POLITECNICO DI MILANO

School of Industrial Engineering

Master of Science in Mechanical Engineering

Management of Uncertainty in Engineer to Order (ETO) Operations: the case of Danieli SpA

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Abstract

Uncertainty problem happens almost in all production operations, specifically in large production based operations which the amount of uncertainty bring more destructive consequences; So for large production projects, various Engineer To Order (ETO) methods are assumed for facing and preventing of it. Although we can analysis different risk management method in theory, there are some challenges which make difficulties in practice. In this thesis we want to show possible solutions for resolve uncertainty problems and find appropriate suggestion to prevent this kind of problems.

In chapter one of this thesis, first we describe uncertainty problem which is defined by the difference between the information that is necessary to make a reliable decision and the information that is available; secondly we describe the ETO supply chain which analyzes the projects that suffer from delays in completion, budget overrun and quality defects. After that, we discuss the role of uncertainties on various levels of ETO manufacturing planning and control by presenting some previous researches which studied in ETO criteria. Then we describe different procedures of risk management to prevent or overcome the issue and some relative project management method; at the end of this chapter major practical challenges to implement these risk management methods are described.

In next chapters we analyze overweight problem in a "cold leveler" project as our case study. The project is for a Chinese customer and "Danieli Wean United" is the supplier. For this case study, firstly we have a brief overview of the Danieli Company based on strategic and technology approach and introduction of Danieli information system like; RIO, JET, DDMS. Then we explain the role of project manager duties in ETO and EPC operations by assuming three main constrains in all projects; scope, cost, and time. Moreover we define the crucial role of PM in all projects in order to reducing percentage of allocated contingency during the operation of project.

For the case study, first we introduce a background about Chinese project and compare Danieli Company to other competitor's offer, later we introduce what happened during Kick of meeting and RIO of this particular project. Then we analyze the weight of some items by considering both estimated weight (by commercial office) and calculated one (by technical office) in order to recognize the amount of extra cost. For studying the overweight in more detail we consider this problem also from commercial office point of view.

To overcome the overweight problem of this project, we need to consider a variety of solutions and relative advantages and disadvantages of each solution and by comparing these solutions we can find the best answer which is able to reduce the extra cost of the overweight problem for this particular project. Survey of these solutions showed that some of these solutions are not applicable for some projects, due to specific limitations of the project.

Finally, Due to the reason that wrong estimation of weight can happen for future project with prototype components; we recommend to have more communication between commercial and technical departments during preparation of the offer. Moreover in order to achieve better result during offer phase, Danieli should allocate some extra budget for evaluating projects that contain new components.

Chapter 1

INTRODUCTION

1.1 Uncertainties in Project-Based-Operations

1.1.1 Uncertainty

Uncertainty is given by the difference between the information that is necessary to make a reliable decision and the information that is available. A common source of this type of uncertainty is engineering decisions taken on an early information basis, leading to changes that again may lead to alterations in the project supply chains, e.g. termination of one supply chain and activation of another. Uncertainty has to be dealt with actively, and that has given rise to uncertainty management as a specific topic within project management. Though, the most important aspect related to uncertainty is that it is treated consciously and proactively, it should not be allowed to just 'happen' Our success derived from deliberate front end planning , not from good luck randomly drawn from possible future states of nature. We were lucky in the sense that we were not hit by randomly drawn states of seriously bad luck' (Heyerdahl 1999)[1].

As stated above, uncertainty management should be deliberate and start early in the project, or even before one has defined a project, i.e. in the front-end phase. It should be part of 'good management', not left to 'luck', i.e. bad management. As such the approach to uncertainty management should be developed and established already in the front-end phase.

A project is an endeavor characterized by uncertainty. Uncertainty is on the top level related to the value of the business opportunity to be exploited and the risk to the financial and resource commitments needed to exploit the business opportunity. This two-sided picture of uncertainty, balancing business opportunity and risk are essential for understanding supply chain management in the project-oriented[2].

1.1.2 Engineer to Order (ETO)

The Engineer-to-Order (ETO) supply chain is almost associated with large and complex project environments and can be defined as a supply chain in which customer order penetrates the design

[1] Heyerdahl 1999

[2] Bjørn Egil Asbjørnslett 1978

and engineering phase of the product (Gosling and Naim, 2009)[3]. Many projects suffer from delays in completion, budget overrun, and quality defects. In many cases, client requirement cause delays, leading to the changes in the product specification. Engineering changes (ECs) are inevitable during the order management process, especially on large and complex projects. Kocar and Akgunduz (2010)[4] reported that ECs can consume as much as one-third to one-half of the engineering capacity. Thus, the importance of proper change handling is unquestionably crucial for a company's competitiveness. Despite of their significant impact on the ETO manufacturing environment, it is actually not too surprising to see the lack of research done in ECs within the context of logistics and supply chain management. This is because most of the published research in supply chain management has already neglected the ETO sector itself (Hicks et al, 2000)[5].

ECs lead to modifications in shape, function, material or dimension of a product .Eventually, the need for synchronization between engineering change, material management, suppliers, and project schedule becomes unavoidable. Thus, engineering change process becomes a rather complex process, involving different disciplines both within the company itself and from physically dispersed supply chain partners (Terwiesch and Loch, 1999)[6].

Hence, this is further extending the EC process to a collaboration issue across supply chain actors in the ETO manufacturing environment. In order to handle ECs properly, supply chain partners should have an integrated system and build a unified collaboration network (Kocoglu et al 2011)[7].

Companies in all sectors are examining ways to reduce costs, shorten product development times and manage risk. The transactions between companies in supply chains are characterized by adding value up through the chain and incurring costs (and consequent payments) down the chain. Supply chain management aims to reduce costs, risk and lead-times associated with these transactions, thus

[3] Gosling and Naim, 2009

[4] Kocar and Akgunduz

[5] Hicks et al., 2000

[6] Terwiesch and Loch, 1999

[7] Kocoglu et al 2011

releasing value. There is limited research into supply chain management in the low-volume Engineer to Order (ETO) sector[8].

The characteristics of Engineer to Order (ETO) companies are described in terms of their markets, products and the internal processes of their organization. These are set in the context of current trends in supply chain management. The business processes associated with the purchasing and marketing functions and the interactions with other processes are analyzed. These are compared for a number of different types of ETO Company. The variety of work in ETO projects, the customized, complex products and the underlying uncertainties of markets all indicate that procurement and marketing need to be integrated with other processes. These characteristics put constraints on the application of established supply chain management methods.

1.1.3 Uncertainties in ETO manufacturing planning and control

Uncertainties play a role on various levels of ETO manufacturing planning and control. At the strategic level, economic developments or the political climate force decision makers to deal with uncertainties. At the operational level there are many sources of uncertainties, such as inaccurate processing times or resource breakdowns or problem relative to overweight during different phase of project. For an extensive taxonomy of uncertainties on the operational planning level we refer to Aytug et al. (2005)[9].

Work content of activities: The work content of an activity is generally an estimation based on historical data or the experience of the planner or the customer. The accuracy may vary considerably depending on the nature of the activity or the required resource group. For instance, consider the under water damage of the Jonah. The damage cannot be inspected before dry-docking, so it is hard to make a reliable estimation of the work content of the repair activities. Furthermore, the disaggregation of activities into operations for operational planning is a considerable source of uncertainty because of priority of relations, setups, or multi resource requirements. We refer to this uncertainty as disaggregation uncertainty.

[8] C. Hicks 1999

[9] Aytug et al.2005

Occurrence of an activity: The occurrence of some activities may also be uncertain. A test or inspection activity may, for instance, result in additional work that was not expected. In the Jonah example, dry-docking and inspecting a ship may reveal additional repair work. For example, once the ship is dry-docked, manholes can be opened, revealing the condition of the ballast tanks.

With respect to the occurrence of an activity, weather conditions may play a role, or the ship owner may decide to postpone less critical repair activities.

Resource requirements of an activity: At the tactical level engineering has often not been completed. As a result, resource requirements of some activities may be uncertain.

Capacity availability: If a resource is expected to be unavailable for a long time it should also be accounted for on the tactical planning level. Consider, for instance, the risk of personnel being on long sick leaves. The availability of no regular capacity can also be a major source of uncertainty.

Precedence relations: Precedence relations may also be a source of uncertainty. Suppose the damage of the Jonah is located closer to the engine compartment than expected. Activities that were initially planned in parallel, for instance, burning out a damaged section of the ship and working in the engine compartment, may then have additional precedence relations.

Release dates: Release dates can depend on special material requirements or special activities upstream in the supply chain, which can result in uncertainty in the delivery date.

Rush orders: Rush orders are a typical source of uncertainty for ETO production. At any moment a rush order can arrive, which may have such high strategic priority that other orders have to be re-planned to give precedence to the rush order. In the situation of the ship repair business, rush orders are common practice[10].

Uncertainties affecting supply chain operations are recognized as significant obstacle to achieving value for customers. As a result, researchers in the field of operations management and supply chain management have examined sources and types of supply chain uncertainty and strategies to cope

[10] thesis_Gerhard Wullink

with such uncertainties (Childerhouse and Towill, 2004; Mason-Jones and Towill, 1998; Prater et al., 2001; van der Vorst and Beulens, 2002; Wilding, 1998)[11].

One strategy for coping with uncertainty is to build flexibility into the supply chain. Flexibility is generally perceived as an adaptive response to environmental uncertainty (Gerwin, 1993)[12]. More specifically, it is a reflection of the ability of a system to change or react with little penalty in time, effort, cost or performance (Upton, 1994)[13]. The link between uncertainty and flexibility is well established, with many researchers outlining the importance of flexibility in coping with uncertainty (Prater et al., 2001; Tang and Tomlin, 2008)[14]. Flexibility has been researched in a number of different areas relating to operations management including manufacturing flexibility, supply chain flexibility and transport flexibility.

1.1.3.1 Literature Review

Davis (1993)[15] suggests that the underlying problem when managing complex networks is "the uncertainty that plagues them". Understanding the sources of supply chain uncertainty and managing these uncertainties is clearly of interest to researchers and practitioners alike. A useful definition of supply chain uncertainty is offered by van der Vorst and Beulens (2002)[16]: supply chain uncertainty refers to "decision making situations in the supply chain in which the decision maker does not know definitely what to decide as he is indistinct about the objectives lacks information about its environment or the supply chain lacks information processing capacity is unable to accurately predict the impact of possible control actions on supply chain behavior or lacks effective control actions".

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[11] Childerhouse and Towill, 2004; Mason-Jones and Towill, 1998; Prater *et al.*, 2001; van der Vorst and Beulens, 2002; Wilding, 1998

[12] Gerwin, 1993

[13] Upton, 1994

[14] Prater *et al.*, 2001; Tang and Tomlin, 2008

[15] Davis (1993)

[16] van der Vorst and Beulens (2002)

Uncertainty and risk are very often confused or used interchangeably. Raftery (1994)[17] proposes a continuum with risks on one extreme, quantifiable, data driven and open to statistical testing, and uncertainties at the other, based on subjective probability and informed opinion. This is supported by Rodrigues Et Al. (2008)[18] who argue that risk is a function of outcome and probability and hence it is something that can be estimated, uncertainty, on the other hand, occurs when decision makers cannot estimate the outcome of an event or the probability of its occurrence. The two concepts are clearly closely related and intertwined. Uncertainty increases risk and risk is a consequence of uncertainty.

Mason-Jones and Towill (1998)[19], building on Davis (1993), developed the uncertainty circle model to conceptualize the different sources of uncertainty that affect supply chain performance. The uncertainty circle classifies supply chain uncertainty into four general types: process, supply, demand and control. Process uncertainty affects internal abilities to meet a target. Supply uncertainty results from poorly performing suppliers handicapping value adding processes. Demand uncertainty is associated with specific customers in relation to schedule variability and transparency of information flow. It also refers to the difference between the end marketplace demand and orders placed by customers. Control uncertainty affects the ability to transform customer orders into targets and supplier raw material requests. It has subsequently been refined and applied in a number of different ways (Rodrigues et al., 2008) and, therefore, it is considered as a suitable basis for use in this paper and a convenient way to categorize the disturbances encountered in construction projects[20].

Project heterogeneity and the resulting uncertainty or risk is well documented. Differences such as location and the amount of projects within an overall program and the amount of technological uncertainty have been described in the literature. (Evaristo and van Fenema, 1999)[21] a considerable

[17] Raftery (1994)

[18] Rodrigues et al. (2008)

[19] Mason-Jones and Towill (1998)

[20] Gosling_and_Naim

[21] Evaristo and van Fenema, 1999

amount of published material relating to project risk analysis and assessment is available (Ackermann et al., 2007; Mustafa and Al-Bahar, 1991)[22]. Risk management has also been a popular area for researchers (Al-Bahar and Crandall, 1990; Conroy and Soltan, 1998)[23]. Much of the risk management literature seeks to establish formal risk management processes, protocols and management tools and techniques.

A number of strategies have been proposed to cope with uncertainty. A possible solution is to reduce uncertainty. Childerhouse and Towill (2004) show how reduction of supply chain uncertainty can lead to benefits associated with inventory, cost, market share and profitability. Another strategy is to respond or mitigate uncertainty via building flexibility into a system. Tang and Tomlin (2008)[24] develop models to demonstrate the power of flexibility to mitigate supply chain risks and uncertainties. They provide a convincing argument for firms to build a degree of flexibility into the supply chain. Other researchers have also highlighted the link between uncertainty and flexibility and have developed models and definitions.

