QUALITY MANAGEMENT SYSTEM AS AN ASSET

Case Study: Small Enterprise in Global Turmoil

HAMK
HÄMEEN AMMATTIKORKEAKOULU
HÄME UNIVERSITY OF APPLIED SCIENCES

Master's Thesis

Business Management and Entrepreneurship

Visamäki, Autumn 2016

HAMK
HÄMEEN AMMATTIKORKEAKOULU
HÄME UNIVERSITY OF APPLIED SCIENCES

ABSTRACT

VISAMÄKI
Business Management and Entrepreneurship

Author Ilkka Gustafsson **Year** 2016

Title of Master's thesis QUALITY MANAGEMENT SYSTEM AS AN ASSET
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ABSTRACT

This Master's Thesis was set on the very recent past of turmoil in the maritime market, of which the author has been a part of for the last ten years. The case company has been on the same market for much longer and has managed to navigate the peculiar fluctuations of the industry, but even they were not fully prepared for the effects from the capitulation of Lehman Brothers in 2008 – the following financial crisis threw the whole world into chaos.

A substantial part of the thesis looks into the case company's main customers and their changing market situation around the Baltic Sea during the years 2013 – 2016. Special interest is in the maritime industry's environment; the shipyards and the network companies. Some land-based endeavours are also scrutinized to gain depth for the research. Further depth is reached by studying the phenomena of Quality, from the time of the Egyptians to rebuilding of post-war Japan to modern times. Theoretical background is furthermore framed by introducing some famous authors. The case company itself is analysed in detail to show the challenging situation as well as their needs for the future as clearly as possible. Evidence of the case company's innovative approach to solving problems is portrayed by a few examples.

The solution provided for the case company by the author was a complete Quality Management System, documented in the form of a Quality Manual, which was based on actual process descriptions created in practice. The Thesis and supporting research demonstrate clearly how the construction of a quality management system and clever use of it as a part of the marketing initiative helps in gaining a competitive foothold in new potential markets as well as secures the brand with the old market customers in an ever changing business climate. A quality management system compiled together with the quality awareness and innovative nature of a small and agile company will start to generate results. Furthermore, documented processes will help enormously in the transfer of tacit knowledge.

The scientific importance of the topic is to acknowledge that sudden and rapid fluctuations are in today's world more or less the norm – we need to be prepared for it. Perhaps this Thesis may encourage some small company to start thinking "quality" too.

Keywords Quality Management System, Manual, Maritime industry, Tacit Knowledge

Pages 55 p. + appendices 3 p.

HAMK
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TIIVISTELMÄ

VISAMÄKI
Business Management and Entrepreneurship

Tekijä Ilkka Gustafsson **Vuosi** 2016

Työn nimi QUALITY MANAGEMENT SYSTEM AS AN ASSET
Case Study: Small Enterprise in Global Turmoil

TIIVISTELMÄ

Tämän lopputyön aihepiiri käsittelee meriteollisuuden lähimenneisyyden myllerrystä kirjoittajan kymmenen vuoden alan työkokemukseen pohjautuen. Toimeksiantajayritys on toiminut samalla alalla paljon pidempään ja on siten kohdannut useita alalle tyypillisiä vaihteluja niistä selviten. Tästä huolimatta yritys pystyi vain osittain varautumaan vuoden 2008 Lehman Brothers-pankin kaatumisesta aiheutuviin seurauksiin – sitä seurannut globaali finanssikriisi ajoi maailmantalouden kaaokseen.

Merkittävä osa lopputyöstä tarkastelee toimeksiantajayrityksen pääasiakkaiden tilannetta Itämeren alueella 2013 – 2016. Erityisenä kiinnostuksen kohteena olivat telakkayhtiöt sekä niitä tukevat verkostoyritykset, mutta myös joitain maapuolen asiakasyrityksiä tarkasteltiin tutkimuksen kaikupohjaksi. Syvyyttä kaikupohjaan saatiin tutkimalla laatua ilmiönä aina pyramidien mestarirakentajista toisen maailmansodan jälkeisen Japanin jälleenrakentamisen kautta nykypäivään. Teoreettinen viitekehys asetettiin kohdilleen perehtymällä muutamiin laatualan kuuluisiin tutkijoihin.

Toimeksiantajayrityksen haasteellinen nykytila on analysoitu yksityiskohtaisesti mahdollisimman selkeän kuvan luomiseksi – samalla selkeytyivät ja vahvistuivat tulevaisuuden tarpeet. Yrityksen innovatiivista ongelmanratkaisukykyä esitellään muutamin esimerkein. Ratkaisuna toimeksiantajayrityksen tilanteeseen, tutkija rakensi Laadunhallintajärjestelmän, joka dokumentoitiin laadittujen prosessikuvauksien perusteella syntyneeseen Laatukäsikirjaan.

Lopputyö ja sitä tukeva tutkimus havainnollistavat kuinka laadunhallintajärjestelmä ja sen taitava käyttö osana markkinointia auttaa varmistamaan jalansijan uusilla potentiaalisilla markkinoilla sekä vahvistaa yrityksen brändiä nykyisten markkinoiden jatkuvasti muuttuvassa ilmastossa. Laadunhallintajärjestelmä osana pienen ja ketterän yrityksen laatutietoista ja innovatiivista luonnetta luo kilpailukykyisiä tuloksia. Lisäksi, dokumentoidut prosessit auttavat hiljaisen tiedon siirtämisessä.

Lopputyön aihepiirin tieteellinen tärkeys voidaan kiteyttää toteamukseen että äkilliset ja nopeat vaihtelut ovat nykypäivän normi – meidän pitää pystyä varautumaan niihin. Toivottavasti tämä lopputyö rohkaisee joitain pieniä yrityksiä ajattelemaan ”laatua” omalla kohdallaan.

Avainsanat Laadunhallintajärjestelmä, Laatukäsikirja, Meriteollisuus, Hiljainen tieto

Sivut 55 s. + liitteet 3 s.

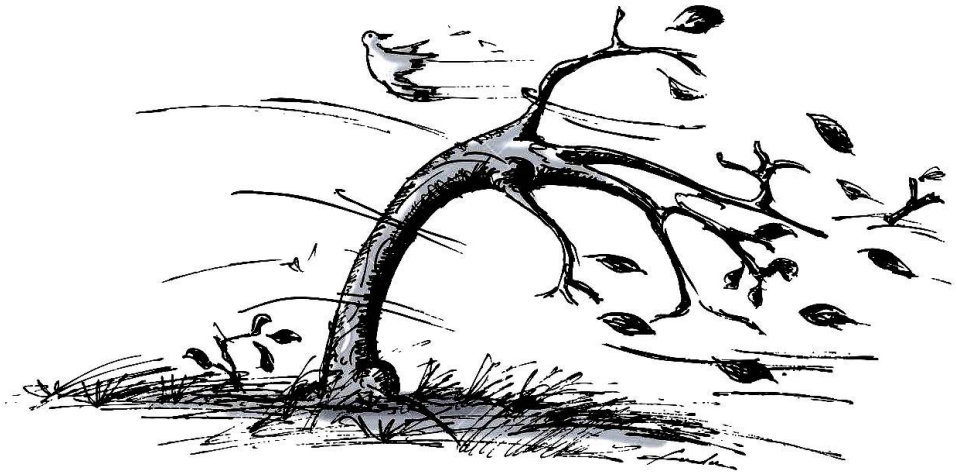
GLOSSARY OF ACRONYMS

AUTOCAD	Computer software used in designing; AUTOmated Computer Aided Design
Block	A part of a ship structure which is a three dimensional entity, constructed usually from several sections and prefabricated pieces
CA	Confidentiality Agreement
DNV	Det Norske Veritas, an Oslo based international classification society
DNV-GL	Name of the classification society after the merger of DNV and GL
EC/CE Certificate	Declaration of Conformity; European Community (English), Conformite Europeenne (French)
GL	Germanischer Lloyd, a Hamburg based international classification society
Hull	The structural body of a ship, incl. shell plating, framing, decks, bulkheads, etc. Constructed from several blocks.
ISO	International Organisation for Standardization
LNG	Liquefied Natural Gas
NDA	Non-Disclosure Agreement
QM	Quality Manual
QMS	Quality Management System
RS	Russian Maritime Register of Shipping, based in Saint-Petersburg
Section	Sometimes synonymous with ship hull “block”, comprising usually from a cross section of a ship’s hull
Stiffener	A structural steel beam, usually a T-beam, attached to steel plate by welding to strengthen it
T-beam	A structural steel beam, with a cross section shape resembling the letter T
Turnbuckle	A device with opposite internal threads for pulling parts together (or pushing them apart)
Wedge	A piece of tapered metal, that can be hammered into a narrow opening
WPS	Welding Procedure Specification

CONTENTS

1 INTRODUCTION: SMALL ENTERPRISE IN GLOBAL TURMOIL

This Master's Thesis will analytically propose that a documented quality management system may become a very important asset for survival in global turmoil. In the trying times between 2013 and 2016, a small enterprise almost became a leaf on the wind…



An important trigger for this Master's Thesis can be found in the research report "Target Market: Russia", which was prepared for a small family enterprise, Craftmer Oy, in March 2015 (later "Craftmer" or "case company"). A substantial contribution to this Master's Thesis is drawn from that research conducted by the author and his student colleagues Juha Joutsijoki, Mika Soinisalo and Sari Pery for a course at HAMK. After presenting the report and especially the conclusions and recommendations to the management of the case company, the researcher was asked to prepare a draft for the implementation of a quality management system and a quality manual. The main reason for this request was the non-existence of a documented management system. Based on the findings and recommendations presented in "Target Market: Russia", it had become clear for the management of Craftmer that they had a major deficiency when trying to survive in the stormy maritime market and especially when trying to enter new markets in a very challenging situation of external and internal factors:

- the maritime market in Finland, Germany and in many other countries were hit hard by the global downturn in business,
- the main customers, the shipyards in Finland, were in a very poor shape after a long string of bad owners,
- the maritime market in Russia was seen as very potential, but also as a tough market to penetrate due to various reasons,
- transferring of responsibilities within the case company management due to a possible near-future retirement.

The case company is one of several hundred enterprises that contribute in the maritime sector of Finland. The number of companies operating directly in the shipbuilding sector is 867, according to survey conducted in 2014, but the number is much higher when all small and micro sized companies are taken into account – estimated total being up to 3000 (Karvonen, T. et al. 2016. p. 27). The operations of micro-sized companies may be small in scale, but the significance is in the dedication to core competence – the produce is usually high-end quality and competitive even on a global scale. However, negative news in their customer's situation will impact these highly specialized companies gravely.

Preliminary analysis of the challenges presented by the case company led to an interesting journey all the way from building pyramids to survival in a modern fluctuating market. During the course of gathering the research material from a multitude of published literature, news media, press releases of the involved companies, pages of history and from various interviews, the case study evolved into a practical action research. The main research problem was established as a question:

How can a small enterprise ensure its survival in a challenging environment?

The sub problems generated by the main research problem were further defined as following;

- How to present the exceptional quality and usefulness of the products of the case company?
- How to keep the old customers from the old market?
- How to find and obtain new customers from new potential markets?
- How to secure transfer of tacit knowledge in a generation exchange?
- How to do all this in a cost-efficient and economical fashion?

This Master's Thesis is to all intents and purposes a description of the research process, a brief historical overview of the maritime industry in Finland, a study of quality as a phenomena, and functions as a report of analyses drawn from actual events, culminating in a rationalized proposal as to why a small enterprise should consider implementing a quality management system.

2 THEORETICAL FRAMEWORK ON QUALITY

Understanding the significance of quality and applying the concept in practice has been and still is one of the most central factors in success in the development of humanity's history. One of the first challenges is already in the definition of the term "quality". In the daily talk we use the term as a general term, applicable to any trait or characteristic of a person, material or matter. According to American Society of Quality it is also: "a subjective term for which each person or sector has its own definition". The definition goes further and explains that "According to Joseph Juran, quality means "fitness for use"; according to Philip Crosby, it means "conformance to standards set by customers" (http://asq.org/glossary/q.html). In his book "Laatuajattelu" ("Quality Thinking") Paul Lillrank presents a method for defining quality: "When defining quality, it is imperative to agree on the phenomenon itself, what is included and even more importantly – what is not included. When the phenomenon is defined and limited clearly, the next step is to think about the problem or question related to it. For what do we need a solution or an answer to?" (adapted from p. 19). He continues that this method is an essential tool when writing reports, analyses or theses, as the applicability is identical:

phenomenon → *problem/question* → *solution/answer* → *reasoning*

As it seems, a singular, definitive, clear or simple definition does not yet exist, and therefore we need to take a look at some philosophy too, in addition to history. The following is a perspective from the time when the pyramids were built, led by master builders in masonry – back then, the name of a master builder was an assurance of quality. It is significant that the same term and description are still today attributed to certain individuals and that a craftsmen's guild of the same profession exists.

2.1 Historical Perspective

The ancient Egyptians knew the significance of quality and process management. The cover page (in figure 1) and the contents of Juran´s "Quality Control Handbook" inspired a short research into the explanation of thousands of years old picture showing the accuracy control of the carved stones intended for building pyramids.

Figure 1 Pictogram on the cover page of Juran´s book

The research into this pictogram became an adventure, as it comprised a total quality management system in practice: thousands of people were organised and scheduled in a huge process starting from the early planning of a project, including the phases from stone breaking, transportation and finally resulting in the construction of a pyramid! The pictogram shows that every stone was examined by a master builder; most passed the scrutiny without any modification necessary, but sometimes a stone with wrong dimensions or shape was delivered or a flawed stone had to be replaced. The faulty stones were removed and sent to a workshop for recutting to the size and shape which the next phase required.

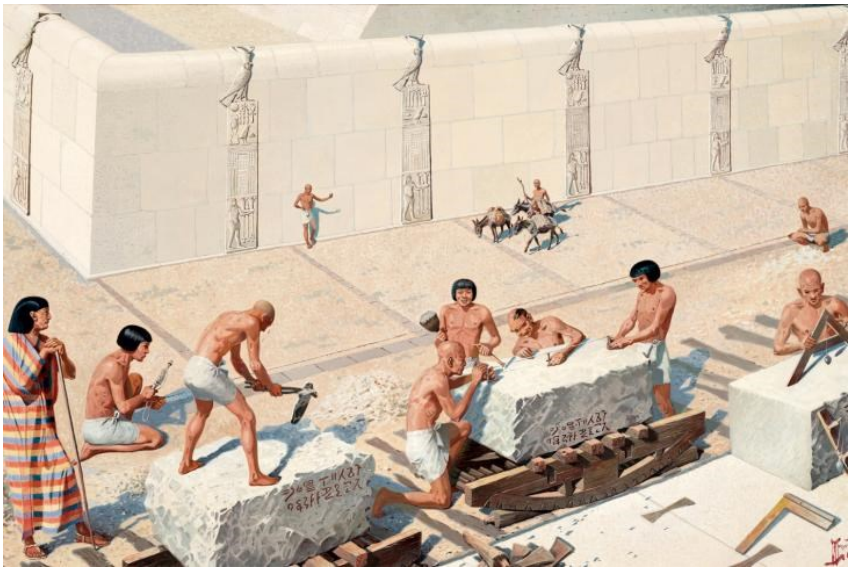


Figure 2 “Stone breakers” (The Bridgeman Art Library)

One of the more interesting and probably less-known facts about building the pyramids was researched by Dr. Heribert Illig and Franz Löhner in their book “Der Bau der Cheops-Pyramide Nach der Rampenzeit“. They had calculated the total manpower necessary and concluded that 6700 workers could have completed Khufu's pyramid, but here is the surprising bit: “Most of those were highly skilled craftsmen and artisans, not unskilled workers or slaves”, as is the usual idea about building of the pyramids. Seems that quality has been a key factor in completing challenging projects in the past, but it isn’t any less important today.

