A DESIGN PERSPECTIVE FOR THE CONCEPTING PROCESS IN THE MARITIME INDUSTRY

Rationality and Aspiration
I SEE IT
I KNOW HOW TO GET THERE
A Design Perspective for the Concepting Process in the Maritime Industry – Rationality and Aspiration

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Abstract

Design methodologies and versatile empathetic thinking are emergent practices among different industries. Due to high risks and the conservative nature of the maritime industry, the traditional product concepting process produces incremental technological innovations. The common understanding of design within the maritime industry is generally considered to be associated with the styling at the end of the process.

This thesis compares design-driven and technology-driven approaches, introducing the idea of aspirational thinking within the partner company ABB Marine. The research conducted within the thesis follows a technology-driven product concepting process, and the outcome of the thesis was acquired by testing design concepting methods in practice. The research includes the organization and managing of concepting workshops within the R & D team, participation within concepting training at a design consultant agency, evaluations with project leaders and the development of concept presentation material for customer meetings and collaboration.

Findings from this thesis show how design thinking and design concepting methods can encourage the process, enabling different areas of expertise to work cohesively when reaching the shared understanding and vision. The thesis offers an example of how a design approach can be taken into consideration within the processes in the maritime industry.

The result incorporates a new model for the early phase of the product development process for the partner company. It discloses how a design perspective can improve the existing process in an area which has been predominantly driven by engineering.
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For the reader

I have a strong background in product design. Through 10 years’ experience in the field of design I have faced and noticed many opportunities and challenges of multidisciplinary teamwork. I am used to working with people from various fields such as technology, science and business but generally concentrating on my own specific task that I have learnt to handle from the expected perspective as I am a designer. Multidisciplinary teams tend to patronize and permit the common way of doing, where each participant brings out one’s own excellence and effort. In this point designer’s skills are often considered as a stylist, also reflecting to scheduled tasks in the teamwork. Nonetheless I have never conducted a design project without searching for alternative solutions or seeking advice from others. Input from the point of view of engineers and business people, has most often provided the most desirable outcome. This research follows a technology driven product concepting process from design perspective in the maritime industry which is too often exclusively in the field of engineering.

This thesis is divided into four chapters (figure 1). The Intro chapter explains the project’s background and the topic’s significance. The Intro chapter clarifies the challenge and the design opportunity the writer is facing and transfers an indication of what this thesis is aiming to reach. It gives a short introduction of ABB Marine Finland which is both the partner and target of the research. The Intro chapter shows how processes are conducted today and how much design is involved in there. The chapter also supplies a little enlightenment of the industry and the concepting phase of a product development project which enabled this research.

The Research chapter combines two sections, Theory and Practice. The Theory section introduces the research question and the scope. It familiarizes the reader with definitions used in the thesis and also provides a view on methodologies and theories that I have found relevant to frame the research. The Practice section brings the theories and methodologies in practice. A reader will gain an understanding of how the research and the parallel concepting process pave the way for the forthcoming result. It encloses the research part of the thesis. This chapter also includes the majority of the research for the thesis.
The Result chapter incorporates a proposal for the sponsoring party based on the findings and insights gained in the three previous chapters.

The Conclusion chapter concludes the thesis work and analysis. What could have been done differently? Was the research question properly addressed? What are the next steps? How could the results be implemented?
Intro chapter explains the project’s background and the topic’s significance. The Intro chapter clarifies the challenge and the design opportunity the writer is facing and transfers an indication of what this thesis is aiming to reach. It gives a short introduction of ABB Marine Finland which is both the partner and target of the research. The Intro chapter shows how processes are conducted today and how much design is involved in there. The chapter also supplies a little enlightenment of the industry and the concepting phase of a product development project which enabled this research.
Background and significance of the thesis project

Think about general cargo: goods, oil, gas and food inside containers; in boxes, cases, pallets and barrels. The maritime industry is the biggest carrier of freight throughout the history. (Wikipedia, 2012) Among the present-day shipping trends there are various segments of ship building: multi-purpose ships, yachts, container ships, car & passenger ships, chemical & liquefied natural gas tankers, offshore support vessels, fishing vessels, drilling rigs all consisting of a number of highly different types – to name a few. (Dokkum, 2007)

I worked at ABB Marine house, Vuosaari, for the summer 2012 as an industrial design trainee in the Solutions Development team. The team is in responsible for the early phase of product development called concepting. They are also continuously developing new ideas and improving old ones. This job was a positive experience, as it provided the most diverse working environment compared to my previous design opportunities. I found it really interesting and challenging to be hired by a global corporation that has proven to be flourishing and driving innovation whilst lowering environmental impact in the maritime industry.

The reason I was hired in the first place was the company’s increasing awareness of the significance of in-house design. Although the ABB Corporation employs some 7000 people in Finland and invests the second most (after Nokia) on research and product development, it has only a few in-house designers. However, ABB has noticed that design could offer diverse but valuable thinking on the product development process. (ABB, 2012)

As I see it, ABB Marine has been open to new ideas and approaches, design being a part of each project, but not as a whole. Subcontracted consultants from several agencies participate in different phases of product development projects. Small design teams normally consisting of professional engineers from their specific expertise develop complicated products and systems whilst somehow implementing concepting methods that may be just learnt or are not completely suitable. In my point of view projects employing many people for a long period of time require a deep and shared mutual understanding, which includes the strategic point of view, understanding the customer and the end use. The lack of the big picture when creating, selecting and communicating ideas and concepts, can make projects prolong and vulnerable – resulting mediocre products for constantly more and more competitive markets.

The role of design in different industries is about to change. Design ROI (Return On Investment) research project by Aalto University and the Finnish Design Business Association created a model to measure the benefit and
effect of design investments in companies (DesignROI, 2012). This impact of design within companies has been previously measured. For example, Danish companies that have invested in design have achieved a growth 22% more than, companies that have not invested in design. Continuous investment in design can make the difference up to 40%. (DesignROI, 2012) Proaktiivinen muotoilu (English Proactive design) made in cooperation with Successful Finnish companies Kone Oyj, Raute Oyj, Metso Oyj and Rautaruukki Oyj shows that companies have understood the significance of design when developing businesses in more customer-oriented and cost-effective way. (Leppänen, et al., 2006) The CEO of Kone Oyj has stated that their concept development used to be conducted “backwards”; “Technology platform and product concepts were created first and design was brought later in the project when the product development project was started.”1 According to him this is the reason why design was considered more cost increasing, rather than cost reducing factor. He continues in his statement that “Kone Oyj did not have the culture for viewing their products from a design perspective early enough. Basically design was brought in to ready-made product and now they have understood that product concepting should be better managed already in the earliest phase of the process unlike usually in the phase where products are customized for specific market segments.”2

Considering this I see that design in general can be the most significant and beneficial matter when producing new products, services and businesses. World’s leading companies from varying fields such as Virgin Atlantic Airways, Whirlpool, Starbucks, Sony and Lego have incorporated design in their processes, to play a fundamental role to improve their success (DesignCouncil, 2007). Methodologies of design and versatile empathetic thinking is emerging among businesses and I understand that for ABB Marine Finland to become a truly forward thinking and innovative company, design can open new possibilities for their future.

**Challenge and opportunity**

I have an idea of how ABB Marine benefits from design right now. The benefit comes from designers’ ability for different kind of thinking from engineers, which normally is questioning the traditional way of thinking – also without deeper understanding of technological matters. At the moment design is solely involved with the creation of visuals using pencils, markers, 2D or 3D softwares. Within some projects designers are in responsible for making tangible 3D

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1) Own translation from Finnish, 2012 (Leppänen, et al., 2006, p. 35)
models and/or prototypes, and too often this is done in the very late stages of projects. Despite ABB’s open door for design and designers there exists either a problematic attitude or a general lack of understanding of the possible benefits of design amongst colleagues from different disciplines; producers, engineers, marketers and management.

My designer-colleague at ABB Marine, was introducing himself at an ABB seminar in Western Finland, heard someone say: “Why do they have designers at ABB Marine even though the product is underwater?” During the summer we were planning a new concepting room for the Marine house. The area of the planned concepting room was limited and the need for the use of the area was highlighted by several departments. Someone asked “are you guys (he meant designers) going to make some clay cups or why would you need a share of the space?”

After gaining a little knowledge of the maritime industry, these statements became relevant to me. The industry is and always has been very technology driven so these points of view are not uncommon or unusual, but rather normal reactions towards design – design as non-designers normally see it. The term design, itself in the industry is commonly used for all engineering work such as electric design and mechanical design. I realized that the lack of understanding applies to the other way as well. Designers fail to grasp the role of engineers and marketers. My supervisor once reminded me that “something that is natural is hard to be changed”.

In this Master’s thesis, as a design “prophet”, I will introduce the idea of design driven approach, what I call as aspirational thinking, to ABB Marine. By studying, testing and evaluating the suitability of design in concepting, the early phase of product development, I am looking for the answer to: what can design offer to the concepting process within a technology-driven product?

The need for improvement

I have noticed that the most successful ideas in the maritime industry are based on implementations of technological inventions. The common association of design, within the industry and ABB Marine, does not actually include that many designers and design as I understand them. I interviewed a Doctoral Researcher from Aalto University who has conducted a research project in ship planning and building for Viking Line M/S Grace. He has a broad understanding of designers’ contribution within the ship development in ferry and cruise ship segments – which is probably the most design friendly segment in the industry.
One ship development employs around 8000 workers. (Kauppalehti, 2013) Among them there are two to six designers. To the best of his knowledge, designers focus primarily on spatial layout design, styling and creating visuals for marketing and sales purposes. (Researcher, 2012) In the industry a common maturity level of design is more about styling. It is very rare to have design included in functions and processes.

I find the observation by Austin Govella (2008) interesting when he discusses the correlations with design maturity continuum by Jess McMullin (2009) and the level of innovation in an organization. Figure 2 represents his view of how design thinking maturity can differ from “no conscious design”, where design is not recognized as valuable, to the higher level where design redefines and shapes a company’s strategy.

My supervisor roughly expressed the relation between drivers in ABB Marine; technology 99% and design 1%. It can be said that the 1% for the design driver came recently when the ABB Marine House started to use in-house design. (Product Manager, 2012) I think that these drivers cannot be directly comparable to maturity level, however it indicates the general involvement of design in the company. I think that in Govella’s description this share would relate to somewhere between levels of no conscious and styling.

Figure 2. Correlations with design maturity continuum and the level of innovation in an organization.

