to be relevant, but depending on the activities in which a manufacturer wants to collaborate. For some activities, such as logistics, it could be better a large partner that guarantees a widespread presence and timeliness on a certain territory; for other activities, such as outsourced processes, a SME partner would be better to guarantee flexibility and attention to the manufacturer. In general, however, manufacturers belonging to multinational groups are "highly structured firms that have internal mandatory procedures with different steps, which make everything very long in time". For this reason, where possible, manufacturers always tend to prefer a collaboration with a SME that doesn't give rigidity problems. As can be seen from the values shown in the table, the SMEs are the most careful about the size of the partner. In particular, the SMEs are reluctant to establish partnerships with multinational firms, as they would feel oppressed and would have minimal decision-making power.
- **Product/Service Type and Quality**: For Italian manufacturers, who make high quality products, it is essential to find a partner that can guarantee a quality at least similar to theirs. Indeed, if "products are perceived on the market as quality products", it can be dangerous to associate with someone who can outshine the manufacturer with its poor quality products. The quality of the products is the most important element especially for SMEs, manufacturers that partly have still an entrepreneurial approach, and therefore traditionally still put a lot of dedication and passion in what they produce.
- **Problem-Solving Capabilities**: In reality, staff competence "is not completely measurable", a firm's problem-solving capabilities cannot be assessed a priori. "Problem solving capabilities, at long last, can be seen when a problem arises". "From the inside firms look very imperfect, even if then products come out because there is an oversized system, but if we enter into the problem solving capabilities and staff competences, you discover that all firms are standing for 4-5 people out of 100 that make things working". The important element on which it's possible to rely is the **nature of leadership,** instead. "Because the nature of leadership essentially qualifies the **business climate**, the business climate leads to the improvement of

problem solving skills and staff competences". Especially in the modern economic scenario, where there is a great global mobility of people, "the patrimony of a firm is quite evanescent from this point of view". Therefore, they aren't so much the problem solving capabilities and staff competences that influence the choice of the partner, because they are difficult to measure; but rather the business climate and the nature of the leadership are of great importance. Once considered this reasoning, however, it's possible to state that the business climate and the nature of leadership are the most important characteristics on which basing partner selection. After all, the collaboration idea "always starts from two people, just two in number, who if trust each other by instinct, then can arise a starting point for subsequent analyzes". Large firms and multinationals are more convinced of the importance of this factor. This is probably linked to the fact that, having had more interactions and collaborations (both temporary or lasting) at group level, they had the opportunity to experience directly how the nature of the management itself is decisive for qualifying the partner attitude towards collaboration.

- **Resources and Skills Complementarity**: This feature is important, but remains slightly overshadowed by other features. As previously mentioned, the SMEs that want to collaborate abroad to meet local content requirements, are looking for a reliable (that can be trusted) partner who has good connections in the area. Other resources and capabilities, as well as their complementarity, has usually little influence. Manufacturers part of multinational groups, on the other hand, having already a widespread presence in different countries, evaluate with a more critical eye the complementarity of resources and skills, in order to optimize the group presence in different areas.
- **Collaboration Experience and Motivation**: The manufacturers' managers interviewed don't boast a high number of collaborative experiences in their past, and consistently do not pretend that their partners have them. "It is obvious that if they have experiences it is better, but if one does not have a previous experience, but shows that he can still do that math...". On the other hand, if there are bad rumors about a possible partner on the market, this is often enough to exclude the possibility of collaborating with that firm.

- **Financial Stability and Solvency**: "The financial part is becoming very problematic", in the period after financial crisis especially. It is essential to have a partner financially stable, but as in any other industrial sector, it doesn't seem an issue particularly critical for the O&G market.

Flexibility has proved to be a very important factor for partner selection, especially when it comes to suppliers of materials and outsourced processes. Flexibility is very important in this IPBSC, because manufacturers "typically have to move very fast" in order to meet the customers needs. Small and medium suppliers, in particular, can guarantee great flexibility to manufacturers, namely their historical customers, working sometimes also on shifts or on public holidays. In this way, manufacturers can deal with orders respecting content and delivery times, even in the event of unforeseen events or changes on the project.

Despite the manufacturers "have to be involved before the project really starts", their "supply lasts around one year", while the project normally lasts 3-4 years. Therefore, the manufacturers analyzed have a rather limited visibility of the project, the manufacturers only deal with their scope of supply, interacting from time to time with other manufacturers of complementary products. This because most of the products offered by the manufacturers analyzed, in economic terms, represent a really small fraction of the supply necessary to develop and build the entire project. "It's not that the valve is one of the main supplies of the project"; while products such as heat exchangers, boilers and engineered solutions in general have a greater importance and weight on the whole project. The majority of opportunities for collaboration "come and go in the context of the specific project". In these situations, usually "the range of options is limited, because while looking for a collaboration on a project in order to buy something that is missing, it is often mandatory to move within the scope of the project vendor list". For these reasons, project features are less important when choosing a partner. Because in the case of short-term collaborations, first of all manufacturers need to satisfy the customer's needs at best, if possible, turning to companies with whom they have historical relationships. While long-term partnerships also have long-term objectives, such as the achievement of a specific market for example, hence manufacturers have to consider mainly potential partner characteristics that may help in reaching the objectives. Anyway, here are some considerations on the **project features**:

- **Duration**: It's the least influential feature, as manufacturers usually deal only with the supply of their components. Once manufacturers have provided requested

products, usually in quite standard periods, they disregard the progress of the project unless issues related to their products arise.