2.2 Philosophy from the Land of Quality

Right after the Second World War, experts of every kind were sent to Japan to help in the efforts of recovering the industry from the damages of the war. The main objective was to improve the quality of products and services by means of totally re-thinking and re-engineering processes to enable the customer to receive desired products and services.

From all the experts sent to Japan, the most pertinent quality experts for the topic of this research are briefly introduced here, as they have had a significant effect on quality as we know it today.

Each of these men developed a personal viewpoint towards quality, resulting in different aspects of quality philosophy, which later became known as "Total Quality Management".

Joseph Moses Juran (1904 – 2008) is a respected quality authority, known from many expressions which have become globally known concepts, such as: "Fitness for Use" or "Quality is Fitness for Use" and "Juran´s Trilogy" (Juran´s Quality Control Handbook, 2.7, 2.8, 18.31-38). An interesting finding for the case company is in Juran's Trilogy; how to plan quality already into the products and processes? The Craftmer tools are more or less designed from the start together with the customer, for the purposes and needs of the customer – this in addition to Craftmer's intimate knowledge of the operating environment of the customer and skills as craftsmen. Basically, quality is already built-in.

Philip B. Crosby (1926 – 2001) is another famous quality authority who in 1979 shook the world with his innovative writings in the book "Quality is Free". As the title of his book, his great idea was very simple: "Quality is free. It is not received like a gift, but it is for free. Quality failure costs money – the fact that the things are not made correctly the first time" (freely translated from the 1986 Finnish translation of the book "Laatu on ilmaista", chapter one). The bridge to Craftmer is also simple; the tool design process is a standard part of the cost structure, so it does not cost anything extra – it is free.

W. Edwards Deming (1900 – 1993) was a mathematician, statistician, engineer, professor, lecturer and a consultant. Like Juran and Crosby, he worked in the post-war Japan to contribute to the economic miracle of Japan in the 1950's. Deming is perhaps best known from his practical "14 points", which he used in Japan successfully and described in his book "Out of the crisis", first published in 1982 (p. 23-24). In short, the fourteen points say that the management of the company must re-establish operational functions within the company to follow the Plan-Do-Check-Act – philosophy, which was published in 1993 in the "The New Economics for Industry, Government, Education" (p. 132). The method is known as "PDCA" or Deming or Shewhart cycle. It is a practical tool to identify available information before next decision. The PDCA-method and its applicability are closer examined in a later chapter.

Professor at University of Michigan, Jeff K. Liker is an authority of a new generation concentrating on modern quality themes. He has spent a great deal of time and effort in researching and writing about Toyota's advanced ways of building cars in Japan. So far, at least eight of his books have covered a multitude of quality themes; lean leadership, continuous development, product development and people development. A closer look at "The Toyota Way" and its meaning for the case company is presented in chapter 3.5.

Paul Lillrank (born 1955) is the Professor of Quality and Service Management in Aalto University, School of Science.

Following the example of the well-known American gurus from a few decades earlier, he studied and did research work in the 80`s in Japan, at the Tokyo University. In 1990 Lillrank published a book "Laatumaa" (The Land of Quality), where he describes the Japanese way of thinking quality. His book includes sharp observations about "Superpower of Quality – Japan". Lillrank describes six "aspects of quality" in his book on pages 41-51. The focus areas are in Manufacturing, Product, Value, Competition, Customer and Environment:

- Manufacturing aspect underlines the importance of error free manufacturing and that standards have to be fulfilled.
- Product aspect is based on examining the level of product development and design that goes into a product.
- Value aspect is based on marketing and sales where price depends on the quality of the product.
- Competition aspect describes the quality of the product in comparison to competitor's quality.
- Customer aspect reflects the success of the product in the use of the customer.
- Environmental aspect refers to use of less resources, like materials, in making of the product.

These can be directly applied also for a small company like Craftmer.

Olli Lecklin is an experienced consultant and lawyer with expertise in business and quality systems – he has written several books that are used in universities and universities of applied sciences as lecturing material. An interesting fact is that he has acted as a judge in the Finnish quality award competition organized by "Laatukeskus Excellence Finland Oy". In his book "Quality as a success factor of the company", Lecklin refers to the Japanese quality philosophy by describing quality as a "critical success factor", and lists several examples of what could be considered as critical factors within a company (p. 24-31). The most interesting aspect for the case company within his theory is the interconnection between quality and survival. This is further studied in the next chapter, "Total Quality Management".

According to the author's knowledge, Dr. Mikko Mäntyneva has not studied in Japan, but he is well known in Finnish business academic community as a lecturer and speaker. His expertise includes growth strategies related to innovations and to improvement of productivity. One of his several books, "Kasvua Innovaatioista" ("Growth from Innovation") describes and discusses the role of innovations in the implementation of company´s growth strategy. Chapter 3.4.1 in this Thesis will present how some of his ideas worked also at the case company.

2.3 Total Quality Management

TQM is a globally spread expression to generally describe methods and tools for organizations and companies to continuously develop quality products or services to customers. The origin of the term "Total Quality Management" or "TQM" is often referred to be an American Walter A. Shewart, yet many scientists, consultants and institutions have developed a lot of aspects and principles, which are based on TQM. It was also in a main role of the quality world in the 70´s and 80´s and led to the launching of the ISO 9000-series of standards in the 90´s.

Since those days, TQM has evolved to encompass even more; according to Lecklin quality must be considered to behold the leadership, strategic planning as well as development of the organization (Lecklin, p. 17). Additionally, customer focus was previously seen as an external factor, but is now considered to surpass everything else. "Customer's needs are the foremost consideration in quality work", states Lecklin. An adaptation of Lecklin's illustration in figure 3 underlines the importance of the customer in modern interpretation of TQM.

Figure 3 TQM (adapted from Lecklin, p. 19)

Without even realizing it, the case company has applied the principle of TQM in their day-to-day by working closely together with their customer. Their customer oriented approach was never written down as a guideline nor did it have a fancy name, yet emphasis was always laid on understanding the total situation of the market and the customer, then acting accordingly in a professional manner.

A further theory of Lecklin is surprising but quite fitting especially in the context of a small enterprise in global turmoil: he proposes that when viewed in a long-term perspective, the significance and meaning of "quality" becomes "survival" of the company. The interconnections of various aspects affecting the company are shown in figure 4.

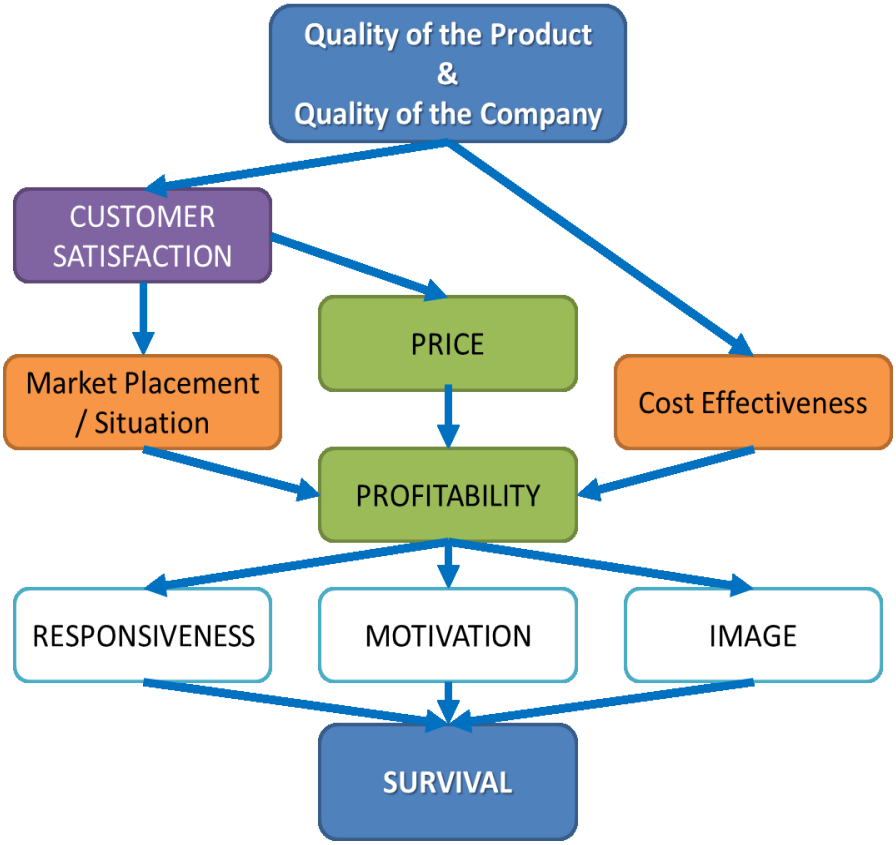


Figure 4 The significance of Quality is Survival (adapted from Lecklin, p. 26)

3 CASE COMPANY & OPERATING ENVIRONMENT

Craftmer Oy is a small family business in the field of tool manufacturing. To create a comprehensive view of the company as well as the market it operates on, the makings of, the history of the company and the current market situation were researched and analysed in detail. The goal is to provide an in-depth analysis by looking at the various aspects that comprise the case company's core business, the fluctuating situation of the market and the marketing activities of the company – one focus area being at the recent efforts to penetrate the Russian maritime market.

3.1 Background

Craftmer was established in 1991 to manufacture tools and utensils based on own innovations for the shipbuilding and heavy engineering industries. The roots of the case company however reach back to the 1970's, when a skilful and innovative plate fitter at the yard, Tauno Keskisarja started to develop his tools of trade in order to improve his own work conditions. For the sales and further development of the innovative shipbuilding tools his son Veli-Pekka Keskisarja founded the company in 1991.

Since the beginning, the aim of the company has been to ease and quicken the assembly work of heavy steel constructions and to enhance the productivity of hull construction and assembly at shipyards, by improving the techniques and installation tools of the plate fitter. Simultaneously, great emphasis has been laid on the design to improve the work safety of the people using the tools.

The business idea seems to follow one of the well-known aphorisms of Joseph M. Juran; "Quality is Fitness for Use". The tools and applications developed by the company are the total sum of intricate knowledge of the techniques, methods and environment of the work place, coupled into design of an appropriate tool and method for that environment and work. Continuous dialogue with the installers and fitters ensure that the products conform to the evolving specifications of the construction phases and materials. There are certain differences between the blocks and sections of cruise vessels, ice breakers and offshore products, but the range of applicability of the Craftmer tools has been designed to cover a large scale.

At the moment Craftmer manufactures primarily twenty different standard products, but the whole product display includes a total of 150 various innovations. The company is mainly run by the Managing Director and the Sales Manager, complemented by a crew of three professional metal craftsmen. When necessary, the management pulls on the overalls as well. Once larger orders are reined in, the company subcontracts part manufacturing and painting works to other small companies in the close vicinity. Design work of creating the needed drawings may also be sub-contracted

to an AutoCAD professional. Warehousing and logistics are handled by yet another small company, depending on the needs of Craftmer.

According to the Managing Director, Mr. Keskisarja, the tools designed by Craftmer are responding well to the needs of the customers. For example, modern shipbuilding demands ever lighter and more durable tools - the job at hand needs to be completed quicker and at the same time with more flexibility and efficiency. The customer expects the tools to fit their purpose, be easy and safe to operate, cost-efficient and reliable. "In designing the tools we have focused in these core values - based on the customer feedback, we have succeeded." states the Director. In addition to more than one hundred customers in Finland, Craftmer has clients in Norway, Germany, United Kingdom, Denmark, Lithuania and in the United States. Some of the products have been specifically designed for certain customer's needs. This kind of co-operation with the biggest clients has been very close.

The lightness and durability of the products has been achieved by careful material selections and the continuous development of the tools has shaped them to be highly practical and time-saving, proven in practice. The development continues by testing the tools' e.g. lifting, pulling or pushing capacities in real-world situations, and by asking the customers for feedback. In the design of the tools, work safety related issues have also been in the focal point; many of the Craftmer products allow for safer use. When tools and devices are delivered, an EC certificate of conformity will follow to show the norms, regulations and standards by which the tools were manufactured.

According to Sales Manager Vesa Klen, the company's strengths are in the solid knowledge of the business and high level of specialization, own product range and further development of the products, long-term business relationships and quality wise market leadership. Furthermore, the personnel are all professionals of their fields and the production is very flexible. The location of the company at one of Turku's industrial areas in southwest Finland is logistically good; the largest customers are located nearby enabling personal contact, and roads, railways and ships all meet in Turku, allowing for easy access to export.

3.2 Competition

In the field of special shipbuilding tools, no real competition exists in the home market of Finland. Some importers offer a narrow range of similar kind tools or devices from foreign manufacturers, but those are often meant for general use, not specifically designed for shipbuilding. Many suppliers carry also a range of hydraulic and mechanical jacks and chain blocks / hoists.

In the recent years, an influx of some cheap Chinese tools has found their way to the market, to compete with the well-known manufacturers. Very often these tools look similar than their western counterparts, yet the quali-

ty, reliability and durability differ greatly. It is possible to use commercially available common tools for the job, like a turnbuckle or a hydraulic set, instead of a Craftmer tool. By using a turnbuckle, the investment for the tool is very low, however, the time it takes to use it is quite a lot longer. In comparison, hydraulic tools tend to be quite expensive and heavy to use, but they offer more power in return.

The common approach to adjusting a bulb profile with the plate it needs to be welded to, is to use a sledge-hammer, steel wedges and a manual jack. Almost every application requires a support for the jack and the wedges – these need to be welded onto the profile. When this traditional approach is compared to using Craftmer's "PALMEK" or "MINIPALMEK", the time-saving can be more than 50%, as no welding, cutting or grinding is necessary (see figure 5).