1.2 Risk Management in Project Based Operation

Overview of Project Risk Management

Project Risk Management includes the processes concerned with identifying, analyzing, and responding to project risk. It includes maximizing the results of positive events and minimizing the consequences of adverse events.

"Figure 1–1" provides an overview of the following major processes:

1.2.1 Risk Identification—determining which risks are likely to affect the project and documenting the characteristics of each.

1.2.2 Risk Quantification—evaluating risks and risk interactions to assess the range of possible project outcomes.

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[22] Ackermann et al., 2007; Mustafa and Al-Bahar, 1991

[23] Al-Bahar and Crandall, 1990; Conroy and Soltan, 1998

[24] Tang and Tomlin (2008)

1.2.3 Risk Response Development—defining enhancement steps for opportunities and responses to threats.

1.2.4 Risk Response Control—responding to changes in risk over the course of the project.

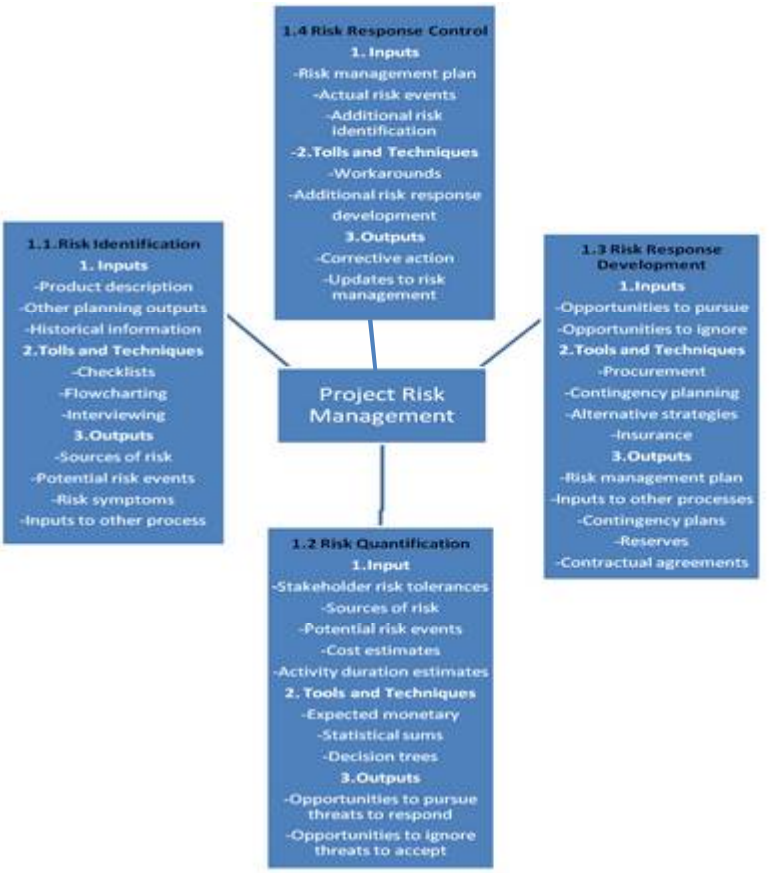


Figure 1 - Project Risk Management Overview

These processes interact with each other and with the processes in the other knowledge areas as well. Each process may involve effort from one or more individuals or groups of individuals based on the needs of the project. Each process generally occurs at least once in every project phase.

Although the processes are presented here as discrete elements with well-defined interfaces, in practice they may overlap and interact in ways not detailed here.

Different application areas often use different names for the processes described here. For example:

- Risk identification and risk quantification are sometimes treated as a single process, and the combined process may be called risk analysis or risk assessment.
- Risk response development is sometimes called response planning or risk mitigation.
- Risk response development and risk response control are sometimes treated as a single process, and the combined process may be called risk management.

1.2.1 Risk Identification

Risk identification consists of determining which risks are likely to affect the project and documenting the characteristics of each. Risk identification is not a onetime event; it should be performed on a regular basis throughout the project.

Risk identification should address both internal and external risks. Internal risks are things that the project team can control or influence such as staff assignments and cost estimates. External risks are things beyond the control or influence of the project team such as market shifts or government action.

Strictly speaking, risk involves only the possibility of suffering harm or loss. In the project context, however, risk identification is also concerned with opportunities (positive outcomes) as well as threats (negative outcomes).

Risk identification may be accomplished by identifying causes-and-effects (what could happen and what will ensue) or effects-and-causes (what outcomes are to be avoided or encouraged and how each might occur).

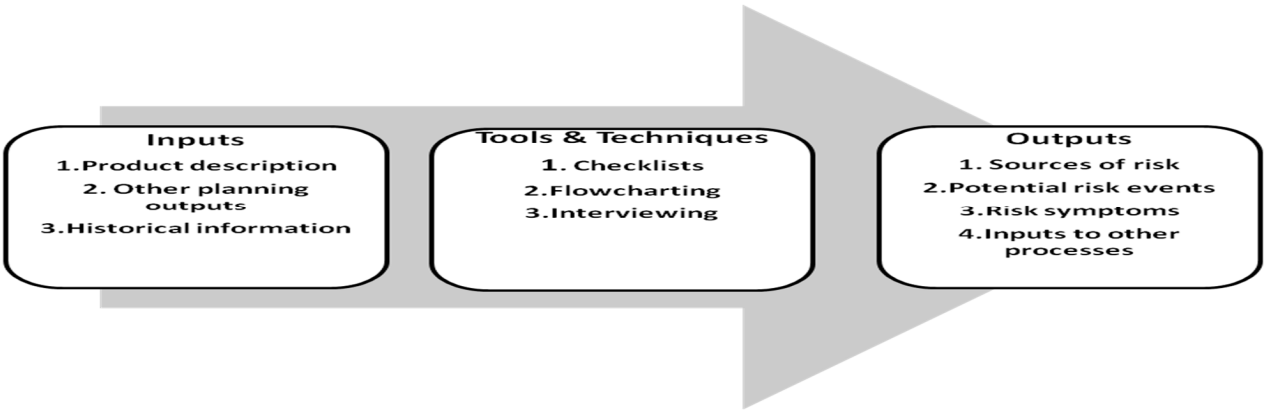


Figure 2 - Risk Identification

1.2.1.1 Inputs to Risk Identification

1. Product description

The nature of the product of the project will have a major effect on the risks identified. Products that involve proven technology will involve less risk than products which require innovation or invention. Risks associated with the product of the project are often described in terms of their cost and schedule impact.

2. Other planning outputs

The outputs of the processes in other knowledge areas should be reviewed to identify possible risks. For example:

- Work breakdown structure: non-traditional approaches to detail deliverables may offer opportunities that were not apparent from the higher-level deliverables identified in the scope statement.
- Cost estimates and duration estimates: aggressive estimates and estimates developed with a limited amount of information entail more risk.
- Staffing plan: identified team members may have unique skills that would be hard to replace or may have other commitments that make their availability tenuous.
- Procurement management plan: market conditions such as a sluggish local economy may offer opportunities to reduce contract costs.

3. Historical information

Historical information about what actually happened on previous projects can be especially helpful in identifying potential risks. Information on historical results is often available from the following sources:

- Project files: one or more of the organizations involved in the project may maintain records of previous project results that are detailed enough to aid in risk identification. In some application areas, individual team members may maintain such records.
- Commercial databases: historical information is available commercially in many application areas.
- Project team knowledge: the individual members of the project team may remember previous occurrences or assumptions. While such recollections may be useful, they are generally less reliable than documented results.

1.2.1.2 Tools and Techniques for Risk Identification

1. Checklists

Checklists are typically organized by source of risk Sources include the project context, other process outputs, the product of the project or technology issues, and internal sources such as team number skills. Some application areas have widely used classification schemes for sources of risk.

2. Flowcharting

Flowcharting can help the project team better understand the causes and effects of risks.

3. Interviewing

Risk-oriented interviews with various stakeholders may help identify risks not identified during normal planning activities. Records of pre-project interviews (e.g., those conducted during a feasibility study) may also be available.

1.2.1.3 Outputs from Risk Identification

1. Sources of risk

Sources of risk are categories of possible risk events (e.g., stakeholder actions, unreliable estimates, team turnover) that may affect the project for better or worse. The list of sources should be comprehensive, i.e., it should generally include all identified items regardless of frequency, probability of occurrence, or magnitude of gain or loss. Common sources of risk include:

- Changes in requirements.
- Design errors, omissions, and misunderstandings.
- Poorly defined or understood roles and responsibilities.
- Poor estimates.
- Insufficiently skilled staff.

2. Potential risk events

Potential risk events are discrete occurrences such as a natural disaster or the departure of a specific team member that may affect the project. Potential risk events should be identified in addition to sources of risk when the probability of occurrence or magnitude of loss is relatively large ("relatively large" will vary by project). While potential risk events are seldom application-area-specific, for example:

- Development of new technology that will obviate the need for a project is common in electronics and rare in real estate development.
- Losses due to a major storm are common in construction and rare in biotechnology.

Descriptions of potential risk events should generally include estimates of (a) the probability that the risk event will occur, (b) the alternative possible outcomes, (c) expected timing of the event, and (d) anticipated frequency (i.e., can it happen more than once).

Both probabilities and outcomes may be specified as continuous functions (an estimated cost between $100,000 and $150,000) or as discrete ones (a patent either will or will not be granted). In

addition, estimates of probabilities and outcomes made during early project phases are likely to have a broader range than those made later in the project.

3. Risk symptoms

Risk symptoms, sometimes called triggers, are indirect manifestation of actual risk events. For example, poor morale may be an early warning signal of an impending schedule delay or cost overruns on early activities may be indicative of poor estimating.

4. Inputs to other processes

The risk identification process may identify a need for further activity in another area. For example, the work breakdown structure may not have sufficient detail to allow adequate identification of risks. Risks are often input to the other processes as constraints or assumptions.

1.2.2 Risk quantification

Risk quantification involves evaluating risks and risk interactions to assess the range of possible project outcomes. It is primarily concerned with determining which risk events warrant response. It is complicated by a number of factors including but not limited to:

- Opportunities and threats can interact in unanticipated ways (e.g., schedule delays may force consideration of a new strategy that reduces overall project duration).
- A single risk event can cause multiple effects, as when late delivery of a key component produces cost overruns, schedule delays, penalty payments, and a lower-quality product.
- Opportunities for one stakeholder (reduced cost) may be threats to another (reduced profits).
- The mathematical techniques used can create a false impression of precision and reliability.

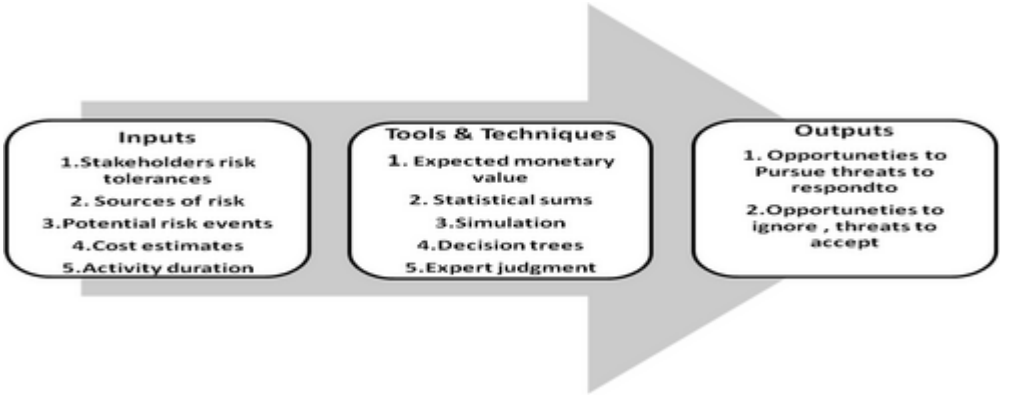


Figure 3 -Risk quantification

1.2.2.1 Inputs to Risk Quantification

- Stakeholder risk tolerances
- Sources of risk
- Potential risk events
- Cost estimates
- Activity duration estimates

1.2.2.2 Tools and Techniques for Risk Quantification

1. Expected monetary value

Expected monetary value, as a tool for risk quantification, is the product of two numbers:

- Risk event probability: an estimate of the probability that a given risk event will occur.
- Risk event value: an estimate of the gain or loss that will be incurred if the risk event does occur.

The risk event value must reflect both tangibles and intangibles. For example, Project A and Project B both identify an equal probability of a tangible loss of $100,000 as an outcome of an aggressively priced proposal. If Project A predicts little or no intangible effect, while Project B predicts that such a loss will put its performing organization out of business, the two risks are not equivalent. In similar fashion, failure to include intangibles in this calculation can severely distort the result by equating a small loss with a high probability to a large loss with a small probability.

The expected financial value is generally used as input to further analysis (e.g. in a decision tree) since risk events can occur individually or in groups, in parallel or in sequence.

2. Statistical sums

Statistical sums can be used to calculate a range of total project costs from the cost estimates for individual work items. The range of total project costs can be used to quantify the relative risk of alternative project budgets or proposal prices.

3. Simulation

Simulation uses a representation or model of a system to analyze the behavior or performance of the system. The most common form of simulation on a project is schedule simulation using the project network as the model of the project. Most schedule simulations are based on some form of Monte Carlo analysis .The results of a schedule simulation may be used to quantify the risk of various schedule alternatives, different project strategies, different paths through the network, or individual activities. Schedule simulation should be used on any large or complex project since traditional mathematical analysis techniques such as the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT) do not account for path convergence and thus tend to underestimate project durations. Monte Carlo analysis and other forms of simulation can also be used to assess the range of possible cost outcomes.