<table>
<thead>
<tr>
<th>CULTURE</th>
<th>PROCESS</th>
<th>PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Framing" /> Design redefines the challenges facing the organization. Moves design from executing strategy to shaping strategy.</td>
<td><img src="image.png" alt="Problem Solving" /> Design finds new opportunities and process generates alternatives within a problem space.</td>
<td><img src="image.png" alt="Function &amp; Form" /> Design makes things work better. Classic practice of design. Limited to incremental improvements.</td>
</tr>
<tr>
<td><img src="image.png" alt="Style" /> Design is stylish, but too often perceived and practiced as a cosmetic afterthought.</td>
<td><img src="image.png" alt="No conscious" /> Design value isn't recognized. There are more important issues to deal with.</td>
<td></td>
</tr>
</tbody>
</table>

ref. McMullin, 2009, re-drawn
However, ABB Marine house has previously used a design approach within projects. Generally this has been carried out by visiting consultants from several design agencies. Many times design has been a part of the processes but primarily within the later stages, after conceiving in the product development phase. A good example of empathetic and collaborative design activities within the ABB Marine house can be noted in the collaboration with Link Design. They created 1:1 scale prototype of the confined space of the Azipod in order to experience the situation of the service employee who is changing shaft seal lips from inside. At the time, the seal manufacturer also participated in the testing along with ABB Marine R&D. (Product Manager, 2012) (photo 1) ABB Marine has also used methods and approaches that designers too often consider as their activities only. One example of simulating user’s experience is the collaboration with Aboa Mare Simulation Center which is located at the Aalto university campus area in Espoo. During my project I also got a chance to experience the situation of a ship captain and co-navigators alongside the R&D team which was gaining insights for new bridge control panels. (photo 2) This experience showed me that ABB’s design maturity level in some cases is more than only styling, and has the ability to also affect the forms and functions, ensuring products work better. This thesis is an opportunity to test; can a design perspective affect also a process and find new ways for problem solving and even frame new challenges for a company?
There is also a demand to which this thesis could give answers. Despite the success of the advanced manufacturing processes developed during the evolution of previous propulsion products and systems, the early phase of the product development process is in need of improvement. Even if the concepting process is well organized, it does not include any design activities or definite outcomes during the concepting phase. In my opinion a chance for a coincidence, unforeseen result, is eliminated already in the very beginning and final concepts may be selected from ideas that are not always clearly communicated and developed in shared understanding. ABB Marine has measured a generic time span and use of resources in the general product development process. In the figure 3 it can be seen how projects generally use more resources than is planned for. Ineffective use of resources in the beginning of the process has direct effect on the time and cost (Product Manager, 2012). I think that this early phase of the product development process can be improved by design.
Rational and aspirational mindsets

Generally a product development process is broken down in several steps. According Ulrich & Eppinger (2004, p. 203) the process can be divided into five phases. In the same Figure 4 they express the common view of utilization of industrial design in two types of processes: technology driven and user-driven processes. Just like the research, proactive design, showed that a technology-driven process does not include design in its early phase. This view might have changed over the years but in this thesis I try to point out that design thinking and a design perspective can also be part of a technology driven process from the beginning throughout the duration of the process.

I think that it is essential and common to have different kinds of personalities and roles in the design process. Kelley & Littman write about the benefits of having people with different approaches involved in the process fostering the creativity and creating a “culture of innovation” (Kelley & Littman, 2006). I agree with him, however in this thesis I did not try to analyze any personalities, nor try to find any kind of special roles for them. I was not interested in creating any kind of a “dream team”, but I believe that I was working with similar situations and environments.

In the matter of fact that design is more than aesthetics, I think that good design is often dependent on great engineering skills. Therefore I do not see any
competition or polarity between these disciplines. Both engineers and designers have yet the same objective – to create a successful outcome. However, I have experienced that their approaches are different. This is why it was necessary to differentiate between the two mindsets, that helps me in the discussion in this thesis. The differing mindsets and their approaches have been researched before and seen as, “styles of thinking” called top-down and bottom-up approaches. The top-down approach breaks down the system in order to “gain insight into its compositional sub-systems”. The bottom-up approach instead is the, “piecing together of systems to give rise to grander systems (Wikipedia, 2012). Different mindset styles and approaches have also been divided into the analytical-logical and interpretative-intuitive (Bason, 2010).

I feel that the above mentioned descriptions are correct, but are not sufficient enough for my point of view. So, in this thesis I define these approaches and mindsets as, rational (technology-driven) mindset and aspirational (design-driven) mindset. I try to explore their compatibility in the maritime industry.

In my opinion a rational mindset breaks the complex problems in parts in order to analyze and understand them better. It favors more calculating and fact-based linear approach. I think that without rational thinking it is impossible to manage complex projects, budgets and technological systems.

Aspiration – “a hope or ambition of achieving something”. (Oxford Dictionaries, 2013) The design-driven mindset that I consider here as aspirational is based on feelings, aspirations and emotions. It is more about personal or shared desires and visions. It is similar to seeing a desirable result as sort of an idealistic and perfect solution, covering a desired objective as a whole. Without aspirational thinking, it is more difficult to see, i.e. interpret, the possible result from wider perspective. Brown proposes in his book Change by Design (2009, p. 69) that the creative process relies on synthesis, “the collective act of putting pieces together to create whole ideas” I believe these approaches, both rational and aspirational include synthesis and they are equally important in the creative process.

It has been said that all the people are creative. I believe that by utilizing the right tools and methods, both analysis and synthesis, it is possible to increase the level of aspirational thinking in processes within the maritime industry and make rational, technology driven process, to reach more holistic and groundbreaking innovations.

“Creativity involves breaking out of established patterns in order to look at things in new or different ways” (de Bono)
ABB

ABB is a fusion of two remarkable companies; Swedish Asea and Swiss Brown Boveri. ABB is a global leader in power and automation technologies improving performance and lowering environmental impact in over 100 countries. Its business is divided in five divisions; Power Products, Power Systems, Discrete Automation and Motion, Low Voltage Products and Process Automation. ABB invested in R&D $1.3 billion in 2009, it has seven research centers, 6000 researchers and developers and collaboration with 70 universities across the world including Aalto University. ABB currently has around 4780 active patent families and around 20000 active patent applications. (ABB, 2012)

ABB’s mission is to: 1. improve performance, helping its customers create more reliable and productive operations, whilst saving energy and lowering environmental impact, 2. attract talented employees into the global working environment, 3. drive Innovation and quality in ABB’s product, system and service offering, 4. act responsibility, is the core value of the business, when it comes to environmental impact and ethics within ABB’s operation. One of ABB’s strategic imperatives it has identified, is to its long term competitiveness and success goes; innovation across every area of the business - not just product innovation. An innovative culture is the one of the most important competencies in the future. I surely agree that carrying out all above mentioned ABB is able to offer sustainable best-in-class products, systems and services reaching its vision and mantra: “helping customers to use electrical power efficiently to increase industrial productivity to lower environmental impact in a sustainable way. Power and productivity for a better world” (ABB, 2012)

ABB Marine

ABB Marine is a part of the Process Automation division and its Marine and Cranes business section. This section covers marine systems, products and lifecycle services for ship-owners and shipyards, and harbor and industry crane solutions. (ABB, 2012)

Throughout its history of 60 years supplying electric power and propulsion systems for various ship types, ABB Marine has gained the technological advantage. The outstanding era of innovation started after delivering the first electric propulsion system in 1983. In 1990 ABB revolutionized ship propulsion when it delivered the first electric podded propulsion system Azipod® to the
service vessel Seili. Since then, “ABB Marine [has been] the leading manufacturer of electric power and propulsion systems”. It is a global maritime organization providing reliable, safe and environmentally friendly solutions and qualified services to reduce operational costs and ensure optimum vessel lifecycle for customers. (ABB, 2012)

Like Kim & Mauborgne suggest companies to do in their book, Blue Ocean Strategy (2005) it can be said that with Azipod, ABB created new uncontested market space that gave them a huge advantage, allowing them to differentiate from their competitors. This breakthrough happened decades ago and I think that in order to keep the achieved profitable growth in the market space that is nowadays filled by competitors’ products ABB is in need to better its products - or create new uncontested market.

The maritime industry

I believe that the maritime industry is one of the most conservative industries in the world. Referring to my colleagues at ABB Marine House it has been said that developments, 30 years old can still be considered new in the maritime industry. This is a presumptive opinion of the industry which has big risks in the business where every ship building is based on loans. Routines, tight schedules, safety, restrictions, the need for wide variety of different know-how, requirements and price dictate the conditions for decentralized large scale projects where investing in new innovative technologies, is really challenging. (Researcher, 2012)

In my opinion the real challenge for ABB Marine is to push innovative and environmentally friendly products into the markets when the industry itself does not hold similar values. Another challenge for ABB Marine is that some of its competitors also supply design for the whole ship when ABB Marine offers (only) the propulsion and automation systems. When attempting to justify my claim regarding the conservative nature of the industry, is that originally shipbuilding work was handled by shipyards themselves, mainly because of their technological advantages. However, marine equipment manufacturers have become more important over time. Nowadays the role of the marine equipment industry, as a supply industry to the shipyards, has increased dramatically. The share of marine equipment is assessed at 50%-70% of the product value, and can be up to 70-80% in the more specialized segments”. Today this share may be increased even higher. (Ecorys SCS, 2009)

Therefore very close ties between suppliers and shipyards exist. Generally shipyards organize the trade between suppliers and ship buyers. When shipyards are in need of new marine equipments, desired by customers it is reasonable to contact suppliers that are able to answer the demand - as quickly as possible.
According to Danish ship finance; the global economy generates the bulk of the demand, whether it is through imports of raw materials or the trade of finished products. This demand is also affected by seasonal fluctuations, haul distances and transportation costs. Size and composition of the world fleet reflects the supply of different vessel types. An average time for a new ship to be delivered from order takes one to three years. Flexible freight rates and shipbuilding costs motivate ship-owners to recognize long term savings. (Danish Ship Finance, 2012) Sometimes it is more economical to invest a double amount of millions to reconstruct a decade old ship using the latest technology, rather than buy a new ship with the same equipments, if the operation can begin half a year earlier. (Product Manager, 2012)

The need for equipment from suppliers is tied to the size and composition of the world fleet and suppliers, as ABB Marine are forced to cover any type of vessel. Indeed this demand creates more difficult competition within the market space. This results in suppliers investing more on R&D searching for new, more attractive and energy efficient solutions, which in turn creates a premise for new innovations. Shipyards do not develop as fast as suppliers. The sad truth arising behind this is that more often, over the energy efficiency or environmental aspects, the biggest criteria with new designed products for shipyards has the lowest cost. (Lead Engineer, 2012) (Product Manager, 2012) (Researcher, 2012) There also exist exceptions. For example in the development of Viking Line M/S Grace environmental aspects were significantly taken into consideration, although it increased the initial costs. Eventually in the ship’s life cycle the added cost will be paid back. (Researcher, 2012) Regardless, I see that money is too often the matter that goes beyond other values. Manufacturing also tends to stay on the same level as standardized technologies at the shipyards. Comparing with any other industry where an expense of single products is lower it is easier to implement new ideas and concepts because manufacturers hold the most advanced platforms. One aspect in this thesis is collaboration. Maybe innovative companies with talent and expertise could change the game of the industry.