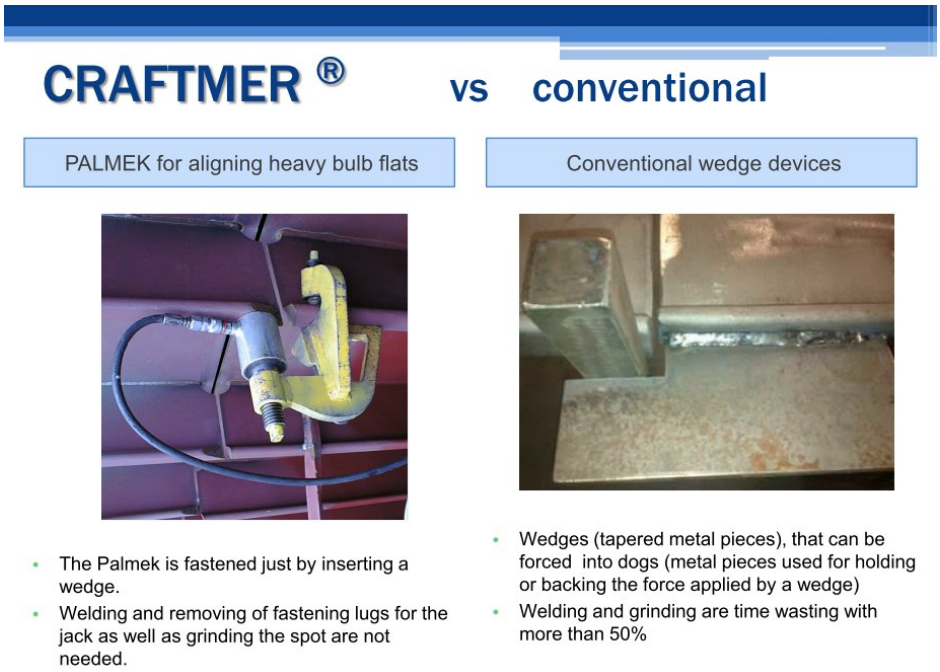


Figure 5 Craftmer tool vs. conventional method explained (Craftmer's presentation)

3.3 Customers & Market Situation

The first tools of Craftmer were born out of necessity at Turku's old riverside shipyard in the 70's. Upon the demand for larger ships, the building of a new shipyard was started – concurrently, also the need for proper and more diverse tools emerged. By the early 90's, the home market of Craftmer comprised all of the Finnish offshore and shipbuilding companies; Mäntyluoto Offshore, Hollming Shipyards, Rauma-Repola Shipyards, Turku New Shipyard and Helsinki New Shipyard. Also numerous of the domestic subcontracting companies in the maritime industry were their clients. Business relationships with the companies that still exist, continue even today in 2016.

In the mid 90´s shipbuilding industry in Europe was already suffering the effects of strongly increasing competition from Korea and Japan and in the new millennium also from China. However, the remaining European shipyards in Germany and Norway were still successfully competing against Far Eastern countries. Offshore industry in Finland, United Kingdom and Norway had found Craftmer´s products. In the late 90`s Norwegian shipbuilding group Kvaerner owned shipyards in Finland, Norway, Germany and USA, which all became customers of Craftmer due to exchange of information between these shipyards.

In addition to the companies within the maritime cluster, several heavy duty machine shops have found Craftmer tools and innovative solutions to be of use in their lines of business. One of them is the current "Sandvik Turku Plant" (formerly "Tamrock", ex. "Auran Rautateollisuus Oy"), nowadays called "Sandvik Mining & Construction Finland Oy", a part of a multinational Sandvik-group. As the name implies, the company manufactures heavy machinery for use in mining and construction (see figure 6). The Turku Plant has developed and delivered special underground machines since 1971 and is the clear market leader in the world. According to Sandvik homepage news, the 9000th underground machine was delivered in September 2016. In order to manipulate heavy and cumbersome pieces of frames and equipment during the production phases, a wide range of heavy-duty tools, equipment and accessories are necessary.

Figure 6 Sandvik Drilling Machine at work (photo courtesy of Sandvik)

Also considered a land-based endeavour, shipping company "Meriaura Oy" operates several cargo vessels on the Baltic Sea - two of the ships are specifically designed to carry special cargoes. Craftmer has developed superior equipment to secure a special cargo quickly and safely onto the ship's deck – even so when these have a high centre of gravity, like is shown in figure 7.

Figure 7 MS Aura transporting very tall wind mill foundations, held in place with Craftmer's securing equipment (www.meriaura.fi)

The loading and unloading of the cargo is possible to do 50% faster with the new type of securing equipment, shown in figure 8 - this is excellent news for the ship's operator, as the vessel does not earn anything when moored to a quay.

Figure 8 Cargo securing equipment in use (www.craftmer.fi)

3.3.1 Fluctuation in the Market

Unfortunately, in a global world, problems quickly become global too. The latest economic avalanche, which started in April 2008 in the USA, was described in a European Commission study as: "…the deepest, most synchronous [crisis] across countries and most global one since the Great Depression of the 1930s." (Economic Crisis in Europe: Causes, Consequences and Responses, p. 14). There are very few or no historical parallels to the manner in which this modern day depression caused almost synchronized damage around the world (p. 27).

A comparison chart (figure 9) in the same study shows the two periods of depression from the view of industrial output – the similarity is frightening, if the resuscitation of the global economy will take as long as it did in the early 30's.

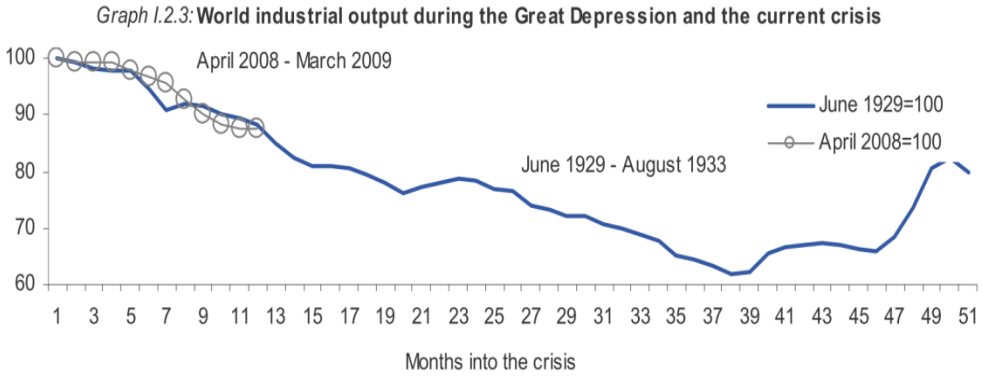


Figure 9 Comparison chart of the world industrial output in two time periods (Economic Crisis in Europe: Causes, Consequences and Responses, page 16)

Due to this steep economic decline in global business, shipbuilding among other fields also experienced steep roller coaster-effects in their business in the period between 2009 and 2015– this however was nothing new for experienced shipbuilders at the Turku shipyard. When looking back in history, it seems modern shipbuilding has always been a field of extreme highs and lows, as can be seen in figure 10 (courtesy of Mr. Kari Sillanpää, Head of R&D, Meyer Turku Oy). It must be noted here that the graphic was published on 30th of August in 2015, and at that time the future seemed quite bleak.

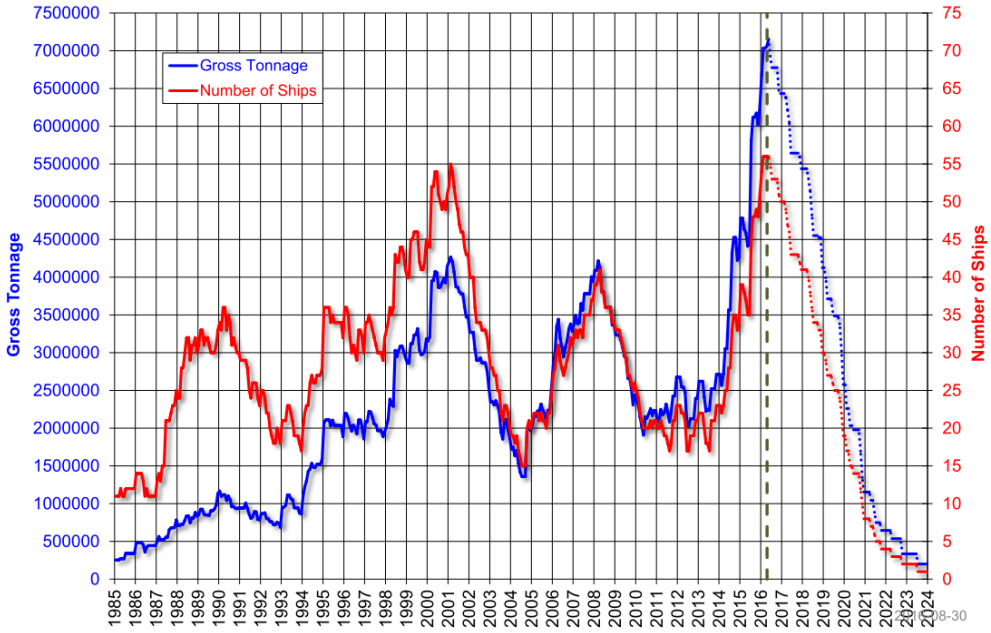


Figure 10 Fluctuation of global cruise vessel market through the years

Finnish maritime industry has always been hit especially hard by trouble in the market, as it is almost entirely dependent on foreign export. The global orderbook situation therefore understandably reflects directly to the financial status and situation at the various shipyards – in turn, the depression of the shipbuilding enterprises have a significant effect on the prosperity of all subcontracting companies. For the case company, the demand of the shipbuilding industry affects directly the demand for new tools. As the products of the case company are highly durable in the intended use, the turnover drops to zero during the periods of depression of its clients – revival of the business takes a long time as well. For these reasons it is imperative for a small enterprise to try to stay ahead of the curve, to find new market areas in times of duress and to create a brand of exceptionally high quality products coupled with innovative product development.

Another phenomenon, and a direct result, of fluctuation in the maritime market is the frequent change in ownership of the Finnish shipyards. The figure 11 “Timeline of the Finnish Yards” is a modified version of the official graphic from Meyer Turku Oy’s website (meyerturku.fi) and it shows the continuous documented history of various owners, dating back almost 300 years. In order to fully understand and write the whole history of shipbuilding in Finland, other theses should be commissioned. For this research, the past few decades and the fluctuations within that period of modern shipbuilding are of most interest.

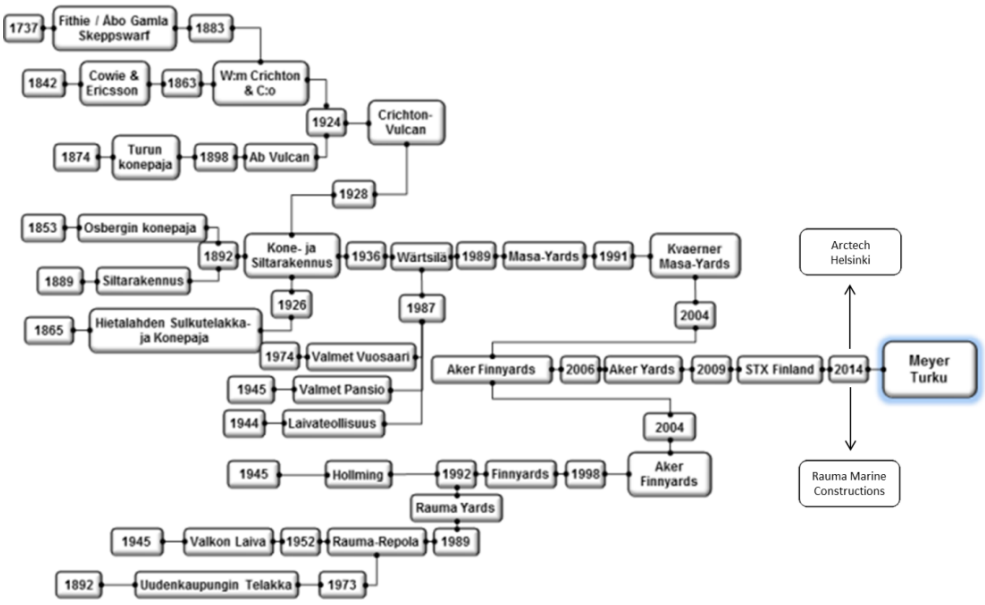


Figure 11 Timeline of the Finnish yards (www.meyerturku.fi)

One of the major structural changes happened in 1986, when the governmental company "Valmet" and the privately owned "Wärtsilä" closed down a number of their smaller shipyards spread around Finland and began concentrating efforts to the larger yards located in Turku and Helsinki – the name to define the new joint venture was "Wärtsilä Marine". By that time, the companies involved in the merger had delivered a total of 2600 ships of various types and sizes. In spite of good intentions, the newly minted company went bankrupt already within three years, in 1989. The now highly modern yards of Turku and Helsinki were however able to continue their existence, this time as "Masa-Yards", aptly named after the nickname of CEO Martin Saarikangas. A Norwegian shipbuilding group "Kvaerner ASA" had noticed the potential of two modern yards and bought them both in 1991, renaming the company "Kvaerner Masa-Yards" as well as effectively moving the Finnish shipbuilding know-how to become Norwegian property. The new yards "KMYT" (Kvaerner Masa-Yards Turku) and "KMYH" (Kvaerner Masa-Yards Helsinki) operated under the new management for a surprisingly long time.

On the background another Norwegian holding company, "Aker Maritime ASA", had been working to gain an opening into "Kvaerner" since 2000 and finally succeeded in creating a merger, thus forming "Aker Kvaerner" in 2002. Within two years, "Aker" was the only one left. Around the same time in 2004, "Aker" consolidated all three Finnish shipyards located in Turku, Helsinki and Rauma, to become one company with a new name "Aker Finnyards". The name was changed in 2006 to "Aker Yards" and at that point the group consisted of a total of 15 shipyards in Norway, Germany, Finland, and France, employing roughly 16 000 people.

A fairly big surprise was announced in August 2008, when a South Korean conglomerate purchased most of "Aker Yards", renaming it "STX Europe" and which included the three Finnish yards, with a fairly logical name "STX Finland". The parent company "STX Group" was a mega-

sized industrial entity established in 2001, which followed its illusional slogan of "World Best" and bought companies one after another operating solely on debt-financing (The Korea Herald, 31.5.2016). Among shipbuilding entities, this bubble became the largest in the world, constituting from 19 shipyards across the globe, with some located in very exotic places like Brazil, Romania, Vietnam and China.

The downturn in global business and financial world sent a shockwave through the shipbuilding industry that same year and began the most difficult period ever at the Finnish shipyards. For almost a decade, there was a lack of interest in the development of the yards or its operations – there was hardly any money around for necessary investments, like proper tools, for example.