- **Complexity**: It's possible to state that a project becomes complicated as the supply order fragmentation increases. "The complexity of the project also pushes manufacturers to look for partners, because where they cannot manage to arrive on their own", they need external support. Especially for large manufacturers and multinationals, that maybe have to supply many different product categories, the complexity of the project can have a weight on the choice of the temporary partners.

Now that the characteristics determinant for partner selection have been analyzed, it's therefore possible to understand where the **lack of appropriate actors in the network** comes from. Whereas the Italian industrial fabric has stable and long-standing relations for years at country level, there are few possibilities for new partnerships, so let's take a couple of considerations on foreign markets. The two most important characteristics, namely **product/service type and quality** and **nature of leadership and business climate** (replacing **problem-solving capabilities**), are those where foreign local partners are weaker. Although it may be difficult to match the quality of Italian products, the majority of foreign manufacturers do not have this sensitivity and focus on quality, they prefer to focus on cost optimization. Moreover, cultural differences and the widespread lack of intellectual honesty in certain countries, reduce the confidence of Italian manufacturers towards these foreign firms. This amplifies the differences, or at least their perception, between the business climate of the two firms, also reducing the affinity at leadership level, and as consequence Italian manufacturers take a more cautious approach.

2.3. RESOURCE INDIVISIBILITY

In some collaborations partners can combine resources or jointly develop their capabilities in order to obtain idiosyncratic and indivisible resources. Despite the high value and non-replicability that these resources can achieve, coevolving they can create a resource-indivisibility problem. Resource indivisibility can undermine a firm's ability to use its decision-making power over resources initially bestowed. The risk is to limit one's ability to control, manage and redeploy the resources at will, leading to potential flexibility losses.

Resources indivisibility, however, doesn't seem to worry too much the manufacturers considered in the study; unless they go to "operate in areas that have a certain risk context". "Who has the leadership tries to keep the leadership on its own resources", even if it could "require attention and efforts". It is essential to guarantee this leadership from the beginning, otherwise the collaboration would have no reason to take off. Maybe not everything will be perfect, "because maybe the blanket becomes short", but "it's a must to be able to keep under control the added value brought to the JV by the firm". In any case, when a manufacturer commits to a collaboration, this usually represents "a fairly low percentage compared to the global business of the manufacturer".

While some manufacturers, having left no significant collaborative experiences behind them, didn't want to count one's chickens before they hatch; others would be worried about a possible loss of flexibility, rather than about a loss of control over their resources or about the difficulty in redeploying resources. Collaboration, "certainly risks to restrict a little certain practices", as there would be new priorities and influences to be considered while normally running the business. However, even if it does not seem problematic to maintain the leadership on the resources made, there is always the fear that there may be know-how spillovers.

2.4. INSTITUTIONAL ENVIRONMENT

Institutional environment can potentially encourage or foster trust among trading partners; on the other hand, it may not lend itself to cooperation and can raise transaction costs. There are some countries, such as South Korea, that have been very proactive in defining an institutional environment that fosters the development of collaborations. "It is also politically the government, the state, which pushes a lot, subsidizes a lot, incentives a lot; there are also organizations in Italy, too, but Italian manufacturers still have to take a cultural step, because in the end participants express intentions, they sit at the table with all the positive intentions, then when they get to the point, each one try to push its own way". There are also incentive plans that are created periodically to open production facilities in certain countries; these are forms of protection based on "a business guarantee fund which, to be activated and exploited, however, needs some requirements". For example, "the Minister of Trade or Foreign Affairs starts and makes an agreement with the Brazilian Minister in which they say: <<Mutual

credit insurance>>; so if the Italian sells in Brazil through the channel they created, or vice versa, they are insured; so small or big manufacturers know that if they start a business relationship with firm X, their money will be 90%-95% guaranteed by a higher-level third-party". Therefore, there are country-specific institutional environments that can make a certain country more or less desirable to the idea of undertaking business and/or collaboration.

	Main Institutional Environment Restrictions Perceived by Italian Firms			
	Legal Restrictions	Organizational Restrictions	Political Restrictions	Cultural Restrictions
Total (14)	11	8	8	8
SMEs (8)	5	5	4	6
Large or Multinationals (6)	6	3	4	2
Commodities (8)	7	4	3	3
Engineered Solutions (6)	4	4	5	5

Table 11 - Number of manufacturers, for each category, that perceive the presence of the different kinds of restrictions (perception, each interviewee has expressed its concerns about none, one, some or all kinds of restrictions).