Environmental aspects & Azipod C series

The Solutions Development team, which I was part of, was involved in the Next Generation Compact Azipod (Azipod CX-project) development, and mainly in the concept development phase of it. These few paragraphs introduce the Azipod C series to the reader (which is the existing compact Azipod) and shortly explains how the product features were designed and how the system operates. (ABB, 2010)
After the launch of Azipod in the 1990s, ABB Marine started a new project aiming to meet market needs for lower power ranges. Utilizing features from bigger Azipod units "such as low emissions, high efficiency, ease of installation, ease of use and maintenance". In autumn 2001, the first pilot unit started operation. Since then the compact product family (The letter C for the name comes from the compact size) "has grown both in sizes and in applications." (ABB, 2010) In photo 3 Azipods are installed under the ship. Photo 4 shows how systems are located on the board.

Azipod C is a combination of innovations put into one simple but sophisticated system. Essential technological decisions were based on ABB’s own experience gained from the larger Azipod units and interviews that were made with shipyards and operators. (ABB, 2010)
One of the key drivers when developing the Azipod C was the permanent magnet technology which “had reached its commercial maturity and was feasibly available.” Within the technology, it was possible to cool the unit directly to surrounding sea water ensuring zero heat losses from the rotor. (ABB, 2010)

Three modules were developed. (figure 5) 1. Steering module, combining all monitoring, supporting and steering functions and connecting the unit to the vessel. 2. Strut module, which is used as a bridge between the motor module and the steering module. 3. Motor module, which rotates the propeller and creates the thrust force. Also the manufacturing process and logistics played a leading role when the module platform was designed.

Each module can be produced separately in parallel manufacturing processes with different combinations. Pre-designed standard modules ensure the flexibility of the product. One characteristic feature for the Azipod C was “to make the maintenance as easy as possible.” The components that require maintenance are installed in the Azipod room (the space surrounding the steering module). It is planned in a way that all the components that need dry docking of the vessel need maintenance intervals of five years. In order to fulfill all the need ABB created service packages to support the maintenance. A majority of the Azipod components are made of recyclable materials. It is designed for low emission. In addition to being energy efficient it holds low amount of chemical substances, has low heat, low noise and low vibrations. Silent operation is one of the most necessary features of the Azipod C. (ABB, 2010)
Azipod CX project

During the summer, I helped the team leaders to visualize results of the market research which was conducted to outline the new project. The aim for my contribution was putting those market “Hotspots” in more understandable forms and making them visible for the product development team, as in figure 6. The idea was to print posters and set them on walls where everybody, also members from other departments, could provide some thoughts and feedback, enabling and encouraging multidisciplinary teamwork. Through this task, I gained valuable understanding of the project, which broadened my view and made me consider how complex the forthcoming project will be, and how competitive the market space really is.

Eventually posters were never used as was initially proposed, however they were viewed in several occasions. The visuals were simple, but due to the lack of my own understanding of the product they were not as informative as I would make them today. To be honest I do not think that the purpose of the posters was made apparent for all members of the R&D team, not to mention employees from other departments, when seeing the posters for the first time.

Since I began pondering the topic for my thesis, I was asked to introduce some design methods for ABB’s product development team. This matched with my pre-framed thesis plan and I found it challenging to take part in a big real-life-project testing design methods and suitability of design in its process. This is the first time that ABB Marine is including in-house design in a projects concepting phase. (Product Manager, 2012)
The Theory section introduces the research question and the scope. It familiarizes the reader with definitions used in the thesis and also provides a view on methodologies and theories that I have found relevant to frame the research.
Scope & research question

The Azipod CX-project functioned as a case study for this thesis project and generated the scope for the thesis. This happened because the project started almost at the same time as the thesis. It was relevant to focus on concepting which happened during these few months (figure 7).

Research question

What can design offer to the concepting process within a technology-driven product?

Concepting is the crucial phase of the product development process. Moreover it is the process that should be done before the actual product development process begins. The phase from planning to communicating the results to decision makers inside the company, and outside the company to customers and partners.

Hypothetically I assume that by increasing the design approach within ABB Marine’s processes it could become more effectual and result better innovations. In this chapter I discuss theories and literature that I find relevant in reinforcing the hypothesis and team working skills.
As mentioned I concentrated on the early phase of the product development process, formerly called “pre-design”. This phase of the process is notoriously viewed by Sanders and Stappers, in their recent researches. They view this phase as the fuzzy front end because of its ambiguity and chaotic nature. (2008, p. 2) The fuzzy front end is a critical phase where many activities come together. Sanders and Stappers state (2008, p. 3) that: “understanding of users and contexts of use, exploration and selection of technological opportunities such as new materials and information technologies, etc.” The main intent of the early phase is to determine “what is to be designed and sometimes what should not be designed”. As a small distinction on their representation of the fuzzy front end and what they claim, in the figure 8 I include the concepting entirely within the fuzzy front end or extend it to include concepting.

Before going any further, I have noticed that in my field people tend to use definitions that may have different meaning within other fields. Sometimes definitions dismiss the original intention. For example in this project I noticed that some misunderstanding, caused by definitions, occurred in the very beginning of the project and continued until the end of it. Therefore in order to avoid this confusion within this thesis I clarify to the reader what terms used means to me.

A term I often use is design thinking. It has almost as many definitions as users of the term. The same problematic exists with the word, concepting. Both terms play a significant role in this thesis, thus I must make them clear to the reader.
Definitions

Design
Design is a manifestation of an idea. In my opinion industrial and strategic design links applied arts, applied sciences and the business world. Through the constant pursuit for understanding the user and the surrounding environment it improves aspects of physical ergonomics, usability and functionality of a product, service or space. Not to mention the consideration of aesthetics and ethics in products and manufacturing processes and environmental impact within them. It has a role in developing utility products, service systems, brands, industrial processes and business strategies. The definition presented by ICSID (International Council of Societies of Industrial Design), is a definition with which I agree; “Design is a creative activity whose aim is to establish the multi-faceted qualities of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange.” (ICSID, 2012)

To be clear; design, industrial design and industrial & strategic design all have the same meaning in this thesis.

Idea
In my opinion an idea is a form of a thought of something either abstract or concrete. An idea can be specific or general. It can be personal or shared. An idea can be universal or particular. It can pop up from “out of the blue” from any human mind. It can be an expression of art, someone’s skills or knowledge. It can also be an ability to solve the problem or answer the question: Do you have any idea of...?

McGrory, a professor at the Aalto University, elucidated me and my classmates during the course - design strategy and innovation (2011): “ideas are ways to signal (i.e. agents) and satisfy (i.e. to convey and realize) concepts. An idea (like a ‘road-map’) helps to achieve or realize a concept – [answering to question] how to...” (McGrory, 2011)

Concept
I agree with the definition Keinonen presents, (2006, p. 16) that a concept is not an object brought to the marketplace. Instead it is a design and design process that is not meant to be implemented without major additional design work which differentiate it from the core meaning of product design or product design development.
Ulrich and Eppinger describes concept as “approximate description of the technology, working principles, and form of the product”. As described in many situations “concept is usually expressed as a sketch or as a rough three dimensional model and is often accompanied by a brief textual description”. (2000, p. 108)

I think a concept is normally a blanket notion, a sort of a destination that can be reached but it requires more time and effort than reaching only an idea or ideas. McGrory (2011) declared that “concept is a developed form of idea or ideas [and they] are a framework for thought which help envision, inspire and incite creativity and change.” He clarified my view of concepts, comparing them to a compass that suggests the right direction but does not reveal how to get there.

Innovation

Innovation is a successful implementation of ideas and concepts. In my opinion this does not have to mean that innovation should always be related to money, as people so often attribute it to. Innovation is creating something that was not thought before, from the same perspective. For example track-and-field athlete Dick Fosbury went against conventional “straddle”-style in high-jumping in 1960’s and kept practicing backward “flop” and eventually created the new way of high-jumping. It was considered as so weird motion that experts said that he will end up breaking his neck but instead he broke all the world records and won the Olympic gold medal. (Kelley & Littman, 2006, pp. 80-82)

Conzepting (concept design, conceptualizing)

when creating a concept or concepts

The term concepting is often replaced or mixed with brainstorming, which can include similar activities to concepting. Kelley & Littman write in their book, The Ten Faces of Innovation, that brainstorming creates innovative culture. 1. Supporting organizational memory allowing a group to explore past, present and future. 2. Reinforcing an attitude of wisdom, making participants to challenge their worldview with other’s point of view to improve their own ideas wiser. 3. Creating status actions with a free-spirited atmosphere that gives all participants a chance to have attention and status that could not be possible for them otherwise. They claim that “regular brainstorming is as critical to an organization as regular exercise is to your health”. (2006, pp. 150-151)

I agree with the work of Ulrich & Eppinger (2000, p. 108) who have a quite obvious but concise description of concepting, stating that it is comparatively inexpensive and quicker than the rest of the development process. According to Keinonen (2006, pp. 16-18) concepting uses methods and processes of product design, such as user-centered approach and model creation. But furthermore
he continues in his description, that it can also play many roles, supporting a company’s business by giving it “a more extensive coverage of the company’s different functions than product design”. Sometimes concepting generates ideas that could be possible but not yet. This can support company’s strategic decision-making in the future product development and research activities.

Keinonen has divided the general objectives of concept design into five segments, which I find valuable and relevant to mention within this project. In my opinion these objectives should not exclude each other, rather they should be combined or used in different phases in a process.

**Concept design for product development**

According to Keinonen concepting is not meant to solve only a present problem, but also define the project targets and find alternatives. I agree with him, that concepting is used to create main outlines for the product development project. “The aim of the concepting is to prepare for concurrent engineering by specifying the fundamental solution to the design problem, which is used as the basis for the decision to go ahead with detailed design.” (Keinonen, 2006, p. 20)

This is what I find extremely relevant and necessary for product development, however it is rarely used.

