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THE SEARCH OF POTENTIAL ASME SUPPLIERS FOR WEIR POWER AND INDUSTRIAL FRANCE

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The purpose of the thesis was to search for potential suppliers that conform to the standards of the American Society of Mechanical Engineering, for the case company Weir Power and Industrial France, and finally to create a list of possible potential ASME partners. The problematic of the thesis was to analyze how the strategic sourcing methods could be used for the implementation of a specific supply chain that complies with ASME III requirements.

Accordingly, the conceptual framework of the study has shown interrelationships between two key concepts of the project: general issues of suppliers search and specific issues of ASME requirements. General issues have involved research on suppliers' product range and capabilities, suppliers' reputation. Specific issues have concentrated on the suppliers ASME requirements such as quality and qualification requirements.

In order to find out an answer to these issues, theoretical research was performed on the strategic sourcing process, the supplier identification process, the supplier evaluation and selection process. Besides, theoretical research on ASME codes and standards was conducted.

The empirical research was carried out based on primary data from the internal interviews, direct questioning of employees and from responses of suppliers to the questionnaire. Of course, secondary data including suppliers' web sites, catalogs, and internal company's data were also used in research. Nevertheless, the questionnaire was the main tool in conducting the empirical research. Questionnaire was sent to potential suppliers in order to evaluate their capabilities and quality program which had to comply with ASME III requirements. Besides, the internal interview with ASME Stamp Project Manager has helped to understand the strategic orientation of the company concerning ASME sourcing and has enabled to provide some recommendation to the Weir Company on how the strategy could be developed.

The final results have indicated that due to specific product requirements there were only few ASME suppliers that could meet the needs of the company. Gap in the product range, non-conformance to the technical requirements, insufficient manufacturing capacity provoked difficulties for establishing cooperation. Hence, to define and to analyze hazards that could arise out of the development of new sourcing strategy, the risk assessment process was undertaken.

TABLE OF CONTENT

1 INTRODUCTION

The development of the company's sourcing strategy is vital to success in business. Effective sourcing strategy is one of the important processes to strength a company's competitive advantages.

First let's give some few words about the context of my work research. Currently the case company, Weir Power & Industrial France intends to sell its core product, nuclear safety relief valves, to the US market. However, all the activities related to the nuclear business in USA, must follow specific engineering standards – ASME III standards developed by the American Society of Mechanical Engineering.

To put into action the new strategic purpose, the first step for the company is to employ ASME standards in their practice. As of today, the European nuclear engineering standards RCCM are commonly used by the Weir Company. These standards are also widely applied around the world but their requirements differ from ASME requirements and cannot be used for the intended purpose of the company. The Weir Company's familiarity with ASME issues is quite tenuous. In the same time ASME III requirements are a challenging technical issue and demand specific knowledge and experience from the company.

Generally, the semi-finished products used in fabrication of the company's core product are purchased externally from different suppliers. Consequently, in compliance with USA regulatory issue, the purchasing organization for company's projects conducted in USA where customers are requiring ASME codes and standards, must be performed only in cooperation with ASME-authorized suppliers.

Thus, the current supply chain of the company is no more sufficient and new suppliers that are in conformance to ASME regulations have to be found. The Sales & Purchasing Director suggested me to work on this project. For me, it is a great opportunity to use my working experience and my studies in SAMK in order to perform this work research. Indeed, I am eager to apply the theory about sourcing strategy in this very practical case.

Firstly, it is necessary to have a clear picture of what are the ASME regulations which is a very specific aspect of the project. But I consider also as very important to apply the general theories of strategic sourcing process. Indeed as it is presented in the conceptual framework part, this is the intersection of these two aspects that is the heart of my work research: the application of the general theory about sourcing strategy with the very specific requirements of ASME standards. As, it is presented in the methodology parts, all this background information, are the input data of my work research, that is to say, the data necessary to ensure an effective implementation of the project.

Finally it is necessary to achieve the main purpose of the thesis by getting the output data: a list of the most appropriate suppliers, taking into account all the requirements of the project. The chapter 7 about the implementation of the research describes in a very practical way the process which enables to get the list of the most appropriate suppliers from the input data (desk research, internal interview and questioning of employees), and thanks to the questionnaires.

2 PRESENTATION OF THE CASE COMPANY WEIR POWER AND INDUSTRIAL

Weir Group Company is an international company founded in 1871 in Scotland. The Weir Group is structured in three sector-focused divisions: Weir Minerals, Weir Oil and Gas and Weir Power and Industrial.

The core business of Weir Group Company is pumps design and production. Being recognised worldwide as a pump and valve company, Weir, over the following 140 years, also has built cars and buses, constructed prefabricated housing, oil pipelines, desalination plants, made armaments during two World Wars and been involved in the development of the precursor to the helicopter.

Today Weir's global footprint covers over 70 countries employing in the region of 13000 people.

The thesis project is performed for Weir Power Industrial Sebim. Sebim is one of the subsidiaries located in the South of France. Sebim manufactures a wide range of nuclear safety relief valves and accessories that are used worldwide. Weir Power and Industrial is a provider of a Sebim brand nuclear valves. (Website of Weir Power & Industrial. 2008).

3 OBJECTIVES OF THE RESEARCH

3.1 Purpose and objectives of the project

The general *task of the project* is the searching of potential ASME suppliers for the case company - Weir Power and Industrial France. But the *main purpose of the project* is to create a dedicated list of potential ASME suppliers.

The project research must enable the company to implement an ASME supply chain. It can also help in assessing threats and opportunities that are involved in the ASME sourcing process.

Here below are presented the 7 steps (objectives) of the project:

1 The first step is to identify problem areas of the project
2 The second step is to analyze what theoretical data are needed to implement the project
3 When the overall structure of theoretical data is defined, the next phase is to analyze what practical researches need to be conducted in order to achieve the project tasks

4 Once all data are harmonized it requires planning for implementation the practical researches

5 Then the practical researches need to be conducted and the data has to be evaluated

6 Being based on the project research, the dedicated suppliers list for the company must be created

7 Finally, the complete project must be provided to the company and to the SAMK

3.2 Project tasks and problem areas

The problematic of the thesis is to analyze how the strategic sourcing methods can be used for the implementation of a specific supply chain that complies with ASME III requirements.

In order to find an answer on this issue the theoretical researches on the strategic sourcing process must be conducted.

In addition, to perform the thesis research the following problem areas related to ASME sourcing strategy are identified:

1 What is ASME III in general?

2 Why the company intends to develop the ASME sourcing strategy?

3 How many ASME III potential raw material suppliers exist on the global market?

4 Brief suppliers' analysis:

- 4.1 What are the products and services offered by these suppliers? Is it in accordance with the company's demand?
- 4.2 What are the suppliers' capabilities according to the requirement of ASME III?
- 4.3 What type of additional service conforming to the requirement of ASME III and the company's requirements the suppliers could offer? (Machining, stamping and so on).

5 What are the raw material suppliers' quality requirements in accordance with ASME Section III?

6 How the ASME III suppliers could be qualified by the company? Are the company's current suppliers can apply norm ASME III in their practice?
7 Why is the company interesting to get ASME III accreditation? What are the requirements to obtain ASME III NV?

3.3 Conceptual framework

The graphic illustration of the interrelationships between key concepts of the project could be presented as the following:

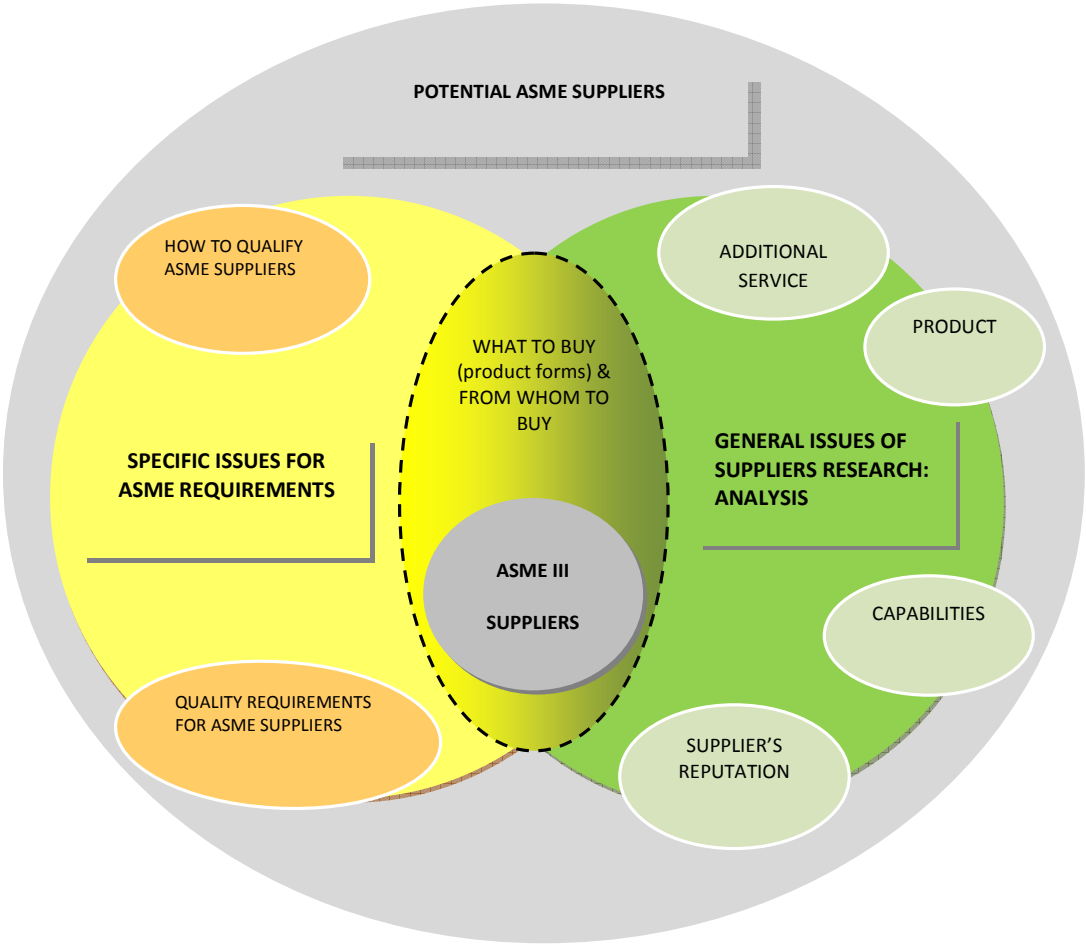

Figure 1: Conceptual framework of the study. The version is based on my own design.

The conceptual framework shows that the project is the intersection of two problem areas: general issues of suppliers search and specific issues of ASME requirements.

General issues describe the problem areas regarding the supplier's assessment criteria. Products offered by suppliers, suppliers' capabilities, suppliers' reputation on the market, additional service provided by suppliers are the main research factors for the evaluation of general criteria of the company's sourcing process.
Specific issues describe the ASME requirements for suppliers such as quality testing requirements, qualification requirements and other specific requirements. All these factors should be analyzed and evaluated in order to prepare a comprehensive list of the possible potential subcontractors.

4 ASME CODES AND STANDARTS

4.1 Definition of ASME codes and standards

A standard can be defined as a set of technical guidelines and instructions for designers, manufacturers, and users. Standards promote safety, reliability, productivity, and efficiency in industries that depend on engineering components and equipment. Standards are written by experts and can cover a few paragraphs to hundreds of pages.
Standards do not have the force of law, they are voluntary. Standards become mandatory when they are incorporated into a business contract or into regulations.
On the contrary a code is a standard that is adopted by one or more governmental bodies and has the force of law. (Website of the American Society of Mechanical Engineering 2012).

ASME is the American Society of Mechanical Engineering. It is a professional, non-profit organization which promotes advances in engineering.
Since 1971 ASME grew from certifying manufacturers in 2 nations (The United States and Canada), to certifying manufacturers in 75 nations. Today ASME is a leading international developer of codes and standards associated with the art, science, and practice of mechanical engineering.

So as industrialization reaches the developing world and companies merge across international boundaries, nowadays it is increasingly important to have one global standard. ASME standards are translated into Chinese, French, German, Japanese, Korean, Portuguese Spanish and Swedish.
Over 600 standards are published by the ASME, and many of these standards are adopted as legal codes in nations all over the world. These standards apply in different fields such as pressure technology, nuclear plants, elevators/escalators, construction, engineering design, standardization, and performance testing.

Currently ASME includes more than 120 000 members in over 150 countries worldwide. (Website of the American Society of Mechanical Engineering 2012; American Society of Mechanical Engineering 2008).

4.2 ASME/BPVC Section III Engineering standards for nuclear industry

The ASME Boiler and Pressure Vessel Code (BPVC) is a standard that provides rules for design, fabrication, and inspection of boilers, pressure vessels and nuclear power plant components. The BPVC consists of twelve volumes.
The idea for the BPVC arose in 1911 out of the need for public safety, following the invention of the steam engine in the late 18th century. Throughout the 19th century there were thousands of boiler explosions in the United States and Europe, some of which resulted in many deaths.

The BPVC is divided into the following 14 sections:
Section I – Rules for construction of power boilers
Sections II, IID and IIDM are related to the Material specifications
Section III – Rules for construction of nuclear facility components
Section IV –Rules for construction of heating boilers
Section V is related to the Nondestructive examination
Section VII - Rules for the care and operation of heating boilers
Section VIII – Rules for Construction of pressure vessel
Section IX – Welding and Brazing qualifications

Section X – Fiber reinforced plastic pressure vessels
Section XI – Rules for the service inspection of nuclear power plant components
Section XII – Rules for construction and continued service of transport tanks
Code Cases – Boiler and Pressure Vessels
Code Cases* – Nuclear Components
*Code Cases provide rules that permit the use of materials and alternative methods of construction that are not covered by existing BPVC rules.
(Website of the IHS Inc. 2012).

The BPVC is the largest ASME standard, both in size and in the number of volunteers involved in its preparation.
Various sections of the BPVC are adopted into law in all the Canadian provinces and in 49 of the 50 United States. More than one-quarter of the companies accredited by ASME Codes and Standards manufacturing pressure parts in accordance with various sections of the BPVC are located outside of North America. (Website of the IHS Inc. 2012).

BPVC Section III covers an array of nuclear components, including pressure vessels, piping, pumps, valves, supports, core support structures, pressure relief, containment systems for spent fuel and high-level waste transport packaging, and concrete components. (Website of the IHS Inc. 2012.)

ASME III is a design code that tells a company how to design, fabricate and inspect things, complete with required calculations and material strengths. It requires complete traceability of items from raw material to finished product to installation. (Mayfield 2008). So as the fabrication of pressure relief safety valves for nuclear industry is a core business of the case company, the application of ASME/BPVC Section III – engineering standards for nuclear industry, requires for the company' business operation.

As already said, in compliance with USA regulatory issues, the operations related to the nuclear business in USA, must follow the ASME III requirements.
Thus, the purchasing organization as well as other activities for any of nuclear maintenance conducted in USA or in other countries where companies adopt the

ASME III standard could be performed only in cooperation with ASME-authorized suppliers or ASME-authorized service providers. (Website of the American Society of Mechanical Engineering 2012).

4.3 General requirement for ASME III raw material suppliers

As already mentioned in §4.1 the ASME nuclear component certification program covers different equipment and activities provided by Section III of the ASME BPVC.

Utilization of the ASME certification mark is a means of complying with the laws and regulations in all 50 states in the U.S., and all of the provinces of Canada. In addition, it is estimated that over 100 countries accept the ASME BPV as a means of meeting their government safety regulations.
Currently the quality systems of more than 5800 companies in more than 70 countries are certified by ASME. (Website of the American Society of Mechanical Engineering 2012).