The fact, however, is that the **legal, organizational, cultural and political restrictions** that hinder collaborations are much more than the institutional environments that facilitate them. "So, the cultural and political restrictions, more political than cultural or legislative, don't come from the direct relationships between partners, but it is the general geopolitical picture that can prevent these relationships". "Because everything can work on paper, but then there are some hurdles, perhaps insurmountable, dictated by culture, international restrictions, etc.". Restrictions can have a local or a global magnitude, as well as they can influence other restrictions in certain situations:

- **Legal Restrictions:** At legal level, as already widely discussed, there is the problem of local content, whose requirements may vary from country to country. For example, in Algeria Italian manufacturers "must make a firm where by law the Algerian has the majority share". While in Italy there are no real legal restrictions. The underlying concept is that in many developing countries there are legal restrictions for foreign manufacturers that want to do business in that particular country. These restrictions imply that foreign manufacturers must "meet all local rules" having a minimum percentage of local production in order to operate in that market. The ultimate goal of these governments is always to have a certain percentage of local GDP, possibly combined with an increase in know-how on the

territory. Another legal restriction, especially for collaborations or acquisitions among major competitors, can be represented by the international antitrust rules. "EPCs and oil companies do not look favorably on this type of collaboration", because in fact they reduce the competitiveness within the vendor list, reducing customers' bargaining power. It must be said, however, that "in this sector the market shares are very diversified, there is no one who has 30%, it's very fragmented". Thus, there are "more market, marketing and market share consequences". This because it's actually difficult that the antitrust guarantor intervenes, but there are the oil companies (end-users) and EPCs that maybe decide to put the two manufacturers that are collaborating on blacklist, no longer accepting their offers. Quite rarely there may be problems related to the intellectual property of the product, rather than clauses or limitations on liabilities. Other legal problems can arise when defining the duration of a collaboration and the methods that should be followed to extinguish the relationship. It can happen that "deciding to leave when you want may become difficult". "The escape route is always the biggest obstacle, because doing collaboration is even quite simple, at that beginning everyone is enthusiastic, but it is the termination that becomes critical, and the costs that can derive from it". In conclusion, in reality "there are no particular problems in the legal definition of agreements, if not the complexity of the management of extra-national contracts, which can however be overcome with a good legal partner".

- **Organizational Restrictions:** SMEs don't want to collaborate with multinationals, even for an issue of incompatibility and organizational restrictions. In fact, the rigidity of bureaucracy and the lack of lasting interpersonal relationships is a problem for family owned SMEs, who are used to make agreements and take decisions even with few phone calls only. "Those who interface with a multinational undergo a bit this bureaucratic aspect". If a multinational "would like to open a partnership with any partner, the times would be biblical, there is no flexibility in this sense. The family owned firms are much more flexible, but also because the decision-making process is in the hands of one or two people". "Often it's enough a hand shake without even having a contract". In many cases then, "SMEs are yet undersized", so it can become a problem to understand which human, physical and monetary resources to employ; because "they may have the competence resources, but the time

is exhausted". Therefore, a manufacturer "must always take into account its own flexibility, because in some cases organizational restrictions can be a limit, certainly". Some organizational restrictions may also be a consequence of cultural differences and restrictions. For example, there have been "cases where women have not been granted a visa to access Saudi Arabia". It may also be difficult, in the case of a local JV, to handle trivial issues such as organizing the working week, as Muslims have holidays in different days than Christians. "Because you base yourself on your culture, on your way of working, your way about conceiving work, etc., but others can have a totally different conception of work, which then floors you at the operative moment".

- **Political Restrictions:** The O&G sector "has always been vulnerable to political situations". "In some countries it's difficult to supply for political reasons", for example in: Iran, Libya, Burma, Sudan, Syria, Nigeria, Russia, North Korea... Let's take the case of Iran. Until a few years ago it was possible to do business in Iran, but now US President Trump has put an embargo on the country. Many Italian manufacturers had excellent relations with Iranian customers and agents, some were also considering the possibility of investing and making JVs in Iran; this because the Middle Eastern country represented a substantial slice of business for these companies. Nowadays, instead, operating in Iran precludes companies from operating in many other countries, first of all the US. "An Italian family owned firm, maybe, hasn't such big businesses in US and prefers to monetize the opportunity on Iran, always remaining within the limits of the law, of course". However, although it is still possible to operate in Iran, "the world banks no longer move a single euro if Iran is involved, because they are afraid that there could be a retaliation towards the bank in the US". "So manufacturers cannot conclude any commercial transaction right now with Iran, simply they cannot get the money, and then the transaction becomes complicated". The global geopolitical situation changes very quickly, "there is always something casual, and manufacturers have to compensate with another market" if something goes wrong and they lose a market or part of it. The political restrictions, therefore, vary from country to country and can be linked to accessibility (e.g. need to have a visa to enter) and in some cases also to security (e.g. need to have the escort). "This hampers going to make agreements with firms where

access to the country is difficult". Furthermore, it is quite intuitive to understand how political restrictions can lead to further legal restrictions; like the embargo or more indirectly the question of local content.