**Concept Design for Innovation**

Usually the most creative ideas never reach the product design development phase. As Keinonen claims (2006, p. 20) “Innovations are welcomed, but the uncertainty that often accompanies them tends to favor the traditional approach when deciding which solution to choose in a product development project”. He writes that the only way to manage the decision making and possible risk-taking is further concept development including prototyping and testing before starting the production. According to a Researcher (2012) in the maritime industry the most innovative design concepts are very often too risky, but can help to influence the customer when selling the early concepts that are more traditional and usually easier to implement.

According to Keinonen (2006) and Researcher (2012), tight schedules prevent further examination of the most radical concepts. But like in many businesses sometimes it is needed to take a radical move from a more traditional solution. An example of radical concept design, that became reality, can be seen in the newest Viking Line M/S Grace’s promenade deck, which is traditionally located in the middle of the ship, is now designed to be on the side of the ship, allowing customers to have access to better views (photo 5). The influence for this radical change, came from the theme “Archipelago” – the vision of designers
(Researcher, 2012). Quoting Keinonen (2006, p. 21) “Consequently, it is essential to be able to implement design work that breaks away from the current concrete, technical restrictions and compatibility requirements set by legacy products and production processes, and from the short-term profit targets set by sales departments”.

Keinonen also mentions that both insight and design are needed when finding and implementing new opportunities. Although the foundation for this is dependent on R&D, design is the element that can link the technological development to fit the demand of the market. Keinonen continues that it is not the primary priority to improve the current product in concept design, but it is nevertheless a desirable by-product of the process. I think this should be at the core of concepting, but unfortunately in many industries the number one priority seems to be improvement of the current product. Keinonen describes a solution that in my opinion should be suggested to every company, “design should be created without the immediate exploitation of the ideas being the initial and most important criterion dictating their final evaluation. This need can be met by launching different concepting projects, the key significance of which is to create the prerequisites for innovations”. (Keinonen, 2006, pp. 20,21)

Concept design for shared vision

According to Keinonen, changes within the business environment and especially related to big decisions, such as changes in the production line, adjustments in the product specification and/or transformations in the product portfolio cannot be based on obscure and vague expressions. He continues that in concepting “through simulations, pictures, diagrams, stories and mock-ups [it is possible] to transform existing possibilities, wishes, abstractions and words into physical form”. Therefore also unprecedented concepts of future products can be discussed like existing ones. In my opinion, shared vision is the foundation for every concepting process.
Concept design for competence

Concept design is the phase of product development where also professionals have permission to fail. According Keinonen it is a stage where a required result can be something other than perfect, as required in product design development. I agree with him that concepting is the best way to cooperate between different departments and outside the company. It is also the best way to learn of new technologies and business opportunities. Concepting is also a way of improving relationship with customers and improving team skills and spirit. “Direct business-interests can prevent wide-ranging cooperation because of tight schedules, legislation on competition and confidentiality issues. In contrast concepting is free of these restrictions”. (Keinonen, 2006, p. 25)

Concept design for expectation management

Keinonen discusses that a concept can have the ability to communicate strategic alignments and business goals for stakeholders. The influence of concept design can change the ideas of what customers and partners want or need. Concepting can also be an inexpensive way to promote a brand image and to test a new product in public or closed business meetings. By showcasing an interesting product concept with the new technology or the new design a company can build “market expectations and also contribute the entire industry’s image as a promising career alternative or a lucrative investment target.” (Keinonen, 2006, pp. 26,27)

Desirable approach

As I have previously mentioned, I have experienced and understood the advantage of good teamwork. In the interview in the Rotman Magazine (Christensen, 2009) CogNexus Institute founder Jeff Conklin explains: “why the Age of Design requires a new approach to problem solving that is built on a foundation of shared understanding.” He describes that there exist both tame and wicked problems in the business world. A tame problem can have one right answer or solution that can be made by one thought. A wicked problem instead can be a combination of many different tasks and tame problems. Conklin describes that the meaning of a wicked problem is something that cannot be solved by only one person’s opinion or point of view. I see that it is wicked problems that ABB marine is facing today in ever more demanding and competitive markets.
Conklin compares problem solving between the age of science and the age of design. He explains that in the “epoch of science”, the time when we described the world and started to practice control was the opening for technology - “the art of harnessing, controlling and transforming our world”. I agree with him that since then organizations have borrowed a lot from that model when managing their business targets and predicting the future and trying to control it. He adds that facts have been legitimizing decisions and actions. Problem solving to find the right answer and the problem to which organizations have been devoted to, have been generally tame in nature. The problem definition was generally well understood because the problems were not so complex. In his work he uses a bridge as an example of problems faced. “Stakeholders were few, the constraints stable, and in the end, there was a concrete result that solved the problem.” During this period organizations were rewarding individuals for predicting and controlling their environment. “People worked separately, using a linear process, to gather all the facts so that they might formulate the right answer and deliver it for implementation.” (Christensen, 2009)

The business-as-usual is a traditional linear approach to problem solving. This kind of process Conklin describes, is as follows, “first to problem definition and then to creation of a solution, probably in a group of talented professionals, but all participants working on their own view causing the lack of deeper understanding”. Doing so, they miss out the deeper problems. Complicated problems have required involvement of hundreds of workers and years of effort using a linear approach, but until now the complicated problems have become wicked problems. He says that “now those days are gone and the emerging model is the Age of Design”. (Christensen, 2009)

I find that this aspect is relevant to both the research conducted in this thesis and emerging within the maritime industry. Among global economy issues and rapidly developing technologies I have understood that there are tighter schedules, more legislation on competition, higher confidentiality issues, more consideration in environmental aspects, more extended supply-networks and increased ship segments. These factors together create a premise for a problem that I consider as wicked. In my opinion Conklin’s impression is a little bit too coarse, however it makes clear the fact that times are changing and how much there is the need for both linear, rational thinking and nonlinear, aspirational design thinking in the solving of wicked problems. I think that the time for the age of both science and design, is now needed in the maritime industry.

“In today’s place of prediction and control there is nothing but chaos. In place of individual efforts the problem solving is now collective. In place where decisions were made based on facts, are now based on stories giving us a more consistent sense of meaning. In place of finding right answers we are seeking to gain a shared understanding of possible solutions.” (Christensen, 2009)
Shared understanding

Shared understanding gives wider perspective and judgment for more fertile solution that is easier to implement. Conklin discusses that a “wicked problem requires infinite amount of time, energy, effort or money to solve it.” I think this explanation is a good recipe when planning a project. There is no right or wrong solution for the problem – only better or worse. Good team spirit and shared solution formulation are always a result of shared understanding. As in concepting for shared vision, the more dialogue exist the more different aspects are shared and the easier the forthcoming evaluation will be. Conklin adds “Seeking the right understanding of the problem can already devise few proposals for the solution. When solution, evaluation and understanding are not distinct linear processes but considered as one common and shared problem the solution will be more objective and systematic.” (Christensen, 2009)

Conklin also highlights the importance of social skills and networks, in doing so he reinforces my point of view of the seamless collaboration which in my opinion is the key factor for a most effective and fruitful process. He also crystallizes the challenge and raises my uncertainty of the possible outcome of this thesis saying “Unfortunately, we are babies in the woods in the Age of Design, and the nature of our tool set is quite primitive”. (Christensen, 2009)

Design Thinking

According to Bason, at the heart of design thinking is the optimal balance and connection between those two different mindset styles that he calls analytical-logical and interpretative-intuitive (2010). Martin, Dean at the Rotman School of Business in Toronto, stated that design thinking is integrative thinking; the ability to exploit opposing ideas and opposing constraints to create new solutions for wicked problems. In the case of design it means balancing what human need - desirability, with technical feasibility and economic viability. (Brown, 2012)

I agree with the description of design thinking put forth by Kelley and Brown which was developed when they were struggling to keep IDEO, an innovation and design firm successful. They were constantly asked to take on problems that were not commonly used in the area of design. They were pulled out of their comfort zone, helping companies to better understand their longtime customers and restructuring organizations of some companies. It opened new possibilities for their design. When they thought about the name of this new expanded field of design, Kelley realized that every time he talked about what they are doing he used the word thinking, when explaining what designers really do. Brown now uses it as “a way of describing a set of principles that can be applied by diverse people to a wide range of problems.” Moreover design thinking is something
that goes beyond skills of individual designers. A team of skilled design thinkers together can tackle more complex problems. (Brown, 2009, pp. 6,7)

As mentioned design thinking is a term that does not have any clear definition. It is also impossible to measure the effect of design thinking in businesses and sometimes it is not sure whether it is suitable at all. Bruce Nussbaum, one of biggest advocates of design thinking now claims (2012) that “design thinking is a failed experiment” and “the success rate of design thinking is very low” within different kind of companies. He states that design thinking is a scaffolding of creativity which is packaged within process format and that is the reason why companies have welcomed it. He continues that what happened was that when design thinking appealed the business culture of process, “it was denuded of the mess, conflict, failure, emotions, and looping circularity that are part and parcel of the creative process.” Therefore it could not fit in all companies. The real innovation took place only with companies that allowed the mess that accompanied the process. He thinks that “It was creativity that design thinking was originally supposed to deliver.” He says that creativity is the word that everybody likes, because everybody is creative, and design thinking is the heart and soul of creativity (Nussbaum, 2012). It surely is. But moreover I think that creative work in shared understanding, paired with the right methods and clear communication can avoid the mess and conflicts in a process and make it more successful and effective.

I see design thinking as combination of rational and aspirational mindsets. Design thinking is not only a designers’ ability. In my opinion there are plenty of design thinkers working in the maritime industry. I have experienced that these people have brilliant minds and the capacity to adapt in multidisciplinary groups and create better solutions for complicated problems.

Normally projects in the maritime industry are led by engineers. Engineers’ work certainly requires both analysis and synthesis, for instance planning and leading the processes in cruise ships, which resemble small towns with their entire infrastructure. Think about planning and handling of water supply networks, electricity grids and drainages to fit and communicate together in a floating town - considering the end use and environmental aspects as well. (Researcher, 2012) When more consideration of the end use and customers’ experience and desires are added on the process we can discuss about really complex one. Normally designers’ work concentrates more on the aforementioned users’ side of view; however it also requires both analysis and synthesis. In one previous rare occasion in the maritime industry, the design agency Vertti Kivi designed exclusively for the new Viking Line Grace all the interiors, which normally requires tens of operators.
Constituents of design thinking

Based on a framework that was introduced to me at Aalto University’s Design strategy and innovation course. (McGrory, 2011) I will explain what design thinking consists of and how I perceive it. In general design thinking can be transformed in practices, user research and mindsets for problem analyses and solution finding. (Brown, 2009) I use the collection of seven design thinking constituents to describe the meaning of an ideal standpoint that in my opinion could improve a technology driven process.