4. Decision trees.

A decision tree is a diagram that depicts key interactions among decision and associated chance events as they are understood by the decision maker. The branches of the tree represent either decisions (shown as boxes) or chance events (shown as circles).

5. Expert judgment.

Expert judgment can often be applied in place of or in addition to the mathematical techniques described above. For example, risk events could be described as having a high, medium, or low probability of occurrence and a severe, moderate, or limited impact.

1.2.3 Risk response development

Risk response development involves defining enhancement steps for opportunities and responses to threats. Responses to threats generally fall into one of three categories:

- Avoidance: eliminating a specific threat, usually by eliminating the cause. The project management team can never eliminate all risk, but specific risk events can often be eliminated.
- Mitigation: reducing the expected monetary value of a risk event by reducing the probability of occurrence (e.g., using proven technology to lessen the probability that the product of the project will not work), reducing the risk event value (e.g., buying insurance), or both.
- Accepting the consequences: Acceptance can be active (e.g., by developing a contingency plan to execute should the risk event occur) or passive (e.g., by accepting a lower profit if some activities overrun).

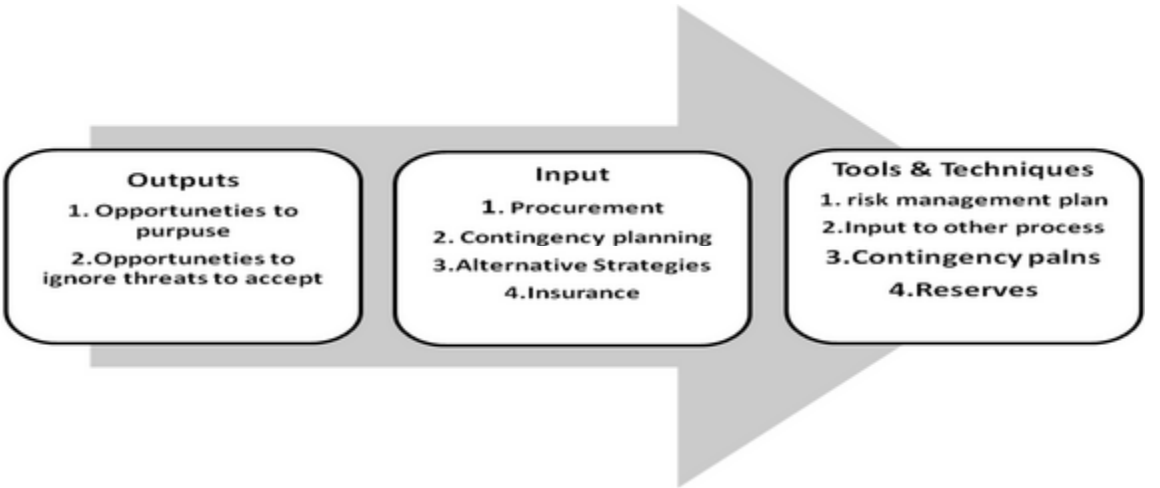


Figure 4 - Risk response development

1.2.3.1 Inputs to Risk Response Development

- Opportunities to pursue, threats to respond to.
- Opportunities to ignore, threats to accept.

1.2.3.2 Tools and Techniques for Risk Response Development

1. Procurement

Procurement, acquiring goods or services from outside the immediate project organization, is often an appropriate response to some types of risk. For example, risks associated with using a particular technology may be mitigated by contracting with an organization that has experience with that technology.

Procurement often involves exchanging one risk for another. For example, mitigating cost risk with a fixed price contract may create schedule risk if the seller is unable to perform. In similar way, trying to transfer all technical risk to the seller may result in an unacceptably high cost proposal.

2. Contingency planning

Contingency planning involves defining action steps to be taken if an identified risk event should occur.

3. Alternative strategies

Risk events can often be prevented or avoided by changing the planned approach. For example, additional design work may decrease the number of changes which must be handled during the implementation or construction phase. Many application areas have a substantial body of literature on the potential value of various alternative strategies.

4. Insurance

Insurance or an insurance-like arrangement such as bonding is often available to deal with some categories of risk. The type of coverage available and the cost of coverage vary by application area.

1.2.3.3 Outputs from Risk Response Development

1. Risk management plan

The risk management plan should document the procedures that will be used to manage risk throughout the project. In addition to documenting the results of the risk identification and risk quantification processes, it should cover who is responsible for managing various areas of risk, how the initial identification and quantification outputs will be maintained, how contingency plans will be implemented, and how reserves will be allocated. A risk management plan may be formal or informal, highly detailed or broadly framed, based on the needs of the project. It is a subsidiary element of the overall project plan.

2. Inputs to other processes

Selected or suggested alternative strategies, contingency plans, anticipated procurements, and other risk-related outputs must all be fed back into the appropriate processes in the other knowledge areas.

3. Contingency plans

Contingency plans are pre-defined action steps to be taken if an identified risk event should occur. Contingency plans are generally part of the risk management plan, but they may also be integrated into other parts of the overall project plan (e.g., as part of a scope management plan or quality management plan).

4. Reserves

A reserve is a provision in the project plan to mitigate cost and/or schedule risk. The term is often used with a modifier (e.g., management reserve, contingency reserve, schedule reserve) to provide further detail on what types of risk are meant to be mitigated. The specific meaning of the modified terms often varies by application area. In addition, use of a reserve, and the definition of what may be included in a reserve, is also application-area-specific.

5. Contractual agreements.

Contractual agreements may be entered into for insurance, services and other items as appropriate in order to avoid or mitigate threats. Contractual terms and conditions will have a significant effect on the degree of risk reduction.

1.2.4 Risk response control

Risk response control involves executing the risk management plan in order to respond to risk events over the course of the project. When changes occur, the basic cycle of identify, quantify, and respond is repeated. It is important to understand that even the most thorough and comprehensive analysis cannot identify all risks and probabilities correctly; control and iteration are required.

Figure 5 - Risk response control

1.2.4.1 Inputs to Risk Response Control

1. Risk management plan

2. Actual risk events

Some of the identified risk events will occur, others will not. The ones that do are actual risk events or sources of risk, and the project management team must recognize that one has occurred so that the response developed can be implemented.

3. Additional risk identification

As project performance is measured and reported potential risk events or sources of risk not previously identified may surface.

1.2.4.2 Tools and Techniques for Risk Response Control

1. Workarounds

Workarounds are unplanned responses to negative risk events. Workarounds are unplanned only in the sense that the response was not defined in advance of the risk event occurring.

2. Additional risk response development

If the risk event was not anticipated, or the effect is greater than expected, the planned response may not be adequate, and it will be necessary to repeat the response development process and perhaps the risk quantification process as well.

1.2.4.3 Outputs from Risk Response Control

1. Corrective action

Corrective action consists primarily of performing the planned risk response (e.g., implementing contingency plans or workarounds).

2. Updates to risk management plan

As anticipated risk events occur or fail to occur, and as actual risk event effects are evaluated, estimates of probabilities and value, as well as other aspects of the risk management plan, should be updated. (PMBOK)[25].

[25] (PMBOK)

1.3 Agile Project Management

1.3.1 Methods for Projects

Agile project management methodologies used to develop, deploy, or acquire information technology systems have begun to enter the vocabulary of modern organizations. Much in the same way lightweight and agile manufacturing or business management processes have over the past few years. High ceremony projects include projects based on formal or semi–formal project management methods, ones like Prince2, PMI's PMBOK, or processes based on the Software Engineering Institute's Capability Maturity Model. These methods are traditionally associated with organizations that operate in software engineering centric business domains. These domains view software activities as an engineering process, rather than a creative process based in the skill of individuals or small teams.

It is common to talk about Agile methods for modern project management processes in the context of a set of lightweight activities used to manage the development or acquisition of software. These activities include requirements, design, coding, and testing processes based on a minimal set of activities needed to reach the end goal, a working software system.

Although some of these Agile development methods address the management aspects of software projects people, processes and technology, they are primarily focused on coding, testing, and software artifact delivery.

Much like an overweight boat, airplane or athlete, the undesirable weight needs to be removed in order to increase the efficiency of the vehicle. This is a standard best practice in many engineering disciplines. One problem with this analogy though is that anyone suggesting a specific methodology is overweight must answer the question:
If a project management method were properly applied, in the proper domain, to the proper set of problems, with properly trained participants, would it be considered overweight and produce undesirable consequences?

The usual answer is no, of course not. If everyone were doing their job properly, in the proper engineering, regulatory, and contractual environment, then the results would be accepted by all the participants this is the definition of a tautology.

The problem of Agile project management methodology selection is compounded by the behaviors of the method as well as the behaviors of the participants using the method. In addition, the appropriateness of the method for a specific problem domain remains an issue. Making a process lightweight by removing activities or artifacts is most likely inappropriate and a possible source for project failure without careful consideration of the consequences. (Glen B. Alleman Niwot, 2002)[26].

1.3.2 Manage change like a pro with Agile project management

Busy teams looking for a way to control scope and improve project execution timelines turn to Agile project management.

The Agile method helps companies strike a healthy balance between cutting waste, cutting cost and preserving the quality of the product.

Along with delivering value to the customer in a quick and cost-effective way, Agile project management supports project complexities in a way that a traditional waterfall approach cannot.

With Agile, teams can:

- Deliver products more quickly
- Adapt to changes more easily
- Spend less time chasing information
- Improve execution timelines
- Facilitate teamwork and collaboration
- Save overhead cost of working on a project

Agile is an adaptive methodology that emphasizes iterative work, or change-driven work that is done within project cycles that entails team collaboration and ongoing involvement of stakeholders. Collaboration and stakeholder feedback are critical in an Agile environment, especially when the end result is unknown to some degree. In a typical Agile environment, iterations of work are presented during each phase. This allows teams to reevaluate the project based on stakeholder feedback and redistribute work accordingly. Working in increments, rather than completing the pieces of a project in larger chunks, provides a way for project teams to stay on track and for customers to get exactly what they want without overspending.

[26] Glen B. Alleman Niwot, 2002

Agile contains several flavors, or methodologies, which make it possible for Agile project management teams to tailor their approach to fit specific business needs. Sub sets of Agile include:

- Scrum
- DSDM
- Kanban
- Scrumban
- Extreme Programming (XP)

All companies are slightly different in their inner workings. Unique hierarchal structures, reporting mechanisms, the choice to outsource certain functions and unique business needs that are reactive to an overarching business climate are just some of the factors that drive the decisions companies make. The decision of which project management method to use is no different.

Depending on the way in which a company does business according to the current business climate, a company may focus more on saving costs or more on producing the best possible product. However; most of the time, companies want to save as much on costs as possible while preserving the quality of their product. The Agile method of project management helps companies strike a balance between cutting waste, cutting cost and preserving the quality of the product. Furthermore, Agile teams are able to get products to market faster, which helps them collect feedback on those products for future improvements. This contributes to a culture of continuous improvement and makes Agile teams very good at keeping up with the most up-to-date needs of customers.

How are Agile Projects Managed ?

Agile projects are typically managed by the team doing the work. Along with the project lead and an inner circle of stakeholders and/or product owners, projects are kept on track via brief daily stand-up meetings (usually centered around a project or stand-up board) and frequent interactions between team members. A stakeholder is a person who has mandated the

Project or funded the project (from a departmental budget). A product owner sets goals for the project, negotiates the scope of work and helps to prioritize the pieces of work once the scope has been decided.

Many Agile teams assign a project leader to officiate status meetings. The role of a project lead on an Agile team is also to ensure the team is focusing on the efforts that were agreed upon during project planning and to engage the product owner when questions arise. The project leader should be well-versed in Agile and should be able to coach individuals on how to work in an Agile environment while driving the project forward.

How Can Teams Benefit from Agile Project Management?

Teams can benefit from the Agile approach to project management in many ways. Here, we will explore two ideas that form the foundation of why so many teams have adopted Agile as a best practice.

1. Because customers usually cannot finalize business requirements until they have seen a prototype, Agile is suitable for open-ended projects.
2. Changing priorities within the business may impact any number of details related to a project, including scope and even the project's overall objective.

In an ideal world, business requirements for projects would be finalized before the project begins, and they would remain the same throughout the entire project. But we don't live in an ideal world. In the real world, business owners communicate business requirements using the information they have available at the time. However; when priorities change, so do business requirements. Due to the speed with which technology becomes obsolete, software development projects are especially prone to this type of change. It is difficult to accurately ask for something before you really know what you want, so project owners find themselves in the tough position of having to anticipate the true needs of their customers before the customers themselves even know exactly what that need is. Because this challenge is not likely to go away anytime soon, it has led to the wide adoption of iterative development methods including Agile and all its subsets.

Working iteratively enables teams to move projects forward without having to understand what the project fully entails. Iterative teams deliver small portions of the work during the project and provide the opportunity for customers to review the work and correct course based on changes in business requirements or priorities. This communication between the customer and the team allows for continued focus on high-value deliverables and helps control project cost by limiting wasted effort.

The Value of Agile Project Management:

Any team that is not currently using Agile work methods or practicing Agile for project management should examine the benefits. Long-term savings in project overhead costs and gains in return on investment (ROI) are usually enough for teams to justify switching to Agile.

But what does it take to "switch" to Agile? If a team has had little to no exposure to these concepts, they should begin by allowing the principles of Agile to guide them in their day-to-day operations. Practice working iteratively and collaborating more. Start using a kanban board and hold brief daily stand up meetings. Once a team becomes familiar with these new philosophies, they can take the next step to adopting a formal Agile method for project management.