So as the main issue for the case company is to find the material manufacturers supplying product forms and semi-finished product forms such as forged blocks, bars and plates, the ASME III requirements related to this category of suppliers must be examined. In accordance with ASME III standard, accredited ASME manufacturers producing material and components for nuclear industry are approved as **Nuclear Material Organization** (MO). (Website of the American Society of Mechanical Engineering 2012.) Therefore, when searching for the right suppliers it is one of the first parameter that must help me to create the preliminary Excel table with suppliers.

Public safety in nuclear power generation is the main goal of ASME MO (Material Organization) certification. Through their quality assurance program, ASME has established a framework for nuclear materials that match the technological requirements of their nuclear standards.

Certified manufacturers must be in compliance with strict ASME nuclear energy standards concerning

- production
- testing
- inspections
- control measurement
- devices, and
- pass all ASME examinations

Different countries have their own standards for nuclear power generation, but standards for manufacturing materials for equipment are all based on ASME.
Thus, ASME nuclear power standards are not just used in the US, but are essentially global standards. (Website of the American Society of Mechanical Engineering 2012; ONE/TÜV/BV's shareholders 2009).

The evaluation of Quality Assurance Program is the main requirement to obtain ASME MO Certificate. Issuing of the Certificate is always granted only after a satisfactory Survey by ASME. (Website of the American Society of Mechanical Engineering 2012; ONE/TÜV/BV's shareholders 2009.)

4.4 Suppliers quality requirements in accordance with Section III.

The basic elements required by suppliers as a part of ASME III related mainly to the quality requirements.
A brief analysis of Suppliers' quality requirements is presented here so as the technical aspect is not the main subject of the project. The clarification of the basic requirements must provide the readers with the essential data that are fundamental to perform the project.
As already said BPVC Section III applies to different types of nuclear components that cover by different certificate types. Certificate Holders of different nuclear component category have different requirements. Below the different BPVC Section III certificate categories are shortly described.

- N Certificate related to vessel, components, piping systems, pumps, storage tanks.
- NV Certificate is for Pressure Relief Valves.

Requirements for obtaining NV Certificate are briefly analyzed in the paragraph 4.4, considering that the obtainment of NV Stamp by the case company is the main strategic aim for 2013 year.

- NPT Certificate – parts, appurtenances, welded tubular products, piping subassemblies.
- NA Certificate related to assembly of all items.
- NS Certificate related to support.
- Own Certificate is for Nuclear Plant Owner.
- **Quality System Certificate** (QSC) – Materials. (Requirement for raw material suppliers). (Website of the American Society of Mechanical Engineering 2012; LaRochelle 2010).

4.4.1 Quality System Certificate Holder (QSC)

All ASME III accredited material manufacturers are Quality System Certificate Holders. QSC is obligatory requirement for all ASME manufacturers and suppliers producing or supplying ferrous and non-ferrous materials.
Every Certificate Holder gets its individual certificate number.
Quality System Certificate Holders are audited by ASME at least once annually. (Website of the American Society of Mechanical Engineering 2012).

4.4.2 ASME II – Materials

ASME Section II provides material specifications for ferrous and non-ferrous materials which are suitable for use in construction of pressure equipment.
In addition to QSC, the obligatory requirement for raw material manufacturers is to work according to ASME Section II. ASME II provides specifications that contain requirement for manufacture, chemical composition, heat and product analyses,

mechanical test requirement, methods of testing and other requirements. (Website of the American Society of Mechanical Engineering 2012).

4.4.3 Non-destructive Examination (NDE) methods conforming to ASME standards Section V

ASME BPVC Section V: Nondestructive examination contains requirement and methods for nondestructive examination (testing). It includes manufacturer's examination responsibilities, duties of authorized inspectors and requirements for qualification of personnel, inspection and examination.
Requirement for ASME III suppliers is NDE examination performed in compliance with SNT-TC-1A. (Website of the National Board of Boiler and Pressure Vessel Inspectors 2012).

The NDE is ASME engineering division that covers the evaluation of critical system components for material, defect, and structure characterization through nondestructive methods. For the case company - ultrasonic, penetrate and magnetic-particle are the most important methods to be evaluated. (Corsetti, personal communication on 27.01.2012).

Successful and consistent application of non-destructive testing techniques depends heavily on personnel training. Personnel involved in application of NDE methods should be certified. Usually certification is enforced by law or by the applied codes and standards (depending on country and company's business activities). For ASME III members the certification is enforced by applied practice SNT-TC-1A. (Website of the National Board of Boiler and Pressure Vessel Inspectors 2012).

SNT-TC-1A is Personnel Qualification and Certification in Nondestructive Testing written by the American Society of Nondestructive Testing (ASNT).
This document requires an internal company procedure and establishes levels of qualification based upon a combination of education, training, experience and qualification examinations.

There are three qualification levels applied by SNT-TC-1A practice. The basic levels begin with NDT Level I primary used as an operator technician. NDT Level II, the next level requires more training and experience. The NDT Level III usually requires 4 years of experience as an NDT Level II in the method.

4.4.4 Accredited laboratories according to ISO 17025

International Organization for Standardization (ISO) is the world largest developer and publisher of international standards for business, government and society. ISO is a network of the national standards institutes of 163 countries.

ISO standards aim to ensure characteristics of products and services such as quality, environmental friendliness, safety, reliability, efficiency and interchangeability.

ISO 17025 standards are general requirements for the competence of testing and calibration laboratories. ISO 17025 controls all aspects of how laboratories conduct their business (ie. who, what, when, where, how, how much, & why) of measurement, testing, certifying, recommending, & reporting.

In accordance with ASME Section III, suppliers should establish, implement and maintain the Quality Program that compliance with the requirements of ISO 17025, meaning the use of a testing laboratory accredited according to ISO 17025 quality standards. (Website of the International Organization for Standardization 2012).

4.5 ASME III NV Stamp: general requirement for application

Currently the case company has a strategic aim to supply components (valves) for a nuclear power plants located in USA and in other countries where nuclear business certified by ASME standard.

The U.S. Nuclear Regulatory Commission, responsible for issuing construction permits and operating licenses for nuclear power plant, requires conformance with certain ASME codes and standards in its regulations. Therefore to obtain a construction permit or operating license, company must meet the requirement of these codes. (Website of the International Organization for Standardization 2012).

In the company's case the "NV" Stamp is needed in order to receive authorization to supply nuclear components (valves) in accordance with ASME requirements.
Code Symbol Stamp "NV" is set for ASME Nuclear Safety and Pressure Relief Valves Accreditation. (Corsetti, personal communication on 27.01.2012).

In order to get the "NV" Code Symbol Stamp the case company must meet requirements conform to BPVC under Section III Div.1, Subsection NB.
(Corsetti, personal communication on 27.01.2012.)
The main requirements related to Section III are that N-type Certificate Holders should comply with ANSI/ASME NQA-1-1994 Edition (ANSI is American National Standards Institutes) - Nuclear Quality Assurance Requirements for Nuclear Facility Applications. Main Nuclear Quality Assurance Requirements define the following criteria:

- Design bases (design process, design analysis, specifications, procedures and instructions);
- Material certification meeting certain standards;
- Personnel and equipment qualification requirement;
- Inspection requirement for personnel and items related to test procedures, control, handling and storage

Audit must be performed to verify compliance with all aspects of Quality Assurance Program and its effectiveness. Audit performs by the ASME Survey Team together with ANI Supervisor. The ASME requires that an audit acceptable to the ASME should be performed at each field site to assure that the Quality Assurance Program is implemented and enforced. Authorization to apply a Code Symbol Stamp to an item is granted only after a survey by the ASME satisfactorily demonstrates the adequacy and implementation of the Quality Assurance Program.
(Website of the American Society of Mechanical Engineering 2012; LaRochelle 2010).

Obtaining a Code Symbol Stamp “NV” must make possible to extend the company’s market share and to reduce ASME-related barriers to trade. Moreover, after receiving the NV Stamp, the company must be authorized on its own to certify suppliers which are not accredited by ASME but are valuable for the company. In this case, the certification process is more simplified and takes a shorter time. (Corsetti, personal communication on 27.01.2012).

Finally, when comparing a delicacy of the accreditation process of two different certificate types that are discussed in this chapter, it could be said that the ASME accreditation process to obtain the Certificate of Authorization as a Material Organization is more simple and takes less time than those to obtain any “N” Code Symbol Stamp. In this case, the audit is more demanding and scheduling reviews can take up to 8 months and even more. (Corsetti, personal communication on 27.01.2012).

5. SOURCING PROCESS

5.1 An overview of sourcing process

Sourcing process begins from a company's procurement operations, and reliable supply chain begins with the sourcing process. According to Solish & Semanik (2010, 1) sourcing represents purchasing and management function.

Purchasing covers a variety of activities related to the goods and materials consumed by or used within an organization. Depending upon company structure, these activities might include identification of supplier, suppliers' certification, conducting negotiation and reaching agreements, or background checks (supplier reputation). Purchasing plays a significant role in locating and qualifying suppliers for required products. It takes the lead in price quotes and negotiations and will make strategic recommendations based on any one or combination of the above activities. Purchasing conduct final contract negotiations, fosters agreement, and oversees the approval process. (Solish & Semanil 2010, 1).

Today, in most firms the purchasing considers as an operational function without any strategic potential. There sourcing is nothing more than the plan to pick suppliers. Of course it is a main role of sourcing, but with potential for so much more. (Rogers 2009, 73-74).

Basically sourcing is a process of locating and employing suppliers. However, depending on organizations, this process is often defined in different ways: it depends on how the organization manages its supply chain. Today sourcing is designed to help create a competitive advantage for the company on the market by optimizing spend, improve savings and streamline supplier relationship management. In general, purchases accounts for one of the largest part of the company's total cost. So the importance of sourcing is self-evident. (Solish & Semanik 2010, 1-2).

According to Paquette (2004,7-8) sourcing is a departmental name that is slowly replacing purchasing in companies structured for twenty-first century business.

Finally, the most common definition of sourcing is the process of identifying potential suppliers, conducting negotiations with them, and then agreeing supply contracts with these suppliers. Before implementing any sourcing strategy, it is important for the company to make supply market assessment and to evaluate the projected spending related to the development of a new sourcing strategy. (Solish & Semanik 2010, 1-2).

5.2 Strategic sourcing

Rogers (2009, 71) states that some familiar examples include confusing “strategic sourcing” with “sourcing strategy”. Based on Capgemini Conculting (2008) point of view the sourcing strategy is about defining what an organization wants to do with the tasks, functions or processes that are not differentiating the organization from its competitors. And the strategy does not apply to the non-critical process, but to every task, function or process that provides added value to the organization.

However a strategic sourcing involves the supplier selection and supplier management tasks. It is a process of evaluating, selecting and aligning with suppliers to achieve operational improvements in support of an organization’s strategic objectives. (Duffie 2005.) Thus, strategic sourcing is combination of sourcing strategy and supplier relationship management. (Rogers 2009, 70-71.)

The term “strategic” is applied to recognize that many sourcing projects require a long-term plan of supply chain action. So it meets the needs that make sourcing “strategic”. (Rudzki 2005, 119).

Basically, there are several processes within the strategic sourcing process:

- Evaluation of the company’s current spending

- Assessment of what is currently available on the supply market
- A review of the cost benefit analysis of using other suppliers
- A review and identification of suitable suppliers
- Development of a sourcing strategy
- Negotiations with suppliers to ensure that they meet the company's demand and requirements (price, product, service level, ect.)
- Implementation of the new supplier relationship
- On a continuous process, review and update the strategic sourcing

(Website of Purchasing and Procurement Centre 2012).

Nonetheless, this project research involves mainly assessment of supply market, identification of suitable suppliers, and development of a sourcing strategy.

5.2.1 Objectives

The strategic sourcing plays a central role to become a competitive differentiator for a company's business. As already mentioned, the accomplishment of the strategic sourcing is based on multistage processes such as understanding of supply market, understanding of internal needs, identifying of qualified suppliers interested in company's business, structuring of the right type of relationship, negotiation and implementation.
According to Solish & Semanik (2010, 1-2) strategic sourcing is an organizational procurement and supply management process used to locate, develop, qualify and employ suppliers that add maximum value to the buyer's products or services.

Consequently, the major objective of strategic sourcing is to engage suppliers that align with the strategic business and operational goals of the organization. (Solish & Semanik 2010, 1.)

5.2.2 Assessment of supply market

Assessment of supply market (Market analysis) plays a significant role in strategic sourcing. It is a tool that helps to gather information about availability trends and pricing as well as critical information about inherent risks and the structure of the market itself. It helps to get data about new technology that are available on the market as well as to learn who the key suppliers are and what advantages they offer.

Depending upon company structure and their objectives, market analysis becomes an extensive and time-consuming project. Thus it is important to prioritize the requirements. The objective of the market analysis is to evaluate opportunities and threats evolving in the targeted market. (Solish & Semanik 2010, 81).
According to David A. Aaker, professor at the Haas School of Business of the University of Carolina, the major categories of market analysis that have to be considered are market size, market growth rate, market profitability, industry cost structure, distribution channels, market trends and, the last but not least, key success factors. (Solish & Semanik 2010, 81-82.)

Market share is always important when assessing a particular supplier's position within the market. It helps to assess supplier's success within its industry and explain to what extent a supplier is competitive relatively to other vendors that offer similar products. (Bartolini 2012; Solish & Semanik 2010, 82).

Market growth rate can help to define if there are market capacity available and for how long. Identification of the success or failure of current sales helps a company to decide the continued direction of the business's operations as well as where to go if the product or service is being fully saturated to its potential. (Chavis 2012; Solish & Semanik 2010, 82).

Further, if a company is profitable on the market, it can provide a stable source of supply. Factors that determine the *market profitability* include balance of demand and supply as well as barriers to entry the market, competitive nature of the market, the supplier power and buyer power. The market profitability can be evaluated with a

help of different tools. For example, one of the most known methods for measuring the appeal of market is the Porter's Five Forces model which specifies five main factors (above-mentioned) that influence market profitability. In order to define the appropriate suppliers it is important to identify key suppliers, their markets, and where their major customers are located, if and how they compete with one another. (Solish & Semanik 2010, 82, 184).

Industry cost structure provides an indication on the flexibility and scalability of the business. Having a low cost structure is a strong competitive advantage which market leaders in industry after industry recognize, when companies with low cost business enter their market. (Sundelin 2009; Solish & Semanik 2010, 82).

Channels of distribution are designed to move the product from the hands of the supplier to the hands of the client. Activities involved in this process are wide and varied. So the more hands a product passes through, the higher its price and the slower its delivery tend to be. (Solish & Semanik 2010, 82).

Understanding of *market trends* such as price fluctuation and product availability and being able to project how long these trends are likely to continue, can provide buying opportunities that lower cost. It is important to look at economic levers, political stability, and products development trends to ensure that they are in alignment with the company's forecasted requirements. (Tatum 2012; Solish & Semanik 2010, 83, 185).

Key success factors are important elements that are needed for the company in order to accomplish its market entry goals. There are various factors for success within a market. For example, technological progress, higher quality and satisfaction levels, ability to achieve economies of scale, first to market – all these factors, provide company some opportunities for success. The key success factor may vary over time. It is important to match the company's requirements to the capabilities of suppliers to determine if there is potential fit in terms of technology and capacity. (Website of Penetrating.com 2012; Solish & Semanik 2010, 83, 185).

Finally, during the market analysis, it is important to identify all possible areas of risk and how they can be controlled or eliminated. (Solish & Semanik 2010, 185).
In this project research, market analysis is useful to assess how many potential suppliers exist on the market, what products and services potential partners offer, what are their operational and quality conditions. Also market profitability and market trends are briefly analyzed in order to evaluate opportunities and threats involved in developing new strategy.

5.2.3 Development of sourcing strategy

Dobler & Bur (1996) state that developing a sourcing strategy is a complex process and there are a lot of factors that has to be taken into account. One of the most important aspects to consider when developing a strategy is to define how many parallel sources of supply should be used.