**Holistic** From the holistic approach I use differentiation from the old folk’s idiom: “can’t see the forest from its trees” but instead understanding the diversity of the forest. In any project it is required to step back from the current situation to see the initial task again as a whole from different perspectives.

**Synergistic** Different factors of the problem or a system can logically be separated but unconventionally combined. I see it as a sum of separated parts that can cumulatively be more after a period of time - e.g. Apple products can lose to its competitors when comparing single features between two devices but all the Apple products create the synergistic and unbeatable combination – network or chain of pieces working together.

**Empathetic** Using a user centered approach to empathize and feel the customers’ and end users’ experiences including desires, needs and problems. And their external and internal interests and differences. As a result, new insights and new opportunities can be identified. Empathy can be articulated just as ABB did in cooperation with Link design when creating 1:1 scale prototype of the Azipod maintenance room in order to study the experience of the service employee who maintains it. (Product Manager, 2012)

**Systemic** Systemic refers to a multi-dimensional system that cannot work without any of its small parts, like a human body which is dependent on all the organs in order to ensure the trouble-free performance of the entire system.

Generative - Generative refers to the ability for continuous testing and generation of ideas. Foresighted simulations together with a customer feedback through iterative process help to develop a significant and innovative product. The first idea is not usually the best one and actually in my opinion there will never be a right or optimal solution.

**Collaborative** The process is open for new perspectives – also outside a company. Moreover it is influenced by active collaboration and consultation of experts beyond the person’s own area. It is the ability to work in multi-discipline teams and to understand people from different points of view. Some problems just cannot be solved by one person or a few people.

**Creative** Creativity is seeing beyond the boundaries and outside the box. It is similar to kids playing without any prejudices. It refers for quick generation
of ideas and their initial testing a.k.a. quick prototyping. It is as learning from testing and testing from learning - step by step. A creative mind doesn’t get stuck on either rational or irrational site of reasoning. It is seeing differently, with wider perspective than only the user’s need, wider than the problem itself and beyond the design brief that has been set. The complexity of the system desires open-minded thinking of possibilities. I think that a creative person can yet be creative also in uncertain situations, where surrounding factors can’t be measured or described.

I see that in order to combine and carry out all these constituents in an efficiently working design team, it requires a shared understanding and a shared vision. As mentioned the objective for this thesis is to push design thinking and design approach into a technology driven process and make it more effectual and reach better innovations.

Design driven innovation and technology driven innovation

What kind of innovation? Liem & Sanders (2012) describe a definition for design driven innovation as a manifestation: “reconstructionist or social-constructionist view of the market” where the priori is not in markets but in the interaction between consumers and companies. They continue in their description, that it becomes a task of the consumer to understand radically new meanings and values of new products in their “socio-cultural context.” I think this definition could also be relevant within the maritime industry. However, it is more related to user-centered innovation, where new innovation is centered around consumer products and considered as a social phenomenon – which the maritime industry is not.

According to Roberto Verganti, technology driven innovation “reflects the dynamics of technological research”. This means that radical technological improvement such as ABB’s launch of the initial Azipod. He writes that Design driven innovation is instead, focused on creating “breakthrough [new] meanings and product languages.” like Liem & Sanders also advocated. This kind of innovation can also be seen in the example of Nintendo’s Wii, game console which changed the entire gaming experience. Another example is when Apple created a radical new way of discovering, listening and buying music with the system and business model around the iTunes Store, application and iPod.
In a technology driven industry such as the maritime industry, design driven innovation or user-centered innovation is very uncommon, however it still exists. A good example of this, is the radical innovation of a new hull line design for OSV & PSV segment (off shore supply vessels & platform supply vessels) called X-Bow (Photo 6) created by Ulstein Design and Solutions. Competitors found it bizarre and ship captains refused to operate with it caused by its weird shapes. However, later on the design of the X-Bow was proven to be significantly more effective and more environmentally friendly solution than traditional hull designs. The X-Bow hull ensures softer operation in harsh weather conditions and enhances fuel economics. (Ulstein, 2013) The X-Bow made its way through the markets creating a radical new product language which in turn changed users' expectations and ways of thinking. This is what I call as radical new design language.

Verganti expresses three innovation strategies in the figure 9. The framework highlights that, instead of one-dimensional, only concerned in technology, companies should innovate as two-dimensional as well. “On the vertical axis technological innovation may drive incremental improvement, such as longer life of batteries, [or new functions on the product].”
On the horizontal axis the meaning of the innovation can also differ from incremental to radical. According to Verganti market-pull innovation (user-centered innovation or user-centered design) “starts with an analysis of user needs and then searches for technologies that can better satisfy them or update product languages to respond to existing trends.” It aims not to question and redefine dominant meanings but rather to better understand and satisfy them.” By doing so it “reinforces the existing socio-cultural regime” and does not lead to radical innovation. The optimal, but usually unreached level of innovation becomes true when those two dimensions, both radical innovation of technology and radical innovation of meaning overlap. This interplay is rare because with emerging new technologies companies tend to “substitute the old one and leave the existing meaning untouched” (Verganti, 2009, pp. 60-87)

**Innovation of technology and meaning**

As mentioned, in the maritime industry incremental technological improvements are daily-business. I also believe that through the use of innovative concepting, radical innovations of technology and meaning can also be achieved.

In the fact that too many times the primary criteria in the product development is cost (Product Manager, 2012) (Lead Engineer, 2012) (Researcher, 2012) it is hard to implement several of greatest solutions at the same time. Thus, I have this aspirational idea of innovation of technology and meaning. What if ABB Marine created the best propulsion product that similar has never existed in the markets before?

This could happen by combining an optimal set of the most improved incremental or even radical technological innovations into one sophisticated product. ABB Marine could then begin to develop a supply network that is able to recycle all the expensive raw materials such as copper and steel of each product, after their lifecycle has become to the end. ABB Marine would promise to buy back the products from customers, reuse and recycle the material. The cost of the material in each Azipod is significant part of the product price (Product Manager, 2012). By doing so, it would be possible to decrease the price of the overwhelming new product and increase ABB Marine’s own values improving performance, acting environmental responsibility and driving innovations. Through this new initiative, ABB Marine would create a new meaning for its customers and develop a new uncontested market space. I understand that this is merely an aspiration which would not be easy to implement. There would be a need to change their existing business and product strategy, problems would occur with the delivery of the decommissioned products and they would need to
start new platforms for material recycling. There would also be other issues due to investment cost, management, changes in ship ownerships etc. Regardless, imagine ships sailing under the flag of ABB Marine in this innovative ship owner/ownership vision.

The strength of collaboration

How to make an innovation happen? The footage by Johnson (2012) is a brilliant visual explanation of how we can generate our ideas into groundbreaking innovations that push our lives forward. He explains two patterns for innovation. The first one is called “slow hunch” meaning when greatest groundbreaking ideas almost never emerge from a moment of only a little insight or “of the stroke of inspiration” but instead they need a long time, sometimes years or even more to mature and to become useful and successful. This is what I believe is happening unconsciously in our minds. Especially when working in an innovative and encouraging environment developing new future solutions. Johnson mentions how better ideas come from the “collision of smaller hunches” forming something bigger than themselves. In the video he expresses that the greatest ideas of the history, like the World Wide Web was only a-half-an-idea in Tim Berners-Lee’s mind, he had worked on upon several projects over ten years without the full vision of the idea, until the smaller hunches that had incubated had the collision allowing the bigger combination of ideas – bigger than something of their parts. This is I believe how workers at ABB Marine have great ideas incubated over the years, but sometimes without having that “collision” to become bigger. Johnson tells about another pattern which is how hunches, developed in someone’s mind, need to bump with hunches from other peoples’ minds. This is what I am trying to achieve with my thesis – to make ideas and hunches to collide with each other’s. (Johnson, 2012)

Participatory-design and co-design

Design activities under the heading of this paragraph include working together, sharing and learning from each other’s point of view. These activities have been increasingly involved in many kind of design concepting activities and communication is the key aspect within them. These activities have also increased people’s awareness of design tools, techniques and methods mainly among non-designers that are from other than design disciplines. Säde conducted a study, which examined the application of user-centered design
methods in industrial design. In his Doctoral thesis he describes the importance of the visualizing activities in the process, and how they should be included into the process from the beginning. He discusses about how the selection of different representation techniques are required in order to fully understand the whole problem area. He claims that the “underlying purpose of producing representations is to communicate”. I see that advantage of participatory-design and other related activities is similar – to improve the communication within a process. I think in many occasions, using participatory-design is the best way to gain a wide perspective and understanding of a design problem. As Säde proposed, this kind of activity is the fastest way to create a wide-range of possible opportunities, whilst enhancing the communication within and visual representation of them. (2001, pp. 49-53)

Participatory design is mainly used to engage and involve people from different backgrounds and experiences for new industrial design, product development, service design and architecture. Generally participatory-design aims to develop a product or a service together with potential end-users. Due to Liem and Sanders (2012) in participatory design project designer and/or researcher can be viewed with two opposing mindsets (figure 10).

A designer working in a team as expert seeing others as subjects i.e. users – an activity that I consider as Co-design. On the other hand a designer characterized with a participatory mindset, designing with people seeing

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**Figure 10. Two opposing mindsets.**

- **DESIGN-LED**
  - DESIGN-LED WITH EXPERT MINDSET
  - DESIGN-LED WITH PARTICIPATORY MINDSET

- **EXPERT MINDSET**
  - users seen as subjects

- **PARTICIPATORY MINDSET**
  - users seen as partners

- **RESEARCH-LED**
  - RESEARCH-LED WITH EXPERT MINDSET
  - RESEARCH-LED WITH PARTICIPATORY MINDSET

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ref.: Liem & Sanders 2012, re-drawn
them as expert users. This can be a definition of participatory design in my opinion. My aim and perspective in the research conducted for the thesis, was a bit different. I used participatory design approaches with experts from their respective areas in product design within the maritime industry – experts that are not the end users. I saw myself having a participatory mindset in a design team that uses methods similar to co-design. Therefore participatory-design is not an important focus in this thesis but because of its influence on developing inspirational and interacting methods and toolkits, I have used those methods to support a creative concepting within the design team.

### Generative and traditional design space

Where to make it happen? Sanders (2010) introduced the theory of generative and traditional design spaces. The theory shows how people using creative methods and tools, can generate ideas which break the border between traditional and creative design space, allowing people to create more possibilities and choices affecting the Fuzzy front end.