Additionally, shipbuilding industry is a peculiar field of business in many aspects, from which the financing of building a vessel is one of the most curious. The builder needs to secure financing for about 80% of the total costs involved in the process, i.e. design work, material and equipment sourcing as well as wages for all the workers. It is already a great challenge to acquire such an amount of money with adequate backers for just one vessel, as it can amount up to 900 million Euros. Facing such a challenge, a shipyard even with a good reputation can no longer be rated as creditworthy by the banks, if the ownership of the yard is on a shaky basis – which happened when STX was involved with the Finnish yards.

The sad story of STX ended finally in 2014, when a German family-owned company "Meyer Werft GmbH & Co. KG" bought the majority of the shares for Turku shipyard (figure 12). The Finnish government was partly in business too with a share of 30% until April 2015 when Meyer acquired the rest of the shares.

Figure 12 Aerial photo of the Turku shipyard (www.meyerturku.fi)

Unfortunately, by the time of the deal, STX had already officially closed the shipyard located in Rauma, in order to clean the balance sheets of a

bankrupt company in September 2013 (yle.fi, 16.9.2013). It was a useless last straw - strategy of the director and owner of STX Group, Duk-soo Kang, where he tried to salvage some parts of the vast empire by selling all investments abroad (Turun Sanomat, 3.5.2013).

Since then, the city of Rauma has bought the lands and the facilities to help continue the local shipbuilding tradition which dates back to 1918. In the summer of 2014 the local industry leaders and shipbuilders established "Rauma Marine Constructions" and thereby saved a lot of jobs in the region. The first contract for delivery of a passenger ferry (figure 13) for a Danish shipping company Mols-Linien was signed in the summer of 2016 (Rauma Marine Constructions, 22.6.2016).

Figure 13 Artistic render of the passenger ferry for Mols-Linien (www.rmcfinland.fi)

Further jobs are in the near vicinity as a billion-euro letter-of-intent has been signed on 14th September 2016 to upgrade the Finnish Navy with four state of the art corvette-type vessels shown in figure 14.

Figure 14 Artistic render of the new navy vessels (www.defmin.fi)

The former Helsinki Yard, now called “Arctech Helsinki Shipyard”, went from a fifty-fifty joint venture with STX Finland into 100% Russian ownership in late 2014 (Arctech Helsinki, 30.12.2014). Around the same time, the former president and owner of STX Group Duk-soo Kang was found guilty of fraud and embezzlement and sentenced to prison for six years (Turun Sanomat, 1.11.2014). Arctech is now building a series of ice breakers for the Russian market (see figure 15).

Figure 15 Ice breakers for Russia, made in Finland (www.arctech.fi)

In September 2016, Arctech delivered the “Polaris” which is a LNG-powered ice breaker for the Finnish government (figure 16). It will be operating mainly in the Baltic Sea and is the first of its kind to use LNG as main fuel (Arctech Helsinki, 28.9.2016).

Figure 16 “Polaris”, the new ice breaker for the Finnish government (www.arctech.fi)

3.3.2 Difficulty of Predicting the Future

The future of the maritime market seems to be as unpredictable as is forecasting weather a year in advance – even for experts, but especially for politicians. Back in January 2013, a group of ranking experts led by Mr. Ole Johansson, published their findings in a report stating among other things that the shipbuilding business is heavily unprofitable and warned the Finnish government not to participate in the rescue efforts of the Turku yard. Instead, they wrote, offshore-business is the future and investments should be made into that field (Taloussanomat, 23.1.2013).

However, the financial crisis, dropping oil prices and appreciation of green values was already changing the situation considerably and thereby effectively turned the predicted glorious future of offshore into a deep depression, still evident today. As a grave example, "Technip Offshore Finland" located in Pori, was a major builder of oil rig steel constructions, modules and related products. In 2013, they had more than 750 employees, but in just three years, they had to announce the lay-off of the rest of their workers in October 2016 (Talouselämä, 7.10.2016).

Ole Johansson, the ex-president of "Wärtsilä", is rather well-known in the Turku area from his questionable decision in 2004 of closing the profitable "Wärtsilä Diesel" factories located in Turku and moving the whole production to Trieste, Italy, just right before a major boom in the need for heavy diesel engines. The factory in Trieste has since then also become well-known – from delivery time and quality problems. The predictions and conclusions made by Mr. Johansson and his experts were completely overturned within that same period by a research report sponsored by the Finnish Ministry of Economic Affairs and Employment titled "TEM-Meri project: Finnish maritime cluster moves towards the 2020s boosted by bold innovations and value networks", published in October 2016.

Prediction problems are not only evident in the Finnish maritime cluster. A little while ago, three shipyards located in Mecklenburg-Vorpommern in northern Germany, namely in Wismar, Rostock and Stralsund, suffered a fate not unlike the offshore industry in Finland. During the late 90's these three shipyards were all modernized to become specialized in producing container vessels – the future seemed rather good until the global economic crisis of 2008. According to chapter 3.4 on a research titled "The challenges and best practices of structural change in the European maritime industry", the region of Mecklenburg-Vorpommern was "struck particularly hard" and that the "Adaptation to change began too late, and the shipyards could no longer compete with Chinese and Korean shipyards… In hindsight, focusing on container vessels was seen as a strategically poor choice" (Keltaniemi et al. 2013, p. 25 – 26).

3.4 Surviving the Turmoil

During the period of 2013 to 2015, the traditional maritime market of Craftmer tools was hit by several simultaneously affecting factors:

- crisis of the maritime and offshore industry due to dropping oil prices,
- the prolonged crisis of the shipyards in northern Germany,
- the unstable situation of the Finnish shipyards.

Many of former customers gave up shipbuilding, hence there was no real need for new tools and the case company had trouble finding work in this field.

In 2015, temporary relief for Craftmer came from a familiar direction, but in an unexpected manner: Sandvik's production plant in Turku, which was at first decided to be closed but luckily that decision was later cancelled (Taloussanomat 26.3.2015, Turun Sanomat 12.6.2015). During these six months of uncertain times at Sandvik, Craftmer received a lot of orders from Turku plant designers for special tools and jigs to be sent to USA and other countries where Sandvik headquarters had planned to move the production from Turku. These orders were swiftly delivered by, most of them even before the cancellation of the closing down was announced (yle.fi 8.9.2015). After this brief period of turmoil, additional engineering jobs and tool orders have been steadily placed by Sandvik since autumn of 2015. In actuality, according to the Managing Director, the business with Sandvik was over 50% of the total turnover of Craftmer in 2014 and 2015.

The background for Sandvik's manoeuvring was an effort to decrease costs by moving main production facilities to China. The five Sandvik factories in Finland were originated in the company Tamrock, and their innovative research and development. During the recession of the 90's, Sandvik was able to acquire the facilities and functions of Tamrock piece by piece. However, the offshoring plan backfired, as the customers of Sandvik placed an unbelievable number of orders for new vehicles, equipment and spare parts thereof to Sandvik Turku plant, as the decision to close the factory was made public. Furthermore, Sandvik had developed automated loaders and dump trucks using robotic technology – it was something the Chinese factories were not capable of. The story of moving production to China was short-lived and the manager in charge of the fiasco was fired. Understandably, there is not much mentioned about this period on their website, but there was a lot of media coverage on the subject.

The story of what happened with Sandvik is an essential part of this research; it clearly shows that in a continuously changing world it pays off to be awake, displays the need to know the market and highlights the necessity of producing innovative quality products.

3.4.1 Innovation as a Driver for Success

Like previously explained, all of the standard tools of the case company were born out of necessity, innovated by the man who worked in the heavy field of assembling ship sections. The business however evolved to much more than just a one-off creation of a range of new tools – the market seemed to have needs that standardized solutions and off-the-shelf products could not cover and sometimes even the customers themselves did not exactly know what it was they needed. Craftmer was ready to provide the necessary ideas and solutions.

This new type of innovative tailor-made engineering service was also discovered to help over the slow periods of the standard tool market. Recently, that old market had almost no pull and acquiring new markets is a tough and long job even in a good market situation.

In one of his books, "Kasvua innovaatioista" (Growth from Innovations), Dr. Mikko Mäntyneva describes and discusses the role of innovations in the implementation of company´s growth strategy. On page 14, he poses the same question as Craftmer's management did: "How to ensure the existence [of the company] and competitive edge in an increasingly competitive market?", and he follows-up with the answer: "…in the competition of responding to the demands of the customer, [the company needs to be able] to offer solutions to the specific needs of the customer in a cost-efficient manner". At Craftmer, the solutions of customer based innovational engineering work were not necessarily only new tools, but could vary from deck securing equipment for a shipping company to assisting devices and installation jigs for industrial applications (Meriaura and Sandvik respectively, see chapter 3.3 and figures 7 & 8). The level of quality required and expected near customer's core business are naturally high – a response with exceptional quality solution or product has become one of the success factors for Craftmer.

Due to positive experiences in this field of developing solutions rather than just tools, the management of the case company has been offering this non-standard service as an integral part of the sales & marketing efforts. A recent "meet & greet" marketing trip to Meyer Werft (Papenburg, Germany) exemplifies minutely the kind of innovational engineering Craftmer provides; upon a quick visit to production facility for the actual workers to try out the few standard tool samples, which the salesmen brought with them, a further need was introduced by the client – directly and literally on the shop floor (figure 17).

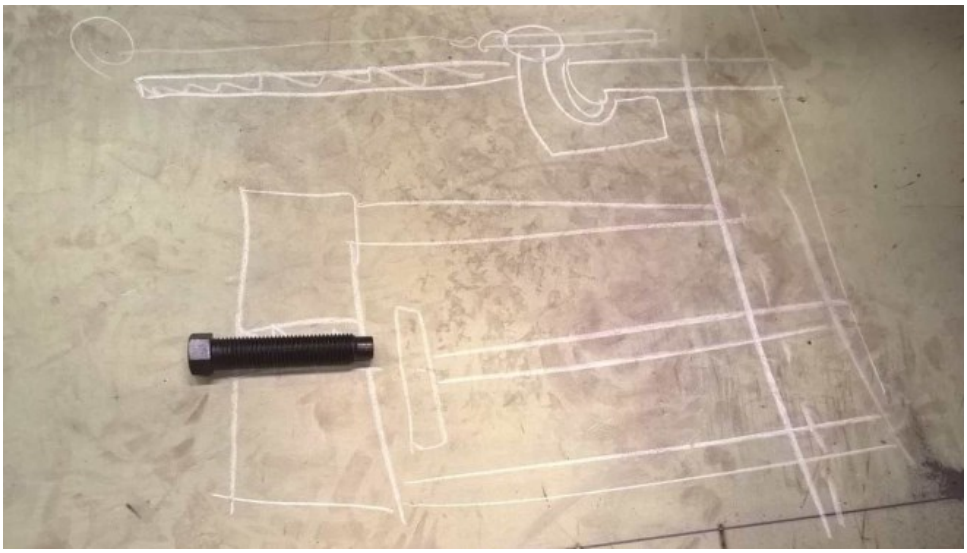


Figure 17 Initial idea drawn on the shop's concrete floor (photo courtesy of Craftmer)

In a nutshell; the client needed an appliance that would press or tighten the T-beam against the steel plate deck for automated robot welding. The tool had to be light enough for one man to handle, but strong enough to take the necessary load – it also needed to have a simple mechanism for tightening and for grapping a hold on the workpieces to be welded.

Discussion of the initial idea continued in the boardroom upstairs, with a very excited client. Some improvements to the rough sketch were made before the salesmen flew home. Within a very short period of time, in just about three weeks, a prototype was designed and manufactured for testing purposes (figure 18).

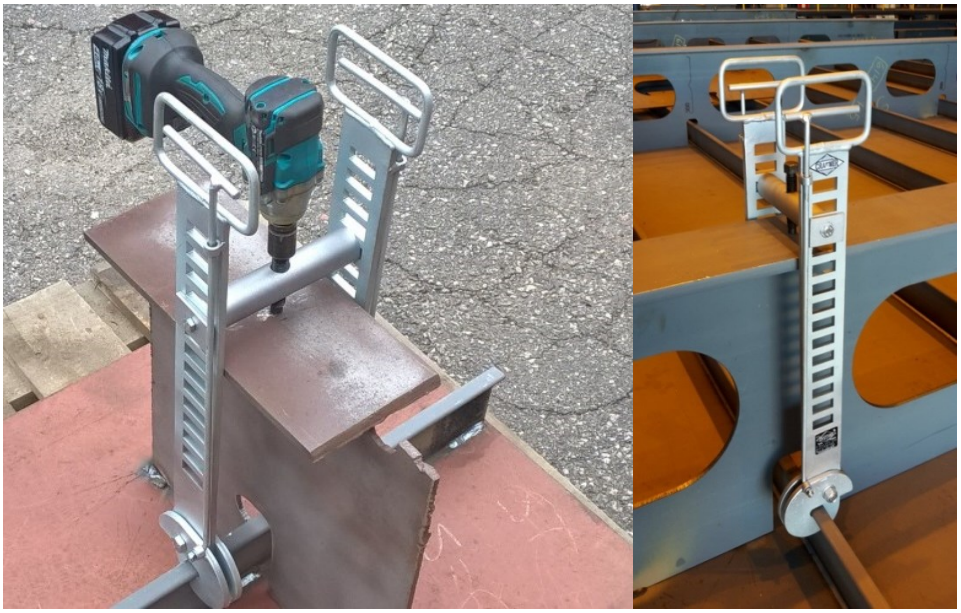


Figure 18 Prototype testing at the shop (left) and in trial runs at the shipyard (right)

In this real-life story, the difference between an idea and an innovation becomes clear and evident. As Dr. Mäntyneva puts it: "…innovations are ideas, which have truly been deployed and adopted into use" (Kasvua innovaatioista, page 16). The story also highlights the various stages of innovating a solution. According to Dr. Mäntyneva the process can be simplified into three main actions (p. 95):

1. Ideation and Conceptualization
   Usually, the process begins from a need of the customer, becomes an idea through discussions and evolves into a concept through research and development.

2. Development Work
   Tight co-operation with the customer sees the concept becoming a prototype, which will be first rigorously tested in workshop conditions and thereafter in real working conditions by the customer. Enhancements and changes can be made according to the needs.

3. Commencement and Commercialization
   Tested and possibly augmented version of the prototype will be created, named and put up for sale (unless it is a specific solution created for a certain customer, who also paid for the R&D work).

The commercialization of this kind of innovative service brings in additional revenue and the business seems to be growing. According to Craftmer, the share of standard tools from the total revenue was well over 50% in the years 2013 – 2015. In the fiscal year 2016 the situation has changed dramatically to the opposite. Evidently, "Innovations offer a real possibility to succeed in the market better than the competition" (Mäntyneva, p. 15).

As of today, it is a regular occasion that Craftmer will be invited to figure out a solution to a client's problem in the production line, either as a new tool or as an engineered solution.