- **Cultural Restrictions:** From a cultural point of view, each country is different and unique, but the interviewees know this very well, because the O&G is a macro-sector that connects many actors on a global scale. Logically "there are big differences in approaching different countries", as they manifest different needs, for this reason manufacturers must have openness to deal with stakeholders from all over the world. "The customer is an entity that isn't represented just by its wallet, but it is also an entity that has its own culture and its modus operandi; each customer must be treated differently, no general rules can be applied". The same can be said for a partner. But respondents agree in saying that the problem "is not insurmountable, it takes maybe a bit of time, maybe one must understand the other and then collaborate". Of course cultural differences and restrictions, if significant, can also lead to organizational restrictions, as mentioned above, but in reality "it's possible to get along with everyone, just as long as everything is clear". Manufacturers part of multinationals, in particular, are the firms that show the lesser problems towards cultural restrictions; as multinationals precisely. So, there are not such big cultural problems, "then each manufacturer has to understand the mentality of the partner, to adapt, to know what to do in presence of an Arab or an American". Some respondents think that, culturally, "the restrictions are more diffused in the Italian context", with reference to the jealousy of the know-how and the individualism that characterize the SMEs in this sector. "It is a question of Italian history that is evolving, but manufacturers still face more difficulties than other cultures in proactively collaborating". Although, apart from some rare exceptions like South Korea, neither foreign manufacturers collaborate a lot.

Chapter 6

Conclusions

According to the RV theory, successful collaborative initiatives between SCs members could lead to sustained differentiated performance, however, inter-firm collaboration often fails due to misalignment of incentives and strategies. RV theoretical perspective has usually been adopted in contexts where the SC was a well-established network overlooking a long-term time horizon. For this reason, it becomes interesting to investigate the co-generation of competitive advantages in temporal SC contexts. In order to fulfill this purpose, the thesis project investigated the SC relationships, strategies and performance in a multiple case study in the IPBSC. The main difference in this context is linked to the fact that SC participants may interact occasionally, just for project purposes, making it difficult to establish lasting collaborations or partnerships which go beyond the single project.

In particular, this study focused on industrial project-based supply chains (IPBSCs) composed by firms providing industrial products (e.g. valves, heat exchangers, boilers, gaskets, …) for projects related to the O&G sector. This because the vast majority of firms considered in the study have more than 75% of the turnover deriving from the O&G sector. It's important to distinguish IPBSCs committed mainly to industrial sector from IPBSCs committed mainly to O&G sector. Because there are significant differences in the structure and dynamics of the reference markets. The projects related to the O&G market follow a very rigid tender procedure, public, where there are well-defined vendor lists that guarantee competition among the participants. This because such kind of projects (e.g. oil extraction platforms, pipelines, refineries, power plants, ...) are of national interest and often have a

direct or indirect participation by governments. The customers themselves, EPCs and oil companies, qualify the manufacturers present in the vendor lists; and they are always the ones who, on the basis of a call for tenders, decide the manufacturers for a specific project. This situation, actually, severely limits the possibility of establishing long-term relationships with other actors in the SC. "In the sense that a manufacturer surely has someone that it likes more than someone else, but if it has to do a certain project and this someone is not on the vendor list, the manufacturer has to go to someone else". Differently, in the industrial sector the projects (e.g. chemical plants, textile plants, Food & Beverage plants, paper plants, ...) follow less structured procedures, bypassing the tendering phase in many cases. Therefore, there is the possibility of establishing more lasting relationships with customers, and consequently also with suppliers or competitors.

The Italian manufacturers considered for the analysis are concerned by the numerous challenges that the O&G market is placing in front of them. With the advent of the financial crisis and the subsequent oil price drop, the O&G market experienced a significant downturn and an increase in volatility. This situation has not only dramatically reduced the amount of market opportunities, but it has also led to a significant shortening in delivery times required by customers, with the introduction of penalties in case of delay. Another new threat, arisen from this situation, is represented by the competitiveness of Asian manufacturers (e.g. Indian and Chinese), who thanks to this downturn have managed to gain access and success on the market, offering products at low prices. To make matters worse, despite the products offered by Italian manufacturers are qualitatively the best on the market, these are products mature for decades and therefore have a very low improvement margin in terms of technological innovation and differentiation. The biggest challenge, however, is the growing demand for local content from developing countries. "This local content is the nightmare of every Italian manufacturer". The local content issue, nowadays quite relevant, arises from the fact that "each subject has a political interest in providing work in the area where the plant is built, or at least to involve actors of its interest". "Local content will be the strategic discriminating factor for supplies in this area over the next 15-20 years".

In this context, Italian manufacturers show some main **weaknesses**, common to most of the manufacturers considered for the study:

- "The business has moved a little further geographically". "This center of gravity has moved in the last 15 years, in the sense that Asian EPCs have become the most

important". "While in the past manufacturers were used to take the plane and go to Rome, Paris or London to do their qualifying audits, now they have to move to other places around the world".