Whether or not your focus is on continuous improvement, the Agile methodology can be extremely valuable to companies that want to reduce the cost of running projects. The value associated with using Agile for project management can be broken down into several key areas, including:

- Predictability
- Adaptability
- Scalability

Is Agile Project Management Right for You?

The Agile method for project management is an effective set of principles teams can follow to produce more using less while improving their existing processes. As you learn more about Agile and its methodologies, you may discover a method that works best for you, or you may find Agile in its truest form to be the best approach. Regardless of your level of knowledge or years of practice, Agile project management has the potential to transform the way you work[27].

1.4 Major challenges and gaps in practices

Managing risks is one of the most important activities in project management in order to making sure about project success. The target of the project manager and the project owner are traditionally to some degree misaligned. While the project manager primarily focuses on operational risks and risks that will influence the success of the project completion, the project owner primarily focuses on risks that may influence the success of the operational project product.

[27] Leankit team documentation

In a discussion of the issue of project success, all participants are likely to agree that this quite simply must be the top priority for projects. But behind the large common agreement we will easily find that there are very different explanations of the term "Project success". For instance the project owner not primarily mean success for the project itself, but he will usually find it more important that the more long-term effects of the project are giving indisputable and clear benefits. The project management team, on the other hand, will most likely above all want to obtain success for the project itself, in the shorter time perspective of a construction or implementation phase and including the hand-over to the user and/or operations organization. In other words, the project management teams focus on cost, schedule and quality in order to ensure project success, while the project owner judges project success in a broader perspective. In order to evaluate and discuss the different kinds of results and effects of a project, we find it useful to introduce the terms "first, second and third order of project consequences", suggested by Johansen et al. (2009)[28]. First order effects are related to the immediate results and deliverables from the project. These are the consequences arising when the project has been executed and has delivered according to its result oriented goals. Second order consequences are the ones arising after the project execution phase is finished and its deliverables handed over. This will typically be benefits in the form of increased sale or sale of new products, or increase in the knowledge within the owner organization. Third order consequences are the ripple effects created in the society as a consequence of the realization of the project. For many of this type of consequences it will take time before they occur.

Four main challenges in practice:

Challenge 1: "Regarding the different perspectives of project owner and project management team: How can the gap be bridged while the owner keeps control of project success?" When this is realized by the actors how can the gap be bridged, cooperation is established while the owner maintains his control.

Challenge 2: "The owner should not take over and run a project, but he should control it." This is based on realizing that there are substantial differences in interests between project owner and project management team. It is also based on what is stated above that the project owner must be at

[28] Johansen et al. (2009)

the steering wheel. However, the project management should still be managing the project, but under the control of the owner, and with everyone aware of the divergence in interests. Finding practical solutions to this will be a major challenge to a successful project execution.

Challenge 3: "Balancing operational and strategic issues, they must both be properly addressed!" Claiming that the project owner's strategic perspective must be guiding for the project management team, this does not imply that project operational issues can be neglected. No matter how important the project life cycle and strategic views are still a number of short term project issues will be critical, not just to project success, but even to project survival.

Challenge 4: "The owner is responsible for both project costs and benefits and must also balance the two." As stated above, one quite unique characteristic of the project owner is the combination of his ownership to both project benefits and project costs. However, this will constantly also mean dilemmas and gives a basis for conflicts. This will for instance be the case when cost reductions are threatening benefits, or when measures made to the project to achieve benefits mean escalating costs[29].

Conflicting perspectives:

As stated earlier, little influenced by their subjective intentions, their factual interests will give strong guidance to their factual priorities, choices and decisions in the everyday work of the project (Olson, 1971)[30].

This will mean that when the project owner is evaluated, rewarded and blamed for the project's benefits to the organization and economical results, then his perspective on the project will be the organizational results, benefits, and financial/economical results that the project is likely to give. Also, the project management team is first evaluated and rewarded or blamed for what appears as a successful project during project execution and at handover to the user/owner organization project

[29] Krane-og-langlo (2011)
[30] Olson, 1971

deliverable as specified, and the project performed according to time plans and within budgets. Hence their focus will be on the specified project deliverable and a well-run project process.

The potential clash between these two sets of interests is obscured by apparently common goals (project success); hence it is often difficult to address properly the challenge of this implicit conflict. Reformulating the stance of the two actors and trying to take a more analytic approach to the dilemma, we could say that the project owner is having a financial/economical perspective or an operational perspective (depending on which of the different owner roles we study), and the project management team has a product/ process perspective on the project.

Multiple project owners for a single project

A basic challenge to the projects regarding project ownership is based on the different interests of the different owner roles. This will be a possible source to internal conflicts. Actors occurring in different owner roles to the same project may easily give different messages, both to the project team and to other stakeholders.

Another challenge can be that not all those who appear in roles as owners are "balanced owners", i.e. having responsibility for both the costs and the benefits of the project. These actors will usually represent different aspects of the project ownership it will be important to handle them as complementary to each other, and not as alternative owner representatives. The multiple project owner roles and the different aspects of the owner roles are described in more detail by Olsson et al (2008) [31] and Andersen (2010)[32].

During the investigations it was found that the identified owner representatives had quite different relations to the projects, and also expressed quite different expectations and requirements. Challenges caused by owners having different interests, needs and perspectives were also encountered in the studies. In particular we observed that roles were quite often mixed, and in some projects some owner representatives behaved as quite "unbalanced" owners.

[31] Olsson et al (2008)

[32] Andersen (2010)

However, examples of "balanced owners" were also considered owners who were taking into account both project benefits and costs. Other good practice observed was a number of project owners acting quite much as strategic owners, having their main focus on the more long-term benefits from their projects and taking a life cycle perspective on the project.

1.5 Aim of Thesis

The aim of the thesis is to analysis how to manage and reduce extra cost which is due to overweight (uncertainty) of items in a large Project Based Operation of Danieli company for a Chinese customer. The problem started at the offer phase of the project when commercial office did not accurately estimate the weight and relative cost of some of the items due to the time limitation in the offer phase. The commercial office of the company had to perform its preliminary calculation quickly because of the competitors, so there was not enough time for proposing the final cost based on detailed calculation. After signing of the contract and start of engineering phase, technical office calculated actual weight of all items of the contract and realized there are some differences between the calculated weight and weights in the offer.

In this thesis we analyze possible solutions with related advantages and disadvantages and find a proper solution.

Chapter 2

INTRODUCTION OF DANIELI COMPANY

2.1 Danieli in world

Danieli ranks among the three largest suppliers of plants and equipment to the metals industry, worldwide. The company has seven factories in Italy, Germany, France, Sweden, Thailand, China and India.

The Danieli Headquarters in Buttrio, Italy .Stands on an area of 320,000 m², of which 92,000 are for workshops and assembly and 28,000 for technical, commercial and administrative offices, and R&D. The sister companies in Europe have 46,000 m² of workshop/assembly area and 7,900 m² for technical offices. They are leaders in minimills, in long product casting and rolling plants, and among the front runners in the flat product and iron ore sectors. Danieli Team mission is to serve Customers with competitive plant and process technology/automation to produce quality at the lowest depreciation and production cash costs and offer friendly after-sale service involving top-specialized engineers.

2.2 Strategic approach of Danieli Company

1. **Innovation**

Danieli strive for innovation and invest heavily in research and development to provide the customers with best plant performances and reliability. The remarkable number of innovative process technologies successfully developed and applied allows the use of "innovation", to indicate innovation in action.

2. **Partnership**

To achieve goals, teamwork is needed and partnership is indispensible for meeting the challenges of technology and production. Danieli truly thank their customers for their innovative ideas, which continuously spur them to improve the steel industry in terms of product quality, plant efficiency, operators' safety and environmental impact.

3. **Reliability**

Company solidity, proven technology, continuously improved design and project management capability, together with excellent manufacturing know-how and production carried out in fully-owned centers, make Danieli reliable partner.

2.3 Structure of working in Danieli

1. **Quality**

Aiming to meet increased demand for products while maintaining recognized quality and on-time delivery for total customer satisfaction, Danieli has recently made major investments in new, modern, fully-owned and directly-managed design and manufacturing centers. Strategically located in China and Thailand, operating under supervision of senior Danieli specialists, the new centers provide the same excellent quality produced at the headquarters workshops in Italy, thus allowing us to state "Danieli workshops: same quality worldwide".

2. **Engineering**

Danieli don't shop around for noble equipment; they build it in their fully owned and directly managed design and manufacturing centers, worldwide. Having the overall control of the projects from in-house design and manufacturing to on-site construction activities, start-up and commissioning creates an ideal virtual loop that guarantees on-time and quality deliveries.

3. **Machining**

Precision, flexibility, and innovative processes are the key to successful machining. Danieli's workshop is equipped with highly technological machinery to produce single components and small lots of medium-large sizes, including gear cutting and grinding. In a fully-equipped department the whole range of all necessary heat treatments is carried out.

4. Assembly

Machines are assembled in specialized areas depending on machine size, weight and functional testing needs. They are equipped with hoisting means having capacities of up to 300 t, and, using jacking supports up to 1000 t. All noble equipment is carefully inspected and must undergo a series of functional tests according to a Quality Control Plan before it is packed for shipment.

5. Testing

A full range of compliance and quality tests are done before and during production and on the finished product, with dedicated areas and devices 3D coordinate measuring machines ensure the accuracy required by high-precision manufacturing.

2.4 Technology approach

Danieli is proud of its technological achievements to support the progress of the steel industry through the experienced companies that make up the Danieli team. In the last decades, through of R&D, consolidated engineering, and own experienced workshops, Danieli can offer excellent and complete packages for carbon, silicon, aluminum , stainless steel and non-ferrous lines, single plants or complexes, both in terms of optimal process and state-of-the-art equipment supply.

2.4.1 Ore processing direct reduction and electric steel making

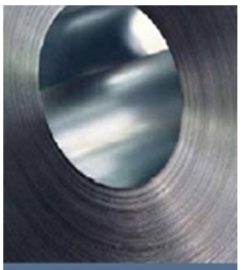
1- ENERGIRON direct reduction process

2- Cash-cost reduction in EAF steelmaking

3- Twin-Cathode DC EAF fed with 100% hot and cold DRI

4- Secondary metallurgy

5- Ecogravel



FLAT PRODUCT ROLLING MILLS AND PROCESSING LINES FOR CARBON AND STAINLESS STEEL

2.4.2 Flat production rolling mills and processing lines for carbon and stainless steel

Superior-quality thick slabs casters

Medium/Thin slab caster

FTSC-flexible Thin Slab Casting technology

Thin Slab Casting and Rolling Technology

Special grades and ultra-thin gauge rolling in TSCR

Flexible Crown-free Rolling mill stand

Flexible plate and coil production with Wide Medium/Thin Slab Caster

Wide plate mill technology

MULTI more torque drive system for plate levelers

Innovative 6-high 3C, a new concept in cold mill design

New design Da Six tandem mill

The largest hot skin-pass mill in the world

The worldwide most powerful single-stand cold reversing and temper mill for top quality coils

Pickling Line coupled with Tandem Cold Mill

High-speed (400 mpm) Turboflo® pickling system for thin gauge strip

combination painting and galvanizing lines

Combination Pickling and Galvanizing Lin

Pollution free tinplate technology

X-Jet air knives

Dainox Bright™

Six-high/S

2.4.3 Long product casting, rolling, and downstream cold processing lines

ECR® Endless Casting rolling system

EWR® Endless Welding rolling process

Fast Cast™ billet and bloom casters

Fast Cast™ Plus

Stainless steel casting technology

PSP® Profile Sizing Process

Special ultra-light parallel-flange beams

Reducing and Sizing rolling for round, square and flat bars

High-productivity, small-size straight bar production lines

Prefabricated counting and bundling station for commercial steel bars

Superior quality stacking station for specialty steel bars

Ultra-high speed wire rod lines featuring TMB® technology

HSS High-Speed Shear

Oil film Bearing Laying Head®

Rotary pit and Easy-Down coil reforming system

Spooled bar-in-coil

Chain track drawing

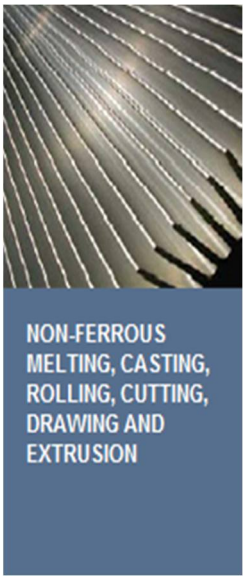
Cold-drawn, chamfered and faced bars

in ferrous and non-ferrous metals

SBQ peeled bars

DRB - Direct Rolling & Bundling (Patented)

FQM™ Fine Quality Mill for seamless tube processing



2.4.4 Non-ferrous melting , casting , rolling , cutting , drawing and extrusion

Melting and Continuous Casting

Chain Track Drawing

High-Speed Trimming Lines

20-High Cold Rolling Mills

CNC Super Slitter

Eddy Current Brake System (ECB)

Endless Copper Tube (ECT)

Front Loading Extrusion Presses

Below figure demonstrate the different configuration of departments according to various products in the Danieli Company.