3.4.2 Maritime Market in 2016

As of 2016, the outlook seems much brighter for the maritime industry in Finland, especially in the Turku region. The new owner of Turku shipyard is a family business "Meyer Werft GmbH & Co. KG", with a keen interest in high-quality shipbuilding. The cruise vessel market shows strong signs of revival; in addition to current projects, new orders were received from TUI Cruises amounting to a total of six luxury cruise vessels (figure 19).

Figure 19 "Mein Schiff 3" – the first of many (www.meyerturku.fi)

An additional vessel contract was signed on 27th of February 2015 to deliver a new generation LNG-powered passenger ferry to Tallink-Silja, with the contract including a few options.

Following the successful deliveries of the first "Mein Schiff" vessels, the cruise operator Costa Crociere placed an order on June 15th 2015 for two green design LNG-powered ships, with expected deliveries in 2019 and 2021 (Meyer Turku, 15.6.2015).

Additional good news about the Yard's orderbook are the successful negotiations with world's largest cruise ship operator, "Carnival Corporation & plc"; on their press release from 6th September 2016, Meyer Group announces that they will be building a total of three vessels from which two will be built at Turku Yard and delivered in the years 2020 and 2022 (Meyer Turku, 6.9.2016).

The latest additions to the orderbook were made in October 2016, as "Royal Caribbean International" signed an order for two new generation cruise vessels, which will be powered with LNG as well as with a completely new technology of using fuel cells in a marine application (Meyer Turku, 11.10.2016).

For now, the orderbook for cruise vessels at Turku yard extends all the way to year 2024 – it is a new record in the whole 300 year history of the company! Having the orderbook full will mean that the facilities can be run on full capacity, effectively increasing the utilization and profitability of the shipyards operations. According to the press release (Meyer Turku, 26.8.2016) on their website, Meyer has announced a plan to improve and invest in the production facilities of Turku yard, amounting now to a total of 75 million EUR. Simultaneously, this situation is a great chance also for the subcontracting network to plan ahead and in the long term.

As the financial situation of the Turku shipyard is now gradually improving, the need for new investments in tools is also revived – however, reve-

nue flow towards Craftmer may take some time, as the life-cycle of their products is very long.

Meanwhile in northern Germany, the three shipyards located in Wismar, Rostock and Stralsund have also been miraculously resuscitated – the long downhill in business, a few insolvencies and changes in ownership were finally over in 2016, when a Malaysian, Hong Kong-based company "Genting Group" took over the helm and announced a lot of new plans but most importantly, orders for a lot of ships for the Asian market. This means that the shipyards will need to invest in the production capabilities and sophisticated building methods. So far, announcements made by the newly named "MV Werften" show various investments totalling 88 million euros (MV Werften, 27.9. and 2.11.2016). It is very probable that also new tools will be needed, not only at the shipyards, but also in the subcontracting network. At the moment, the three yards employ approximately 1500 people, but the plans call for doubling that number within a few years (MV Werften 2.11.2016). The direct subcontracting network is estimated to involve also about 3000 people. For the case company this means new opportunities both in the northern and southern Baltic Sea for years.

3.4.3 Emerging New Market in Russia

For the case company, the latest period of turmoil made it clear that it is essential to think about where Craftmer is now, what is currently done to enhance the situation and where it will go, practically and strategically speaking. A look towards a new market in the east may prove to be a worthwhile effort, even when the traditional market is now on the upswing.

The shipbuilding market in Russia is potential due to huge amount of shipyards with old-dated facilities and technology. Clear indications of the potential market are revealed in a research made for the Pan-European Institute in 2015 by Hanna Mäkinen, "The Russian maritime industry and Finland". Her research was based on official announcement from the Government of the Russian Federation and on Bank of Finland's forecasts. Two of the most interesting paragraphs are so well formulated that they are quoted here directly:
"…, in 2012 an ambitious state programme Shipbuilding Industry Development 2013–2030 was approved, aiming at quintupling Russia's shipbuilding output by 2030 with total state funding reaching RUB 1,3 trillion). The programme, principally executed by the Ministry of Industry and Trade, aims to improve the competitiveness of the Russian shipbuilding industry both in national and global markets and to close the technological gap with other shipbuilding nations, focusing for instance on developing R&D, technologies and cost-effectiveness, as well as expanding the production potential and facilities of the civil shipbuilding industry and improving the knowhow and motivation of the shipbuilding industry's workforce" (Mäkinen, H., p. 15)

Already in the executive summary of her research, Mäkinen explains the main reasons why the Russian shipbuilding market could be a gold mine for Finnish companies:
"Due to historical reasons, the civil shipbuilding industry is weakly developed in Russia and is currently not competitive in commercial sense. The Russian shipyards are in a rapid need of modernisation and the shipbuilding industry suffers from low productivity and technological inferiority compared to other shipbuilding nations. In order to improve the industry's competitiveness, international cooperation is needed".
(Mäkinen, H., p. 1)

One example of the current status of tools in use in Russia is shown in figure 20. The case company's proposal is to replace the self-made conventional contraptions by purpose-built tools.

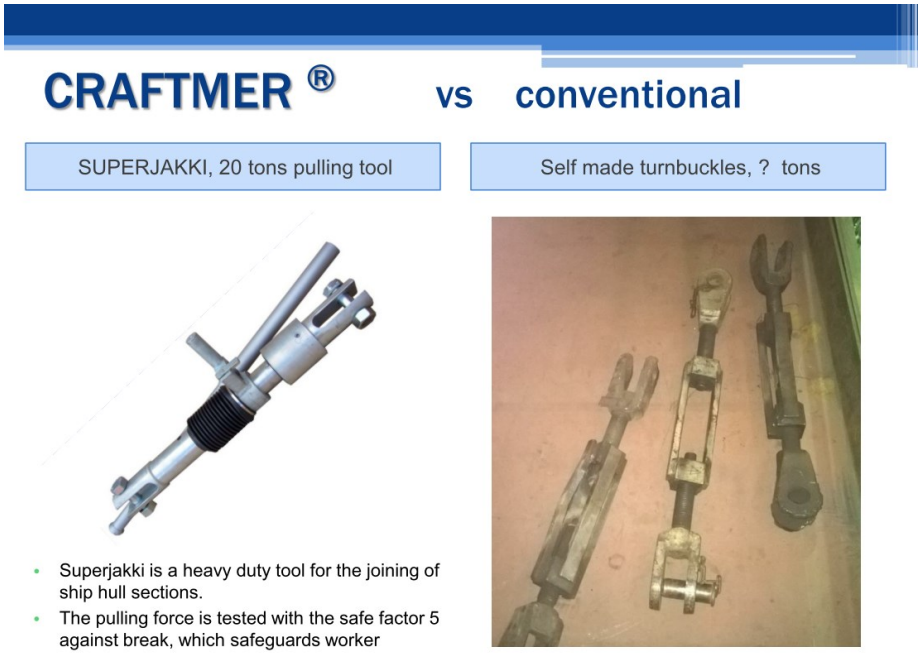


Figure 20 Comparison between tools made for the same purpose (Craftmer Oy)

Even when a huge market for the case company evidently exists, there have been and are naturally some challenges. The first obstacle is the notoriously famous need for several documents and certificates when importing goods to Russia. According to the Finnish-Russian Chamber of Commerce, there are ten different papers that will need to be inspected already at the border (www.svkk.fi). In addition, there are also *force majeure*-type real-life challenges; marketing efforts in Russia were started by Craftmer in 2014 but halted abruptly due to the plummeting of the ruble value in early 2015 and the continuous fluctuation thereafter (figure 21).

Figure 21 Graphic illustration of the currency fluctuation of RUB / EUR in 2013-2016 (European Central Bank)

There are always many reasons as to why the value of a currency drops, yet the most contributing factors here may lie in the globally dropping oil prices and in the on-going conflict with Ukraine. On the below graphic, courtesy of "U.S. Energy Information Administration", a fifteen-year period of crude oil pricing is presented. As most of the income for the Russian Federation comes from exporting some form of oil and gas, it is not surprising to see that ruble's course followed the course of crude oil between 2013 and 2015, shown in figure 22.

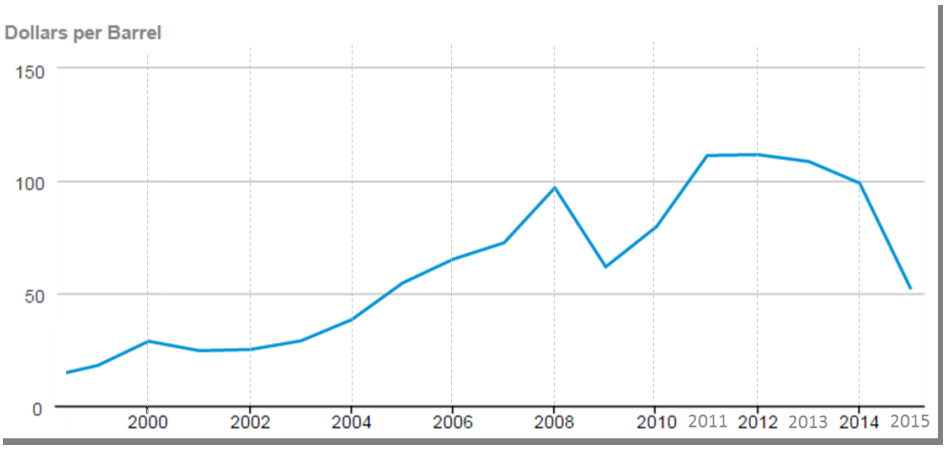


Figure 22 Crude oil pricing development 2000 – 2015 in the European market (www.eia.gov)

One of the immediate effects of the devaluation of the ruble was that the already approved funds for investments at the various shipyards were greatly belated. A secondary effect was that the Federation government issued several strict laws and decrees instructing all industries to substitute exported products with domestically produced ones. This "import substitution"-policy has complicated the acquirement of foreign financing and prohibited a variety of imported goods from entering the market – due to these constrictions, many foreign companies have pulled from the market or abandoned the idea of starting an export/import-business with Russia.

The conflict between Russia and Ukraine has a straight influence on the EU regulations. As the case company is registered in a member state, all business must be conducted under the rules, sanctions and limitations of the European Union. At the time being these limitations are changing rapidly and yesterday's rules are already old today. Due to the conflict, receiving an export permit to Russia may be difficult. However, so far Craftmer or any of their associates presented in this research are not registered on EU's sanction list. According to a press release from the Council of the EU, the sanctions against Russia were extended by further 6 months on the 1st of July 2016 (402/16, 1.7.2016).

The management of the case company is not facing the easiest time to penetrate the Russian maritime market, but instead of backing out, they have actually increased their efforts in 2016; negotiations were opened to start licensed manufacturing of tools at a small workshop located in St. Petersburg which is operated by a Finn with a long business track record in Russia. The idea was to introduce locally produced standard tools for the market. The workshop had no quality management system in place, so the "Craftmer Quality Management System" and "Craftmer Quality Manual" were introduced and applied directly. Production of the first test-series followed quickly thereafter.

Furthermore, as the end-users will likely ask for a certificate of quality for the tools, and as European or western certificates are largely unknown or even unrecognized in Russia, Craftmer decided to turn to representatives of "Russian Maritime Register of Shipping" (later "RS") in Turku, as they have a voluntary certification system for recognition of a company (www.rs-class.org). RS is the leading maritime classification society in Russia, but is also internationally recognized for example by the EU and works closely with DNV-GL (Späth, N., 2016).

Figure 23 The blue star of RS recognition on a certificate may help in marketing efforts (www.rs-class.org)

The approval process is neither too complicated, nor very expensive and thus quite suitable for a small company like Craftmer. In the first phase, a written application and an array of documents need to be provided. The necessary documentation to be inspected includes technical documents, process documents and organizational documents, like a quality manual. Quality management system of the company may also be verified.

In the second phase RS expert will audit the company in order to verify the presented matters. Craftmer is considering applying for the RS voluntary certification for a handful of products and later on also for the Quality Management System.

3.5 Toyota Way vs. Craftmer Way

A book "The Toyota Way" was written in 2004 by Jeffrey K. Liker and it inspired a practical comparison between a huge car manufacturer and a small machining shop – this may seem like a far-fetched idea, but there are some surprising similarities. This chapter describes just two of the main success factors of Toyota, compared to the practices of Craftmer we have learned in the previous chapters.

One of the managers at Toyota, Gary Convis, states already on the cover that "This book tells the reasons of Toyota's success and offers practical ideas by which you can develop your own methods". As an example, one principle Toyota follows is the so-called "genchi genbutsu". Japanese cannot be translated directly word-by-word, and therefore this principle conveys a two-part message; "You need to go and survey the situation in person to understand the whole gravity of it" and "this needs to be done in order to develop a solution to a problem" (Liker, J. p. 223 – 235).

Like presented previously, the same principle has been applied by the case company for the past few years in efforts to penetrate the Russian maritime market. First they gained access to a few of the most prominent Russian shipyards through some appropriately high-level contacts and relationships, and were welcomed for a visit. The main goal was to see the current situation first-hand but naturally they brought sample tools to be presented and discussed. One of the key elements in Craftmer's marketing approach is always to request a visit to the actual shop floor to study the building process and tools in use at customer's production facilities. This allows Craftmer to figure out a proposal for a new tool or appliance or working method and it will be offered to the customer as a proposal to enhance and improve their productivity, quality as well as work safety. However, in Russia, it may take up to a year from an offer to financial negotiations, even for a small investment. During this time, it is essential to stay in touch with the potential customer. Recommendable is also to be present at local fairs and conferences, where the brand name is strengthened and reliability of the tools is presented. This kind of marketing process took about two years before first actual results were gained.

Another principle followed at Toyota is fast product development, described among other success factors in the very first chapter "Operational excellence as a strategic weapon" (Liker, J., p. 5). Toyota uses approximately 12 months to create a new vehicle, whereas the competition usually needs two to three years to achieve the same result. While applying the "genchi genbutsu"-principle at one of the shipyards in the newly revived shipbuilding market of northern Germany, Craftmer salesman was pre-

sented with a few problematic areas in the customer's production, and they were hoping for a solution. Some sketches were made in-situ and a solution was promised to be delivered within three weeks. The solution was pleasing to the customer and it led to further development projects but most importantly, into a few good and sizable orders.

NB! This case is presented in detail in chapter 3.4.1. "Innovation as a Driver for Success".

On page five of his book, Professor Liker writes that "Most of Toyota's success is drawn from the reputation of unbelievably good quality". Craftmer tools have a similar reputation all the way from humble beginnings to today – old customers return for new products year after year. For Craftmer, in the exceptional quality lies also a positive problem: they do not know the actual life-span of their tools. They have encountered some of their tools that have been in heavy use for twenty years and which may not require any further servicing than cleaning and greasing.

4 THE DEVELOPMENT PROJECT

The need for the implementation of this development project and research became evident through another research paper prepared for course work at HAMK (Gustafsson et al. *Target Market: Russia*. 15.3.2015). Discussions with the case company's Managing Director and preliminary research of current situation showed a need for the company to evolve, in practice as well as on paper. The quality of the products was never a question – the real dilemma was convincing potential new customers of it.