A company can choose to take all supply from a single supplier, which is usually called single sourcing, or it can take its suppliers from two or more suppliers, called dual or multiply sourcing. The different strategies are appropriate in different situations. It is important to demarcate one sourcing strategy from another. (Dobler & Bur 1996).

The advantages of single-sourcing strategy include stronger integration between buyer and supplier that allows the stronger cooperation with shared benefits, and long-terms relationship based on high levels of trust. Single-sourcing also provides large commitment of the supplier that is willing to invest in new facilities or new technology. Moreover lower purchase price is another benefit resulting from reduced production costs due to better knowledge of the manufacturing process by supplier and achieved economies of scale. (Costantino & Pellegrino 2009).

In contrast with single sourcing, multiple sourcing might protect the buyer in times of shortages, and to maintain a competition and provide a back-up source. Multiple

sourcing is also appropriated when the customer is a small player in the market for a specific item. (Dobler & Burt 1996).

One other thing has to be considered when developing a sourcing strategy is whether to source locally, nationally or internationally. Pro and contra of different sourcing strategy are discussed in §5.3 “Supplier Identification process”.
Meanwhile broadening the supply chain internationally is a part of a strategic sourcing for any organization that runs a business in multiple countries.
Although the most common reason stated for it is to lower costs, there is also a significant advantage in developing a broader supply base, increasing the number of possible suppliers from which the buying company can select. Thus increased competition enables lower costs and provides competitive pressure to suppliers that result in increased overall value. Furthermore overseas sources in some industries can be more advanced technologically than existing counterparts and can provide greater productivity, particularly for specific business.
(Solish & Semanik 2010, 183 – 184).

So the development of sourcing strategy for an international company cannot be considered without factors involved in an international sourcing. Consequently, the strategy should include a set of criteria for making decisions to use international sources.

Solish & Semanik, (2010, 184-188) suggest considering the following issues that generally apply to the development of an international sourcing strategy:

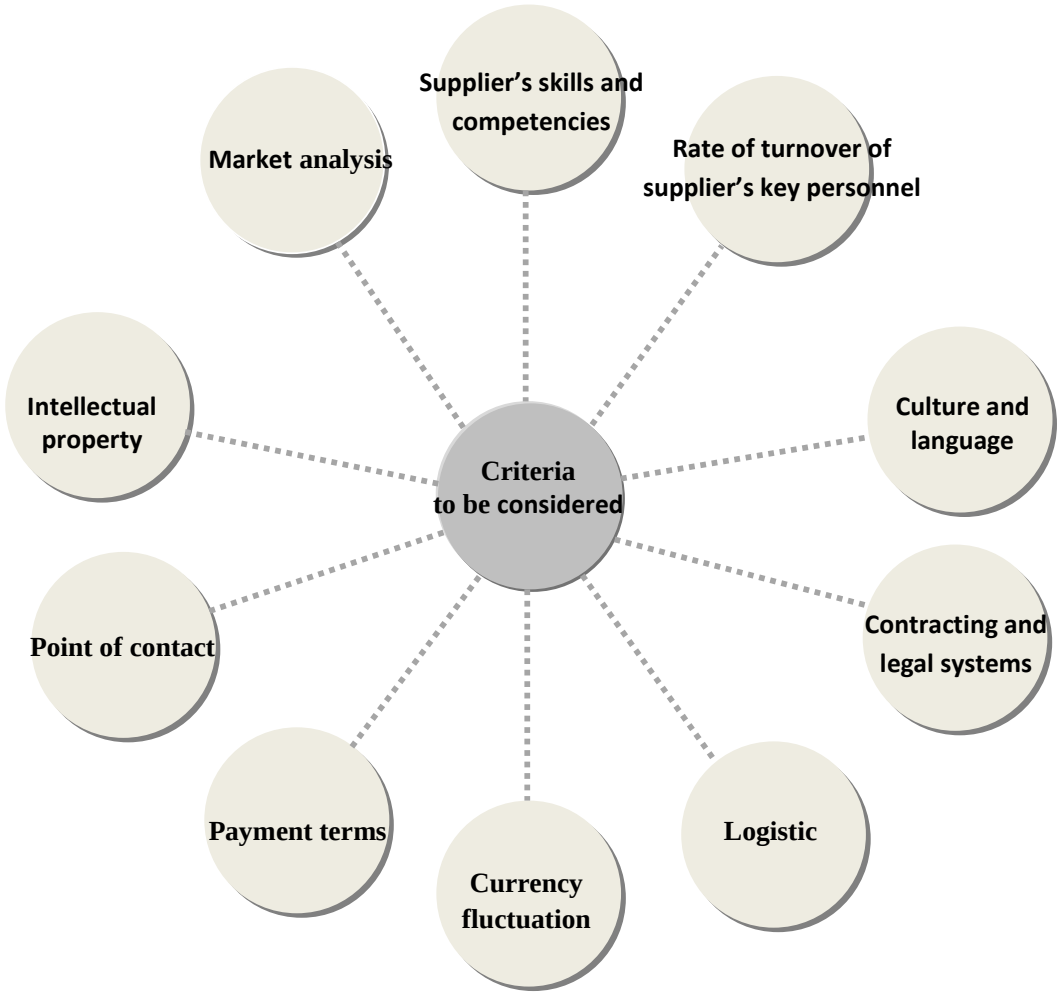

Figure 2: General issues applying to the development of international sourcing strategy (Solish & Semanik 2010, 184-188)

Furthermore, another important aspect of sourcing strategy development is to make a decision whether to buy from a distributor or directly from a manufacturer. In general it is more expensive to buy from a distributor than from a manufacturer, but instead the distributor can add other values to the product. The distributor can for instance, stock products from many different manufacturers and thereby make it possible to order many different products with only one order. This saves money in ordering, receiving, control and invoice handling. It is also often possible to buy smaller quantities from a distributor than from a manufacturer. Thus it is possible to assume that the smaller and less significant the purchase the more likely it is that a distributor is the way to go. (Dobler & Burt 1996).

Finally, a buying company must always be aware of potential conflicts of interests when developing a sourcing strategy and in particular when choosing suppliers. (Solish & Semanik 2010.)

5.2.4 Strategic Sourcing Risk Assessment

Risk Assessment is an essential tool that helps a company to identify and to control hazards involved in sourcing process. However, risks assessment is unfeasible without considering the overall risk management process. It is a part of the ongoing risk management process that assigns relative priorities for mitigation plans and implementation. (SA Survey Analytics 2012).

Developing relevant Risk Management begins with understanding the risks facing the organization, the uncertainty it places on business performance and the organization's ability to scope should the risks occur. (Tervonen 2012.)

According to Solish & Semanik (2010, 171-172) risk management is a process of identifying, assessing, and controlling risk and making decisions that balance risk with offsetting benefits or rewards.

Risk affects many aspects of supply sourcing process. Based on it a company makes a decision when selecting suppliers. A company selects those suppliers that are most likely to meet its stated requirements: suppliers with low risk. (Solish & Semanik 2010, 171-173.)

With an effective process in place, risk can be managed so that the impact of a potentially catastrophic event can be minimized or avoided altogether. Identifying specific risks is a first step in risk management process. (Solish & Semanik 2010, 171-173; Tervonen 2012). Solish & Semanik (2010, 173-174) suggests consider the following more common categories of risk when dealing with risk management:

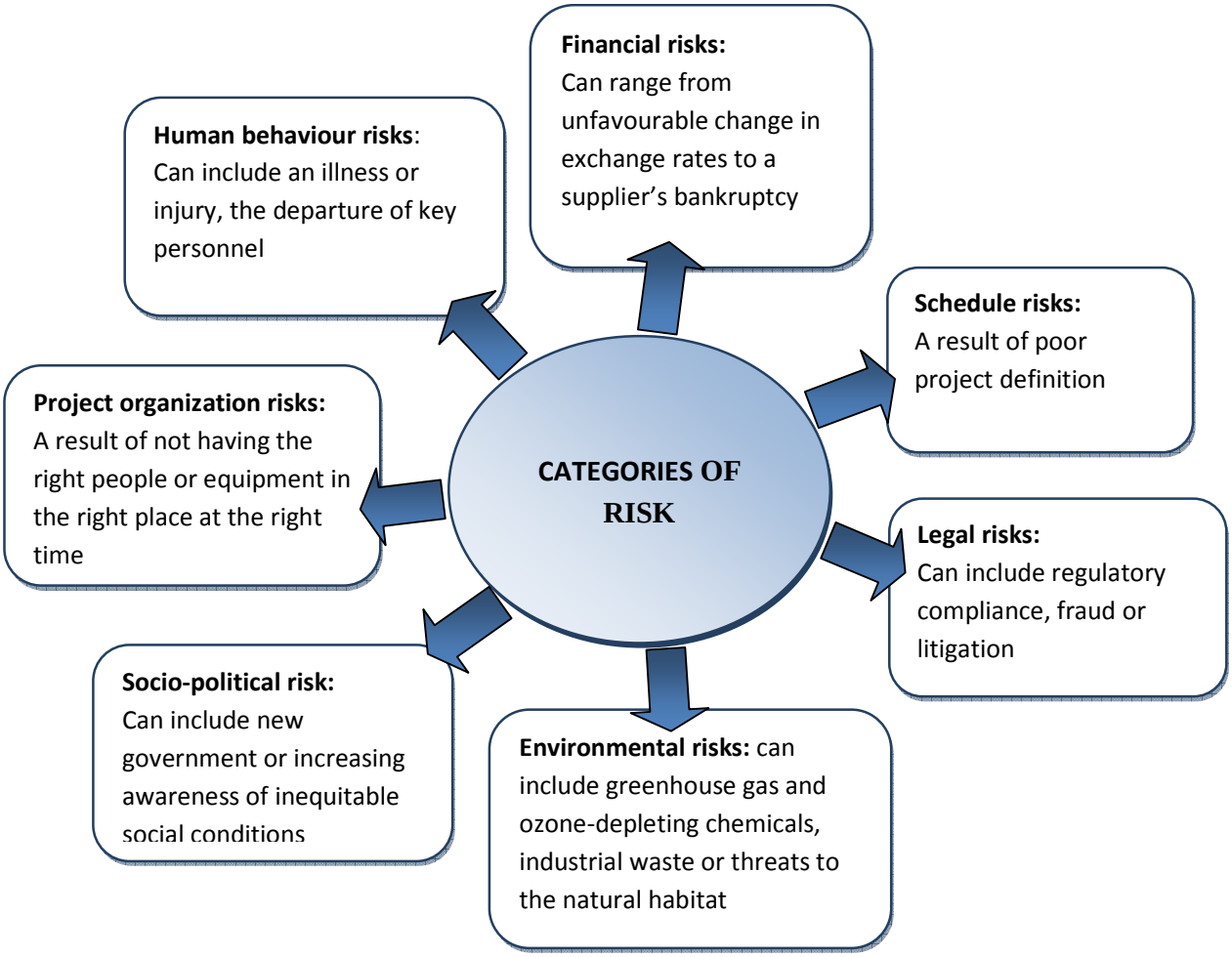

Figure 3: Risk categories (Solish & Semanik 2010, 173-174)

Risk Identification

As already mentioned, a first step towards risk assessment is risk identification. Before any exposure can be effectively analyzed, controlled or financed, it must first identify. (Carothers 2010.)

There are many different techniques and tools that might be useful in helping the company identified risks.

For instance, expert knowledge, or historical database of risks encountered in previous sourcing operations can help to gather the relevant data. Brainstorming, checklists or simulations are other commonly used techniques for risk identification. (Solish & Semanik 2010, 175).

These tools and techniques allow produce a long list of risks. However such laundry list of risks does not provide the big picture view of the project risks. (Website of Acquisition Community Connection 2011; Solish & Semanik 2010, 176; Carothers 2010).

Alternatively, the Risk Breakdown Structure (RBS) used in estimating the work required to get a project done. The model is similar to the Work Breakdown Structure. RBS helps to create a more organized list of risks faced by a project. (Ritter 2008).

The expert knowledge and historical databases are the main tools that are being used to conduct the project research.

Risk Assessment

Risk assessment is a next important step in the risk management process. It helps the company focuses on the risks that really matter in its business – the ones with the potential to cause real harm.

Once the company has identified the elements of potential risk, it needs a method of evaluating or measuring them to determine which require the company's attention, now and in the future. The level of risk is determined by its like hood and severity of the harm. The company can uses qualitative terms such as very high, high, moderate, low, and very low in order to identify the probability of risk occurring and prioritize the risks associated with sourcing. (Solish & Semanik 2010, 176-178).

It is important to prioritize and tackle the biggest risk first. Some examples of hazard might include a cost overrun, schedule slippage, safety incident, health problem, malicious activities, environmental impact, or failure to achieve a needed technological progress. (Solish & Semanik 2010, 176-178).

Risk Control

After identifying and categorizing the risks, the company must take steps to control them. It is evident that the company might not be able to eliminate risk entirely in many situations. However, the company might be able to minimize risk or mitigate it. Other available options to control risk are to avoid it altogether or to transfer the risk to the company's supplier. (Tervonen 2012).

Moreover, the implementation of the control measures for those risks that cannot be eliminated must be prioritized according to the level of risk, with the highest risks being tackled first (Tervonen 2012.).

Identified risks can be managed with a variety of methods. Solish & Semanik (2010, 178-181) underline the following key techniques of risk control:

- If the company can identify the cause of risk, it might be able to reduce or eliminate risk through **avoidance**. Some risks may be too costly to bear a burden and this means that the company has to prevent any impact that may result to such a loss (Tainers 2012.).

  For example, if the lack of skilled resources causes a risk, the company can eliminate the risk by building cooperation with qualified supplier who is able to perform the required services.

  Or, let's suppose, for example, that the project calls for the heavy use of certain material such as stainless steel nuts. The cost of these nuts fluctuates daily. So it is difficult to estimate the project cost over several dozen weekly purchases of nuts. The threat of cost increases is highly probable with a potentially significant budget impact. Using the method of avoidance, the company might contract with the supplier to buy nuts at a fixed price for the expected duration of the project. (Alderman 2011).

  Nevertheless, the avoidance of risk is a negative rather than a positive technique. Personal growth of the individual and progress in the business both require risk taking. If risk avoidance techniques are utilised extensively, both the individual and society would suffer. For this reason, avoidance is an

unsatisfactory approach to dealing with many risks. (Australian Risk Services 2012).

- **Reducing risk** is an essential part of risk management. It is important to implement the control measure so that the hazard occurs as rarely as possible or that the consequences are small as possible, or preferably both. For example, a supplier missing a scheduled ship date may be a signal that goods will not be delivered on time to meet the deadline. Consequently the person in charge has to be responsible for checking with the supplier to make sure goods are shipped on the specified date. (Solish & Semanik 2010, 178-180; Tervonen 2012).
- A company may choose to **accept** the consequences and likelihood of a particular risk. This can happen if risks are not fully identified. Many of the risks included in this category cost less to fix when they occur than it would cost to investigate and plan for them.

  An example of risk acceptance is the risk that items that are purchased for the project can be defective. Let's suppose that there is a probability of 2 percent that this may occur. That is, those items are delivered on are not acceptable for the fabrication and should be replaced with new items. This causes a delay of ten days to a task that has forty days of free float. (Egeland 2009).
- Along with key elements of risk control listed above, a risk can also be **transferred** to another party by agreement, or by buying insurance to cover any financial loss. In some situations, supplier, subcontractor or insurance companies may be better suited to dealing with a particular risk. However, a risk transfer may come with additional cost, such as the cost of insurance or an additional amount tacked on to the pricing by the supplier in order to deal with the risk. (Solish & Semanik 2010, 181).

5.2.5 Impact on the company's strategy and internal organization

As mentioned earlier, strategic sourcing is an important tool to be used in the transformation process for organization. Strategic sourcing has a potential to create value for an organization. It delivers a solution that contributes to the organization's

success and minimizes sourcing risks. However in order to maximize the benefits of strategic sourcing it must become an integral part of the business strategy. (Purchasing Practice 2008).