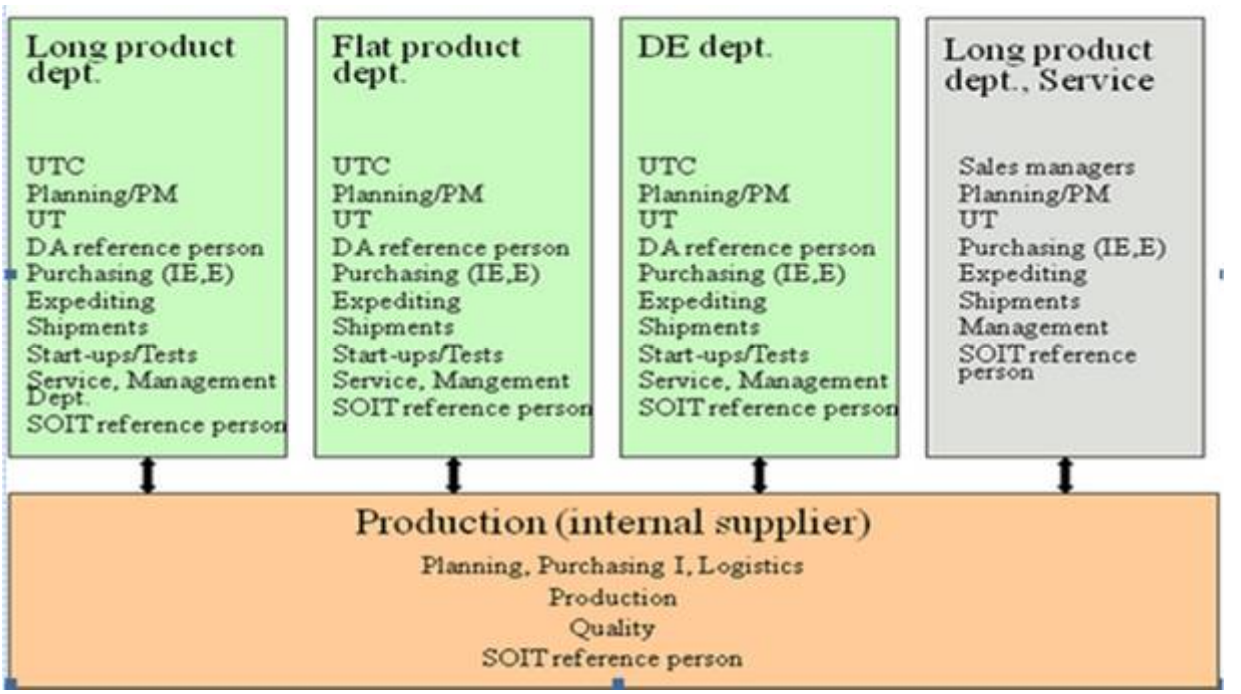


Figure 6- The D. & C. organization according to different departments

2.5 Danieli information system

1. Illustrate Danieli information system

2. Illustrate the structure of Danieli & C

1.1 An ERP system (One World) managing the following areas

- Commercial
- Engineering
- Purchasing
- Costing
- Shipping
- Invoicing

2.1 Other satellite software for specific functions interfacing with OW (One World) management system

- One Cad: engineering
- Sales Logix: CRM
- DLM: warehouse
- Business Object: data warehouse
- MRP: planning

2.5.1 PLANT JOB ORDERS

OFFER PREPARATION

The Sales Manager (SM) of the Engineering and Sales Department (UTC) is responsible for coordinating the company departments of the product lines involved in determining which technical and economic documentation is to be attached to the offer to satisfy the customer's requirements.
The SM receives the offer requests directly from the customer (by e-mail and/or tender), from external consultants or from one of the following company sources:
- Customer Responsible (CR)

- Key Account Manager (KAM)
- Jumbo Area Manager (JAM)
-Job Order and Contract Management (UCC).

The main figures that can interact with the customer enters the sales opportunity in Sales Logix (SLX) then asks UCC for an offer code, which in the case of order acquisition, becomes the job order code. UCC assigns the offer code by creating the offer header in One World (OW) (the system automatically attributes "Situation 1" status to the offer), updates SLX and if the customer does not have a code in OW, asks the Invoice Checking Department (CFA) to enter one.

The SM, in collaboration with the Tech Team / UT, and any other company departments that are involved, does a preliminary feasibility study for all the parts/machines/plants that have not been standardized by D&C; should the feasibility study be negative, he suggests alternative or better solutions to the customer.

The SM or SL (when appointed) will ensure that a document is drawn up and kept updated to summarize the points that were not fully defined/solved during the feasibility analysis and subsequent preparation of the proposal. This must be a brief document drawn up according to the same logic used for the RIO form to make it easier to use during the actual RIO.

The SM begins preparing the technical/commercial proposal interacts with the department managers and any subsidiary companies involved in preparing the offer to identify the reference resources that will provide the necessary support and to forecast each department's commitment expressed in hours and/or costs. Instructs the Proposals to assess the impact of the information/data supplied by the customer and prepare a draft of the sales JET that will be completed by the SM. With the technical team and the Engineering Departments (UT), checks the process parameters required for plant sizing, determines which technical standards are to be applied and their impact on engineering and plant delivery costs/time schedules. in collaboration with the Costing Department, the MacroP group examines the delivery schedules of the machines/items then sending to the area PMF the draft of contract pointing out any discrepancies with the Contract Must List, together with the "Check List - Costing" in order to compare and analyze the critical points of the financing schemes proposed by the Sales Manager.

In the case of intercompany job orders, interacts with the SM of the company involved, regarding information on products to be supplied by company, with the Purchasing Department, studies the impacts of customers' requests on the standard Vendor List. Together with the PMF examines the proposed contract terms, especially in terms of the liabilities associated with the contract, payment conditions, risks and the customer's credit worthiness ,also indicates the requirements for the issue of any bank guarantees (amounts, duration) allowing the PMF to negotiate and obtain the necessary credit lines in suitable time. Together with MAC, studies the aspects concerning supervision, start-up and any erection work. Based on the information that is gathered, the SM with the help of the proposals officer and after having spoken with the Dir.PM of the involved LdP:

prepares the sales JET, which represents the scope of supply and the company targets in terms of time, weights and costs; this operation can be accelerated by using the configuration.
The association between D&C items and contract items must follow the criteria indicated below:
- A JET position can only be associated with a single contract item.
- A contract item can be associated with "n" JET rows.

The SM then sends the Sales JET and the "Check List Costing" to UAC. In order to calculate both direct and indirect company costs and have a basis to determine the sale price to submit to the customer, the SM prepares and signs the "Proposal Sales Form" (PSF) using the information provided by the company departments involved in the offer and discusses with his superior anything that is unclear. For projects involving several product lines, each PSF, or the PSF showing the costs of each LdP involved in the proposal is signed by SL.

While negotiating and determining the needs of the customer, the SM will update the documents (tech specs, MoM, Commercial Specification, and PSF), file them and update SLX accordingly.
The SM will record the meetings with the customer in the "Minutes of Meeting" and then file them in SLX. The SM/SL assigns to each offer a status that is directly related to its probability of acquisition, thus identifying the offers that need to be reviewed (RIO). The SM/SL is responsible for updating Sales Logix in real time as to the changes in offer status.

2.5.2 RIO (Review OF the Offer)

A review of the offer shall be carried out for all the job orders with high take-over possibility (more than 70% and sign in six months) also involving the project manager in order to finalize scope of supply and JET.

In the offer review (RIO), the delivery dates are also defined by applying the standard UT/UP lead times. Totally The RIO has to be carried out according to the Product Line (LdP) manager's decision, in any case before order acquisition. The RIO may be preceded by targeted meeting with UT, UA, Manufacturing, Legal Dept., DA, DCI, etc. (For important or complex projects, the Level 1 Manager of the LdP shall call a corporate meeting (RIO) for final verification.)

In any case, result of RIO must make available the following documentation sufficiently in advance:

- Scope of supply
- Time schedule
- Cost Estimate Spreadsheet
- Layout
- Potential criticalities

RIO has critically re-examined the feasibility, performance, payments, risks, times and costs. The result of the meeting should not be in very details and it should be understandable even for who didn't participate in meeting.

2.5.3 JET (job enterprise target)

JET is a document that is made up of positions, phases and sub-phases, which describes the scope of supply and the company's objectives in terms of time schedules, weights and costs.

The JET defines the scope of supply and the enterprise/project targets in terms of:

- time
- weights
- costs

Different JET documentations

1) STANDARD JET

Document listing all the possible items standardized by Danieli & C. Officine Meccaniche S.p.A., with the exception of the costs and cost centers in charge of performing the activity in question, which could be part of a job order JET;

These items constitute the range of machines, plants, engineering and services of the product line to which the STANDARD JET refers.

2) JET RIO

Document issued following the Offer Review

3) JET 0

Document taken from the JET RIO issued after contract signing.

4) JET 2

Document taken from the JET 0 issued following the launch of a job order, that describes the scope of supply, the company's objectives in terms of times, weights, costs, cost centers in charge of performing the activity in question, and describes the phases and sub-phases of a specific job order. Thanks to the integration of the various company departments, it allows you to run operating processes and monitor the progress in terms of target costs, actual costs, rescheduled dates and actual dates. (MODULO 2 (tender and contract management))[33]

2.6 DDMS – Danieli Document Management System Functionalities Overview

Electronic document management with DDMS

DDMS is the management/tracking system for Danieli Job documentation. Each document pertaining to a job/project must be managed and stored using this application software, thereby making it possible to keep an updated database with all the document workflows, both incoming and outgoing, which can be consulted by all authorized users.

[33] MODULO 2 (tender and contract management)

The people involved in document management are mainly the PMs (Project Managers), the ETD managers (Engineering Departments) and their staff.

Basic functionalities of a document management system:

- Document Archiving
- Document Classification
- Document Search
- Document Protocol
- Life Cycle management and tracking of document modifications
- Document access securities

DDMS - Features 1

- Complete life cycle management of documents (classified in DDMS) belonging to a job/project
- Document management based on document families (technical, quality documents, etc.) and on document classes (drawings, lists, reports, etc.)
- Standardizes, centralizes and traces sent documents and displays them so their status can be monitored.

DDMS - Features 2

- It works together with ERP and engineering systems (One World and One Cad) item master: each document (drawing/specifications) launched by One Cad is automatically displayed by DDMS.
- Manages outgoing (from Danieli to the outside) and incoming (from the outside to Danieli) transmittal lists, with approval status traceability
- Include reporting and data extractions[34].

[34] DANIELI library

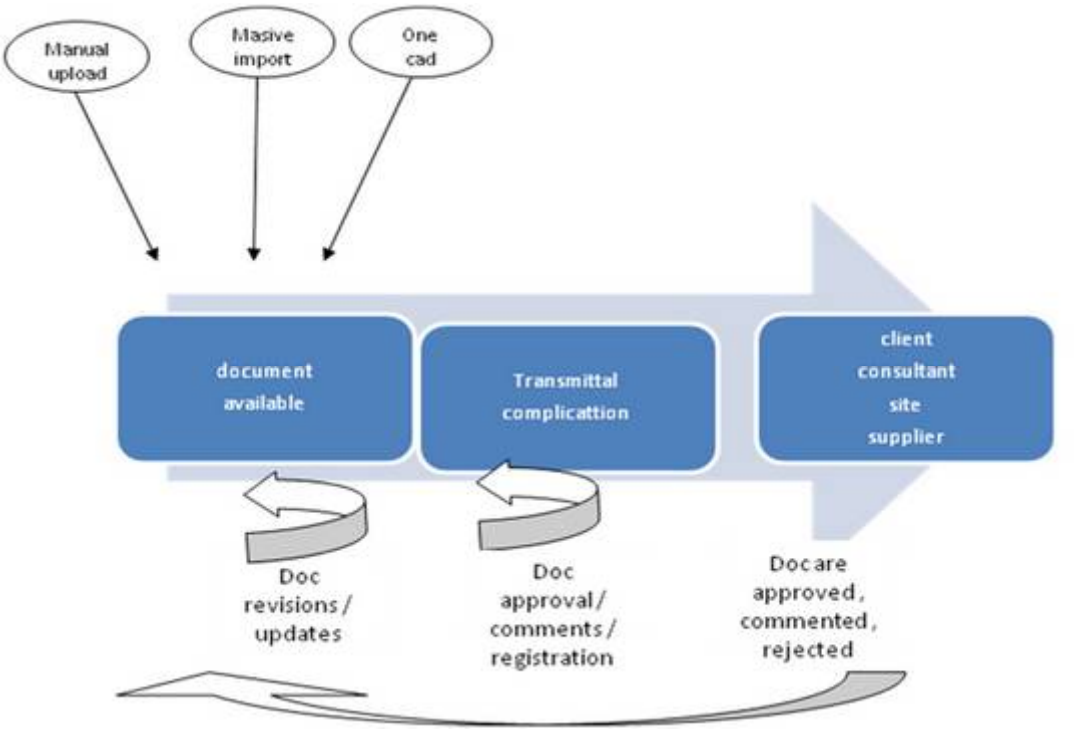


Figure 7 - DDMS - Document Flow

Chapter 3

THE PM ROLE IN DANIELI ORGANIZATION

3.1 Overview of typical PM duties in ETO and EPC operations

Project Management is the discipline of planning, organizing, and managing resources to bring about the successful completion of specific project goals and objectives.
The primary challenge of project management is to achieve all of the project goals and objectives while adhering to classic project constraints, usually: scope, quality, time and budget. The secondary, and more ambitious, challenge is to optimize the allocation and integration of inputs necessary to meet pre-defined objectives. A project is a carefully defined set of activities or tasks that use resources (capital, human resources, materials, energy, space, provisions, communication, motivation, etc.) to achieve the project goals and objectives.