Sanders represents two different design spaces with shapes (figure 11). Generative design space: a round shape which contains areas of stuff-and-stories from left to right and making-and-telling from bottom to up. It is a space where people can be more creative using the correct tools to open their perspective towards making-and-telling. I imagine it as a space that people can
achieve using creative tools and aspirational thinking, fore-casting – predicting the future. Another shape presented is a rectangle; representing traditional design space where people normally tell stories and make stuff. This is what I call a space of rational thinking and approach where the practice is based on back-casting – something that has been made and proven possible in the past. In the representation she used black dots as stepping stones representing, amazing stuff that can be done and amazing wishes that can be made for the future. These shapes were then set on top of each other, to represent looking beyond the traditional design space using generative design tools when telling stories of futures and creating stuff that reveals dreams and aspirations. In this way they showed how to bridge the gap between generative and traditional design space. As far as we have located the stepping stones, the gap between those spaces is connected and the fuzzy front end will change. (Sanders, 2010)

I believe that this theory, if put into practice with the right methods, would offer the better premise of various ideas that can help to envision and achieve a wider perspective for the concept development. This simple model encourages design teams to achieve more using creative methods in spite of individuals’ backgrounds.

**Physical design space**

There are many theories and descriptions of physical design spaces used in the literature as well as many examples of different cooperative and participatory design activities within those spaces. However, it was not my focus to introduce them in this thesis, but rather to learn about setting up the concepting facility. Kelley & Littman remind us that “innovation need a place to flourish and grow. A place where team can meet, discuss findings, hash out prototypes, and present their work” (2006, p. 210) One theory that I find interesting, was introduced by Sanders and Westerlund at the Nordic Design Research Conference, in Helsinki (2011). In their article for the Conference; Experiencing, exploring and experimenting in and with co-design spaces, they had an example where a group of researchers, PhD students from different departments at Linnaeus University participated in a workshop situated in the front end of the design process. In the workshop they aimed to create a Design Space that “refers to at least three quite different definitions or interpretations” 1 The experienced physical space, as practical space where and with which design work takes a place including right physical materials and tools. 2 The current work, which includes different aspects and some proposals of the work that has been currently made or is on at the time. 3 The future situation that allows participants to imagine and create something what is located in the future. (Sanders & Westerlund, 2011)
I find this method remarkable because it seems to be different from the traditional, rational and repetitious methods used in technology-driven processes. I thought that for the CX project, these three “spaces” can offer a different workshop experience. I think that jumping between different spaces can break routines and make people to think differently, or at least challenge them to think outside the work they usually do.

Sanders and Westerlund write that there are many different co-design approaches that have been tested and explored, all having problems that tend to happen when people are not experienced in design. They continue that normally, “too much time is spent on early idea” and that the process lacks the exploration of alternative possibilities. They also mention problems with people thinking that they are not having enough knowledge for creating new ideas. Third problem occurs when participants do not feel that they are creative enough for this kind of activity. (Sanders & Westerlund, 2011)

I thought that participation in a process that uses design methods may cause these problems also at ABB Marine. It is difficult to say which would be the right theory and method to use. When, “as in so many cases in the history, research and reality are facing the result is a case by case result”. This was mentioned by Vaajakallio when she defended her doctoral dissertation. She pointed out that there is no method existing that would put meaningful theory into reality without many cases of testing. (Vaajakallio, 2012)

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**Deficient process models**

This research focused on the process. Former studies about design and product development processes show that some key features define the “state-of-the-art” in modern processes, but usually processes are unique and set even similar firms apart. Therefore it may be risky or insufficient to compare those unique processes of different companies. (DesignCouncil, 2007) (Leppänen, et al., 2006) There are plenty of different kinds of models where the flow of concepting in a product development process can be viewed. In-depth processes are not usually public. Depending on this and the significant nature of the maritime industry, I did not see any case studies of other companies processes necessary in this thesis. Instead, I studied processes on general level and used existing process from ABB Marine as a case study.

Process models include the divergent phase where some amounts of ideas are generated and the convergent phase where selection of ideas is done following
some decided criteria. The idea of the models is that each phase of the concept generation should lead to some solution that can be reviewed and researched further in proceeding steps. In concepting, a common example that is often used is the waterfall model Figure 12 (Keinonen, et al., 2004, p. 11) where the output of a preceding phase serves as an input for the next phase.

A similar model of the activity in a process of creating choices and making choices is depicted in figure 13 (Brown, 2009, p. 67). In this model new options emerge and in a certain point of the process the choices and elimination of options need to be done. An advanced version of this, is the double diamond model (figure 14), which was developed through the qualitative in-depth research by Design Council UK, which illustrated how leading global companies manage design in their businesses. The double diamond model is a simple graphic that describes the general design process. It contains four phases mapping the divergent and convergent thinking of designers within a process; discover, define, develop and deliver. (DesignCouncil, 2007)

Generic activities in the product concepting is well described by Takala, et al. (2006, p. 60) There are three layers which make up the generic activities.
First, the background research where the information of the technology and market need is gathered to meet the business strategy. According to Takala and al., “background research explores wide range of possibilities to identify opportunities.” This can help to create a driving vision for a concept creation or can help reinforce an existing one. I think that the driving vision can develop and change during the concept generation, which is the 2nd layer of their description. Concept generation allows to look at the opportunities (identified in the first layer) from different perspectives and to create solutions that can produce new guidelines for decision makers. The 3rd layer is the concept evaluation where solutions are reviewed in the light of these new perspectives. In this phase concepts are benchmarked against other concepts or existing products and the objectives are created for the product development. This description is similar to the double diamond model excluding the delivery stage portion which includes final testing and approval to launch the product to the market. In concepting I consider the delivery stage a phase where concepts can be communicated to the customers and managers, starting the feedback loop. The stage where project targets are redefined and concepts are finalized, before specification engineering and possible product development could start.

Ulrich & Eppinger (2004, p. 23) show an example of three different product development process models in the main front-end, including different functions and activities (figure 15). The first example shows a generic process,
the second is a process with many iterative cycles before production and
the third is a complex process including parallel designs and tests and their
integration.

In my opinion projects in ABB Marine could follow a model similar to
aforementioned waterfall model, double diamond model, a generic model
of conceiving with three layers and model of the three different product
development process models that includes the activities.

I understand that the above discussed models and activities in them are
merely general descriptions and frameworks of different phases of a process.
Many similar process models define the whole product development process
in the same way and do not provide any guidance in practice. Models do not
present activities or expected outcomes during the process. Therefore companies
use these kinds of models as a base structure when creating their own unique
process models, trusting that they will give them more specific information of,
how the concept development should be done – as efficiently as possible.

1 GENERIC PRODUCT DEVELOPMENT PROCESS

2 SPIRAL PRODUCT DEVELOPMENT MODEL

3 COMPLEX SYSTEMS DEVELOPMENT PROCESS

Figure 15. Process flow diagrams for three product development processes.
R&D project within ABB marine can be expressed with a similar model. In figure 16, business and product strategies define new R&D projects, which depending of its budget is followed by either mini gate-model or extended Gate model. The gate process model, where a gate is a decision point in a project and where achieved results are evaluated from a business and strategic point of view. In a gate, a project is reassessed to determine whether to continue the project or not. The gate assessment is done by the project team to ensure that all the relevant information is available, enabling a decision to be made at the gate-meeting, its purpose is to confirm and not to analyze. Any analysis and review should be done prior to the meeting with a so called, Steering Committee, that consists of business managers and other experts. (ABB, 2012)

My own understanding of the Gates and phases are shown in Figure 17. This thesis work focused on the concepting in the early phase of the product development process which in Gate model tends to happen during gates 0, 1 and 2. (ABB, 2012)
Gate 0 (G0) is the agreement to start. It initiates the rough benefit and feasibility evaluation. G1 is the agreement of scope. Alternatives are investigated and requirements are base-lined to form the basis for planning. A first prioritization on requirements have been done, that will fit to the time plan and total project costs (EAC) and available resources. G2 is the agreement to start the project execution. It marks the agreement on requirements, concepts, design, project plan and resources. The focus from G2 to G3 is on specification of functions and architecture. (ABB, 2012)

Figure 17.
Gate process model.
The Practice section brings the theories and methodologies in practice. A reader will gain an understanding of how the research and the parallel concepting process pave the way for the forthcoming result. It encloses the research part of the thesis. This chapter also includes the majority of the research for the thesis.
As a part of the master’s thesis I organized and managed five concepting workshops for variety of teams in the Azipod CX-project. As mentioned before, ABB occasionally uses design consultants to organize and manage concepting workshops. However the workshops at ABB Marine are mainly carried out using traditional ideation methods, such as brainstorming, where ideas are generated and shared in groups, rather than ideating individually. (Product Manager, 2012)

The schedule of the Azipod CX-project was tight. The team consisting of engineers with various expertises and one industrial designer had already conducted some ideation sessions. They had brainstormed ideas and this time they went through them (what some of them called concepts) and developed criteria in order to be able to evaluate the ideas. I was allowed to participate in the first evaluation session as an observer. The session was dealing with mechanism inside the steering unit, such as sealing and bearings, etc.

Takala, et al., discuss that the evaluation of concepts is one of the most critical steps in a process. It is obvious to agree with them that the goal of the evaluation is “to make a decision on whether to discontinue the concept, further iterate the concept or start to utilize the concept.” At this time in CX-project, it was about the two first mentioned. Takala, et al., also mention that the, “lack of accurate information makes evaluation difficult.” With user-centered product concepts, testing can complement the evaluation, but generally there is no accurate quantitative data or good results for qualitative evaluation. According to them one of the most used evaluation methods, is the scoring method which is also referred as value analysis. The scoring method is a good and clear way to have a documentation showing the evaluation result. They also propose that this scoring method is typically used best when evaluating concepts that are on a phase that is “relatively long way into the specification process.” (2006, p. 67)

Takala, et al., describe that evaluation should have a variety of experts involved in order to get a wide-ranging view. In my experience, there was variety of engineers participating in the evaluation. Like Takala, et al. mention I think that including multiple areas of backgrounds and expertise, should be present in the evaluation, but with cases requiring the special expertise of technological matters, it may be better that only people who understand the case should be involved. According to them criteria should be available for everyone and it should be easy to understand. (2006, pp. 69-72)

In the evaluation the criterion was based on required features of the product such as simplicity, manufacturability, easy assembly, maintainability, reliability,
flexibility, availability (including suppliers overseas and delivery time), space requirements (considering maintaining), ABB’s own know-how, technical credibility, amount of planning, initial cost and life cycle cost. They evaluated each idea giving pros and cons, comparing features with the previous Azipod C. Later on the results were calculated on a table, summarizing the evaluation. It worked as ranking of those pros and cons as losses and wins versus the older product. Then the ideas having the most endorsement by the evaluation team were highlighted.