The role of the strategic sourcing as well as the sourcing in general is to link the company's business needs with the capabilities of external suppliers. Thus, supply must be able to interface with the external world of the market place and suppliers, as well as with the internal world of the business units, projects and functions. (Aqua Management Consulting Group 2008).

Company creates the strategic sourcing in order to improve productivity of resources, to develop technologies and skills, to reduce costs and improve service as well as to improve the critical aspects of business performance including time-to-market and supply chain management. All these factors influence internally as well as externally on the company's business organization process. It allows the company to concentrate on core competencies and speeding up the development of new ideas for the business. (Morgan 2003).

5.3 Supplier Identification Process

5.3.1 Locating new suppliers

As already mentioned in previous chapters, one of the most important steps in strategic sourcing process is the supplier identification process. How the company identifies the suppliers depends on the estimated value of what is needed.
For example, suppliers for lower value requirements can be identified using company's own knowledge, trade magazines ect. For higher value requirements, an advertisement can be placed to which a number of suppliers may respond. (Website of Procureweb 2012).

When the requested products are not covered by an existing purchase order or contract, or the purchaser is not satisfied with the company's existing suppliers, it is

necessary to identify prospective suppliers who can meet the company's requirements. Of course, each purchaser has their own methods for locating supplier candidates. (Website of Procureweb 2012).

However, according to Solish & Semanik (2010, 72-75) it is common to rely on one or more of the following strategies which are summed up in the following table:

Table 1: Methods for locating suppliers

Company experts as engineers, production managers	+	They are users of key inputs so can provide required information very specifically
	-	Limited and subjective knowledge
Current Suppliers	+	They have often required information and solutions that meet the company's requirement
	-	Risk to miss innovative, competitive alternatives
Recent market research (similar purchases, review records relating to the prior purchases)	+	Save time
	-	Previous purchase can be not in compliance with new requirements
Internet	+	Too much information available on the Internet
	-	Difficulties to search the right data
Online database (Industry website and consolidated catalog sites, or source list from other sections within the company)	+	Suppliers already known internally by the company or by the industry. Return on experience.
	-	Can be too limited for new requirements
"Directories and industrial guides" (for example Tbomas Register)	+	Contain information about supplier' product or services, capabilities, size and market segment, along with contact names, e-mail-address, web site URLs, and telephone numbers. Directory covers several hundred industries and hundreds of thousands of suppliers.
	-	Time consuming to sort the appropriate suppliers that answer to the specific requirement
Trade shows and professional exhibitions	+	Good opportunity to examine supplier's product and technologies.
	-	Time consuming
Professional association	+	Relevant information for purchasing managers. For example, ASME provides information about manufacturers and suppliers of engineered products according to

		ASME requirements.
	-	Can be time-consuming and risky, concerning information confidentiality.
Expert outside the company	+	Helps to save time on findings new suppliers and developing the partnership
	-	Could be expensive

5.3.2 Organizing suppliers data

After gathering all necessary data, it is important to organize it in order to prevent information overload and to facilitate the supplier selection process. Depending upon company' priorities the data could be catalogued and classified in different ways. However Solish & Semanik (2010, 75-79) suggests purchasing managers to organize data into the following several major categories:

- *Financial and business data* often may not be so easily to obtain, nevertheless it is important for critical suppliers. The information about supplier's position in the market, its customers, supplier profitability can be put into this category.

- *Technology* that supplier employs and if it operates in correct way.

- S*upplier's manufacturing and distribution capabilities*: the criteria such as geographical location of supplier facilities, production volume and production capacity, supplier experience in required field, or quality standards supplier applied can be put into this category.

- *Supplier's governance and organization*. It is important to consider how decisions are made within the supplier's organization and how it affects its customers. Supplier's obligations under law, compliance with the country's governmental regulations and other similar factors are also included in this category.

- *Supplier's business relationships* (external and internal). Relationships with supplier's employees and contractors, or local government are important criteria to be considered in order to understand the supplier position in the community, supplier' fulfilment of social obligations and other factors that could influence the future business relationships.

- *Local, domestic or international suppliers*. Sourcing decisions based on a supplier's location often provide advantages. For example, closer cooperation is possible due to the close geographical proximity. Moreover local suppliers can provide faster response time as well as lower freight costs. Alternatively, the buying company can develop greater competition by expanding the geographical range of its sourcing on national and international sources that made provide better pricing and wider choices.

- *Payment methods* must be also considered when evaluating offshore or domestic sources. Usually sellers want overseas buyers to guarantee payment through some form of bank document such as a Letter of Credit (LC). This can be a relatively costly process and can tie up cash or credit lines for an inordinate period of time. Also, any additional risks that can arise due to fluctuations in currency exchange rates when purchasing internationally must be considered. Moreover, logistical issues such as custom duties, taxes, tariffs, and added shipping costs must be taken into account.

The result of research should be recorded in a manner that enables to prequalify the most capable suppliers so that they can be included on a supplier list for negotiation.

Gathered data is a key element that helps a buying company to develop competition between suppliers and to provide a better understanding of the drivers in that particular product or service (such as costs, time, location, technical and quality standards, capacity, number of suppliers on the market and ect.). Moreover, the data helps to assess possible future risks inherent in the sourcing process. (Solish & Semanik 2010, 79-81).

Supplier's manufacturing and distribution capabilities, technology, supplier's location, and supplier's business relationship are the most important data gathered and organized for the further research.

5.3.3 Solicitations of suppliers

Once the supplier research and market analysis is completed, and possible suppliers are identified, solicitation phase can be developed. Literally, solicitation means "urgently asking". In sourcing, solicitation is a process of requesting bids or proposal from potential suppliers.

In this stage the nature of the acquisition must be evaluated to narrow the sourcing possibilities. Solish & Semanik (2010, 87-96) suggest considering the following solicitation possibilities:

- Request for Quotation (RFQ) is the most viable option for solicitation unless the acquisition decisions focuses on elements such as pricing, terms and conditions, availability, return policy and so on. The RFQ simply requests a quotation for price and delivery where other terms are already specified.
  Information for Bid (IFB). IFB is another option: it is a primarily price competition and the lowest bid is winning.

- Request for Proposal (RFP). It can be used when the company has not too precise specification of its requirement. RFP typically consists of three sections:
  1. Introduction section describes the purpose of RFP. It is important to present the company in its most favourable lights. It might be helpful in making the responding supplier decision to respond or not.
  2. Requirements section describes buyer needs in details such as time requirements, quality requirements, known constrains and so on.
  3. Attachment section includes boilerplate terms and conditions and other contractual requirements that help potential suppliers to determine any issues that may be arise during the contract formation phase.

- Request For Information (RFI) also can be applied in sourcing. RFI is a tool used to help to determine a supplier's capabilities and financial health.

5.3.4 Solicitation channels

Further it is important to examine the communication tools available for distributing and responding to the RFQ, RFP, and RFI. There are different methods available to distribute a proposal, however not all of them could be practical in specific situation. They are presented in the table below (Solish & Semanik 2010, 96 - 99):

Table 2: Solicitation channels

E-Mail Solicitations	+	Helps to reduce cost and time required by other methods
	-	The maintenance of security to ensure the confidentiality of information.
Telephone	+	Simple and quick
	-	Inaccuracy of information transmitted : appropriate for simple or low cost acquisitions
Mail or Courier	+	Traditional method which ensure formal transmission of information and requirements
	-	Risk that request not get to the right individual and the answer get back to the originator. Comparatively slow method when compared with the electronic tools.
Web-Based Portals	+	Most Fortune 500 companies – Intel, Cisco, HP, Procter & Gamble and others – maintain their own supplier portals. Enable to share widely the requirements.
	-	Expensive and time consuming for small-sized businesses.
Published posting ("an expression of interest" is solicited through newspaper ads or through industry and government publications)	+	Mostly in cases where it is required by law
	-	Not adapted in many cases
Crowd sourcing (posting a set of requirements on a specialized job board.)	+	Members with access to the site can offer bids using a simplified online form by responding with their prices, lead times, and other information requested by buyer

	-	Solution that is not always possible to organize for small-sized businesses.

5.4 Supplier Evaluation and Selection Process

5.4.1 Supplier Evaluation

It is evident that supplier evaluation and selection is one of the more critical activities in strategic sourcing planning. There are a number of circumstances in which suppliers must be carefully evaluated. Usually a formal evaluation and qualification process is used when the buyer establishes a partnering relationship.

How the buying company choose a particular supplier is largely dependent on the criteria they use for evaluation and how the company applies last-mentioned. There are various criteria to choose from, however not all are equally valuable in any given situation.

There are two major categories to consider in the supplier evaluation process: business criteria and technical criteria.

Business criteria evaluate the health and performance on an organization and include the following issues that must be assessed

Table 3a: Business criteria (Solish & Semanik 2010, 101-107)

Historical data	How well did the supplier meet its obligations to its customers in the past? The buying company must also develop a specific set of evaluation criteria based on its own current needs
Financial analysis	Organization's ability to generate enough income to maintain its financial health and growth in both the near term and long term. Assess potential risks linked to supplier with poor financial situation. May also be required in order to meet audit compliance requirements.
Efficiency	Often this leads to lower prices for the buyer. Efficiency is one of the more difficult aspects of a business organization to assess from the outside
Market share	A supplier with a small market share may be devoting its resources in other areas, thus providing very little support for that product or service; high market share may indicate sizable

	purchases by large companies and the potential for ignoring the needs of those with less purchasing power.
Customers and reputation	Determining a supplier's reputation is important in understanding how well it services the market and how reliable its products or services are in the eyes of its customer and industry analysis

Technical criteria focus on an evaluation of the specific supplier activities such as quality levels, capacity, scheduling accuracy, risk management and so on.
Technical criteria presented in the table below, include the following issues that must be assessed by the buying company.

Table 3b: Technical criteria (Solish & Semanik 2010, 107-116)

Quality management process	Quality as : - Conformance to specifications. - Perceived value and desirability The buying company must also consider how quality is controlled at the source by the provider in order to minimize the likelihood or receiving faulty product or service without the expense of performing incoming inspections. Supplier certification is one way of eliminating the need for incoming inspection. When a supplier is certified, it means that buying organization relies solely on the supplier's internal controls to produce acceptable quality.
Measuring quality performance	These measurements tell the buyer if the material or service conforms to their specifications or if the process being used to produce the products has the capability of doing the job. One of the most important criteria to measure quality performance is to check whether or not the supplier is ISO registered and has internal control system in place. In relation to the subject of the thesis, another important criterion to measure quality performance is to check if the supplier conforms to ASME quality standard.
Evaluating engineering expertise	It is essential to consider how quickly the supplier can develop a new product to meet buyer' specifications, relying on both engineering expertise and state-of-the-art equipment.
Conducting site visits	A site visit is one of the most powerful tools available to the sourcing team as a means of observing firsthand the supplier's operations and capabilities. It is the opportunity to meet and to evaluate key personnel who may have an impact on buying company's business and with whom the company may want continuing contact. Some characteristics that can be important to observe during the site visit are the maintenance a systematic, well-organized operations; level of quality in the production process (if the inspections methodologies effective, are

	internal and external audit conducted regularly and so on), organization of facilities; an interaction of employees as a way of evaluating the commitment to team work; and etc.

5.4.2 Supplier Selection

The clear documented set of evaluation criteria helps the buying company to assess and to select the best suppliers. There are many different practices existing to select the right supplier, but among them all Solish & Semanik (2010, 117–123) outlines one of the main concepts: value-based source selection.

Value based supplier

According to the U.S. Federal Acquisition Regulations, "best value" means the expected outcome of an acquisition that, in the Government's estimation, provides the greatest overall benefit in response to the requirement. Value-based supplier selection is used in situations where price is not a single controlling factor.

Price and costs always play a dominant role in source selection, however best value approach also takes into account non-price factors that offer the greatest benefit in term of performance, risk management, and other intangible factors.

There are many of various contexts that affect the selection of evaluation criteria. The choice of evaluation criteria may differ as a result of one culture to another, type of industry, corporate strategy, ect.

Solish & Semanik (2010, 117-118) propose the following number of factors that represent the key areas of importance and emphasis that must be considered in the selection process. Among these key factors are:

Table 4: Key criteria of supplier selection

Price	Price is the overall cost of acquiring the product or service. Often "landed price", which includes the cost of the goods plus transportation and duties is considered.
Quality	Quality can be evaluated as the cost of poor quality – for example, field replacement, scrap, inspection, level of defects

	and so on.
Technical capability	It includes unique designs or advanced technology that increases sales. It could also evaluate how the supplier is positioned in the market place as a developer of new technology.
Lead time	Lead time is always a valuable commodity: how well the supplier meets their deadlines based on input from existing customers or their own records?
Service	Service is evaluated as a combination of factors: technical support, warranty coverage, replacements, etc. Service also relates to: - How well the supplier satisfies its customers. - How well it carries out its responsibilities. - How well the supplier responds to customer requests for information.
Process	Evaluation of the supplier's internal system for driving continuous improvement.

6 METHODOLOGY

6.1 Input and output data

The sketch below presents the methodology of my work research, in particular regarding the sources of information that are used. It is important to distinguish two types of data:

The input data:

These data are needed to implement the project, that is to say, to understand the needs of the case company, to apply the background theory (strategic sourcing, ASME), to prepare and to send the questionnaire. Finally these data are also needed to perform a proper analysis and to sort the output data.

The output data:

These data are properly the results of the work research. These data are mainly collected through the questionnaire sent to potential suppliers. After analysis, these

output data should be used directly by the case company, for prospective supplies, conforming to their specific requirement.

Also as the research is based mostly on the desk research, interviews and direct questioning of employees for the input data and on the questionnaire for the output data the work research uses mainly qualitative data (Gillham 2010, 9-12; Pirkanaho 2009.)

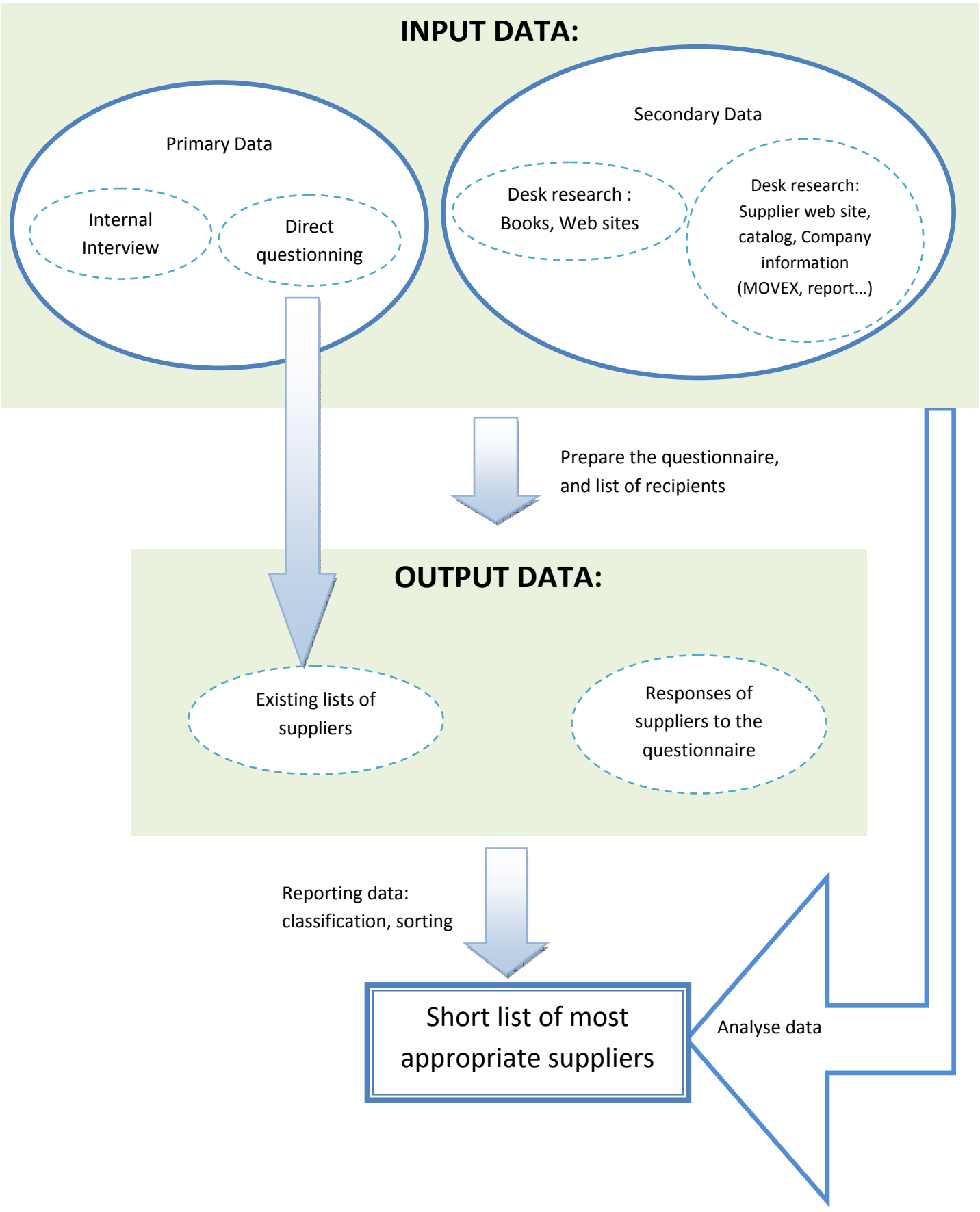

Figure 4: Methodology of the thesis.