- Italian manufacturers that have local production plants in foreign countries are a minority. And the idea of being able to have production facilities wherever local content is required is unthinkable.
- The high quality of Italian products implies high production costs, both for materials and for skilled labor. Furthermore, delivery is also expensive as the applications are mostly requested in non-European countries.
- The Italian industrial fabric is composed by many SMEs, although part of them has been acquired over time by multinational groups. The SMEs are often undersized and it is very difficult for them to devote resources to collaboration, for example in order to approach the markets where local content is required, because simply "the competence resource can be present, but time is exhausted".
- Smaller manufacturers have a narrow product portfolio, while multinationals tend to expand their product portfolio as much as possible. Finding a manufacturer with a broad product portfolio is very interesting for customers, who can simplify and reduce procurement costs by assigning the supply of different items to a single manufacturer.
- Generally speaking, Italian manufacturers, conscious of their products value, tend not to collaborate, in order to keep their know-how within firm boundaries. In many SMEs there is a strong sense of entrepreneurship. After all, "the Italian set-up of SMEs is familiar, this in Italy hinders the managerial perspective of the thing, therefore inevitably these types of relationships are managed in an emotional way by the owners". Therefore, there is no such a great willingness pushing Italian manufacturers to work together to face foreign competition.

On the other hand, however, Italy is a world quality leader in this sector, as well as the second exporter of this kind of products after China. The **strengths** of Italian manufacturers are in particular:

- Quality and reliability of products.
- Great experience and excellent engineering skills.

- Great attention to the customer, which allows Italian manufacturers to meet the needs, even unexpected, of the most demanding customers. This is also possible thanks to the high level of flexibility, in terms of design and delivery times, that especially SMEs can guarantee.
- Most of the manufacturers have a decades-long history, their name has over time become synonymous with quality for many customers, and they are therefore present on many vendor lists.
- In Italy there is the Valve Area (Brescia-Bergamo-Milano), an area where are located the main valves, boilers, heat exchangers and similar manufacturers for the O&G sector. "Around them, a whole network of firms specialized in various activities (e.g. painting, welding, heat treatments, …) was created, only for the O&G sector". "These possess a whole range of qualifications and certifications required by EPCs." Italian manufacturers helped these suppliers of outsourced processes in obtaining approvals over time. Over the years, very informal relationships have been established between Italian manufacturers and suppliers of different tiers, leading to great benefits in terms of costs, not only due to the proximity of the companies, but also for the trust relationships that have simplified the interactions reducing the transaction costs. This situation has also improved skills and products quality of every actor in the area. This industrial fabric is unique in the world and inimitable, because developed over the decades thanks to the continuous interactions of hundreds and hundreds of SMEs.

In light of the premises made so far regarding the reference sector, manufacturers' weaknesses and strengths; the following are the main **future objectives** of Italian manufacturers:

- Many manufacturers want to expand their product portfolio by adding complementary products, in order to be more competitive and attractive to customers.
- To find a local partner in the countries that represent the most important geographic markets. This is important first of all to have a commercial support that allows to deal with the customers of the area, secondarily it can be strategic for the start of local production that can satisfy local content requirements.
- To protect company know-how.

- To establish more and more exclusive and lasting relationships with end-users, in order to have preferential access to certain projects.
- To reduce costs and lead times for the procurement of materials, services and outsourced processes.
- To reduce costs of production phases of certain products that do not require specialized labor, delocalizing production in countries with a low labor cost.

In light of these observations, basing on RV theory, let's try to understand how Italian manufacturers can set SCCs, reducing their weaknesses and exploiting their strengths, to create a shared competitive advantage and jointly achieve common objectives. In order to do this, we analyzed both the current situation of their collaborations and the general perception of the interviewees regarding collaboration topics and opportunities, always under the RV theoretical lens.

1. Relational View Perspective Conclusions

We give an overview of the most effective **enablers** to co-generate a competitive advantage in the IPBSC analyzed.

When a manufacturer wants to collaborate with a partner to target a particular **foreign market** (be it a competitor or a manufacturer of complementary Italian products, rather than local a supplier or an agent), the most effective enabler to gain a competitive advantage against competitors is to do **exchange and investment in partnership-exclusive assets** for the **geographical approximation of assets**. This leads to a competitive advantage, as in many developing countries is spreading the habit of requesting a percentage of local content production. For this reason, manufacturers who have local production facilities are advantaged in tenders. Although only processes with a low added value, that doesn't need skilled labor, are usually relocated. Italian manufacturers must carefully weigh opportunities to understand which countries are most fertile, where there are EPCs and end-users that can guarantee generous revenues prospects. Usually, if a country or a customer is really such important in terms of sales for a manufacturer, it certainly already has local commercial agents or commercial branches; maybe it can even have warehouses for the storage of spare

parts and the provision of assistance and maintenance services. At this point, the wisest move is to co-invest locally with the current local partners (e.g. commercial agents, suppliers ...) or together with manufacturers of complementary products, so as to offer the customer a wider product portfolio. Subsequently to assets such as warehouses and production facilities, it will also be necessary to **invest in equipment and tools**; but usually Italian manufacturers prefer to avoid this monetary disbursement, by leasing the burden on the local partners and by **sharing only the know-how strictly necessary** for collaboration. This situation inevitably leads to a **combination of scarce resources and capabilities** that is needed to collaborate in the given country. In particular, Italian manufacturers share a part of the technical know-how (of which they are very jealous) to train local employees, while local partners support Italian manufacturers by sharing their commercial know-how. This over time leads to an increase in **human asset specificity** without a real investment involving a money outlay. Usually, however, no routines are **defined for knowledge and information sharing that boosts joint-learning.** This is because Italian manufacturers are justly jealous of their know-how, and try to share only the bare essentials, usually on an occasional basis, when opportunities arise. There are no particular **governance mechanisms** that can be used to effectively protect partners against possible opportunistic behaviors. The interviewees reported that contracts never really protected involved partners, so much that formal contracts can be formalized fairly, without placing too many constraints on partners.