Tasks: They are a division of all the work that needs to be completed in order to accomplish the project goals.
Scope: of any project is a combination of all individual tasks and their goals.
Resources: can be people, equipment, materials or services that are needed to complete various tasks. The amount of resources affects the scope and time of any project.

3.1.1 The traditional triple constraints

Like any human undertaking, projects need to be performed and delivered under certain constraints. Traditionally, these constraints have been listed as scope, time, and cost. These are also referred to as the Project Management Triangle, where each side represents a constraint. One side of the triangle cannot be changed without impacting the others.

Figure 8 - The project management triangle

The time constraint refers to the amount of time available to complete a project. The cost constraint refers to the budgeted amount available for the project. The scope constraint refers to what must be done to produce the project's end result. These three constraints are often competing constraints: increased scope typically means increased time and increased cost, a tight time constraint could mean increased costs and reduced scope, and a tight budget could mean increased time and reduced scope. The discipline of Project Management is about providing the tools and techniques that enable the project team (not just the Project Manager) to organize their work to meet these constraints.

Another approach to Project Management is to consider the three constraints as finance, time and human resources. If we need to finish a job in a shorter time, we can throw more people at the problem, which in turn will raise the cost of the project, unless by doing this task quicker we will reduce costs elsewhere in the project by an equal amount.

3.1.2 The Gantt chart

Gantt Charts are the primary tool for Project Managers, and are the main workspace of your project. A Gantt chart consists of a hierarchical spreadsheet on the left which lists your tasks, and a time-scaled diagram off to the right. It enables you to see both the tasks in your project, their structure, and their ordering in time.

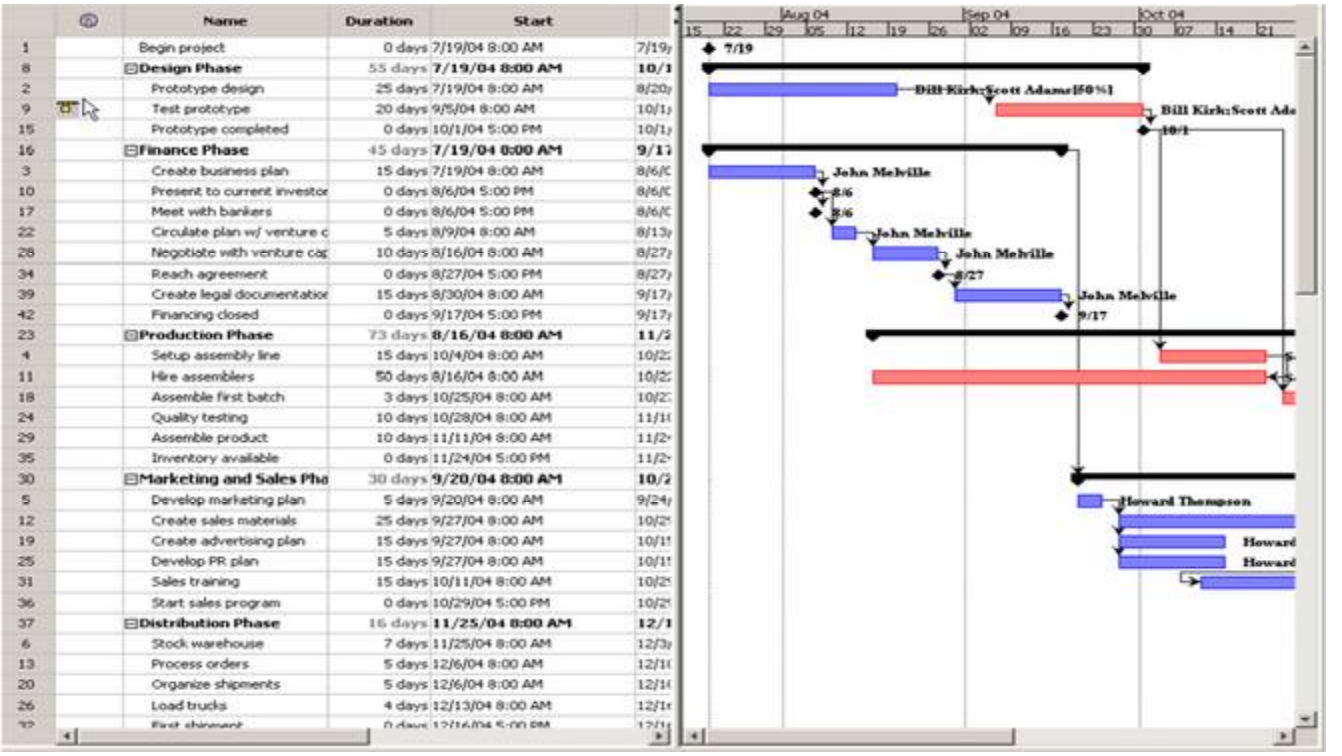


Figure 9 - Sample of Gantt chart

(Primavera® P6™ Project Management)[35].

3.2 Project Manager in Danieli

A project's focus is to achieve an identified goal and it's the project manager's responsibility guiding the project based on established parameters, such as time, cost, and resources, while maintaining a specified standard of quality.

3.2.1 Purpose of PM

1. how to prepare and review offers, acquire contracts, launch "plant" job orders and issue the JET2 in compliance with the Quality System of Danieli .

[35] (Primavera® P6™ Project Management)

2. How to launch and manage research job orders acquired by the Danieli Research Center as instructed by the product line. Procedure, Spare Parts and Machines Overhauling" is applied to "spare parts" job orders.
3. The Dir.PM or Level 1 manager assists the SM in the final preparation stages of the offer.
4. Sends the sales JET to the SM, who checks that it is consistent with the scope of supply.
5. Coordinates the work of the Economic Job Order Review and the Job Order Launch and issues the associated reports.
6. Manages the activities concerning a possible revision of the JET2.

3.2.2 The main activities and responsibilities concerning the job positions

- Addition/deletion of positions with default launch of phases/sub-phases
- Updating of machine code, reference branch plant and similar drawing, product type, flow type, …
- Assignation of payment and price group
- Assignation of shipping data (Cesped group)
- Function "Jet Dating Sub-phases" or "Target date update" to recalculate the sub phase macro dates.

PM activities for each job positions are:

- Entering of UT hours (phase 20)
- Checking of weights (phase 30)
- Cost center assignation (phase 40)
- Cost allocation for own positions/phases (job management, UT, MAC, Cesped, DA\DCC) and zeroing of buffer positions [36] .

3.2.3 Main project management milestones

RIO = Offer Review = Offer review, make/buy, purchasing strategy (cost type)

KOM = Kick-off Meeting = review of contractual constraints

EEC = Job Economic Review = finalization of the overall job costs

SPED PLAN = shipping planning = Final planning of both normal sized and oversized shipments

[36] MODULO 1 (tender and contract management)

RS = Release for Shipment = Block/release due to possible shipping constraints

VERS. UP = UP "work done" = Completion of production and purchasing activities. End of phase 40

SPED = shipping phase = 5510 "Ready for shipment", 5520 "Packing" and 5530 "Shipment

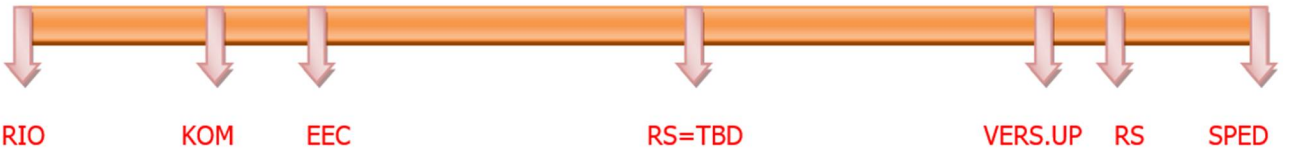


Figure 10 - Main milestones

3.2.4 Contingency management according to risk and uncertainty in Danieli

Dealing with risks and uncertainties is a typical problem for both company and customer. This problem might end up with considerable financial losses for both sides. Although the size of a project is the main factor that causes risk, there are other factors like cash flow and quality problems which having crucial role in happening the risks. In assuming the risk analysis dealing with uncertainties, several methods have been suggested. Among these methods contingency is one of the most Significant.

Most projects include a contingency budget to cover both anticipated costs due to the project's phase and unexpected costs. Contingency is an amount included in the construction budget to cover unknown conditions, allowance for design growth, errors in the contract drawings, and minor changes within the project scope. In Danieli At the end of the Project if project dose not face with some unpredictable condition the rest amount of contingency will be assume as positive operative income of the company .

It is important to note that the contingency fund is included in the budget of supplier address risks and unpredictable events that may occur during a project. The total amount of contingency is consisting of three main factures:

1. Innovative cost
2. Process commissioning cost
3. Mismanagement cost

For all projects there are some basic amounts of contingency that including 2% for innovative cost, 7% process commissioning cost and 5% for mismanagement cost. This mentioned percentages were the minimum amount which should be allocated for all projects and after signing the contract according to other factors which mentioned below the commercial office modify this amount of budget.

One of the most important factors which effect on the amount of contingency is the customer country, because in some country Danieli should be aware of not only technical aspects but also the policy point of view related to customer's country which required its specific consideration.

Below graph demonstrate the relation between risk and Contingency applying in Danieli, according to this graph more slope demonstrate the project should be more conservative due to mentioned reasons.

For instance, based on former Projects, cost contingency for a specific risk level in countries like China, Turkey and some other Middle East countries (more conservative) is considered more than cost contingency for European and American countries (less conservative).

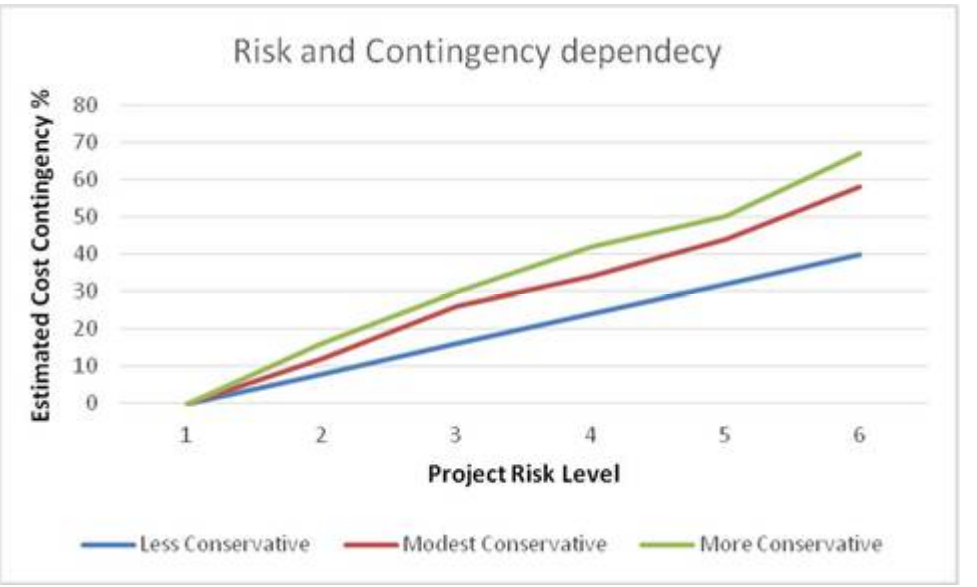


Figure 11 - Risk and contingency dependency

In Danieli Company, there is a specific budget for contingency but due to company's policy project manager does not have access to the information about the amount of budget. The main reason that the percentage of contingency is not determined clearly for everyone, is because of this amount of fund is allocated only for emergency unknown condition and it is project manager's responsibility to follow the project by assuming some solutions and saving this allocated budget .

Chapter 4

CASE STUDY 'COLD LEVELER' PROJECT

4.1 Brief Introduction and short background about the 'cold leveler' project

4.1.1 Brief introduction

As a case study I considered a project relative to Chinese customer performing by Danieli Company: The name of the project is 'Cold leveler 'and the contract was signed on 23ed of October 2013 and it is a Heavy Duty Cold Plate Leveler Project in PR China.

The plate leveler will be installed in an existing plant between two cooling beds together with a pre leveler.

The existing configuration is the following:

1. Cold leveler with drive.
2. On board machinery piping and wiring.
3. Foundation Bolts and leveling.
4. Stairs, Handrails and Access Platforms.
5. Hydraulic system.
6. Oil Lubrication Systems.
7. Air/oil Lubrication System.
8. Gears Lubrication Systems.
9. Pneumatic systems.