6.2 Methods of gathering the input primary data: internal interviews and direct questioning

The primary data are collected in form of face-to-face internal interviews with employees, and from direct questioning of employees.

Internal interviews

Semi-structured interviews are conducted, where the topic is presented to the respondent and then are discussed rather openly. Semi-structured interviews are the most suitable when conducting a research interview because of their flexible structure. (Gillham 2005, 70-71.)
The well conducted semi-structured interview can be the richest single source of data. (Gillham 2010, 65.) However, at the same time, the flexibility of semi-structured interviews may lessen reliability. Moreover open-ended questions are more difficult to analyze. (Website of Nationa Learning Network.ac.uk 2004).

Mainly, two interviews are conducted with personnel involved in the sourcing and purchasing process, The Sales and Project Director, and the ASME Stamp Project Manager. It is a very efficient mean to gather quickly some background information necessary for further research.
The interviews are conducted in French and are held at the office of respondents and are booked in advance. The results from the interviews are not in form of protocol but more often a brief review describing the view of respondents on a certain process. These two internal interviews are conducted for thesis research:

- Sales and Project Director. The purpose of the interview with Sales and Project Director is to get their overall views on new sourcing strategy and also to receive some instructions for the creation of the project plan. Additional meetings are held with Sales and Project Director to get approval of drafts (questionnaire, project plan, suppliers' list and ect.) to continue working according to project requirements.

- ASME Stamp Project Manager. The interviews with ASME Stamp Project Manager are used to get the data related to the quality requirements for the ASME suppliers according to the company's demand. Also the information related to ASME III NV Stamp is acquired through the interview. Finally, ASME Stamp Project Manager is interviewed to get the overall view on the development of the company's ASME sourcing strategy. Later the input from the ASME Stamp Project Manager is used to create suppliers list as well as to provide the recommendations for the company.

Direct questioning

Further, some data are also gathered through direct questioning of employees. In this research, the direct questioning is usually used to verify the relevance of data used in questionnaire design, to verify the data of questionnaire responses and to acquire the additional information required by suppliers.

Then the employees participating in direct questioning discuss the final draft and make changes so that the interpretations of different sections of questionnaire are correct, or if all information required is provided to suppliers. This also gives the opportunity to discuss those sections where the results from questionnaire responses are inconclusive and the best option could be chosen. The direct questioning is usually held with the members of Purchasing and Procurement Department.

The following responsible persons are systematically questioned:

- R&D Manager
- Quality Manager
- Senior Purchasing Manager
- Contract Engineer
- Engineering Manager
- Technical Director

6.3 Method of gathering secondary data

6.3.1 Desk research

Deck research generally refers to secondary data. (Hague 2004, 34.) Desk research is involved in collecting data from resources. It is considered a low cost technique as compared to primary research. Published reports, libraries, the Internet, online databases, interviews with experts are important sources of secondary data.

One of the main purposes of desk research is to conduct the starting phase of market research since most of the basic information on competitors and suppliers, business, economic trends and market trends could be easily fetched and used in process. (Hague 2004, 33-44.)

For my project, the desk research plays two main roles:

- The gathering of information to understand the background theory.
- The completion of preliminary list of potential suppliers at which the questionnaire should be sent.

6.3.2 Desk research for the theoretical part of the thesis

Data collected through desk research help to get a picture of the sourcing process and strategic sourcing as well as the constituents of the strategic sourcing: identification, evaluation, and selection of suppliers. The data is gathered from various sources. The literature review is conducted mainly through SAMK E-brary. The relevant information is also found by using databases such are Ebsco and Emerald. However databases do not give a significant input to the work. Most of the input comes from e-books and online articles. Moreover on-line companies database and directories are examined; it provides with sources of information related to purchasing and procurement operations. The results from the literature review are also used to verify the information gathered from the primary data.

Also data collected through desk research are used to get an understanding of ASME codes and standards. In order to find relevant information, professional e-magazines as well as professional websites are analyzed. The sources are selected critically to guarantee the relevancy and accuracy of the information.

Therefore, two major chapter of the report such as “ASME codes and standards” and “Sourcing Process” are implemented based on the secondary data from desk research.

6.3.3 Desk research for the practical part of the thesis

Research on company’s databases and directories as well as on brochures, internal documents and companies’ official website is necessary to gather preliminary information about the potential suppliers (main activities of the supplier companies, size of their business, head offices and branches contacts, etc), to which the questionnaire should be sent.

6.3.4 Disadvantages of desk research

Notwithstanding the above mentioned points, the desk research has some disadvantages. For example, the information could be in old reports that are deemed useless because of their age. Sometimes the information is devaluated simply because it seems to be too easily available. (Hague 2004, 34).

Also data may be in the wrong format or incomplete. It can be difficult to acquire the detailed data because some sites can offer free portions of a research and then charge expensive fees for the full reports. (Website Tutor2u.net. 2012).

Moreover, it is also difficult to verify the accuracy of the secondary data: how the information is gathered, analyzed and presented. (Website Managementstudyguide.com 2012.) Therefore, all these disadvantages can return inaccurate results.

6.4 Method of gathering output data: the questionnaire

As already mentioned in the beginning of §6, the output data are mainly gathered thanks to the questionnaire. Indeed, the selection of the most appropriate potential suppliers is performed essentially after analysis of their responses to the questionnaire. As explained later in §7, only few appropriate suppliers are found through direct questioning of Purchasing Manager, that transmit contact of existing company's suppliers (existing suppliers of WEIR USA).

Therefore the questionnaire plays an important role in the project research. Moreover it helps me to record responses in a consistent way thereby facilitating data analysis.

In this study the semi-structured questionnaire has been chosen. Semi-structured questionnaire comprise a mixture of close and open questions that usually used in business-to-business market research where there is need to accommodate a large range of different responses from the companies. (Hague 2004, 99-100.)

The questionnaire is administrated through e-mail. In this project, the online distribution of questionnaire is the most convenient one. It is least expensive since it is intended for wide distribution, as it is described in §5.3.4 *Solicitation channel*. Also online distribution provides better chances to receive the responses because less time needed to send questionnaire back: no folding, stuffing or dispatching is required. (Hague 2004, 143.)

The questionnaire is forward approximately to 64 potential suppliers. The collected information is handled and processed by using Excel table and Excel checklist that is created during the working process. The rate of responses and the reporting of these output data are presented in detail in following chapters 7 and 8.

So as the questionnaire sends to respondents from different countries, it is designed in English. It allows me to facilitate data analysis thereby saving time required for data translation. Along with the questionnaire, the cover letter sends to every respondent. The introduction is one of the key elements of any questionnaire. It

designs to quickly and concisely communicate the legitimacy of the survey. The well-written introduction provides a better chance that the questionnaire can be completed. (Hague 2004, 115; Pirkanaho 2009).
Another special feature of the cover letter is reference by name. A letter that is addressed to a person by name has more impact than one that is simply addressed. (Hague 2004, 143-144.) Moreover the letter must also give an assurance about confidentiality and conclude with the clear instructions on what to do next. (Hague 2004, 144.)

Before sending, the designed questionnaire is verified by the Sales and Project Director. This is necessary to eliminate incorrect use of phraseology and unclear information signs, and to check the ease of answering. (Hague 2004, 117; Pirkanaho 2009.)

Notwithstanding the above mentioned positive factors, the self-completion questionnaires have some major disadvantages. One of the biggest weak points is that they generate low and uncertain response rates, which could be below 10% of all the questionnaires sent out. (Hague 2004, 142.) Moreover in some situations, it is difficult to analyze if the question is fully understood by the respondent and the interviewer will receive the expected response.

However the second mailing is also important when sending the questionnaire. Second mailing can boost the response rates. If the first mailing yields a 25% response, a second one could draw a further 10% to 15%. (Hague 2004, 154-155).
To complete the project research the second and third mailing is sent to every respondent.

6.5 Reliability, validity and quality assessment of the research

It is evident that if research is performed poorly it does not yield relevant results. Moreover, all research, even well-controlled, have the potential to be wrong.

Consequently, it is important to assess the reliability and validity of the data in order to ensure the competency of the research.

Validity tells about how well the survey measures what it sets out to measure. Of course, ultimate validity cannot be proven, but can be supported by experts' opinion, for instance. (Website KnownThis.com 2012).

To measure the reliability it is possible to compare the data by using different source of information. If data are similar then it is likely the information gathering is reliable. (Website KnownThis.com 2012).

Therefore, during the project research, all the data are carefully analyzed in order to guarantee the validity of the information. Some information is verified with the help of company's experts through the interviews and direct questioning. To minimize the risks of misinterpretation, multiple responsible persons are asked to present their point of views on a certain issue.
To ensure the reliability of research, the data are verified by using several sources of information related to a certain issue. Moreover the sources are carefully checked to guarantee the freshness of the information.

7 RESEARCH

7.1 Selection process of ASME raw material suppliers

To identify prospective suppliers who can meet the company's requirements I have used the following methods presented in the table below:

Table 5: Locating new suppliers

Company experts: ✓ Supply Chain Manager & Senior Purchasing Manager ✓ Purchasing Managers from Weir USA & Weir UK	With their help suppliers that have already been in cooperation with Weir Group have been identified
Current Suppliers	I have verified if the main company's suppliers have been certified as ASME III or if they have the possibility to be certified as ASME
Recent market research (similar purchases, review records relating to the prior purchases)	The company's internal online purchasing system "Movex" has been used to identify suppliers that correspond to the current requirements and if those suppliers have been qualified by the company
Internet	Suppliers conformance to the company requirements has been assessed through the suppliers websites (product range, quality requirements, manufacturing processes, manufacturing capabilities)
Online database	ASME online database provided me with the list of all existing ASME MO suppliers

In order to create a preliminary list of ASME III Material Organization suppliers, different sources of information were examined. Some suppliers were identified with the help of Weir division in USA and headquarter of Weir Power & Ind. in UK. Some other suppliers were already cooperating with Weir France. However the majority of potential suppliers were selected throughout the ASME website.

As already mentioned in §4, the Quality Certificate was an obligatory requirement for Material Organization suppliers. The website of ASME provided links to a Certificate Holders Search that have included a dedicated database for different types of Certificate Holders. With the help of this database all potential ASME III MO suppliers that more or less meet the company's requirements were identified.

After that, the website of each potential MO supplier has been analyzed and the most appropriate suppliers were chosen. Potential suppliers were selected according to several different criteria:

- *Range of products*

The purchasing organization of the company was mainly focusing on the supply of raw material in form of specified semi-finished product such as block, bars and plates. Therefore suppliers were selected according to the manufacturing requirements.

- *Manufacturing capabilities*

The core product of the case company did not fit for a large-scale fabrication and it was difficult to find suppliers that could answer to specific demand with small quantity. Indeed most of the potential suppliers concentrated on the manufacturing of the big pieces in the large volume.

- *Country of origin*

During the supplier selection process, preferences were given to suppliers located in Europe. First geographic proximity affected positively the cost and the delivery lead time. Secondly, the cultural proximity reduced the risk of misunderstanding of the general company requirements (quality, term of payment…)

In a second step, suppliers from USA were considered. As already discussed in §4, the majority of ASME III MO suppliers were located in USA. Consequently there were many possibilities to find the appropriate suppliers. However the product costs and delivery costs were significantly higher than in the European market.

In addition, suppliers' capabilities from Asian countries were also analyzed. However, in most cases, technical standards of Asian suppliers did not correspond to the company's requirements. Consequently, Asian potential partners were not considered on the priority basis.

Finally, it took about one month to collect the basic data to create the preliminary suppliers list. Overall, 64 suppliers were selected to be more deeply considered. The list of potential suppliers has been created in form of Excel table. It has helped to provide a clear picture of the existing ASME suppliers market and to facilitate the

process of further work. Appendix 1 presents a curtailed table to provide a general idea of the work done.

The preliminary suppliers list has included the following information:

- supplier's product range
- supplier manufacturing capabilities
- the identification number of the supplier's Quality Certificate
- supplier's contact information

The most critical problem related to supplier selection process was to acquire the relevant e-mail contact information from suppliers' websites and especially from websites of American companies. When necessary, the information was acquired by phone call or by placement of the enquiry through internet-based web form on the supplier's website in the section "contact information".
Of course there were some specific challenges related to communication process. The phone conversations with Americans were not always performed in a successful way: the acquired information was incorrect or the understanding of the reason for the call by other party was not fully reached in the expected way.
Moreover, the data related to production range and manufacturing capabilities was not clearly specified on some of the websites reviewed.

7.2 Preparing and sending the questionnaire

7.2.1 Redaction of the questionnaire

After having collected a background and a contact information from suppliers, I have started to analyze the data and to prepare the vendor qualification questionnaire. The questionnaire was developed in accordance with requirements necessary for basic evaluation of ASME MO suppliers. Moreover, the questionnaire was partly prepared based on the information requested by Sales and Project Director and by ASME Stamp Project Manager.

The questionnaire included two different sections:

General information

General information has consisted of data related to supplier background information. This kind of information has helped to identify possible division and subsidiaries in Europe and, particularly, in France.

Special information

This section has included different information requested regarding supplier activities.
The most critical data were related to required semi-finished products. A table with the basic product description has been prepared.
The information requested in the table was:

- *The description of the product itself,*
- *Bill of material according to ASME section II,*
- *Material quality level*
- *Dimensions of the product according to the case company's demand.*

The additional information requested in the questionnaire was:

- *Price and manufacturing lead time*

Ideally, specific requirements related to the product should have been included with the enquiry. According to these specifications supplier had to consider all the quality, design and technical requirements of the product to provide accurate price and delivery lead time information.
But, given that the company's ASME policy was still in a process of harmonization, it was not possible to provide the accurate technical data for suppliers and to prepare the relevant enquiry according to required standards. For this reason, there was a big delay in suppliers' responses and in some cases the information on prices and on lead time was insufficient or incorrect.

- *Operating activity*

Further, the section “Special information” has included additional issues related to supplier operating activities. The supplementary services such as stamping or machining operations that could be offered by supplier in addition according to company’s demand were an important factor in the supplier evaluation process.

- *Origin of material*

In order to evaluate supplier as a raw material fabricator, the information related to the origin of different material used in fabrication of the required products was requested. It was important to know how many percent of raw material were produced in the property and/or purchased outside.