4.1 Preliminary Scope

Craftmer did not have a management description or a system in place. It was proposed that a system would be put in place, not solely for marketing purposes but also to clarify the operations of the company as a form of transferring tacit knowledge. A documented management system could be presented to a potential customer as a part of a basic information package about the company, for example in the form of a quality manual. The Quality Manual ("QM") and the Quality Management System ("QMS") were planned to become powerful marketing assets and to increase additional confidence of customers towards Craftmer.

The structure of the QMS was proposed to consist of three levels;

- Level A consists of Quality Manual with a general approach to quality
- Level B includes procedures, which are short descriptions of the processes and responsibilities
- Level C includes detailed instructions for staff and workers; work instructions, standards, design guidelines and operating manuals

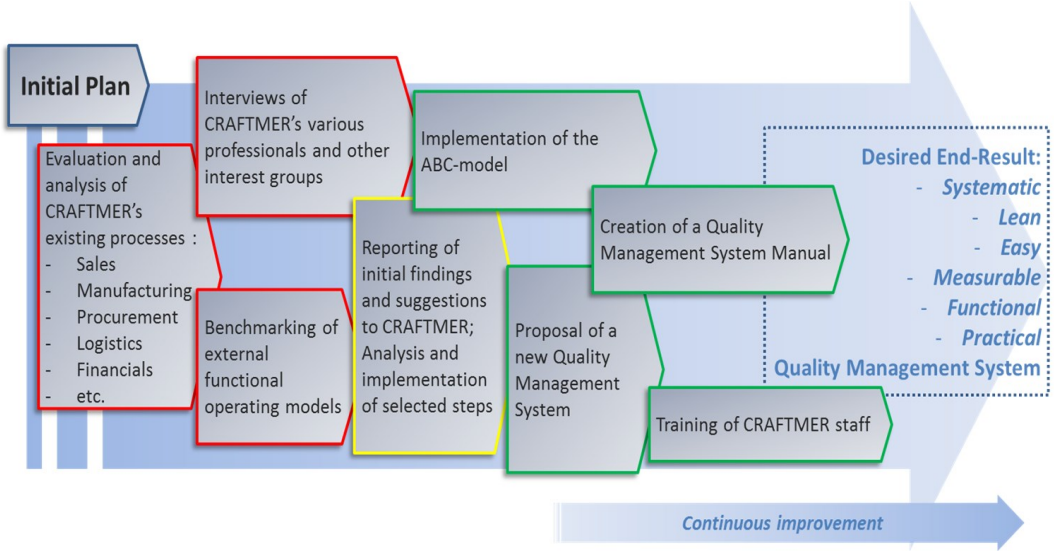


Figure 24 Preliminary Proposal of the Development Project to Craftmer in 2015

Additionally, their supply chain consists of several small enterprises without proper quality management. It should be considered vital to include the most important partners within the framework of Craftmer's QMS. The process descriptions and audit practice could also be depicted in the Quality Manual of Craftmer.

It was also proposed that the QMS would demonstrate certain conformity to ISO 9001 in praxis, even when it would not be accredited by an authorized accreditation body. Should it at a later stage be deemed necessary by Craftmer, the QMS should be planned and implemented in such a manner that it could be certified by an external body, for example by a recognised classification society.

The proposed scope was in general accepted by the case company's Managing Director Veli-Pekka Keskisarja and Sales Manager Vesa Klen, yet some modifications were naturally done as the work progressed. One of the major modifications to the original scope was the somewhat surprising announcement of the new revision of the ISO 9001-standard.

4.2 Starting Point

After the scope was agreed, the main task in the beginning was to become more familiar with the activities of the company by interviews of the staff and workshop floor observations at the company. For the purpose of conducting the initial hands-on research properly, the author of this Thesis attended an internal auditing course arranged by DNVGL in April 2015 – the course provided great theoretical insights into matters experienced previously at daily work of auditing external suppliers of the shipyard. Practical work, as well as the knowledge gained from the auditing course, proposed that in a small-sized enterprise, the creation of a quality management system is best done by first studying and then analyzing the current status of all functions, aspects and activities of the company. At Craftmer, this concept posed a problem for the research as the staff generally had all work related information only in their heads, and very little of the knowledge was documented onto files, drawings, notebooks or electronically. The company had neither operation manuals nor other organized files, and the most critical information was embedded in the Managing Director's brain. Upon several interviews and discussions however, all relevant data was found – and this time it was recorded.

4.3 Methodology

As the main goal of the development project was to improve the performance of the company by creating and implementing a quality management system for the case company, the research method started out as a qualitative analysis, even when some aspects could have been measured quantitatively.

It was quite clear already from the beginning that the project would require a whole lot more active participation than just testing a single theory or a hypothesis would. The research became an inductive analysis, wherein the collected data was inspected and reviewed in detail and as comprehensively as necessary. It is said that when conducting this type of research, the most important factors will present themselves and the results are not greatly emphasized by the researcher's opinion (Hirsjärvi et al. 1997, p 155).

Each separate interview could be defined as a qualitative one-time research in itself (Hirsjärvi et al. 1997, p. 153), and simultaneously, listening to the stories surrounding the business of an inventing entrepreneur brought a level of reality into the research. The themes brought up in interviews were analyzed by using participatory observing methods and then later further researched within literature as well as in history. All of the data found relevant from the interviews were critically evaluated, and then further unified views were brought into the research, as syntheses from the main objectives (Hirsjärvi, et al. 1997, p. 172).

During the course of the development project, the theoretical research plan however evolved into an action research, as the case company was very much involved in the research process, as was the author himself. Without either party, the research could not have been completed.

This research should be seen as reliable, as the theoretical framework was mostly shaped based on reliable and valid source literature. Additionally, the research culminated in the launch of the Craftmer Quality Management System and Quality Manual and these are in use today.

4.4 Why Craftmer needed this?

The Founder of the company, Managing Director and Owner had already started preparations for retirement. He had recently sold one third of the shares to a younger generation engineer, who started to work in the company full-time. Yet, the small company was facing a global shipbuilding crisis and a possible annihilation in the turmoil of the market – something needed to be done. This chapter describes in detail the main triggers and reasons for the realization of the Development Project.

4.4.1 Fading of the traditionally profitable market

The traditional domestic and foreign shipbuilding markets were affected by the global crisis for several years and the sales of new tools was on a very low level. Luckily for Craftmer however, many shipyards had started to cut operating costs by eliminating their own workshops which used to create and manufacture special tools, jigs and other appliances for their own production – therefore it was possible for a small but renowned tool engineering shop to survive. At the same time Craftmer's marketing efforts suffered from the lack of dealers in foreign countries.

Some foreign representatives in the 90´s had retired and the important connections disappeared with them. Additionally, due to lack of steady orderbook in the core business of standardized tools, Craftmer had to create tailor-made solutions for one-off clients, often without the ability to transfer the R&D costs of that work into the standard tool pricing.

4.4.2 Time & Human Resources

All the products are designed, manufactured and assembled in own workshop. This is an advantage but at the same time it could become a risk: as well as the Managing Director of the company, the workforce of Craftmer is aging; one metal worker is nearing the retiring age and there only a few representatives of younger generation employed. For now, the current workload can be managed but once a larger order comes in, majority of the work will be subcontracted to reliable partners. A detailed listing of the partners is an essential part of Craftmer's Quality Manual. Some of the partners, like Eskomatic and Timeka, have ISO-certified processes, but the smaller ones have nothing comparable.

4.4.3 Business based on Tacit Knowledge

Craftmer did not have written descriptions of various work phases or any Welding Procedure Specifications (WPS) to guide the welding works. Just a few work instructions had been made during the past. All practical aspects of the business, the products or pretty much any Craftmer-related information was held within the knowledge of a few people. Naturally, a quality manual or an operational manual were non-existent.

4.4.4 Intellectual Property Protection

Already a long time ago, the owner of Craftmer had decided that a small company would not begin to patent its products, as it would have been a big financial contribution, and the benefits of doing so were seen as insignificant and of little worth. Defending own patents against bigger companies eats a lot of resources and the end-result is unsure, despite the fact that many of Craftmer's innovative products are novelties in the market. This decision has been consistently followed – even so far that the tools were never marketed toward the Asian "reverse-engineering" market, like China, Korea or Japan.

4.4.5 Lack of quality problems

The owner and manager of the company did not recall one single incident where a client would have complained about a quality problem – going back two decades. It is therefore understandable that the matter of non-existing quality management system or manual never arose with the existing clientele.

4.4.6 Problem of convincing new customers

During the search of new markets and customers outside of the EU, especially in the Russian maritime market, at many instances a question was posed about the tools fulfilling the local quality and safety requirements. All of the Craftmer products are delivered with an EC/CE Declaration of Conformity, but it was not known to any of the Russian shipyards. In order to tackle the question without having to apply for local certifications, which would take a lot of time and effort, the plan called for a creation of a quality management system for Craftmer, which would be documented on a quality manual – both would need to be implemented and construed according to the ISO 9001: 2008.

4.4.7 Eastern Trade: Target Market Russia

As presented in chapter 3.4.3 of this thesis, the magnitude of the Russian shipbuilding market directly correlates into the related tool and equipment market – it is huge. Nevertheless, it is wise to remember that a market with great possibilities will also present great risks and barriers to trade. Since starting to look east, Craftmer has visited several Russian shipyards in order to learn how and with what kind of tools they are currently building their vessels – through these visits it has become clear that a niche is available.

4.5 ISO 9001 – Study of Conformity

The announcement of the launch of the new ISO 9001:2015 on September 23rd 2015 (DNVGL.com) prompted an additional conformity study into the different versions of ISO 9001 as well as a detailed comparison study to Craftmer's new Quality Management System and the Quality Manual at a later time.

The study revealed that the fifth edition includes some completely new clauses, the order of clauses is changed, totally new management principles are introduced, "normal" technical revisions are made in many clauses, and last but not least, the standard introduces seven new principles and three new concepts, which together create the new spirit and define the content for this standard.

For the purpose of the thesis, this study's focus is on the differences that would have had the most significant impact on the creation of a quality management system and quality manual for the case company. In order to better understand the differences between the 2008 and 2015 editions, we will first have a closer look at some of the actual clauses and their changed content in the newest version, and then move onto the new principles and concepts.

ISO has prepared a document "Correlation matrices between ISO 9001:2008 and ISO 9001:2015". It shows clearly "where the new, revised and deleted clauses are located, as well as the location of clauses that are unchanged" (Correlation matrices…, p. 1). For the purpose of comparing the contents of case company Quality Manual to both 2008 and 2015 editions of ISO 9001, the author followed the same simplified method of conformity comparison and created a chart which can be found as Appendix 1 of this Thesis. The most significant and pertinent differences for this research of the 2015 edition are listed below;

The mandatory documents of ISO 9001:2015 are described in these clauses:

4.3	"Scope of the Quality Management System"
5.2	"Quality Policy"
6.2	"Quality Objectives and Plans for Achieving them"
8.4.1	"Procedure for Control of Externally Provided processes, Products and Services" (outsourced processes)"

The number of mandatory documents looks like just a few, but in reality many records are impossible to create without proper documentation and agreed procedures. Additionally, it is quite astonishing that e.g. a quality manual is not listed as a mandatory document, but is still referred to in many clauses.

Mandatory records are mentioned under the following clauses:

7.1.5.1	"Record of Maintenance and Calibration of Monitoring and Measuring Equipment"
7.2	"Competence Records"
8.2.3.2	"Product/Service Requirements Review Record"
8.2.3.2	"Record of New Requirements for product or Service"
8.3.3	"Design and Development Inputs Record"
8.3.4	"Record of Design and Development Controls"
8.3.5	"Design and Development Outputs Record"
8.3.6	"Record of Design and Development Changes"
8.4.1	"Record of Evaluation of External Provider (supplier)
8.5.1	"Record of Changes on Customer´s Property"
8.5.3	"Record of Changes in the Customer´s Property"
8.5.6	"Record of Changes in Production/Service Provision"
8.6	"Evidence of Products/Service Conformity"
8.7.2	"Record of Nonconformity"
9.1.1	"Monitoring Performance Information"
9.2.2	"Internal Audit Program and Results"
9.3	"Management Review Results"
10.2.2	"Nonconformities and Corrective Action"

The list of mandatory records also looks short, but again in reality in order to be able to maintain and to manage changes on the records, the organisation needs documented procedures, which surprisingly are not mandatory but in real life very necessary.

The newest edition is based on seven quality management principles, which according to ISO are "a set of fundamental beliefs, norms, rules and values that are accepted as true and can be used as basis for quality management" (ISO (2015) Quality Management Principles, p. 3). These seven quality management principles are: Customer focus, Leadership, Engagement of people, Improvement, Evidence based decision making and Relationship management. The motivation of top management, process approach and continual improvement can be named as examples of practical actions in improving the performance of a company´s organisation.

The three new concepts are described in the official ISO publication "The process approach in ISO 9001:2015" as the following: "Risk-based thinking, PDCA, The Process Approach". The paper explains that "these three concepts together form an integral part of the ISO 9001:2015 standard. Risks that may impact on objectives and results must be addressed by the management system" (The Process Approach in ISO 9001:2015, p. 1). For this Thesis however, only the last two mentioned concepts are relevant and further explained here.

4.5.1 PDCA

The PDCA or Plan-Do-Check-Act – methodology as shown below, serves as a tool for managing processes and systems by "promoting the adaptation of a process approach when developing, implementing and improving the effectiveness of a quality management system" the main goal being "enhancing customer satisfaction by meeting customer requirements" (SFS-EN ISO 9001, p. 11). It is a simple yet powerful tool and can be applied to almost any process. It is defined in the above mentioned as follows;

PLAN	set objectives of the system and processes to deliver results (what to do and how to do it).
DO	implement and control what was planned.
CHECK	monitor and measure processes and results against policies, objectives and requirements and report results.
ACT	take actions to improve the performance of processes.

The writer of the book "Quality as a success factor of the company", Olli Lecklin states that: "Quality work includes continuous improvement…Things can always be done better" (Lecklin, O., p. 31). He underlines that the PDCA-tasks in the process of continuous improvement can be defined and measured, which are important for the process management, control and further development. Some of the basic tools that could be used in the development work include feedback systems, reviews, assessment of working methods and tools. Lastly he points out that it might also be a good idea to follow current events happening in the surrounding world.

The figure 25 was created for the Quality Manual of the case company to show the continuous improvement–method as a traditional cycle, showing the relationship and importance of the customer.