These criteria may be appropriate for this kind of evaluation but I also saw many problems with it. It has been mentioned that it is difficult to produce quantitative information from concepts, because important criteria such as “technical feasibility and the ability to satisfy user needs can be evaluated only roughly.” (Takala, et al., 2006, p. 68)

I found this evaluation a bit confusing because there were ideas and sub-concepts evaluated by the same criterion. In my opinion ideas that together, develop a minor part of the whole targeted objective can be called sub-concepts. If they are merely separate ideas without compatibility with other ideas, they are just ideas. I think it is unnecessary to compare ideas so precisely in this phase of concepting. For me it was too difficult to recognize the real value of each sub-concept and idea, because they were either expressed through very basic visuals or rarely had any explanation. I did not understand the reason for this evaluation, but I think all the evaluators did.

What I noticed was that some of the criteria was contradicting each other. For example, measuring simplicity can have many different meanings. It can for instance include at least, manufacturability, easy assembly, maintainability, flexibility, initial cost and also life time cost. Some of the criteria may have exactly the same meaning for an evaluator or they could be combined somehow, such as simplicity, manufacturability, easy assembly, maintainability and flexibility. Finally, there was not and perhaps cannot be a person who is able to measure the weight of each of the criteria compared. The participants with different backgrounds and knowledge in the meeting evaluated ideas and sub-concepts by their common sense, which generated a perspective view for the result. However, because of many of the criteria were overlapping and there were relatively large amount of the criteria, the findings cannot be neither qualitative nor quantitative.

I thought about this evaluation that it must be common in technology-driven projects. (ABB, 2012) It follows the approach based on rational and linear thinking. Perhaps, this evaluation is a continuation of the three specific functions of each modules developed within the previous Azipod product.
Nevertheless, considering the designed module platform for manufacturing processes and logistics, this evaluation and approach started to sound more reasonable to me as well.

When it came to organization of concept workshops for the other parts of the product, I was asked to continue from the stage. After the evaluation session I thought about the project and realized that concepting was already divided into parts. Basically the product ideation was divided in several pieces and the product development team started to find an appropriate solution for one part at the time. I do not say that this approach would be wrong, but I felt that it was lacking something to connect the parts. I think that there was no shared understanding and no shared vision of what we were designing. I desired something which could meet the project objectives and be something concrete for the team to discuss about. Tim Brown mentions (2009, p. 9) that “linear thinking is about sequences” and definitely I started to think how to connect these sequences and create the whole concept.

**Workshop 1, meeting room, Vuosaari**

As planned, the first concepting workshop that I organized focused the upper parts of the Azipod; Slip ring unit and Steering drive. In essence these parts make up the steering module which steers the Azipod, allowing ships to maneuver.

Keinonen notes (2006, p. 46) “concept design teams are expected to propose solutions that goes beyond day-to-day engineering problem-solving”. This is ultimately the reason why some companies leave the company premises and do concepting elsewhere. He continues in saying, that by “Putting a physical distance between the team and their desks makes it easier for them to leave disruptions behind and focus on creative work”. I think that this is dependent on a company, a project and a design team. I am able to be most creative despite the place or time, for example when being tired, during leisure walking or when travelling by train. However, surely I agree that a creative venue can nurture creativity. Kelley & Littman write about building up a design space that they call an innovation lab. They suggest that a space should not be too small, to allow for good group presentations. They also state that wall space should be left for all the creative work and rooms with rules such as, “no tape on the painted surfaces” should be avoided (2006, pp. 210-211).

For this concepting workshop we stayed in the Marine House. The venue was a meeting room for 25 persons. (Photos 7 and 8) The meeting room may not be the most optimal space for concepting, but it was suitable as it was our first design space. As Sanders and Westerlund emphasize (2011), design space
requires room with many free walls for paper and stuff to be pinned up, and tables and chairs should be possible to move and place freely.

There were 11 engineers with different backgrounds and one industrial designer participating in the workshop. I planned the workshop in a way that in the beginning I could introduce myself and point out to the team the reason why I have jumped into the project and why I am managing these workshops. I also wanted to explain the objectives of the concepting, not only to solve one present problem, but also to have a chance to achieve something else as well for instance: creating choices and decisions to go ahead, patents, to increase team spirit, collaboration with customers, to gather future ideas and spin offs to the idea bank and future projects, but most importantly to break old routines. Something similar to what Brown and Conklin had suggested and advocated, to think bigger and to build the shared understanding of what we really need to get done.

The goal setting for the workshop was hard, due to the lack of my own knowledge of the product and it was also the first time in my life that I was tasked to manage such a workshop. Although I have been using quite many design methods in my personal projects, during my studies and other design positions in the past. Objectives of the workshop were supposed to include many ship segments with a wide range of power classifications, which made it a really broad area to cover with concepts.

In order to break routines and make participants to think “outside the box” I reminded them of our creativity and how we are able to think outside our comfort zone just like Brown, Keinonen and other authors advocated earlier. (Appendix 1. Agenda fot the day)

In the beginning of the workshop I showed Steven Johnson’s video clip: Where good ideas come from. Then I lectured about generative design space as presented by Sanders (both introduced in the theory section).

The workshop followed similar method to the design space by Sanders and Westerlund, with these three different definitions. I used them as past, current
The workshop also comprised methods of Tuplatiimi (English Double team) the trademark by Innotiimi Oy. This approach is similar to the nominal group technique for problem solving and decision making in different sized groups but has added working in teams of two. (Nikkanen, 2012) (Wikipedia, 2012)

The name Double team was established when Innotiimi conducted a research of what is the most effective amount of team members in a group for an ideation process. (Innotiimi, no date) The result showed that teams of two were most effective. The Double team follows the basic structure of analysis, ideation and solution. Its main function is to divide these two different stages in the solution development process; the divergent ideation stage and the convergent thinking and finding solutions. Double team enables the interaction between the participant’s interior and exterior world. Criticism should be avoided in the early phase of the solution creation and the cross-evaluation, where participants vote for the solution of others using post-it papers with the rule that only one vote can be given to own idea. When all the solutions are visible on the wall, hierarchies between individuals are blocked and the possible solution is highlighted as a common view of a problem. (Luomi, 2008)

When sending the invitation for the workshop, I asked participants to create five proposals of what they are currently working on and what could be their best solution at the time. All the ideas were put on the wall of the room and after each participants presentations I asked them to select the ideas that already exist and set them to the left side of the wall where I marked them as the past. We also thought of other solutions from the past such as how ships used to move in the past, etc. The ideas that stayed in the middle were somewhat possible to realize already today, thus I marked them as the current. (Photos 9 and 10)

After gaining a little insight about the past and conducted a review on the current, we jumped into the future. Participants worked in teams creating future ideas and presented them to others. Teams shared their ideas, and then the next task was to find the way into the future of other groups. The task was to think of what e.g. technological improvement or social phenomenon should happen, in order to make other team’s future idea possible. (Photos 11 and 12) I then asked participants to rethink the current again, individually. They worked in pairs for their final ideas which were presented to the others. (Photo 13) For the evaluation of concepts we used a method familiar from the Double team where all the teams had five post-it papers that can be given to others, as points. But the rule was that only one point can be given for one’s own work. (Photo 14)
Findings and results of the concepting

In order to understand how well I was understood in setting the tasks for the workshop and how it went, I made a questionnaire. As Sanders and Westerlund urge (Sanders & Westerlund, 2011) it is better to make questions very simple and straightforward in order to get answers from all participants. I then analyzed the answers. (Example of answers - Appendix 2)

**What worked?**

Some people liked the new experience, some praised the open atmosphere and lively, new kind of approach in the process. Due to some answers, the workshop was effective; especially working in pairs was successful. I also received compliments for the well-organized workshop. Almost everybody was pleased about the amount of ideas.

**What did not work?**

The workshop’s goal setting was unclear. People did not have a clear understanding of what we were doing. Some people said that the approach was too wide. We spent too much time in thinking about futuristic ideas instead of concentrating in the “real” and ideation shouldn’t take a whole day. For
some participants it was unclear, were we refining the ideas we already had or creating something totally new? Some participants answered that many of the ideas had been pointed out many times earlier.

**Did we achieve our goals?**

Most of the people answered that yes we did. Some participants pointed out that several of the ideas were new solutions for the familiar and already solved problem. Three of eleven participants were not sure about this. One person asked: “what was the goal for the workshop?”

**Suggestions on next steps and other thoughts?**

In the beginning of the workshop pros and cons of existing products should be briefly reviewed as a reference. The next step could be the iteration of the ideas and evaluation of them with project leaders or a smaller core team, and then showing the results to the team. Some people asked for more detailed ideation. It was also proposed that another group workshop should be organized to solve better defined problem. It was mentioned that ideation session should be quicker. It should also be considered what has been done in previous product development projects. The session could be a bit more formal and the results should be made public (internally in ABB Marine).

I think that I was not clear enough in the beginning when explaining the design spaces, the aim of the workshop and concepting in general. I also think that there was too much new information presented and discussed. The feedback supplements my thoughts, that concepting workshops should be organized within the broad understanding of the project. This requires a deep understanding of formerly done concept workshops and products. It demonstrates the demand for the ABB Marine’s Idea bank which is developed by the Solutions Development team. Similar concepting methods as we used in the workshop should also be used when creating a solution for a more specific and defined problem. I also agree that the results should be showed internally within the company. (We got some 30 ideas and 9 sub-concepts)

After the concepting I was not sure about the next steps regarding this thesis. Some of the ideas were little details of parts that I couldn’t recognize or was not sure about. Some of them considered many parts of the product – some of them were ideas, some were sub-concepts.

I heard that the team’s earlier concepting workshops had dealt with the same area of the product, than with the workshop I held and some members of the team said that even though the workshop was something different they had already given all they have.
After analyzing the questionnaires I realized that the next concepting session will be even more complicated. In my opinion, it seemed that the project had already drifted too far apart. I thought that the ideas that we got from the first concepting were separated ideas and from the forthcoming workshop we may get separated ideas again. For me it seemed like we had already created whole concepts and now we were solving the specific details within them – but we had not. Instead, in my opinion we had ideas and sub-concepts, just like rational and linear process usually has in this phase of the project. It seemed to be, that some details were already under development when I did not see much of the possible outcome.

I talked about this with my designer colleague and he supported my thoughts that the project was going too far already and it was hard to include a design perspective for it anymore. In order to use typical design methods that may differ from typical process in the Marine house the process needed some amendment. I was encouraged to talk with my supervisor.