- *Supplier’s sales activities*

The suppliers’ main clients of the products targeted and their period of cooperation were an important aspect to be evaluated in order to get a picture of suppliers experience in the required field and to analyze their reputation on the market. Moreover it has helped to evaluate the suppliers’ interest to the case company’s demand. For example, suppliers that cooperated mostly with big corporations for large volume demands were not very interesting in making a quote for small requests.

- *Quality testing requirements*

The last section of the questionnaire has concerned quality testing requirements. As already mentioned in § 4.3.3, NDE examination conforming to ASME III standards and performed in compliance with SNT-TC-1A was an important criteria to be evaluated. With the help of ASME Stamp Project Manager, the NDE methods and NDE qualification levels of personnel required by the company’s demand were identified and chronicled in questionnaire. For the case company - ultrasonic, penetrate and magnetic-particle were the most important testing methods with the qualification level of personnel N° II and N° III according to SNT-TC-1A.

However the quality requirements of almost all MO QSC suppliers have corresponded to the case company’s requirements given that the ASME MO suppliers must perform NDE examination in accordance with ASME requirements.

7.2.2 Sending the questionnaire

As soon as the questionnaire has been created and approved I have began to distribute it widely among potential suppliers. The questionnaire has always been sent by email to an appropriate person from a Sales Department. A letter of representation with explanation of the reason for request has been always attached to the questionnaire. The questionnaire and the letter of representation are provided in Appendix 2.

The vendor qualification questionnaire has been forwarded to 64 suppliers from different countries and regions. As already said, preferences were given to suppliers from Europe. Among them the majority of suppliers operated in Italy, further follow France and Spain. Suppliers from Germany, Sweden, Austria, United Kingdom and Belgium accounted for negligible quantity. Moreover a significant number of questionnaires have been forwarded to suppliers from USA. Those suppliers have accounted for a considerable part of potential partners. Further, there were few suppliers from China, South Korea and Japan to whom the questionnaire has been also sent. Even though suppliers from Asia were not considered on the priority basis, it was important to be familiar with the production scope, capabilities, quality standards and prices set by Asian suppliers. This information should help the case company to make an adequate choice when identifying the most appropriate suppliers.

The number of questionnaires sent regarding the country of destination is presented in the figure 4 below.

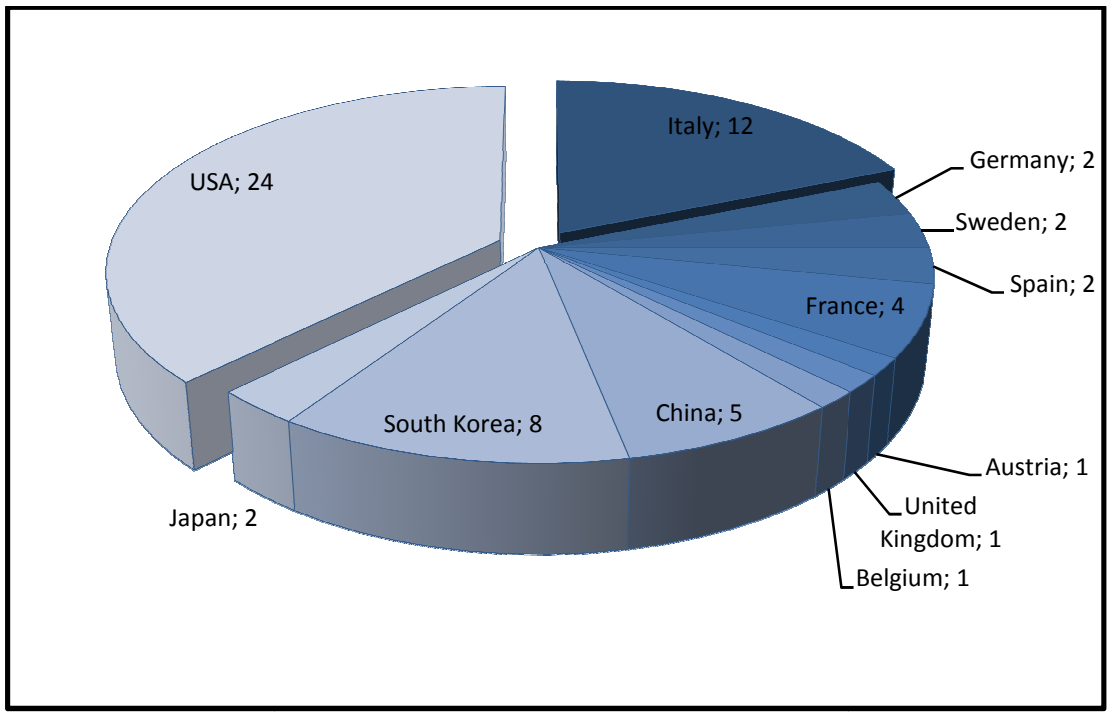

Figure 5: Number of questionnaire sent out

7.2.3 Rates of response

It was mentioned in the letter of representation a desired response time made up one week. However, the first replies have been received in three weeks despite a regular reminder.

In general, suppliers from Italy and USA were among the first to reply. Also, suppliers from USA provided the most accurate information in comparison with suppliers from Europe. However, American potential partners were more demanding and requested more precise technical data. It has caused a big delay in replies and minor responses to the questionnaire. Also, the responses from Asian suppliers have been received with a big delay.

There were also many difficulties in communication with suppliers from China and, particularly, from South Korea because of language barrier. In some cases the

acquired information was not correct. In other situations it was difficult to explain the requirements requested by the case company.

Moreover, as already mentioned most of suppliers' websites did not provide the contact information link. So in most cases, the e-mails contact information has been acquired by phone call. It caused difficulties to get accurate information. In many cases the data were not correct and have been requested several times. So, a nuance such as a language barrier was a cause of delay in responses and of receiving irrelevant data. In some cases, the same challenges in communication with American suppliers were noticed.

Further, in terms of flexibility in communication, suppliers from USA were the most committed and responsive in providing the information at short notice. The reminder for every supplier has been sent on average four times. Some of them provided response within the first two weeks, but it was rarely found.

As already said the suppliers from China and South Korea were among the last to reply. More than five reminders at large have been sent to each of those suppliers. The same response rate was typical among Italian suppliers.
I have regularly kept in touch by phone with every supplier. However, the work done has shown that there was no significant difference by keeping in touch with suppliers by mail or by phone. The results have been remained more or less at the same level.

Finally, the most prompt and accurate responses have been detected in the following cases:

- When the questionnaire has been addressed to several recipients of the company.
  When I was able to acquire more than one appropriate email contact, the inquiry has been forwarded to all of them. When the information has been transmitted to several persons, I have usually received the most prompt and accurate responses.

- When a reference name and surname in electronic correspondence was used. It has proven to contribute to higher attention to the request.

- The context of the cover letter played also a critical part in the process of communication.
  The appearance of letter as well as linguistic performance or polite form of address was important to report message clearly and courteously.

Finally, in total from 64 sent questionnaires, about 45 responses, both positive and negative, have been received. Most of the responses were received within one or two months. So it took more time than expected to gather and analyzed the data and to record it for further evaluation.
The figure 5 below shows the number of received answers regarding the home country of potential supplier.

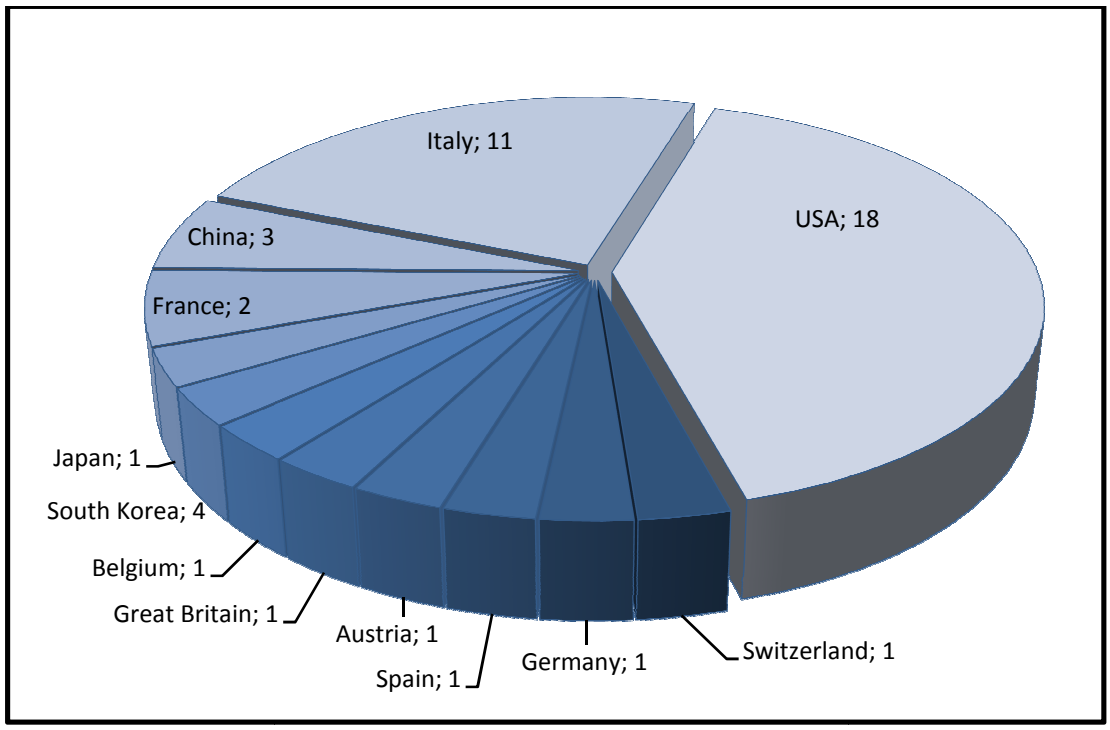

Figure 6: Number of received answers

Among those 45 responses, only 10 suppliers have been considered as the most appropriated. Three of them were located in Italy, the others operated in USA. Some

suppliers located in USA have already been in cooperation with company's division in USA for several years; so when I needed specific data, the information has been directly acquired from American colleagues. It has helped to save time and to get some advice on the potential cooperation with these suppliers.

8 ANALYSIS

8.1 Background of the work research: ASME sourcing strategy of the case company

To ensure that my work research corresponds to the needs of the case company it is very important to understand clearly the strategic orientation of the company concerning ASME sourcing.
The collection of information about the development of ASME strategy by the company is mainly performed thanks to an interview with the ASME Manager.

8.1.1 Cooperation with ASME suppliers

Possibility for WEIR to qualify ASME MO suppliers

Potential ASME suppliers have to correspond to ASME requirements that meet company's requirements: QSC, ASME II, NDE conforming ASME.
After the appropriate suppliers conforming to these requirements are found, the Quality Department has to audit them. The audit performs by the qualified responsible team or a person in charge according to ASME requirements.

The most important suppliers' criteria that have to be checked include technical parameters, quality parameters, and internal organization. It takes approximately from 2 to 4 days to complete the audit. The audit includes the manual of required

parameters (in accordance with ASME requirements) that must be checked in priority.
After completing the control, the manual of audit performed sends to suppliers with the points “conform” or “non-conform” to required criteria. The points “non-conform” must be checked and revised by supplier in order to set the desired partnership. All appropriate suppliers record in Quality Vendor List.

Specific risks in setting potential cooperation

It is difficult to name specific risks that could be detected in cooperation with ASME MO suppliers. Risks could vary, it depends from supplier’ activities at whole as well as from their range of products and services. In some cases, risks related to suppliers’ activities comprise of 50 percent, but they are small and it easy to prevent and eliminate them.

In other cases, risks consist of only 10 percent, but they consider as the most serious and could lead to a big negative consequence for the company as well as for the supplier itself.

The most serious risks that could be mentioned here relate to the nonconforming to technical specification such as quality testing requirements. For example, if supplier does not perform the certain tests (ultrasonic test or chemical analysis and ect.) for certain type of material conforming ASME standards it contravenes the ASME regulations. Therefore it negatively affects company’s reputation and imposes a fine or restrictions on company’s activities.

Quality and design criteria

ASME Quality criteria are demanding and require complete quality control of material and semi-finished products supplied from ASME suppliers. Quality control must be performed by company’s representatives within several days.
Design criteria must conform to ASME standards. Consequently, design criteria take into account before sending the request for quotation for potential suppliers.

8.1.2 Impact of obtaining NV stamp for the development of ASME supply chain

The obtainment of NV Stamp has to facilitate the search of potential suppliers so as NV Stamp must give the opportunity to qualify suitable non-ASME supplier by the company itself. Being certified as ASME gives the company an opportunity to request the possibility to qualify appropriate non-ASME suppliers in accordance with ASME requirements, but only for the company's own use. Potential non-ASME suppliers have to be audited in accordance with ASME requirements.

8.1.3 Impact of the development of ASME supply chain on the internal organization of the case company

Development of the ASME strategy requires developing a new organizational structure by re-organizing activities of Sales Department, R&D Department, Commercial Department, and Quality Department.

ASME requirements, code and standards are totally differing from those European standards "RCC-M" that are currently used by the company. Consequently the new strategy demands the setting up of a new organization structure. In overall, the invention of new internal system might take about eight months.

Moreover an invention of a new strategy affects the internal performance of the company. So as ASME standards develop by the American society, it requires following all procedures, specifications and requirements only in English language. So it may affect the internal work of different departments. All documentation as well as technical specifications must be recorded in English. So as not all company' employees are English-speaking, it requires to obtain English courses and pass a certain examination to be able to follow the working process.

In addition, the supplier qualification according to ASME meets different requirements in comparison with European norms that are in used by the company. So the special training is required for Quality department employees as well as for

Sales department employees. As already said, design criteria must be in accordance with ASME codes and standards. So special training for employees from R&D Department is needed as well.

8.2 Output data reporting

All the data gathered and collected are reported by using Excel tables. It helps to structure and to evaluate the information by different criteria and to facilitate the further project analysis.

First data reporting: *preparation of the preliminary suppliers' database*

Before sending the questionnaire to selected suppliers, the preliminary Excel table is prepared. The table includes the background information about each of 64 selected suppliers. As mentioned in §7.1, the information related to the supplier product range and technical capabilities, supplier location, holding of the Quality Certificate is the most important one. It helps to understand which suppliers are the most appropriated one. In addition, the supplier contact information is included in the table. This section provides me with the appropriate e-mail and phone contact information, the responsible contact person is also noted. Moreover this table is used to track the suppliers' response rate. The addition columns are added to note the sent date, the received date and the reminder date for the questionnaire. This information is used to check when the next reminder needs to be sent. The results from responses are also briefly summarized in the table. (Appendix 1)

Second data reporting: *supplier evaluation*

As already discussed in precedent chapters, among 64 suppliers only 10 of them are selected.

As the case company is not able to provide precise technical data it is difficult for suppliers to give accurate price information and manufacturing lead time. Due to such kind of problems some suppliers decline to quote items requested, consequently

those suppliers are dropped off from the suppliers list. Also, majority of suppliers decline to provide a quote by the reason of small weight of items requested. Capabilities of those suppliers focus on manufacturing items only in large weight or in a big volume. So they are unresponsive to the company's demand. In other cases, suppliers are not capable to fabricate such small volume of required product because their manufacturing capabilities are not adapted to the low-volume production. Besides the material specified in quotation, product dimensions or required quality requirements are not always conformed to suppliers' standards. It is another reason to declare off a bargain and dropped off a supplier from vendor list.

To evaluate and analyze the questionnaire responses by the 10 most appropriated suppliers, checklist in Excel format is prepared (Appendix 3). In the project, the most important criteria that should be evaluated are technical criteria. The specific supplier activities such as quality and capacity are most important one.
Also, the value based source selection method is used to assess suppliers' capabilities. However, the data received from suppliers are insufficient to analyze all criteria discussed in the theoretical part. Only few of them are applied, but some new other criteria are added.