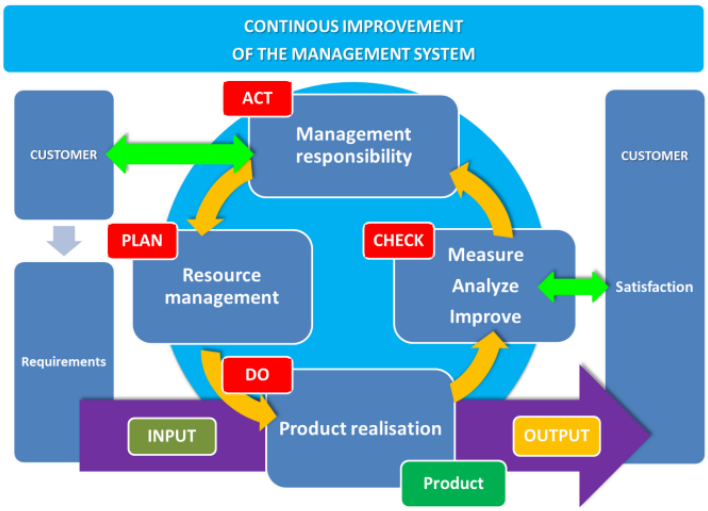


Figure 25 The cycle of continuous improvement (from Craftmer Quality Manual)

4.5.2 Process Approach

Process Approach is defined by the SFS-EN ISO 9001 standard (p. 9) in the following way: "The application of a system of processes within an organization, together with the identification and interactions of these processes, and their management to produce the desired outcome, can be referred to as the Process Approach". When this is typed in common language and in as practical manner as possible, the definition could be something like: All organizations have processes which can be defined, measured and improved. Processes have an interaction with each other and culminate in producing results according to the goals set by the organization. According to Lecklin ("Quality as a success factor of the company", p. 137) the process approach can be shown as a simple and easy to understand form, as an illustration of several interconnected links in a chain, in which Input becomes Output (figure 26).

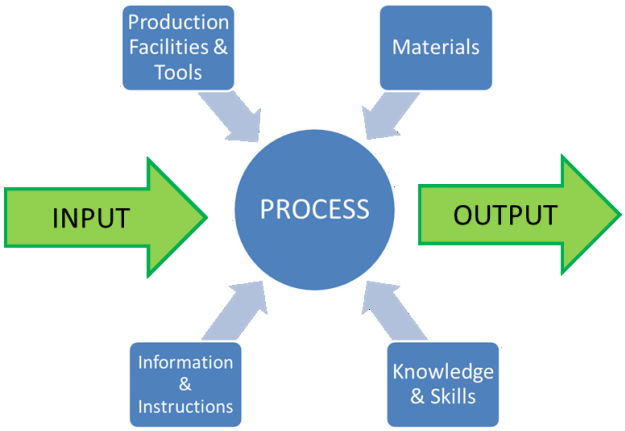


Figure 26 Business process, simplified (adapted from Lecklin, Figure 4.1, p. 137)

4.6 Creating Process Descriptions

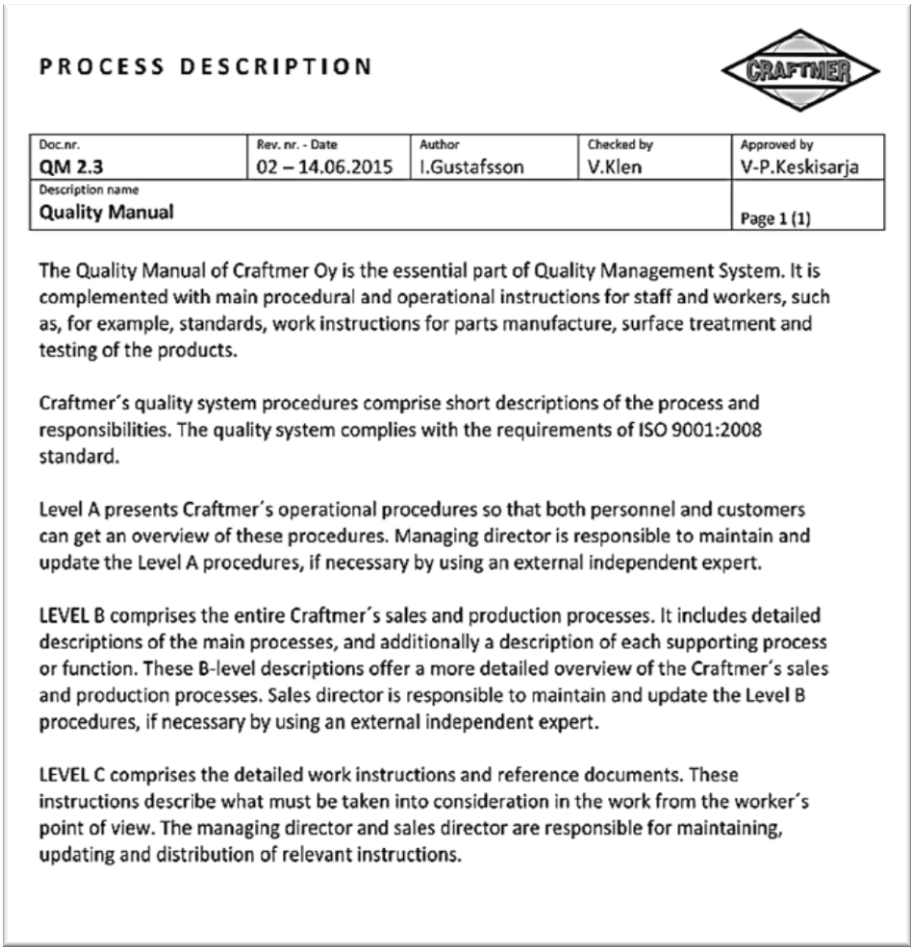
"Documented processes are the basic minimum to create customer satisfaction" according to Lillrank's book "Quality Thinking" (p.132 – 134). He further outlines that a functional quality management system is the most valuable tool in development of quality within a company – and audits are the maintenance tool to uphold an effective system.

In addition to the requirements set by the ISO 9001:2008-standard, these were the principle, most important guidelines when the process of creating process descriptions started at the case company.

Yet, a slight contradiction emerged when small companies are the subject. On page 27 of the same book, Lillrank questions himself and the reader; if the environment and relationships between production, sales and invoicing within the company are in the hands of just a few people, "is it really necessary to define separate definitions at all, because the situation is, literally visible and clearly transparent".

Thankfully, the ISO 9001:2008-standard allows for a lot of adaptation, and that is exactly what was done. First the products, the case company and its history as well as the business environment were studied by discussions and free-formed interviews. Then practical visits to the workshop floor were conducted, focus being on the work that the people were doing but especially in where they gained their information on what and how to do it. This data was stored in a multitude of manners; on legal pads, a sheet pinned to the wall or on the CNC-machine, some were found in file folders in the office – however, the most important part of the data, years of knowledge and skills gained in practice, was mostly stored in-between the ears of the employees.

As much as was possible, the data collected through interviews, discussions and research notes, was written down and grouped by subject. For the purpose of clarity, a document template was created to type each process description in similar, coherent fashion. Following closely the various clauses of ISO 9001:2008, each document was given a descriptive title as well as a document number. Additionally, a standard header was introduced to log and store important data, like revision number, date, author, checked and approved by, as shown in figure 27.



PROCESS DESCRIPTION

CRAFTMER

Doc.nr.	Rev. nr. - Date	Author	Checked by	Approved by
QM 2.3	02 – 14.06.2015	I.Gustafsson	V.Klen	V-P.Keskisarja
Description name: Quality Manual				Page 1 (1)

The Quality Manual of Craftmer Oy is the essential part of Quality Management System. It is complemented with main procedural and operational instructions for staff and workers, such as, for example, standards, work instructions for parts manufacture, surface treatment and testing of the products.

Craftmer´s quality system procedures comprise short descriptions of the process and responsibilities. The quality system complies with the requirements of ISO 9001:2008 standard.

Level A presents Craftmer´s operational procedures so that both personnel and customers can get an overview of these procedures. Managing director is responsible to maintain and update the Level A procedures, if necessary by using an external independent expert.

LEVEL B comprises the entire Craftmer´s sales and production processes. It includes detailed descriptions of the main processes, and additionally a description of each supporting process or function. These B-level descriptions offer a more detailed overview of the Craftmer´s sales and production processes. Sales director is responsible to maintain and update the Level B procedures, if necessary by using an external independent expert.

LEVEL C comprises the detailed work instructions and reference documents. These instructions describe what must be taken into consideration in the work from the worker´s point of view. The managing director and sales director are responsible for maintaining, updating and distribution of relevant instructions.

Figure 27 Excerpt of a Process Description from Craftmer Quality Management System

A preliminary version of each description was sent to the management of the case company for review and approval. When approved, the descriptions would be typed into the Quality Manual.

During this process, significant amount of tacit knowledge was stored in writing and as illustrations too. Examples include the creation of an organizational chart which is focused on the operational matters of the company (see figure 28), as well as a main process chart (shown in next chapter, figure 30).

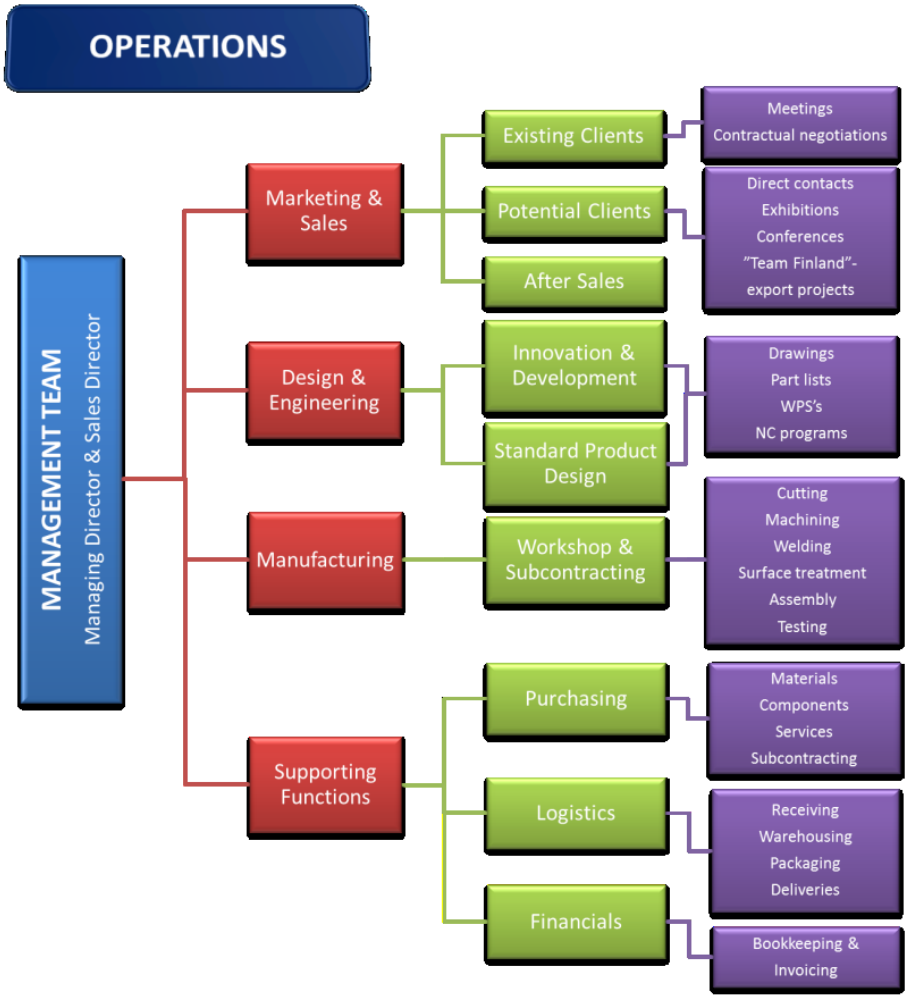


Figure 28 Operations chart of Craftmer

4.7 Creating the Quality Manual

How to create an appropriate yet functional quality manual for Craftmer?

On page 34 of his book ”Quality as a success factor of the company” Olli Lecklin defines it very clearly; “The premise for a quality manual are the needs of the company. The contents and structure should be accommodated to serve these needs as well as possible.” A well-fitted quality manual and system are like a good two-piece suit; they create an atmosphere of sincerity to allow establishment of quality control measures to support the planning, implementation, follow-up and performance development. It does need to be overly complex.

The significance of a documented quality management system is presented in Lecklin’s book (p. 32) as an illustrated picture of a triangle, with the top position labelled as Quality Manual. For Craftmer, the manual was designed and structured as a triangle-formed four level-system, shown in figure 29, which was helpful in categorizing various documents. The governing document for the system and other documents is naturally the Quality Manual.

Figure 29 Structure of the Craftmer Quality System

The structure of the Quality Manual was originally drafted to fit into the demands and requirements of ISO 9001:2008-standard, for a later day use if the case company wished to certify the management system at some point. The various process descriptions were numbered as per the requirements of the ISO. Upon grouping the descriptions under the main process chart of the case company, it was noted that the numbering of the process descriptions and the actual processes did not exactly follow identical paths. It was however possible to assign the process descriptions to certain parts of the process chart (shown in figure 30). Even when this was an unexpected turn of events, in the end all necessary requirements of the ISO 9001:2008 and the needs of the case company were taken into account.

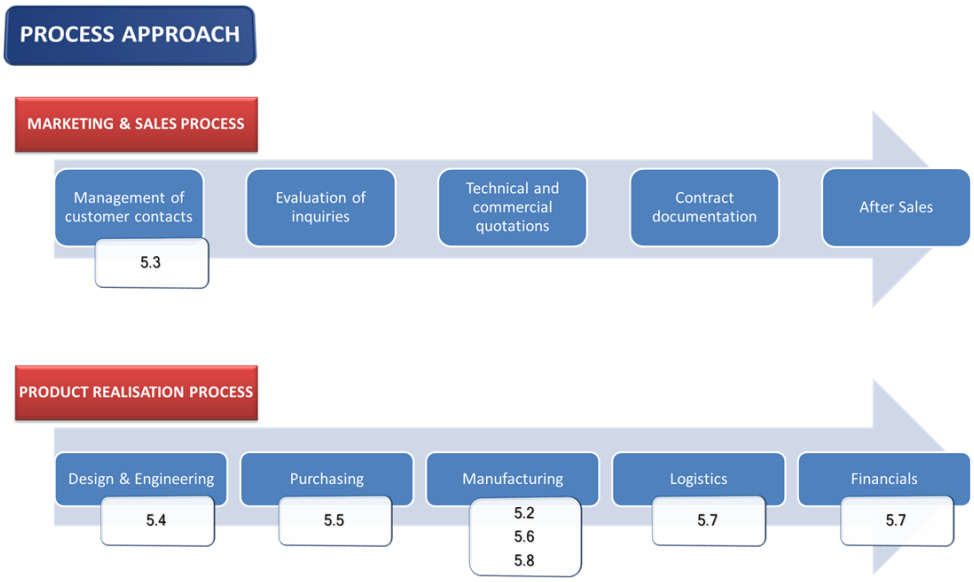


Figure 30 Illustration of Craftmer's main processes and the allocated process descriptions

The “Craftmer Quality Manual” includes six chapters and three annexes, as is shown in figure 31. The structure follows the requirements described in the ISO 9001:2008 as closely as possible;

- Chapter 1 “Introduction” presents the company and its background
- Chapter 2 “Quality Management System” (Clause 4)
- Chapter 3 “Management Responsibility” (Clause 5)
- Chapter 4 “Resource Management” (Clause 6)
- Chapter 5 “Realisation of products and services” (Clause 7)
- Chapter 6 “Maintenance and improvement of the Quality Management System” (Clause 8)
- Annex A describes in detail the conformity of QM and ISO9001:2008
- Annex B presents the list of current process descriptions
- Annex C is a form for external auditing

CONTENTS

Figure 31 Index of Craftmer Quality Manual contents

In the effort of keeping the Quality Manual as clear as possible, but still in conformity with the ISO 9001:2008-standard, a comparison chart was created to show the differences between them. The conformity chart is an essential and permanent annex of the "Craftmer Quality Manual". For the purpose of this research, a further chart (Appendix 1 of this Thesis) was drawn to compare all three versions in question:

– ISO 9001:2008
– ISO 9001:2015
– Craftmer Quality Manual

Even when the updated content of the newest version seems very different at first, and it actually has presented new features and clauses, the core agenda of the standard has remained as "guideline for companies to apply".