Below table show us the time scheduling of the project from the beginning until the end of the project

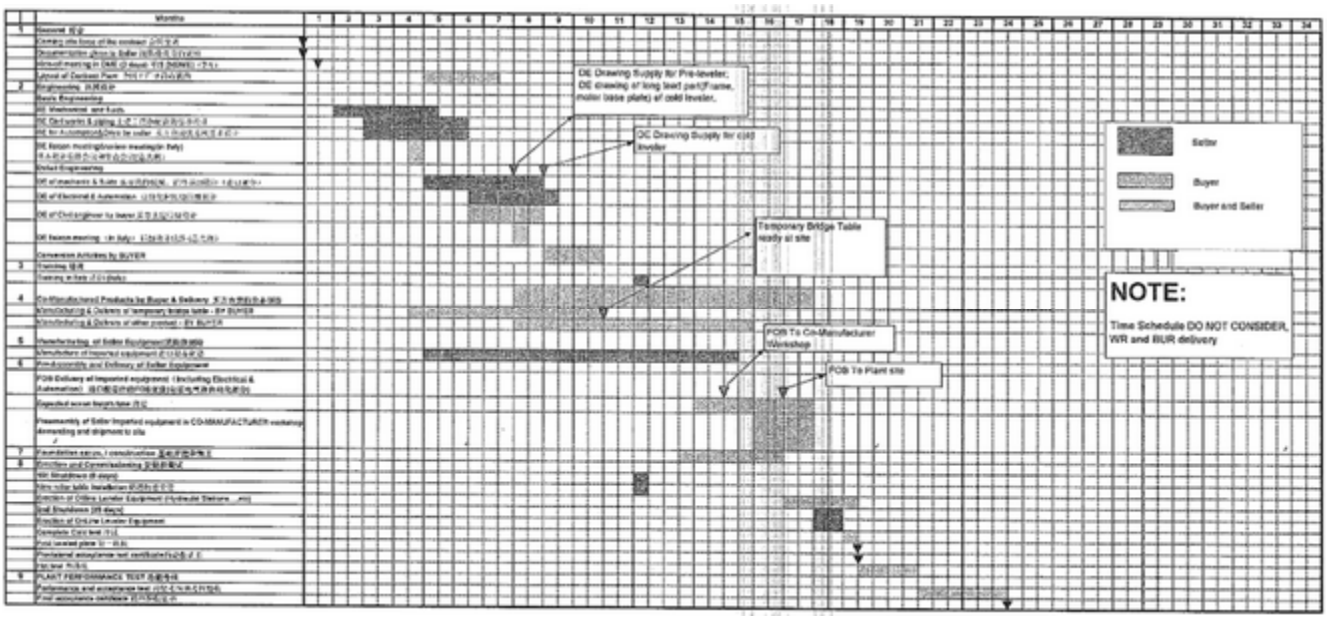


Figure 12 - Cold leveler project schedule

(Mechanical equipment, technological package)

4.1.2 Some background about 'cold leveller' project

For 'Cold leveler 'project at the beginning Danieli tried to propose one machine pretty similar to one of the reference which had already installed in similar plant in China. Customer refused to take even in consideration the proposal because they have already similar arrangement in the other plant which supplied by Daniela's European competitor (we can consider it as competitor 1), and the experience and feedback about the performance of this machine were not good.

Therefore customer addressed all the 4 competitors in choosing one of the following potential approaches:

1. Single cassette machine with double roll diameter (by competitor 1)
2. Double cassette machine (the remaining three competitors (Danieli , Asian competitor (consider it as competitor 2) , competitor 3)

Competitor 1 picked up one of their reference machine (of 1998, the only one they did and result were not good since from that project they've never proposed again such solution) and updated with considerable modification.

Danieli, competitor 2, competitor 3 that they have not similar arrangement in their portfolio decided to go with approach #2. Since the design of the proposed machine was far from the reference Danieli offer the prototype machine.
The machine is a prototype so Danieli has started from the similar commercial reference and had introduced improvement in order to reach required technical specification.

Possible solutions from competitors and Danieli:
- Solution of competitor 1:
15 single cassette rollers (D220/D320). 15 Engines,
Max Leveling X kN. Total Sellers mechanic on about 383 tons (excluding spares)

- Solution of competitor 2:
Double cassette 13 (180) + 9 (360). 13 Engines
Max leveling Y kN. Total Sellers mechanical approximately 593 tons (excluding spares)

- Danieli proposal is:
Double cassette solution 9 (180) + 9 (360). 4 motors. Max Leveling Separating Z kN. Total Sellers mechanic on about 539 tons (excluding spares)

('Y'KN >' Z' KN > 'X' KN)

4.2 RIO meeting and technical feature of project

RIO meeting have been done on 7th August 2013 by participation of below persons:
-SM (Sale Manager)
-PMF (Project Financial Manager)
-Dir.PM / appointed PM (1)
-MacroP
-UT manager of the LdPs involved

-Level 1
-DA manager
-DESY Civil

According to what discussed on RIO, below information obtained:
BID opening foreseen for 29th August 2013 with probable CIF at contract signature (target end of October 2013).
Customer is Chinese company and the project is focused on the supply of engineering and technological equipment of two Levelers, to be installed in the existing facilities.
There will be 2 separated BIDs, one for First pre-Leveler and one for the cold leveler. Pre-leveler unit arrangement should be further analyzed by Danieli service due to probable interference with actual building columns. Danieli Service should check if this is matching with available space and budget.

Major technical criticalities were:
The height of the machine should not exceed more than 7.5 m due to actual building & crane limitations.
Static pressure between Work Roll and Back up Roll is actually too near to BUR limits and no possible supplier has been individuated until now.
Top roll individual adjustment should match with two different cassettes (different WR diameters and roll gap), so dedicated solution need to be studied and implemented.
Danieli has very good design features and references for the Pre-Leveler, but the cold Leveler is completely new machine.

Customer strongly preferences on European competitor design and the advantage of the preferred competitor could be in making all the engineering in Chinese Standard based on former experiences of DWU and DME technical offices.
The scope of supply includes the detail engineering of all technological equipment except roller tables, centering system and hydraulic & lubrication (only Basic Design required).
The manufacturing will be done for the 90% of the equipment directly by Costumer, selecting as preferred Co-Manufacturing 'Cold leveler 'project First heavy.

Preliminary Time schedule has been discussed and could be optimized in order to get low advantages against competitors .Since liabilities will be directly linked to engineering deadlines, planning should be accurate.

4.3KOM

Kick of meeting was held on 04th of November 2013. In the meeting the following points had been discussed.

1. Engineering

Civil drawings are needed in order to establish the required spaces and the locations for the new hydraulic system and also the available space for outline the machine assembly. A dedicated meeting/survey before the KOM will be required to customer in order to find the needed information.

2. Production & Erection

Part of manufacturing will be done by Customer (Co-manufacturer) but the Co-manufacturer has not been chosen by costumer yet.

According to the contract the machine will be assembled in the co-manufacturer workshop and after that it will be dismounted and re-assembled out of line in the plant. Two shutdowns of the plant are scheduled:

- The First shut down to install the bridge roller table.
- The Second shut down to install the leveler which will be completely assembled and tested out of the line.

3. Documentation for KOM customer site

During the meeting was decided following documents should be prepare for second KOM which should be held in customer site:

- Organization chart
- Preliminary project schedule
- Eventual Standards clarification
- Site survey
- Utility consumption confirmation
- Preliminary information about leveler installation
- Preliminary information about oil cellar dimensions

4.4 JET 0

The JET0 is a stage when the contract has been signed, but by internal rules project cannot start until a down-payment or other warranties are provided from customer side. During this period the JET is being reviewed by PM together with production and commercial department.

As demonstrated below in the JET0 there are information mainly about weight and the cost of different positions and due date related to different phases.

At the end of above activities the JET0 will be changed into JET2 by PM.

Below table is a part of JET0 which arranged by commercial department on 14th on November.

Below table show some positions considered for our case of study.

Pos.	Pos. Description	Pos. Lang. Description	Product Type	Flow Type	Quantity	Branch	Total Cost (Base Currency)	Weight	2030	2040	4060	Currency
0100	Area spianatrice Layout	Leveler Area Layout	56	NP	1	DP0HAM020100	#####	#####	15/05/2014	13/06/2014		EUR
0101	Modifiche vie a rulli in ingre	Entry/exit table modifications	56	NP	1	DP0HAM020101	#####	#####	15/05/2014	13/06/2014		EUR
0102	Guide di sollevamento e centra	Lifting and centering guides	56	NP	1	DP0HAM020102	#####	#####	15/05/2014	13/06/2014		EUR
0105	Via a rulli temporanea	Temporary roller table bridge	56	NP	1	DP0HAM020105	#####	#####	15/05/2014	13/06/2014		EUR
0110	Supporto misuratore di spessor	Entry thickness gauge support	58	NP	1	DP0HAM020110	#####	#####	15/05/2014	13/06/2014		EUR
0200	Spianatrice a Freddo - Assieme	Cold Leveler - Assembly	56	NP	1	DP0HAM020200	#####	#####	15/05/2014	13/06/2014		EUR
0201	Corpo Macchina Spianatrice - A	Cold Leveler Body - CoManuf As	58	NP	1	DP0HAM020201	#####	#####	15/05/2014	13/06/2014		EUR
0202	Corpo Macchina Spianatrice - I	Cold Leveler Body - Incorp. Su	00	NI	1	DP0HAM020202	#####	#####	15/05/2014	13/06/2014	14/11/2014	EUR
0250	Assieme cassetto 205	Cassette assembly 205	00	NI	1	DP0HAM020250	#####	#####	15/05/2014	13/06/2014	15/01/2015	EUR
0255	Assieme cassetto 360	Cassette assembly 360	00	NI	1	DP0HAM020255	#####	#####	15/05/2014	13/06/2014	15/01/2015	EUR
0260	Tubazioni a bordo spianatrice	On board piping for leveler	58	NP	1	DP0HAM020260	#####	#####	15/05/2014	13/06/2014		EUR
0261	Sensori e cavi a bordo spianat	On board wiring and sensors fo	00	NH	1	DP0HAM020261	#####	#####	15/05/2014	13/06/2014	14/11/2014	EUR
0263	Sistema di comando - Ass. CoMn	Drive system - CoManuf. Ass.	58	NP	1	DP0HAM020263	#####	#####	15/05/2014	13/06/2014		EUR
0265	Sistema di comando - Incorp. D	Drive system - Incorp. Supply	00	NI	1	DP0HAM020265	#####	#####	15/05/2014	13/06/2014	14/11/2014	EUR
0270	Riduttore integrato 205	Integrated gearbox 205	00	NI	1	DP0HAM020270	#####	#####	14/03/2014	15/04/2014	15/01/2015	EUR
0275	Riduttore integrato 360	Integrated gearbox 360	00	NI	1	DP0HAM020275	#####	#####	14/03/2014	15/04/2014	15/01/2015	EUR

Figure 13 - JET0 for relative positions of our case study

Chapter 5

MANAGEMENT OF THE OVERWEIGHT

5.1. Analysis of the weight of some job positions

As a general comment, we know that in Danieli Company especially in the flat product line, they execute projects that commonly vary one from the others. It is pretty seldom they are in position to sell/execute a copy machine, or even some machine with small modifications compared to same reference project already have been executed in past because each offer is deeply customized based on buyer's request so due to new technical specification relative to design and engineering should be performed for project .

Commercial department

As mentioned, 'Cold leveler ' project is a new prototype machine due to the special requirement from customer, so commercial office performs the estimation of some items for the first time based on weight of some former references which had similar. Below table indicate information for some positions (according to JET0)

POS	Description	JET Weight (ton)
0202	Cold Leveler Body – Incorp.Su	A
0250	Cassette assembly 205	B
0255	Cassette assembly 360	C
0265	Drive system – Incop. Supply	D
0270	Integrated gearbox 205	E
0275	Integrated gearbox 360	F

Technical department

After signing of the contract, technical office (UT) made some preliminary calculation and realized the difference between calculated weight and offered weight in some cases could be very dramatic. For example in the similar reference related to Cassette we had 52000 kN force while in the calculation we need 62000 kN; so it means we need stronger beam ,shaft ,frame,… as a result the dimension of our frame will be also increased , Below picture show the difference between light cassette and heavy one.

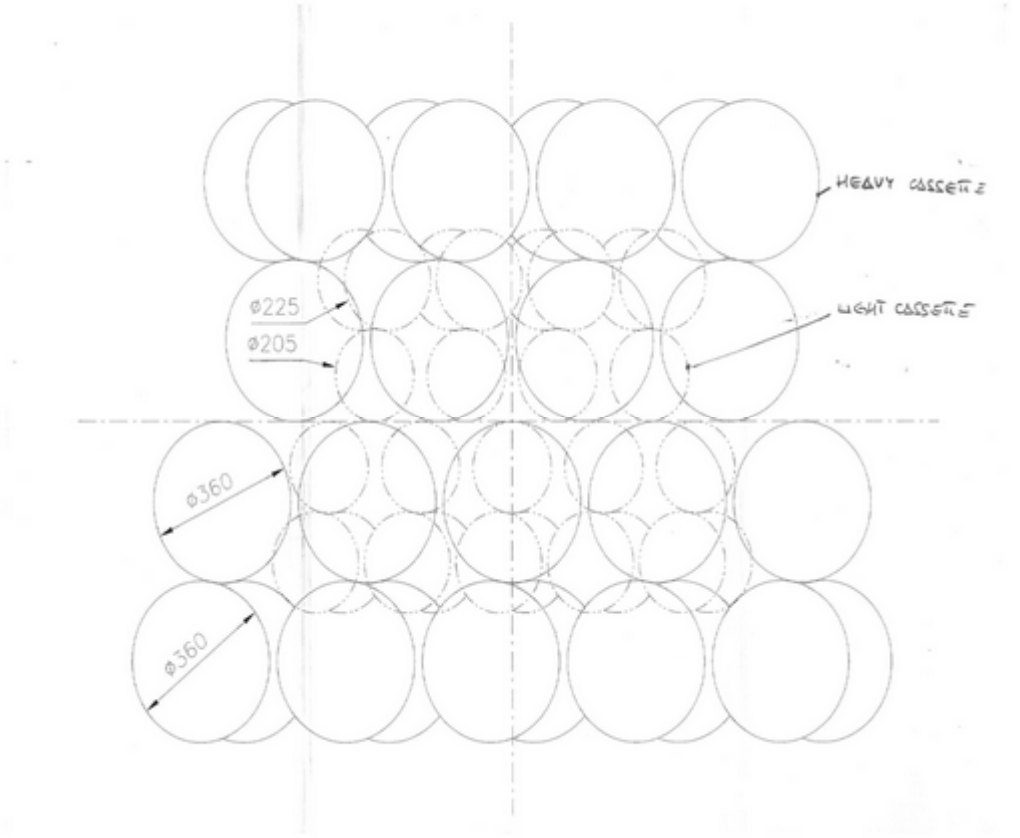


Figure 14 - Differences between heavy cassette and light cassette

Below table shows the preliminary calculation of weight of the items done by UT (this computation have demonstrated by adding some percentages in comparison with relative position which performed by commercial office).