Table 6: Supplier assessment criteria: empirical research

Price	The price information is not evaluated: indeed because of the lack of accurate technical data, this information could not be considered as reliable even when it is provided by supplier.
Quality	The most important parameter concerning quality is the conformity with ASME requirements. In the table I put if the company have the necessary qualification concerning NDE testing.
Technical capability	The capacity to perform machining operations is the important criterion to be evaluated to check how the cooperation can be set
Lead time	Origin of raw material (inside or outside) affect the production lead time and delivery time
Additional service	The possibility to perform stumping operations is one of the additional criteria to be evaluated
Supplied product	Origin of product affects the cost, delivery time and order possibilities
Main customers of products	The information helps to assess the supplier market share, reputation and supplier' interest in cooperation with the case company

Moreover, potential suppliers are classified by different evaluation criteria and some data tables are prepared. Some information are classified in accordance to the country of origin (Appendix 1) where suppliers operate, other data are chronicled in accordance to the product offered (Appendix 4).

Table in Appendix 4 shows that some suppliers fully correspond to the company's demand and can supply all required products while others, can provide only one type of product. Also, in the table I register information regarding the current relation of suppliers with Weir Group. This point is considered as an important one, because it provides information about supplier relations with the Weir Group, how and by which Weir division the supplier is certified and if the additional certification process is required by the case company.

In addition: *supplier's database for other company projects*

Besides the list of appropriate suppliers, I record all ASME suppliers that are not corresponding to the current needs of the company but that could be potential future strategic partners (Appendix 5). Those suppliers are recorded in the Excel table and categorized by the manufacturing type, range of product and location. In addition, I also note the registered number of quality certificate of each supplier in order to provide a clear picture about supplier conformance to ASME requirements.

Also, rough drafts are systematically used to gather the data. I use them in desk research, direct questioning and internal interview. Later, the data collected from every meeting is chronicled in Word format. All the data reports that are created during the research process are used to prepare a Report Presentation in Power point format to the company - "Search of ASME suppliers".

8.3 Description of the most appropriate suppliers

After identifying appropriate suppliers a short analysis must be conducted in order to evaluate each of those potential partners and to select the best one. Therefore during the research process the following potential suppliers are identified (Appendix 6):

- Supplier A (USA)
- Suppler B (USA)
- Supplier C (Italy)
- Supplier D (Italy)
- Supplier E (USA/France)
- Supplier F (Italy)
- Supplier G (Canada/USA/France)
- Supplier H (USA)
- Supplier I (USA)
- Supplier J (USA/France)

Suppliers from Italy:

During the selection process the most critical evaluation criteria are the product offered by supplier and supplier location. As already mentioned in §7.1, European suppliers are more competitive in terms of time and cost. Therefore, based on these nuances, three suppliers from Italy are identified by using the ASME database.

One of those suppliers **Supplier C** is already certified by the company and approved as QCS, because this company is in a continuous cooperation regarding various non-ASME projects.

Supplier D is other potential partner. It is a new supplier without the business relations with the company in the past, so in contrast to Supplier C, the certification process by the case company is required. However, both of these suppliers manufacture products of a big volume. So the cooperation could be possible only for some types of products with the highest weight.

To this point, Supplier C is able to supply two different types of products in opposite to Supplier D that capable to offer only one type of product.

Other Italian supplier, **Supplier F** is also a new possible partner that has to be certified in accordance to the company' requirements. However Supplier F is specialized in completely machined pieces and not in semi-finished products. So there is a possibility for cooperation, but it demands from the company the precise quality specifications that must be delivered to suppliers in order to make an offer for machined pieces.

Consequently, comparing these potential partners, Supplier C is a likely to be among suppliers to be selected by the case company as a future cooperation partner.

Suppliers from USA and Canada:

In terms of production range and capacity **Supplier A** and **Supplier I** are the most suitable potential partners. They have already a long cooperation history with Weir division in USA and are still on high standing with American colleagues (particularly Supplier A).
However in terms of cost those two suppliers are among the most expensive one. In comparison with suppliers from Italy, prices are exceeded in two or even in three times.

The same price variation can be noticed in offer made by **Supplier B**. Moreover, after inquiring some information from Sale Manager in Weir USA Sales Department I get to know that there are some problems in cooperation between Weir USA and this supplier, so Weir USA drops them off the approved vendor list.

Supplier H as well as **Supplier G** are also among potential partners that continuously cooperate with Weir USA. Supplier G is able to supply any of required products. Supplier H has fewer possibilities but still highly correspond to the company' demand in bar products range.

In term of cost, Supplier H is the most convenient partners among American suppliers for Weir France. However, neither the Supplier G nor the Supplier H are certified as ASME QSC. Weir USA has a possibility to utilize non-ASME suppliers by certifying them itself in accordance with ASME standards. However for Weir France only one possible solution exists: to build cooperation with already certified suppliers.

I include Supplier H and Supplier G in a suppliers list because with the joint cooperation of Weir France and Weir USA there are some possibilities to use those suppliers in ASME projects. However, such venture demands huge amount of resources and time.

Supplier J as well as **Supplier E** are other attractive potential partners in terms of location. Both of these suppliers have subsidiary in Europe/France. Of course the production range of these potential partners is corresponding to company's demand. Supplier J's capacity consists of various bar and plates forms, and Supplier E production range include all product types requested by the case company. Another important point is that these suppliers are capable to cooperate even for a small ordered quantity. Moreover in terms of cost, Supplier J is considered as the most attractive partner along with Supplier H. In addition, Supplier J has some business relations with Weir France in the past and Supplier E is in continuous cooperation with Weir USA.

Finally, even if the price analysis is not considered in my project research, a short price evaluation is made based on the received information from suppliers. Thus, among suppliers from USA and Canada, the most costly are Supplier A, Supplier I, Supplier B, Supplier G, and Supplier E. Among the most attractive partners are Supplier H, and Supplier J.

Other important evaluation criterion for the company is supplier quality standards conforming to ASME. Among those 10 suppliers the majority implement quality standards conforming to ASME and to the company's requirements. Some suppliers utilize approved outside laboratories, as Supplier I. Also given that all of these

suppliers are not in cooperation with the case company for ASME projects in the past, an audit in accordance with ASME requirements and certification process must be performed for each of them.

Supplier reputation is also one of the most critical evaluation criteria. As Weir USA already cooperates with some of listed above suppliers, the required information is often acquired from American colleagues. For example, among the most reputable suppliers that are still in cooperation with Weir USA are Supplier A, Supplier I, Supplier H and Supplier G.

Moreover information requested in questionnaire about suppliers main customers and period of cooperation with those customers helps to evaluate the suppliers' position on the market and suppliers' experience in certain activities. For example, for Supplier A, Weir USA is one of the most important clients with 14 years history of cooperation. However, some suppliers do not provide customer information considering it as a confidential, like in case with Supplier G.

Further, supplementary service offered by potential suppliers is also a criterion to be evaluated. For example stamping or machining operations performed by supplier could be important for future cooperation in spite of the fact that these types of service are considered as an additional option. For example, Supplier A, Supplier G, Supplier D and Supplier F are capable to offer machining service. In addition Supplier A is also a stamping specialist.

Unfortunately, as already mentioned in §8 other suppliers are not motivated to provide a supplementary information that is not directly related to the quote. So in most cases information is missing from the questionnaires and cannot be evaluated.

9 CONCLUSIONS AND RECOMMENDATIONS

After establishing the shortlist of the 10 most appropriate suppliers, few recommendations are presented in this part to optimize the new supply chain. Also with a brief risk assessment, the major risks linked to this sourcing are identified and some suggestions are given to mitigate them.

First of all, the company has to consider how the new strategy can be developed. As the company's requirements regarding the purchased products are very specific and demanding, dependence on single sourcing can be a risk. Thus, multiply sourcing is preferable.

Moreover, there are no local suppliers that correspond fully to the company's demand, so the international sourcing can be the only one possible solution for Weir. Also, specific product requirements, in some situation make difficulties to purchase directly from manufacturers. Ordered quantity and availability of product range bring difficulties in cooperation. Consequently, distributor service is preferable. Although it is more expensive to buy from a distributor than from manufacturer, distributor can stock products from many different manufacturers and make it possible to order different products of small quantities with one order.

Secondly, 10 most appropriate suppliers are found for the company. Not all of those suppliers correspond fully to the company's requirements. Non-conformance of some suppliers to ASME requirements, gap in the product range and insufficient manufacturing capacity provokes some difficulties for the company. However, in recent time, more and more companies around the world apply ASME III standard in their practice. ASME online database that provides link to all ASME manufacturers and suppliers is kept up-to-date and regularly augments with the number of new entrant suppliers. Consequently, the ASME database must be regularly checked and analyzed by the Purchasing Manager in order to find new potential partners.

Thirdly, the project research makes possible to define and analyze risks that can arise out of the developing of a new sourcing. When risks are systematically identified, it is quite common to find so many, that is not possible to take care of all the issues. In that case, it is important to identify the problems that most urgently require control measure. Below is presented the table with general risks that can occur within the development of a new sourcing strategy. The sheet explains what can be the cause of each risk and worst consequences of the risk. In order to evaluate the magnitude of a risk, the extent and severity of the consequences of each risk are analyzed. The score from 1 (low) to 5 (very high) are used to determine the level of risk. Finally, suggestions on how each risk can be controlled are written down. All issues are written down as concisely as possible, but in such a way that everyone working in the company understands what it is about.

Table 7: Risk Management Control Measures

Risk	**Causes of risks**	**Typical consequences**	**Magnitude of risk**	**Control Measures**
Bottleneck	Specific product requirements	If there are only few suppliers, the company increases its dependency from those suppliers and it can influence on cost, production time, quality. Also it can provoke product shortages.	5	Advent of new possible potential partners has to be regularly verified throughout the ASME database. Also the company has to take into account all possible partners to maintain a competition and provide a back-up source.
High production and delivery cost	USA suppliers	High cost leads to higher prices. High prices can reduce customer demand.	4	1. Market assessment must be regularly performed in order to find new possible partners thereby maintaining competition. 2. Or, when possible, the company can contract with the supplier to buy product at a fixed price
Non-conformance to the technical and quality requirements	Suppliers from India and China	Low quality product reduces customers' satisfaction and influence on the company's reputation. Also it can bill for penalty charges.	3	When selecting suppliers from China or India, the company must pay attention to the supplier market share and profitability, supplier reputation
Delays in production	✓ Insufficient manufacturing capacity ✓ Poor estimation and	It can result in turning down orders which could lead to customer dissatisfaction		1. The orders have to be placed in advance when possible. 2. The order has to estimate possible schedule delays.

	scheduling of work		4	3. Penalty charges must be provided for in the contract. 4. Possible discount or compensation must be provided for clients
Delivery delays	Geographical dependency, weather forecast, traffic jam, accident	It may cause damage of product, delays in fabrication, customer dissatisfaction	4	1. The delivery has to be carrying out in advance when necessary. 2. The Purchasing Manager has to estimate possible delays. 3. In urgent situation, the company must use the service of the proven transportation companies
Lack of skills and experience in new ASME products	Lack of skills and experience of the company's partners (suppliers), the case company	➢ Design criteria are not corresponding to the ASME standards. ➢ Technical and quality parameters do not meet ASME requirements. ➢ Production delays. ➢ Customer dissatisfaction.	3	1. The company has to provide a professional training for responsible engineers and purchasing managers. 2. Company's suppliers have to correspond to ASME requirements; they must be audited by the Quality Department of the case company.
Difficulties in cooperation	Communication problems: language, culture	➢ Misunderstanding of demand and requirements. ➢ Difficulties to get the accurate results. ➢ Delays. ➢ Interruption to manufacturing process	3	1. Company's employees must obtain the language courses to be able to follow the working process with foreign partners. 2. Technical translator can be employed by the company
Supplier reliability and safety	✓ Non-conformance to the requirements. ✓ Poorly audited suppliers	➢ It affects quality of product. ➢ It may cause penalty charges. ➢ It also provokes interruption in manufacturing process, delays. ➢ Customer dissatisfaction.	3	1. Suppliers must be carefully audited by the Quality Department of the case company before setting up the cooperation. 2. The suppliers reputation, supplier market share and profitability, supplier financial health must be evaluated by purchasing managers before setting up the cooperation

Below, the risk diagram shows hazards described above by dividing them into the following categories: the highest risks with highest impact, the medium risk with high impact, high risk with medium impact and the low risk with low impact. Of course, the highest risk with highest impact must be identified as areas of greatest priority.

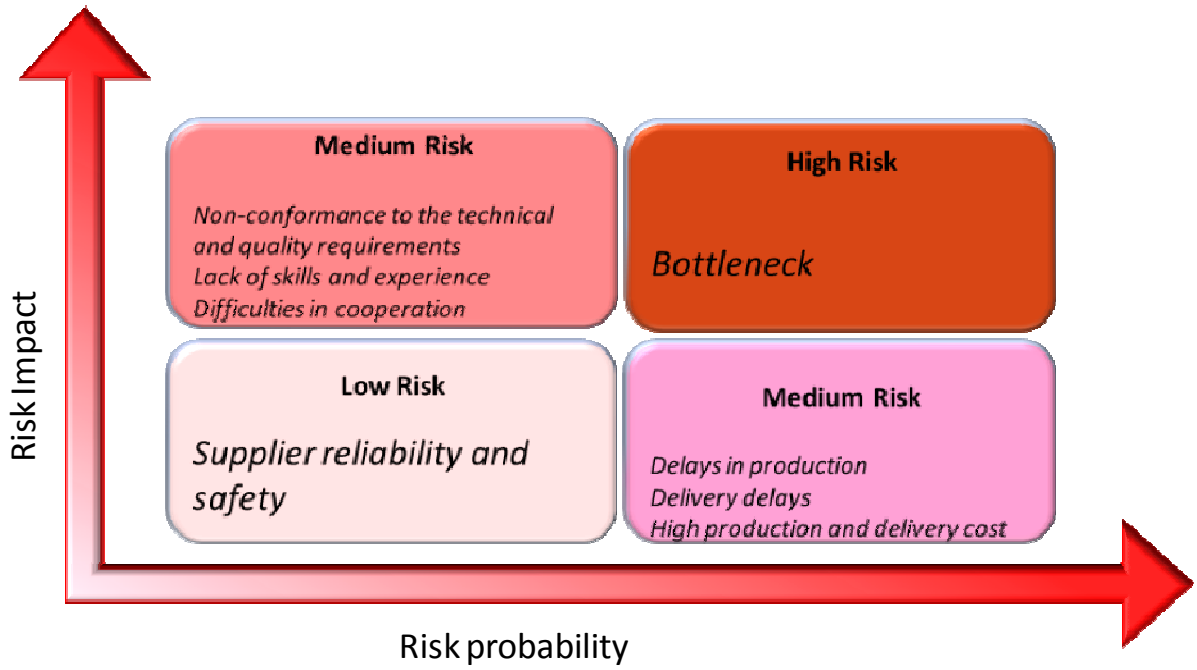

Figure 7: Risk scale diagram

In diagram the highest risk with highest impact is Bottleneck. The risk cannot be avoided by the company. It occurs due to the specific product requirements.

The medium risks with high impact represented in the diagram can negatively influence on the company business but the probability of occurrence of those hazards is modest.

The high risks with medium impact cannot be always avoided by the company. However their probability can be reduced with strong company attention. .

Supplier reliability and safety can influence on the company business. However this risk is classed to the category of low impact because it does not affect directly the company: with the purchasing contract the company can protect itself against default of the supplier. Also the probability of occurrence is considered as low, given that the process to qualify a new supplier is strongly controlled.

10 FINAL WORDS

The starting point of the project was to search for potential ASME suppliers and, based on it, to create the supplier list for the case company Weir Power & Industrial. Therefore, the work research has mainly consisted of suppliers' identification, evaluation and selection process. The data from supplier questionnaire used in research helped to evaluate and determine the relevant potential partners. But in first stage, to ensure that my work research corresponds to the needs of the case company it was important to understand the strategic orientation of the company concerning ASME sourcing. Also, the theoretical research on suppliers' analysis and strategic sourcing has helped to optimize the implementation of the project and contributed in providing recommendation for the company.