4.8 Structure and Timeline of the Development Project

Based on the interviews and discussions, as well as the research into the various topics around the theme of this thesis, it is possible to show the Development Project as a structured diagram of an evolving process in figure 32, with a starting point and an end, with several steps in-between, culminating in the creation of a Quality Management System, Process Descriptions and a Quality Manual for the case company, and finally resulting in the Master's Thesis.

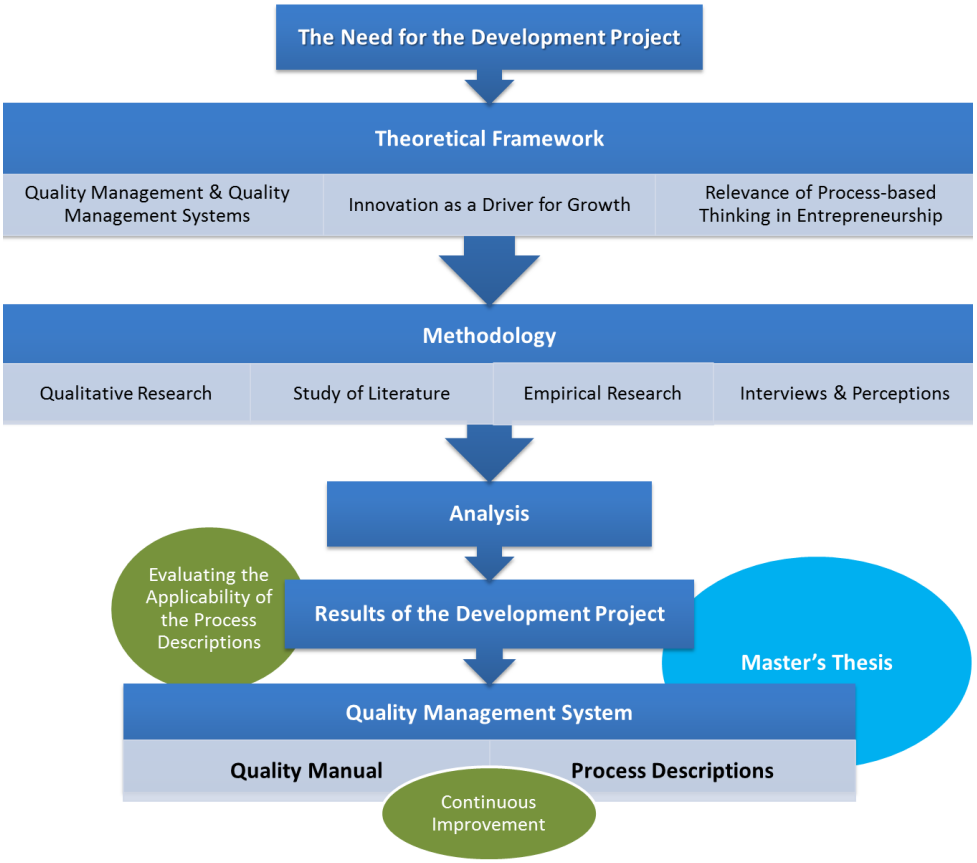


Figure 32 Process diagram of the Development Project

The timeline of the Development Project was initially planned to span approximately just one year, however it stretched considerably from the planned – it had to take into account the challenges at the author's daily work as well as the free-time constraints of the case company management. In hindsight, it might have been more fruitful to complete the project in a shorter time, yet the longer period of time allowed for the case company to already implement some of the results created by this research and to test them in practice.

January 2015	Initial discussions about the development project with the client
February	Topic for thesis outlined Negotiations on the targets with client continue
March	Determining methods for construction of quality handbook Determining preliminary schedule
April	Internal Auditioning-course of Det Norske Veritas - Germanischer Lloyd (DNV GL)
May	Interviews of staff / internal auditioning Writing process descriptions
June	Writing Quality Management System + Manual
July	Theoretical research for Thesis Writing process descriptions
August	Writing Quality Management System + Manual
September	Finalization & completion of QMS Manual
October	OFF (heavy load at work)
November	OFF
December	Writing Thesis
January 2016	Conformity study between ISO 2008 and 2015
February - August	OFF (heavy load at work)
September	Writing Thesis
October	Evaluation of the thesis and theoretical framework, based on actual results and events Writing Thesis
November	Writing Thesis
December	Rewriting and Finalizing Thesis

5 CONCLUSION, RESULTS & DISCUSSION

The hypothesis on the title of this Master's Thesis is considered concluded: The Quality Management System of Craftmer really is an asset for a small company trying to survive in global turmoil.

How did we arrive to this conclusion?

The Thesis and supporting research demonstrate clearly how the construction of a quality management system and clever use of it as a part of the marketing initiative helps in gaining a foothold in new potential markets as well as secures the old market customers in an ever changing business climate. A quality management system compiled together with the quality awareness and innovative nature of a small and agile company will start to generate results. Furthermore, documented processes will help enormously in the transfer of tacit knowledge. It has been an amazing journey in which many theories and principles were reflected upon the flexible but practical and cost-efficient approach of the case company.

The second chapter presented the theoretical research approach and objectives for the development and implementation of ISO 9001 quality management system for a very small company by starting in the Egyptian history and traveling to inspect the re-building of Japan after the Second World War. The theories presented are based on literature studies by respected authors Joseph M. Juran, Philip Crosby, W. Edwards Deming, and Jeffrey K. Liker as well as a few Finnish authorities Paul Lillrank, Olli Lecklin and Mikko Mäntyneva. The authors and their work were later referred to where applicable throughout the Thesis to assist in building a proper theoretical quality framework for this case study. Some astonishing similarities were found in the very practical and innovative results of the case company's survival story and the thoughts of the thinkers.

In the third chapter the case company Craftmer Oy was introduced in detail by describing the background as well as the market situation, focusing on the most unstable years between 2013 and 2016. A somewhat lengthy study to the recent decades of the past 300 years of shipbuilding history in Finland was deemed necessary to explain the nuances of the market environment – especially important was to understand how global fluctuation affected an industry which is almost totally dependent on exporting. It is also shown how it is almost impossible to predict the future of the field, if but only a few years forward – this is shown also in the actual status of the maritime business (in 2016). Another focal point was at the recent efforts to penetrate new and potential but highly complicated shipbuilding market area such as the Russian maritime market. The chapter also explained the business philosophy of the case company with a few practical examples, even a comparison to one of the world's largest car manufacturers, reveals some of the marketing efforts done in the recent times and explored the ways of surviving in a tumultuous market environment.

The fourth chapter was dedicated for describing the building of the Craftmer Quality System and Manual from a preliminary idea to implementation. Empirical research consisted of interviews and familiarisation with the company´s practices and operations, all in addition to literature research, to create an action research. A fairly long portrayal of the reasons why Craftmer needed this is an essential part of the research. As far as applicable to the case company, ISO 9001:2008 quality management principles and requirements were explained in practice by showing the creation of process descriptions and the evolution of those into a quality manual, neither existing previously in the case company – every document and chart were exclusively made for Craftmer. The chapter also presented and discussed the differences between the ISO 9001-versions of 2008 and 2015 – both of these were also compared to the brand new Quality Manual of the case company. To finish the chapter, the development project is put onto a timeline, which spanned almost two full years, however it provided for a chance to follow the implementation from start to finish, and to observe the changing conditions of the business environment.

As last but not as the least, this final chapter was comprised of a rationalized conclusion for this survival story, presenting the achieved results and discussing some important follow-up matters.

5.1 Quality Management System & Quality Manual

The most tangible result of the research was the "Craftmer Quality Manual" which encompasses and documents the Craftmer Quality Management System. It was implemented by the case company into marketing and sales process as soon as it was finished. Some parts of the manual were included in the company presentations and mentions of it were added in the marketing material. The structure of the System and the Manual are fully compatible with the ISO 9001:2008 requirements.

As the manual contains detailed and confidential information of the company, the manual is not released as part of this Thesis.

The development of a quality management system is however not a single event – it is a continuous process of improvement. Plans and needs change direction when the company gains experiences or the business environment becomes upset by a global, unexpected factor. Therefore it is essential and recommendable, that the company management follows and evaluates the quality management system periodically, by external audits for example. The results of an audit are not solely negative, nor should the given "improvement recommendations" be considered as criticism – when applied thoughtfully, they may even result to new innovations. A necessary tool for the application of such recommendations are the process descriptions, which should be kept updated.

A company that stresses quality promotes a culture whose demeanor, attitude, functions and processes will produce value by fulfilling the expectations of the customer.

5.2 Conformity Study of ISO 9001

During the research process, a new version of the ISO 9001-series was launched and it prompted an additional study into the details. Based on the comparison presented, the case company's decision was to continue the research and implementation work as previously planned. The reasoning is quite simple;

Firstly, there is no need to rush into the 2015 edition, as the older version is completely valid for certification up to 2018.

Secondly, if the new version would have been applied, the viewpoints on the implemented Quality Manual should have been mostly restructured and rewritten, as the approach is slightly different.

Thirdly, the 2008 version has been available for a decade and by now has millions of users all over the globe – in other words, it has been proven time and time again, in circumstances too many to mention. Why would it just seize to be applicable?

The management of the case company considered the "Craftmer Quality Manual" as a clear representation of the functions of the company and its quality management system.

5.3 Epilogue

Small and sometimes even slightly bigger innovations have allowed the case company to survive in the various unexpected and overwhelming fluctuations of today's world.

During the year 2016 the situation on the market changed enormously, this time towards positive: the demand for cruise vessels has skyrocketed into a new record, not just in the home market of Craftmer, but globally. There have also been a lot more contacts from potential customers interested in innovative co-operation.

Small growth has been achieved in 2016: the number of personnel grew by 25%, when an additional metal fabricator was hired in the summer. Even better news was the growth of Craftmer's turnover by more than that.

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Conformity Comparison between Craftmer Quality Manual, ISO 9001:2008 and ISO 9001:2015

Based on the “Correlation matrices between ISO 9001:2008 and ISO 9001:2015”, ISO/TC 176/SC2/N1293 (www.iso.org/tc176/sc02/public)

Ilkka Gustafsson / 15.01.2016

Craftmer Quality Manual		**ISO 9001:2008**		**ISO 9001:2015**	
2.	**Quality Management System**	**4.**	**Quality Management System**	**4.4** **5.** **7.**	Quality management system and its processes **Leadership** **Support**
2.1	General Requirements	4.1	General Requirement	4.3	Determining the scope of the quality management system
2.2	Documentation	4.2	Documentation Requirements	4.4.1	Quality management system and its processes
2.3	Quality Manual	4.2.2	Quality Manual	4.4.2	Maintain and retain documented information
2.4	Control of Documents (maintenance)	4.2.3	Control of documents	7.5.3	Documented information
2.5	Control of Records (maintenance)	4.2.4	Control of records	7.5.3	Documented information
2.6	Subcontractor´s Quality Management			7.5.3	Documented information
3.	**Management Responsibility**	**5.**	**Management Responsibility**	**5.**	**Leadership**
3.1	Management Commitment	5.1	Management Commitment	5.1	Leadership and commitment
3.2	Customer Orientation	5.2	Customer Focus	5.1.2	Customer focus
3.3	Company Quality Policy and Objectives	5.3	Quality Policy	5.2.1	Establishing the quality policy
3.4	Strategic and Budget Planning	5.4	Planning	6.1	Actions to address risks and opportunities

3.5	Responsibilities and Authorities	5.5	Responsibility, authority and communication	5.2.2 5.3	Communicating the quality policy Organizational roles, responsibilities and authorities
3.6	Management review	5.6	Management review	9.3	Management review
4.	**Resource Management**	**6.**	**Resource Management**	**6.** **7.**	**Planning** **Support**
4.1	Human and Infrastructural Resources	6.1	Provision of Resources	7.1	Resources
4.1	Human and Infrastructural Resources	6.2	Human Resources	7.1.2	People
4.1	Human and Infrastructural Resources	6.3	Infrastructure	7.1.3	Infrastructure
4.1	Human and Infrastructural Resources	6.4	Work Environment	7.1.4	Environment for the operation of processes
5.	**Realisation of Products and Services**	**7.**	**Product Realization**	**8.**	**Operation**
5.1	Description of Processes	7.1	Planning of product Realization	8.1	Operational planning and control
	5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7,5.8	7.2	Customer related processes	8.3	Design and development of products and services
5.4	Design and Engineering	7.3	Design and Development	8.3	Design and development of products and services
5.5	Purchasing	7.4	Purchasing	8.4	Control of externally provided processes, products and services.
	5.4, 5.5, 5,7, 5.8, 5.9	7.5	Production and Service Provision	8.5	Control of production and service provision
	5.6, 5.8	7.6	Control of Monitoring and Measuring Equipment	7.1.5	Monitoring and measuring resources

6.	**Maintenance and Improvement of Quality Management System**	**8.**	**Measurement, Analysis and Improvement**	**9.**	**Performance evaluation**
6.1	General	8.1	General	10.1	General
6.2	Customer satisfaction Measurement	8.2	Monitoring and Measurement	9.1	Monitoring, measurement, analysis and evaluation
6.5	Control and Non-Conforming Product/service	8.3	Control of Non-conforming Product	8.7	Control of nonconforming outputs
6.6	Analysis of Data and Continuous Improvement	8.4	Analysis of Data	10.	Improvement
	6.6, 6.7	8.5	Improvement	**10**.	**Improvement**