When a manufacturer wants to collaborate with a partner on the Italian territory, instead, **exchange and investment in partnership-exclusive assets** do not appear to be particularly effective. Certainly **co-investment in partnership-specific equipment and tools** can help reduce the costs of processing required by suppliers of outsourced process, but there are not many examples of co-investments in such physical assets. With some suppliers there may be a high **human asset specificity**, which is not the result of monetary investments, but of a long series of interactions that have been taking place for many years among many Italian firms. This has led to the development of the precious know-how of Italian manufacturers and firms that work closely to them. Even in this case, however, there are no real structured **mechanisms for knowledge and information sharing that boosts joint-learning**. Rather, there are several examples of occasional sharing of know-how among the Italian actors of this IPBSC. When an opportunity arises for the **cogeneration of new ideas and innovation**, rather than the need to solve a particular problem in order to satisfy a customer, Italian

manufacturers do not hesitate to consult Italian universities or lower-tiers suppliers of materials, components and outsourced process. This, however, as mentioned, is an occasional technical discussion, which does not follow well defined procedures and is possible only between firms that have maintained good relationships for a long time. The real enabler that guarantees a shared competitive advantage to these Italian SMEs is represented by the **governance mechanisms** in place to manage their relationships. In fact, the high level of trust, respect and mutual esteem of many Italian firms, as well as the string of inter-firm relationships that characterized their past history, have led to an **informal management of the relationships** between manufacturers and suppliers of different tiers. This constitutes an enormous competitive advantage which, in addition to a reduction in transaction costs, allows a continuous improvement, albeit marginal, of the know-how of Italian firms. Among Italian competing manufacturers, however, there are still cultural barriers that must be demolished to collaborate, but something is changing with new generations, and ValveCampus is proof of this.

Now, we also give an overview of the most concerning **barriers** that may hinder the co-generation of competitive advantages in the IPBSC analyzed.

Respondents were not particularly concerned about barriers such as **asset interconnectedness** or **resource indivisibility**. Of course, the creation of **cumulative bundles of joint investment decisions** in some countries may be difficult for legal or bureaucratic issues, while sharing resources may result in **loss of flexibility due to long-term collaboration**; but for Italian manufacturers, they still seem to be situations manageable and not too problematic. **Partner scarcity** has instead turned out to be a real barrier. In Italy, basically, there seems to be no possibility of finding new partners. This because the Italian firms operating in this IPBSC have known each other for decades, their relationships are well established, and it is rare to have newcomers both at the level of manufacturers and at the level of lower tiers suppliers. Abroad, however, the candidate partners abound, but the candidates really valid are scarce. The main reasons are:

- **Low Products Quality**: Foreign manufacturers usually make low quality products; to make a partnership with them, for Italian manufacturers who make high quality products, would entail the high risk of putting their brand in a bad light.

- **Leadership Nature and Business Climate**: The idea of collaboration usually comes from 2 people, who, if trust each other and agree, can lay the foundations for the future development of such collaboration. Perhaps also due to cultural differences, however, it is often difficult to trust foreign actors. These often show little intellectual honesty, and the valuable know-how that Italian manufacturers should share, is often threatened by the possibility of embezzlement and spillovers.
- **Unwillingness of SMEs**: especially SMEs that still have a family approach, prefer to remain small and flexible, without being forced to cede part of their decision-making power.

Another great barrier is represented by the multiple restrictions imposed by the **institutional environment**. There are **legal restrictions** mainly linked to the presence of local content and embargoes in some countries, which are however the result of situations induced by **political restrictions**. There are legal restrictions from the point of view of competition, not so much for a possible intervention by the antitrust authorities, but for actions of contrast that EPCs and oil companies can undertake in order to punish and hinder horizontal SCC between competitors. Furthermore, always at the legal level, there may be patent issues, or various specific restrictions of the various countries. In terms of **organizational restrictions**, it is very difficult for SMEs, which are extremely flexible, to collaborate with multinational companies, which are extremely rigid and bureaucratic. Moreover, there may also be organizational restrictions induced by the cultural differences that may exist between Italians and foreigners, precisely at the level of the conception of the way of working itself. Finally, in a global market such as the O&G one, it is assumed that firms have to deal with various political and **cultural restrictions** on a daily basis. So, no matter how much obstructing they may be, Italian manufacturers have had to learn to live with it, sometimes trying to avoid them, sometimes countering them. However, there are also cultural restrictions at the Italian level according to many respondents. These are mainly given by the strong entrepreneurial spirit of Italian SMEs. Many Italian SMEs still have a family approach, and owners tend to manage the business in an emotional way, avoiding collaborations as much as possible. This in order not to share their know-how and without leaving neither a part of the decision-making power they have on their firm. On the contrary, managers usually tend to manage firms in a more detached and impartial way.