Despite the complexity and extensity of the subject, the research was performed according to project plan and the suppliers list was provided to the company within the stipulated time. The most challenging part in the thesis was the part related to the ASME III requirements. As it was a new subject for the company, it was difficult to find the relevant information about ASME norms. Before starting the project research, I have spent a lot of time to collect data about ASME III and to understand the concepts linked to it. Moreover, the ASME focuses on technical issues so it has also provoked some difficulties to understand the specific requirements.

Finally among the 64 suppliers of the preliminary list only 10 could have been selected with the currently available requirements. However, as it has been presented in the recommendation part, the company must continue to enhance this list with regular updating. This is essential to mitigate the risks that are linked with the implementation of this new sourcing process.

To conclude, as it has been mentioned in previous chapters, it is important that the case company takes some specific actions to ensure the success of its new organization in accordance with ASME requirements: for example English courses,

ASME indoctrination, technical training, communication with clients, etc. This could be a subject for a further research work by another student.

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APPENDIX 1

Suppliers table (shortcut)

N°	Company name	State	Material & products & manufacturing process	Certificate	Contact information	Date sent	Date received	Reminder
1	**Supplier 1**	Italy	Supplier 1 is the biggest open die forging plant in Italy. Supplier 1 can treat every kind of steel and some special alloys within these limits in weight and sizes: Weight: from 2'000 - 60'000kg Diameter: from 150 to 4'100 mm Length: from 150 to 12'000 mm	MO-QSC-XXX	X	13/03/12	13/03/12	
2	**Supplier 2**	Italy	Certificat: Forgings in carbon, carbon-manganese, alloy and austenitic stainless steel (maximum weight 30 tonnes)	MO-QSC-XXX RCC-M material for the stainless steel / ASME STAMP. Approved by Weir France	X	13/03/12	10/04/2012 + 13/04/2012	27/03/2012. The inquiry has been sent 05/04/2012 to Mr X
3	**Supplier 3**	Italy	Heavy rolling and forging sector Rings - 30000 kg in weight; 6000 and 3500 ton presses allow up to 70000 kg of open-die forging	MO-QSC-XXX	X	13/03/12	13/03/12	
4	**Supplier 4**	Italy	**Product**: discs and punched discs, **blocs**, plates, forged round bars, shafts, **flange shafts**, rings, bushes, mandrelled bushes. Production includes: forgings with min. weight 500 kg up to 100 gk. with min. diam. 200mm and max. 4500mm., lenght max. 23000mm. Blocs: L1 max 1500mm, L2 max 1500mm, max weight 120t. **Process**: Cutting, forging, heat treatment, machining	MO-QSC-XXX	X	13/03/12	27/03/12	27/03/12
5	**Supplier 5**	Italy	**Product: Forged and laminated rolled rings** which can have rectangular or shaped sections **Material:** carbon steels, alloy steels, stainless steels, aluminium, nickel alloys, cobalt alloys, and copper and titanium alloys. Dimensional range as per table below: A – Ext. Diameter Min. 250mm [10"] Max.8.000mm [315"] B – Int. Diameter Min.200mm [8"] Max.7.500mm [295"] H – Hight Min.30mm [1.2"] Max.1.750mm [69"] Weight Min.25 Kg [55 Lbs] Max.40.000 Kg [88000 Lbs] Components can be supplied in the following conditions: - heat treated, semi-	MO-QSC-XXX	X	13/03/12		Not suitable - rolled rings
6	**Supplier 6**	Italy	**Products:** discs/rings, blocks, plates, round bars, shafts, flange shafts, bushes/ chills, pipes/ hollow shafts. Max weight: 80ton **Material**: carbon steels, molybdenum-nickel alloys, super alloys, and other ferrous and non-ferrous grades with a maximum ingot weight of up to 100 tons **Manufacturing process** include raw material, heating furnace, forging press, cutting, heat treatment, machining	MO-QSC-658	X	13/03/12	25/04/12	27/03/2012; 05/04/2012; 12/04/2012; **18/04/2012**
7	**Supplier 7**	Italy	**Peoduct:** heavy wall, stub ends, elbows and tees, special design components for power plants (some are produced by forging and others are obtained by machining from forged hollows/blocks, material ASTM A234 WP22), , special lengths components, manifold **Process:** seamless and welding, machining shop, hot forging; heat treatment	MO-QSC-XXX-1 MO-QSC-XXX-2 MO-QSC-XXX-3 MO-QSC-XXX-4	X	13/03/12	22/05/12	27/03/2012; 05/04/2012; 12/04/2012; 23/04/2012 the inquiry has been sent on new email: xxx; 02/05/2012; 09/05/2012; **15/05/2012**
8	**Supplier 8**	Italy	**Materialand ASME standard:** forged fittings from the size of 1/8" to 4" in all *ferrous and non-ferrous materials* in compliance with the standards *ASME B16.11 and BS 3799* **Product:** •Self-reinforcing branch outlets •Special heavy-wall fittings (Tee, Wyes, Lateral Tees) •Flanged and non-flanged nozzles •Anchor flanges and special flanges •Pipes. **Forged products from 1 to 20 kg in weight.** **Standards:** ASME B31.1, ASME B31.3, ASME B31.4 ASME B31.8, ASME Sect. VIII Div. 1 EN 13480	MO-QSC-XXX	X	13/03/12	24/05/12	27/03/2012; 05/04/2012; 16/04/2012; 23/04/2012 03/05/2012; 09/05/2012; 21/05/2012 I have sent the quiz to other person: XX; **23/05/2012**

APPENDIX 2

Letter of representation

Dear Sir or Madam,

I am the Assistant Purchasing Manager from the Weir Power and Industrial, France.

Our company is specialized in the fabrication of pressure relief safety valves for nuclear industry.

Currently the company intends to develop the collaboration with ASME partners and looks for new suppliers capable to meet the company's demand.

For that purpose, could you please fill the enclosed quiz to evaluate your manufacturing capabilities according to ASME?

It will take only a short time to answer to these questions. Do not hesitate to contact me if some clarifications are needed.

Your answers will only be used internally and, in any case, will not be disclosed without your agreement.

Desired response time: 1 week. Please contact me if you have any questions.

I am looking forward to hear from you soon.

Thank you in advance for your cooperation.

Olga Maksimova
Assistant Purchasing Manager
Weir Power & Industrial France
XXX XXXXXXXXXXXX
XXX XXXXXXXXXXXX
Telephone: +33 (0)X.XX.XX.XX.XX
olga.maksimova@weirgroup.com
http://www.weirpowerindustrial.com

Questionnaire

Supplier questionnaire

The attached questionnaire will be used to evaluate the capabilities of manufacturing the material and products according to the requirements of ASME Section III.

General questions:

1.1	Company name	_____
1.2	Address	_____
1.3	Phone	_____
1.4	Fax	_____
1.5	E-mail	_____
1.6	Homepage	_____

If a division of subsidiary, please list name and address of parent organization:

_____

_____

Special information:

1. Manufactured products (production scope):

Description	Material	Dimension (Crude forged pre-machined) Demand N°1	Dimension (Crude forged pre-machined) Demand N°2	Material Quality Level	Manufac turing lead - time	Price
Forged carbon steel block	SA105	490x455x625: **10 blocks**	490x455x625: **5 blocks**	1		
Forged steel block	SA-182 F316L	Ø430x370: **10 blocks**	Ø430x370: **5 blocks**	1		
Bar	SA-638	Ø210x1000	Ø210x500	4		

	Gr660					

Description	Material	Dimension (Crude forged pre-machined) Demand N°1	Dimension (Crude forged pre-machined) Demand N°2	Material Quality Level	Manufacturing lead -time	Prix
Bar	SA-479 F316L	Ø210x3200	Ø210x1600	4		
	ASTM B637 Gr718	Ø170x800	Ø170x400	3		
	SA-479 F316L	Ø180x3000	Ø180x1500	3		
	SA-479 F316L	Ø110x3000	Ø110x1500	4		
	SA-638 Gr660	Ø45x500	Ø45x300	1		
	SA-479 F316L	Ø225x3600	Ø225x1800	3		
	SA-479 F316L	Ø290x700	Ø290x400	4		
Plate	SA-240 F316L	165x85x40: **10 plates**	165x85x40: **5 plates**	1		

2. Are the stamping operations performed in your facilities

   ☐ Yes ☐ No

If yes, specify type of operations performed: _____

3. Sales activities:

Main customers of these products	Period of cooperation

4. The origin of the raw material used and processed for fabrication of the products listed above:

Material	**Produced in the property (specify in percentage %)**	**Purchased outside the property (specify in percentage %)**	**Suppliers of the raw material (name of the company)**

5. Supplied products (specified in the paragraph 1):

6. Quality testing

Does your company implement the following Non-Destructive examination methods conforming to ASME standards?

NDT testing methods	**Yes**	**Non**	**NDT personnel certification, training and qualification**	**Level of qualification and/or certification**
Ultrasonic test (UT)	☐	☐		Level I ☐ Level II ☐ Level III ☐
Liquid Penetrate Testing (PT)	☐	☐		Level I ☐ Level II ☐ Level III ☐
Magnetic Particle Inspection (MPI)	☐	☐		Level I ☐ Level II ☐ Level III ☐

6.1 Please, specify the organization of your engineering team and their qualification levels, dedicated to tests performance:

_____

7. Are the machining operations performed in your facilities?

☐ Yes ☐ No

If yes, specify type of operations performed: _____

INSTRUCTIONS

- If questions are not applicable, they should be identified “N/A”. If the answer is none, state “NONE”. Enter an “X” in appropriate spaces on yes/no questions.

- For any questions, please, contact: Olga.Maksimova@weirgroup.com

APPENDIX 3

Supplier Checklist

N°	Suppliers	Stamping	Main customers of products	Origin of raw material	Supplied products	NDE SNT-TC-1A/Level of qualification	Machining operations
1	Supplier C	Yes☑ No☐	X	–	–	UT - PT - MPI: Level I, II & III	Yes☐ No☑
2	Supplier F	Yes☐ No☑		X	–	UT - PT - MPI: Level II & III	Yes☑ No☐ : Cutting, Drilling, Turning, Milling
3	Supplier J	Yes☐ No☑	–	–	Aluminium, carbon steel, stainless bar, sheet, plate, tube, pipe, forgings, fittings	UT - PT - MPI: Level II & III	Yes☐ No☑
4	Supplier H	Yes☐ No☐	no additional information: supplier of WVC USA				
5	Supplier G	Yes☐ No☑	Confidential	X	Custom Open Die Forged Products	UT - PT - MPI: Level III	Yes☑ No☐ : Milling, Horizontal and Vertical Turning, Trepanning
6	Supplier D	Yes☐ No☐					Yes☑ No☐ : Rough & Finish Machining
7	Supplier I	Yes☐ No☑	X	All material is purchased globally	Nuclear piping, tubing, fittings, flanges, plate, bar, beam, angle, fasteners, forgings, machining, and fabrications	UT Level III: utilize an audited and approved outside lab. PT Level III: DITTO MPI Level III: DITTO	Yes☐ No☑
8	Supplier A	Yes☑ No☐: DIE STAMP/VIBRO ETCHING	X	100% purshased outside the property	–	UT - PT - MPI	Yes☑ No☐
9	Supplier B	Yes☐ No☐	> No additional information: supplier of Company X. > WVC USA had used them years ago but ran in to quite a few problems with them so had dropped them off the Approved Vendor List.				

APPENDIX 4

Supplier classified by country & by product

N°	Suppliers	Certificate	State	Fabrication operations	Product forms	Note	Suppliers approved by WVC USA	Suppliers qualified by WVC UK against the requirements of NCA-3842	Suppliers approved by Weir France	Other potential suppliers with MO-QSC
1	Supplier C	MO-QSC-XXX	Italy	Forging	Blocks	Can supply only blocks for project X (small weight)	n	n	y	-
2	Supplier F	MO-QSC-XXX	Italy	Forging	Bars Blocks Plates		n	n	n	y
3	Supplier J	MO-QSC-XXX	USA/France	Forging &	Bars Plates		n	n	?	y
4	Supplier H		USA	Forging &	Bars	Only for SA105	n	n	n	y
5	Supplier G	NCA-XXXX	Canada/France	Forging	Bars Blocks Plates		y	n	n	-
6	Supplier D	MO-QSC-XXX	Italy	Forging &	Blocks		y	n	n	-
7	Supplier I	MO-QSC-XXX	USA	Forging &	Blocks Bars Plates	supplier of Company X. Company X works with WVC USA	?	n	n	y
8	Supplier A	N-XXXX (NPT)	USA	Forging &	Blocks Bars Plates	Cooperation with WVC USA	?	n	n	y
9	Supplier B	MO-QSC-XXX	USA	Forging &	Blocks Bars Plates	Not QSC, but approved by WVC USA. M X asked for a quotation	y	n	n	-
10	Supplier E	MO-QSC-XXX	USA	Forging &	Blocks Bars Plates	Not QSC, but approved by WVC USA. M X asked for a quotation	?	n	n	-

APPENDIX 5

Other potential suppliers

Company name	State	Certificate	Comments
BIG FORGING			
Supplier 1	Italy	MO-QSC-XXX	
Supplier 2	Italy	MO-QSC-XXX	Maximum ingot is 530 tons, for a finished delivered weight up to 230 tons + small parts (around 20 tons)
Supplier 3	Sweden	MO-QSC-XXX	
Supplier 4	France	MO-QSC-XXX	Min. 10-15 Tons
Supplier 5	United Kingdom	MO-QSC-XXX	
Supplier 6	South Korea	MO-QSC-XXX	
Supplier 7	USA	MO-QSC-XXX	Min. 1500kg
Supplier 8	Germany	MO-QSC-XXX	Min. 50 t for materials out of our EAF (AISI 316 L) and 5 t out of company's VIM/VAR and VIM/ESR facilities (Inco 718).
WELDING EQUIPMENT			
Supplier 9	Germany	MO-QSC-XXX MO-QSC-XXX-2 MO-QSC-XXX-1	Fournisseur de Métaux d'apports en soudage
Supplier 10	USA	MO-QSC-XXX. Approved by WVC USA	
CASTING			
Supplier 11	China	MO-QSC-XXX	
Supplier 12	China	MO-QSC-XXX	
Supplier 13	USA	MO-QSC-XXX MO-QSC-XXX-1. Approved by WVC USA	
Supplier 14	USA	MO-QSC -XXX. Approved by WVC USA	
ROLLED BAR PRODUCTS			
Supplier 15	USA	MO-QSC-XXX	
BOLTS & SCREWS			
Supplier 16	Japan	MO-QSC-XXX	
HEAT TREATMENT AND MECHANICAL TESTING			
Supplier 17	USA	Qualified by WVC UK	
ROLLED RINGS			
Supplier 18	Italy	MO-QSC-XXX	
TUBES & PIPES			
Supplier 19	Spain	MO-QSC-XXX	
Supplier 20	France	MO-QSC-XXX	
Supplier 21	China	MO-QSC-XXX	
FLANGES			
Supplier 22	South Korea	MO-QSC-XXX	

APPENDIX 6

Supplier list

N°	Suppliers	State	Product
1	Supplier C	Italy	Blocks
2	Supplier F	Italy	Blocks Bars Plates
3	Supplier J	USA/France	Bars Plates
4	Supplier H	USA	Bars
5	Supplier G	Canada/France	Bars Blocks Plates
6	Supplier D	Italy	Blocks
7	Supplier I	USA	Blocks Bars Plates
8	Supplier A	USA	Blocks Bars Plates
9	Supplier B	USA	Blocks Bars Plates
10	Supplier E	USA	Blocks Bars Plates