POS	Description	UT Weight
0202	Cold Leveler Body – Incorp.Su	(A + 23%A)
0250	Cassette assembly 205	(B + 69% B)
0255	Cassette assembly 360	(C + 60%C)
0265	Drive system – Incop. Supply	(D + 100%D)
0270	Integrated gearbox 205	(E + 172% E)
0275	Integrated gearbox 360	(F + 118% F)

Speaking with the trader showed that Danieli is very far even from what proposed by competitors for the same application and the same size of the machine (For same type of cassette rollers, 9 φ360, competitor 1 proposed 150 tons while competitor 2 with a 15 cassette roller mixed design around the 190 tons) .The weights estimated for the two gearboxes are comparable with those of gears / pinions cages of a train tapes.

5.2 Overweight and consequence extra cost

1. As shown above, all the items face overweight problem based on UT calculation, specially the overweight problem for positions 0270 and 0275 are very dramatic (more than twice of estimated value in JET0). Extra weight means extra cost, because we should spend much more money for purchasing and manufacturing the respected item from what we specified in the commercial JET document.

   The extra cost is proportional to the extra weight, for clarity if we consider total amount of cost for each Kilo (including labor cost, invest cost, storage cost and etc.) equal to "z" Euro then the extra cost for position 0270 will be as follows:

Estimated Cost = E x Z (€)

Calculated Cost = 2.72E x Z (€)

Extra Cost = Calculated Cost - Estimated Cost = 1.72E x Z (€)

2. As well as the possible extra cost which mentioned before, in some contract according to what specified from customer side which signed between seller and customer there are some specific percentage of penalty related to extra weight. So it can be also other possible loss which company should be aware of that.

5.3 Analysis of the uncertainty based on commercial point of view

- First Question :

What is the reason that commercial department assume for all positions Min possible weight and don't consider some extra possible tolerance?

Normally commercial office makes its estimation by genuine evaluation about what can be the weight of technical solution. Totally the methodology in their field is following some concept roughly connected to price/ton. Typically more tons means higher price. As we know in order to stay in the market each company should try to propose a price in a reasonable range (10-20%) compare to competitors, otherwise company run the serious risk to go out of the market.

Tolerance in this case has been considered not only for the weights but also for the rock bottom price (the commercial decided not to go below a certain level of expected gross operating margin foreseeing some potential over budget coming from the realization of the technical solution), because the machine is very complicated its engineering workload amount is something in the range of 12,000 man-hours, this is the reason why it is almost impossible to run the engineering of the machine before the award of the contract. Customer typically will not pay in advance just because supplier is following the offer. All the workload putting before the contract award is considered free of charge from customer.

- Second Question :

Before final estimation of the weights and relative cost is it better if commercial having more connection with UT department in order to have better idea about calculation of initial weight? (Especially for complex and prototype project)

Commercial is agreed with mentioned statement. They believe This is why as internal procedure Danieli perform RIO meeting when the solution which customer expected is more or less fixed (during offer, especially Chinese customer may change the solution many times). Therefore if Danieli perform RIO too early the final arrangement could be far from the last technical concept (strictly weight estimation), which discussed in RIO and these operations should be repeated many times with considerable time/money losses, As said before all of these operations are free of charge, since there is no compensation coming from customer side.

In RIO sales provide the JET_RIO which is the document including all the main information regarding weight estimation, time schedule, technical specs. Moreover the layout and the potential criticism of the project typically are highlighted and point out so if necessary some technical study shall be performed.

The decision of relation between technical and commercial department depends on many parameters (work load of technical dept. like availability of the resources, time...etc); lots of them are out of control of sales office, since there is no formal dependency of technical dept/PM from commercial office.

Time is a crucial point (especially in Chinese bid, where the RIO meeting and the request for price submission can be in the range of 1-2 months). For sure commercial office cannot withdraw from the determined bid that the submission of the prices has a precise deadline. Therefore what normally happened is that sales office based on the experience/reference of previous projects makes an autonomous and genuine evaluation about the prediction of the weight/cost for the several activities included in the project, in order to be ready for the bid on time. In addition generally Commercial office makes a parallel evaluation of the benchmark concerning competitor’s price.

There is no doubt that if the second analysis highlights the first price evaluation according to the weight/cost estimation it means commercial will propose a double-price compare to other competitors , as a result Danieli wasted some months (moreover some allocated budget) in following the offer because there is almost zero percent of possibility to get the contract. The final price is decided based on the two above considerations.

5.3 Possible solutions by considering their positive and negative point of view

1. Introducing changes of dimension based on technical specifications.

- Positive point:

Change in the dimensions of some items in order to reducing their weights, this solution was occupied during previous projects having same problem.

- Negative point :

Below layout demonstrated the possible places for mentioned items (according to information about installation in customer site) As can be seen there is limitation in case of increasing or decreasing of some dimensions due to existence of some constrains in both vertical and horizontal side which occupied by customer for other industrial activities so there is not enough spaces that Danieli can flexibly applied its modification.

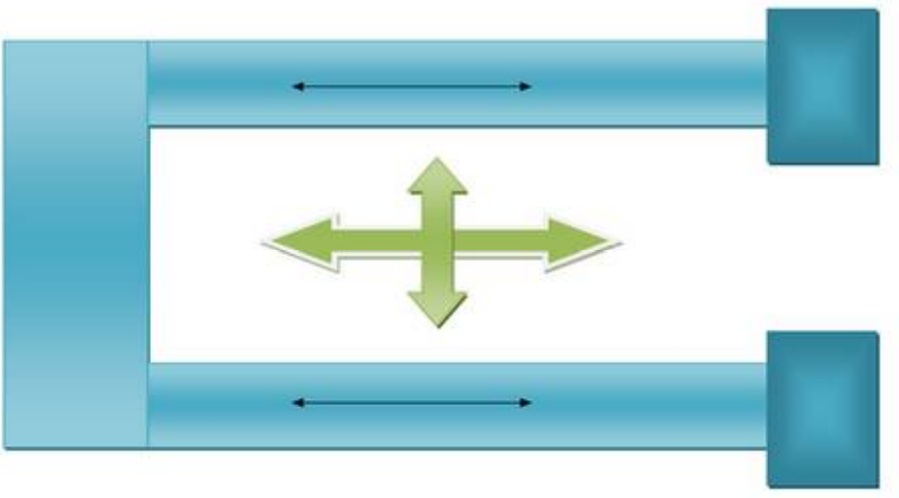


Figure 15- Vertical and horizontal limitation for changing the dimensions in customer site

2. In some items technical office can optimize the weight of them without changing the main dimensions which mentioned in solution 1.

- **Positive Point:**

Using special software and applications optimize the initial weight of items step by step in order to achieving desire weight (like below layout).

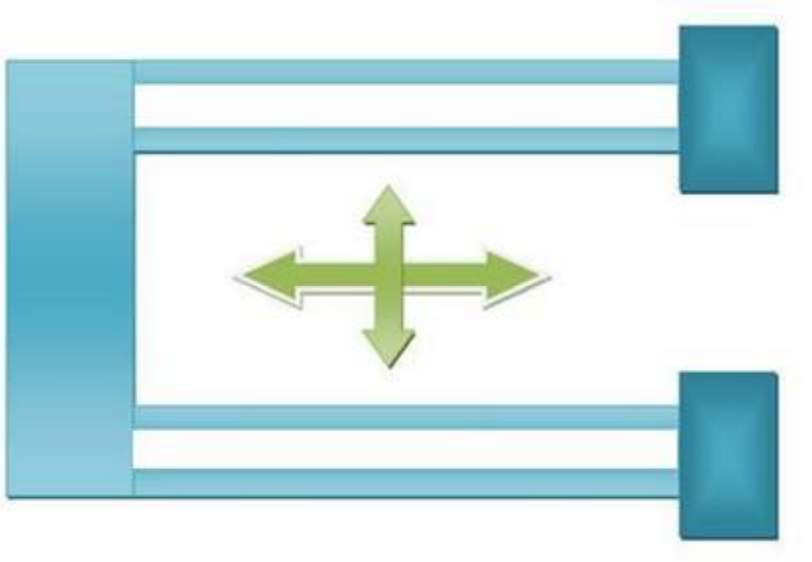


Figure 16 - Applying some optimizations instead of changing the dimensions

- **negative Point:**
  - After optimization of design by technical office it should be verified by technological office for making sure about the efficiency of new designed items and checking whether they are according to Danieli standard or not .
  - In some cases after utilizing this optimization method technical will able to reduce the weight, but at the end it is almost impossible to reach desired weight which is close to commercial estimation.

3. Requesting other company (such as competitor 1) for producing mentioned machines based on their own technical specifications which having similar functions or Danieli calculate and design according to what other competitor such as competitor 2 produce.

- **Positive point**

By applying this solution Danieli can request from other company for producing some items according to their technical specification so there is not any overweight problem. (Such as reducing the number of motors…).

- **Negative point**

- There is some limitation in utilizing other company's design and calculation due to patent problem therefore in many cases it is almost impossible following other company's specifications.

- The project have been already signed by determined technical specification , so if Danieli produce by other company's procedure they should follow other technical specification and customer specifically Chinese one will not accept this procedure .

- For prototype projects it is better that Danieli performs the production by its own standards and technology because other companies utilize roughly different technical specification so it can't be reliable enough for Danieli.

4. By changing the quality (in case of machining, row materials...) it is possible decrease the weight of items.

- **Positive points**

  By assuming this solution we can reduce the amount of '€ / Kilo 'for many items.

- **Negative point**

One of the most crucial point in design and production is that the performance and reliability of each item should be supported from technological point of view so change in quality can be just considering only for limited amount of overweight and it almost impossible solution when we faced with high amount of overweight .

Chapter 6

CONCLUSION

6.1 Result

As we described various solutions to overcome the overweight problem of the cold leveler project in previous chapter, most of the solutions have lots of disadvantages and some of them are even impossible to implement for this project, so the best solution is to optimize dimensions of the equipment by technical office to have minimum difference with the estimated weight value of commercial office; in this case we can reduce the extra cost of the items (solution 2 of chapter 5).
In this solution it is important to keep all the contract conditions of the items and the technological office should approve the final dimensions proposed by technical office.

After all, if the utilizing various possible procedures for reducing the weight does not reduce enough of extra cost, there is always a possibility to use other articles of the contract (which has no restricted value) to recover the extra cost.

6.2 Recommendation for Future Projects

Wrong estimation of weight can happen for any future projects with prototype components and it can lead to over-weight. Considering the big amount of extra cost for this kind of problems, we suggest following preventing procedure to be implemented for the future projects before signing the contract.
It is important to have more communication between commercial and technical departments during preparation of the offer.

Generally in RIO meeting, different aspects of the contract in terms of problems and critical points are evaluated to have appropriate decision about weight and relative costs of the project; but currently the new items of the contract are not discussed enough in the meeting. We suggest having a specific section in the RIO template for new components, so the technical office can carefully study these items before the meeting and discuss the weight and relative cost of these components with commercial office during the meeting.

Generally the properties of the new components changes after RIO due to customer change of requirement (during offer phase), so we need to repeat the RIO meeting more than once, therefore Danieli should allocate some extra budget for evaluating projects that contain new components.
Furthermore it is important to use better references for estimating the weight and relative costs of the new components by the commercial office.

Abbreviation

The following abbreviations are used in this document:

B&F	Patents and Financing Department
CdC	Cost centers
CEO	Chief Executive Officer
CFA	Invoice Checking
COO	Chief Operating Officer
CR	Customer Responsible
CRD	Danieli Research Center
CSP	Shipping Department
D&C	Danieli & C. Officine Meccaniche S.p.A.
DA	Danieli Automation
DFE	DANIELI Co., Ltd.
Dir.	Director
DQA	Danieli Quality Division
DRU	Human Resources Department
DS	Danieli Service
FCO	Financing & Contracting
FIN-CO	Financial & Contractual Features
HQ	Headquarter
ICE	Integrated Configuration Engine
JAM	Jumbo Area Manager
JET	Job Enterprise Target
KAM	Key Account Manager
LdP	Product Line
Lev.	Level
MAC	Start-up and Commissioning Department
MacroP	Macro-planning
MoM	Minutes of Meeting
MUM	Operating and Maintenance Manuals Department
OW	One World
PM	Project Manager
PMF	Project Financing Manager
PSF	Proposal Sales Form
RIO	Offer Review
ROI	Return on Investment
SE	Safety Engineer
SL	Sales Leader
SLX	Sales Logix
SM	Sales Manager
SRD	Scientific Research Division
SW	Software

TEAM Department of Technological Processes
UAC Cost Analysis and Estimates
UCC Job Order and Contract Management
UPP Production Planning
UT Engineering Department
UTC Sales and Engineering Department

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