In conclusion, we can say that the **Relational View theory**, yes, is applicable in temporal contexts, such as in IPBSCs, but within certain limits. In fact, the RV theory was born to be applied in contexts where the supply chain is a well-established network and overlooks a long-term time horizon. The basic problem is that this theory doesn't take into account some aspects determinant in order to contextualize the SCs, such as:

- **Business Type** (What kind of products are produced? What marketing approach do we need to have to successfully market these products? What geographical scope does the business have?)
- **Reference Market Type** (Is it a free or regulated market? Does this market follow particular dynamics that characterize it and differentiate it from classic types?)
- **Opportunities and Necessities** (Are there any real opportunities that require SCC to be exploited? Are there any real needs that require SCC to be met?)

Thus, the RV theory is able to highlight which are the most effective enablers (mechanisms) to establish solid and lasting SCCs; as well as it's able to analyze the main barriers that hinder the formation of such collaborations; but it's not able to consider many important factors that characterize the SC and the reference market. Therefore, the application of RV theory alone, without appropriate context analysis, may be of little significance. This because, often, the importance (high or low) of a particular enabler (or barrier) is highlighted by RV theory, but the reasons for its importance (high or low) are not detected if they are rooted in contextual issues. For this reason, we can conclude that the RV theory becomes as less effective as we move away from the ideal context for which it was designed. The more we move away from the ideal context for which RV theory was designed, the more it is necessary to support its application with an appropriate analysis of the context in terms of SC characteristics, market characteristics, and business opportunities/needs.

2. Insights for Future Research

In light of what has emerged by analyzing the case studies with the lenses of the RV theory, in the future it would be desirable to deepen the research as proposed below:

The IPBSCs composed by firms supplying industrial products for O&G sector projects, as said before, have particular dynamics and follow very rigid, public tender procedures. Moreover, there are many geopolitical and cultural issues that can affect the businesses and the possibility to collaborate. For this reason, it would be interesting to analyze also IPBSCs composed by firms supplying industrial products for private industrial sector projects. In the industrial sector there are "very different customer-supplier relationships, knowing that is possible to work continuously". While in the O&G sector, there is always need "to restart from scratch, the offers are redone and the best one takes the job". The peculiar characteristics of the reference market can potentially influence SCC possibilities, therefore, in the industrial sector collaboration strategies could find more breeding ground.

Subsequently, it would be interesting to make a comparison between the scenario of IPBSCs composed by firms supplying industrial products for O&G sector projects, and that of IPBSCs composed by firms supplying industrial products for private industrial sector projects. Such analysis would be useful to analyze which enablers and which barriers occur in one context rather than another. In this way it could be possible to understand how the peculiar characteristics of the reference market, and which characteristics in particular, can affect or not the effectiveness of certain enablers and barriers.

In the future, it would be interesting to analyze an IPBSC that presents a different situation from the suppliers' relations point of view. The Valve Area represents one in a million industrial cluster, in which the participants managed to establish lasting and informal relationships over time. These relationships have ensured that valuable local know-how was cultivated, developing an industrial cluster of international importance. But what would the situation be like if manufacturers did not have such a solid and valuable cluster behind them? How would the relations with the sub-suppliers be managed in that case?

Finally, it would be interesting to analyze this case study also with the lenses of the Resource Based View, in order to then compare the results of the two analyzes. By doing so, it would be possible to understand if there is a correlation between the private resources of the partner companies and their ability to collaborate and share these resources in order to co-generate value. In this way it would be possible to identify the most important resources to be owned or researched in the partner, in order to successfully take on collaboration.

3. PRACTICAL CONCLUSIONS

In this final part there are some practical advices that will hopefully allow manufacturers to strengthen and consolidate their inter-firm relations in order to jointly improve their performance. Enablers and strategies effective in generating a joint competitive advantage vary according to the direction of SCC (i.e. vertical, horizontal and lateral). Because, logically, isn't possible to apply the same collaboration strategies while relating with suppliers, customers, competitors or agents.

3.1. SUPPLIERS OF MATERIALS AND OUTSOURCED PROCESSES

The Valve Area manufacturers have developed informal, solid and long-lasting relationships with the various suppliers of lower tiers; whether they are suppliers of materials, components or outsourced processes. The network developed over the years has proved to be a trump card for the success of Italian manufacturers on the market. Even if the Italian situation is stable, and the relationships have been consolidated for a long time, the suggestion is to intensify more and more the existing relations, trying to build new ones too. It would be possible to collaborate with the trusted suppliers in order to reduce the costs for the production of materials, components and outsourced processes, but also to shorten the order passive cycle and in general the delivery lead time. These objectives can be achieved by adopting lean management practices that extend upstream beyond firm boundaries, optimizing suppliers' storage, shipping and delivery activities.

Another idea could be to co-invest in partnership-exclusive equipment and tools of the sub-suppliers of outsourced processes, in order to reduce processing times and costs. This investment in equipment and tools could see the contribution of competing manufacturers that exploit the same suppliers and have common needs.

However, we must remember that, although manufacturers always try to address the most trusted regular suppliers, EPCs and end-users can impose suppliers at their discretion. It is therefore essential to evaluate costs and benefits basing on the recurrence of interactions, in order to understand with whom suppliers makes sense to deepen the collaboration.

3.2. COMPETITORS

Among direct competitors there seem to be few real opportunities for collaboration, at least in appearance.

However, it would be interesting to jointly develop "components that can be used by each manufacturer". Similarly, with regard to outsourced process suppliers, that are basically used by every manufacturer, could be nice standardizing certain types of processes and therefore investing in equipment and tools "that are addressed to the interests of several manufacturers". Thus, could be defined an all-Italian standard that allows "to get bigger volumes and be more competitive, attracting more suppliers and succeeding in obtaining better commercial conditions". The definition of technical standards at the Italian level increases the compatibility of products offered by different Italian manufacturers. This can be considered an added value by the end-user, who will benefit from a high degree of compatibility between its plant components and applications. In addition, the end-user will be potentially subject to a lock-in effect on Italian manufacturers, thus creating switching costs for end-users who decide to abandon the products of Italian manufacturers.

Based on these considerations, it would be interesting to expand the role of ValveCampus by building Italian hubs in foreign countries. In these hubs it's possible to employ both Italian technicians jointly trained in ValveCampus and local workforce able to satisfy local content production requirements. By paying close attention to properly segregating information and know-how, these hubs could be devoted to assembly, testing, assistance and maintenance services (in particular regarding the aforementioned standardized components and low value-added processes in general) for all the Italian manufacturers who contributed in investments because interested in that specific geographical area. Instead, it would be appropriate to keep the commercial functions separate, as each company has tailor-made strategies to approach the various customers. Even if commercial agents can still exploit these hubs as a point of support, meeting and eventually exchange. In this scenario, manufacturers would have the opportunity to be present locally in many different countries, where now, alone, they cannot afford to arrive. Generally, reliability and promptness of Italian manufacturers would greatly increase in the eyes of customers, but as a group, no longer as individuals.

"If I lose an order, I prefer that is a competitor from Bergamo to take it rather than a Chinese., because if it's taken by a competitor in Bergamo, I know that it will increase know-how, efficiency and effectiveness levels of all suppliers that I also use. "

3.3. SUPPLIERS OF COMPLEMENTARY PRODUCTS

By investing abroad with manufacturers of complementary products, it would be possible to reduce operating costs and investment expenditures; while at the same time could be possible to offer discounted product bundles that are competitive and interesting for customers. Such collaboration is much more desirable among manufacturers of complementary products rather than between competitors. However, unfortunately, there may be some repercussions. We must remember that EPCs and end-users tend to impose the manufacturers participating in the project through the use of vendor lists, so it is necessary to "always keep an open door". And here the problem arises. For example, "when a valves manufacturer embraces an actuators manufacturer, the market is greatly reduced". This because, if valves manufacturer is the only one winning the tender, it would be forced to go to interface with a different actuators manufacturer who, being aware of the joint venture in progress, certainly will not propose favorable conditions to the valves manufacturer. Therefore, collaborating and investing abroad with a manufacturer of complementary products is an opportunity that must be assessed very carefully. Of course, if both the manufacturers have great relationships with a particular customer, and this customer grant both of them with interesting revenues against local content production, there is a great opportunity for a JV.

3.4. CUSTOMERS: EPCS AND END-USERS

"In the end, the customer is always one who is on the other side of the barricade, and if mistakes are made it is ready to close the door and punish". It is very difficult to establish solid and lasting relationships with EPCs and end-users, because these define a tender for each new project, starting from zero each time and putting manufacturers against each other in order to reduce CAPEX as much as possible.

For SMEs, however, it can be strategic to establish a "lasting and exclusive" relationship with the end-user (with the EPC it is even more difficult); not so much for a question of

revenues that may derive from engineering consultancy, spare parts or revamping projects, but rather to gain a general customer loyalty, whom will know that it can rely on a devoted, helpful and reliable Italian manufacturer. In this way, a manufacturer, if particularly appreciated, could become one of the notorious manufacturers that are imposed in the vendor lists by the end-user. Therefore, to establish more and more exclusive relationships, to find the right agents and local partners to better meet the needs of customers and to closely follow most important customers investing locally (against guarantees on order volumes), casts the manufacturer in a positive light from the end-user point of view, giving an opportunity for an increase in future orders and revenues. Moreover, if, as some of the interviewees foresee and hope, end-users should start cutting out EPCs to reduce costs, having solid and lasting relationships with end-users would become strategically crucial.

All the considerations made, however, fall more in the category of marketing strategies, rather than in collaboration strategies; because there are no common objectives and the efforts of the manufacturer are addressed to increase the turnover.

3.5. AGENTS AND SERVICE PROVIDERS

In many countries it is necessary to have local agents or partners to do business. The most profitable countries have a great strategic importance, so it's necessary to select the local agents and partners very carefully. In fact, these, in many cases, can represent a starting point for the settlement of local commercial branches, warehouses and subsequently production facilities. Unfortunately, "a critical part of the development of new partners in these countries is certainly their intellectual honesty". It is therefore essential to carefully segregate information and know-how, "both in terms of physical spaces and in terms of personnel", in order to avoid precious knowledge spillovers.

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