**Change by Design**

My supervisor is a sympathetic man and he has a positive view towards design. I explained my concerns about the process, which in my opinion was going on without the shared understanding and vision of the possible outcome. I composed this visual (photo 15) helping to explain how contradicting the process was in my point of view.

I felt that we did not collectively understand the big picture. The visual expresses how I saw the process already divided into small parts. It was broken up into smaller problems that the team was solving separately. I pointed out
my perspective on how we should see the problem as a whole and create whole concepts to cover the problem. Concepts that could shift to something else or combine with other concepts during the process – at least something to give us guidance and something to discuss further. From this meeting my supervisor decided that we will take a step back and examine the so called big picture. With the project leader he convinced the team with this solution to step back and we decided that in the next concepting workshop we will try to create a shared understanding and start from the beginning with methods that are usually used in design processes. However we had many ideas and sub-concepts already evaluated and they could be carried on for the latter phases of the concept development.

**Step back achieving the big picture**

For the second concepting workshop there were a few changes in the team, electrical and mechanical engineers participated in the 10 person workshop.

I felt that the thesis research was too pre-defined. At the time I was not confident about theories and methods I was supposed to use in this particular project. During the initial few weeks I read a lot of the literature mentioned in earlier chapters and tried to make sense of what could be worthwhile to use in practice. I found it challenging to use methods in the project where they possibly wouldn’t fit – I thought. Basically, the project had been running for a while and it seemed that some decisions and selections had been made. It was as if I wanted to create some concepts with the design team and the team seemed to be already solving problems of smaller details.

In the workshop I wanted to use IDEO Method cards, the collection of 51 cards that demonstrate design teams how and when they could be used in the project. The IDEO card deck works as a research tool that can be used in different ways, when the goal is to understand and solve the problem of a project. I wanted to use these cards in order to help us to find the big picture.

(Ideo, no date)

I found it problematic to use the method cards because the problem was so precisely defined. I have used several methods similar to IDEO cards in previous service design projects, and in works and studies in user-centered design processes, creating mind-maps, personas and storyboards. I thought that the IDEO method cards were valuable when starting a design process of a new product, service or business. These cards could also be put into use when
managers or team leaders are outlining project objectives. In this case I did not find many of the cards suitable for the project. On the one hand the project’s targets and objectives were precisely defined and it was really hard to make them match with the cards which require a project that has not yet begun. On the other hand, the solutions existed already and as I understood, the aim was to create a next generation of them, but something which I considered as update – i.e. it was an incremental innovation that the project was aiming for.

The workshop was organized to help us in finding new ideas for the strut module and motor modules. Additional pressure was added, to ensure an appropriate outcome was developed, this meant that I started to ponder whether or not I should organize the workshop only for showing methods, that are not normally used within the maritime processes. Methods that consider empathy and understanding of customers and the end users. It seemed that the team thought we knew and understood them already and now it would be a time for looking for more specific technological solutions in the ideas we already had.

In order to use IDEO method cards at this point they needed some sorting. Together with my design colleague we went through the cards so that we could sort out the ones that could be beneficial. In the end we found only a few methods that were relevant. (Photo 16)

I gathered some confidence and insight prior to the workshop, through a discussing with the project leader. I asked him what we were going to achieve from this workshop. In order to keep the day’s agenda consistent, I also wanted to create a design brief. This meant that I wanted to simplify the existing project plan including, objectives such as market needs, product family requirements, target ship segments, cost requirements, etc.
I explained to the project leader that I believed that there was too much and too detailed information to handle in one workshop and I wanted to make it simple at first. I wanted to build the first steps for shared understanding of what we are doing. After the previous workshop, I was pretty sure that we had not achieved it yet. Eventually the project leader gave me the opportunity to create the design brief – of course to follow the original project plan.

After the discussions I went through the method cards again and I came to an understanding that I cannot obey them literally, which is not the purpose either I guess. So I customized the methods a bit, I incorporated methods from service design and user-centered design such as, system mapping and scenario creation. I made some little additions on the methods to make them match with the brief.

**The Brief**

As mentioned in the theory chapter concepting starts from different types of objectives, depending on the expected result by the management. According to Keinonen, concepts created as part of a larger product development initiative are reflected by objectives and restrictions of the project. He writes that it is possible to start a concept development without a well-defined project plan, but normally it happens with companies that are looking for new opportunities. (Keinonen, 2006) I see that a project plan defines and confines the outcome. Well-defined project plans reflect a company’s strategy but can also restrict concepting. Afterwards I understood that if the well-defined project plan does not include a vision of the possible radical innovation it only leads to incremental innovation.

I understand that in this kind of product development process it is important to get started and the progress done before the next phase, as planned. However, in my opinion a simple design brief works as a next step for the shared understanding and shared vision in concepting. As Keinonen discusses about the brief, which does not have to be too precisely obeyed, the brief which can be redefined during the concepting. (2006)

Keinonen writes that Intermediate results can be presented but usually concepting project will end by “producing something which very little was known at the beginning”. I see that this should be one of the core ideas of concepting. According to him “A concept design team operating at the fuzzy front end is a difficult unit to manage and control.” He reinforces my point of view saying that a typical process should start with a loose brief, which will be redefined during the process when the team reformulates the goals, questions and adjusts the methods in the process. Keinonen adds that “the nature of
design problem-solving and the needs of control and management do not make a good combination”. I think that this could be fixed if a team, concepting in the fuzzy front end included members of management. (2006, p. 49)

I agree with Keinonen in that the project plan gives the management and the customer, confidence and security of how the project resources will be used during the process and what can be expected as the result. For the team the plan can be a guidance of what is expected, but it should not restrict the creativity too much. As Keinonen clarifies “a plan created before the project has really started can hardly be expected to anticipate the challenges and opportunities that the work reveals.” In my opinion in the very beginning it can be harmful to get stuck in the plan when it should only provide a loose framework for something that is aimed to be designed in the later stages of the process. Keinonen strengthens my opinion saying: “Sticking in the plan when the opportunities lie elsewhere is obviously a mistake”. Of course I understand that usually when the cost is one of the major criterions, the most traditional solution easily ends up to the product development. Therefore a simple but loose and influential design brief helps to achieve the most outstanding ideas. (Keinonen, 2006, pp. 49-52)

In the official project plan there were specifications of the competitors’ products, prices and performance covering all the segments and power ranges from the markets we were aiming to address. Classifications and specifications of the targeted price were at such a detailed level that understanding and carrying it on during concepting in my opinion is impossible and perhaps unnecessary. I think that it may form constraints that can limit potential concepts. In this point I tried to carry on only the key points regarding what was wanted by the management, customers and other stakeholders and let them create loose constraints for the brief.

According to Brown “the willing and even enthusiastic acceptance of competing constraints is the foundation of design thinking.” The first stage of a design process should be about discovering the constraints that are important and establishing a framework for evaluating them. “These constraints can be best visualized in terms of three overlapping criteria of successful ideas; Feasibility: what is functionally possible, viability: what is likely to become part of the business and desirability: what makes sense to people, what people desire” (figure 18). “This pursuit of peaceful coexistence does not imply that all constraints are created equal; a given project may be driven disproportionately by technology, budget, or a volatile mix of human factors.” Brown writes that different types of organizations may emphasize one of them as more important than the rest. I found that these three overlapping constraints were a simple
way to show the design team what are the main criteria and need that the team is confronting in the project. (Brown, 2009, pp. 18-20) I used these constraints in order to simplify the design brief to fit in those three constraints

**Playfulness**

Brown mentions in his presentation (Brown, no date), about a very important aspect in the concepting process - playfulness. Concepting should be open and relaxing but also well organized and productive; however I have noticed that sometimes people find it awkward to participate in group work. Particularly from my own experience, activities such as drawing, acting and singing can be the most shameful things to do in public. In the video, Brown gives 30 seconds for the audience to draw the face of a person sitting next to each other. After a few seconds the audience starts laughing. Brown explains that it was expected and the laughing is caused by the artist’s shame he or she feels when the portrait is shown to their partner. In this kind of a situation we should learn from children. A child expresses a drawing proudly, believing it is an exact a-look-like. They do not let anything constrain playfulness and creativity, whether it comes to drawing or playing around with the stuff that was not designed for it. I implemented the same tactic in the beginning of the workshop as an “icebreaker” - it worked.

Next we used the IDEO method, the Five why’s. I asked the participants, why are we doing this? The trick is that whatever the answer is, the question why is repeated again for five or as many times you think it is necessary. Doing so participants have to think pretty profoundly and it is a good way to ensure that the team has the same motive and goal in the workshop. (Photo 17)
Know your customers

In the beginning of the workshop the product manager told us about expectations and perspectives from our customers. He had visited some ship design agencies and shipyards in Norway and gave us very interesting insights and a review of the real need in the market. He showed us a video made by a customer, where a vessel operates in adverse weather conditions. This was a really important eye-opener because I think that understanding the customers’ needs and the real situation of the use of the product are the key elements, in regards to the big picture.

Group work - scenarios & stakeholders

In groups we created scenarios and stakeholder maps for understanding the other stakeholders; ship design offices, ship-owners, operators, shipyards and different equipment suppliers within the project. (photo 18) Scenarios are commonly used in design research and user centered design to present early concepts. According to Keinonen (2006, p. 52) scenarios are used in concept design in the early phase to stimulate and characterize the concept objectives. Especially in service design user scenarios are commonly used. Together with service blue prints, stakeholder maps, customer journeys, storyboards and storytelling designers can enact, visualize and communicate the design intention, problem and the solution. (Strachan, 2011)

In the workshop we discussed and went through all the stakeholders that are connected in this project. It helped us to create an understanding of their objectives, and hence widened our own perspective. We described the stakeholders and connections between them and used a combination of
scenario and the IDEO method, Be your customer. The process helped us to communicate and test the essence of a design from a customer’s point of view.

Concepting in pairs

Next we used the IDEO method cards for clarifying the working principles and how the Azipod system functions. We used Card Sort, which is similar to system mapping in service design and a good method to reveal expectations and priorities of a product. Flow Analysis, is a method that helps us to open bottlenecks and find new functional opportunities. It represents the flow of the information and activity through all phases of the Azipod system. (photos 19 and 20)

After we used Error Analysis, which is a quick method to list all the things that can go wrong and determine the various possible causes. It is “a good way to understand how design features mitigate or contribute to inevitable human errors and other failures” On separate cards, teams named all the features, functions and attributes matching with ship segments and targets. Then participants in small teams organized the cards spatially in ways that make sense and fit the brief. (i.e. I asked them to construct as many concept frames as possible) According to the IDEO method cards, this helps us to expose a team’s mental models of a system/product. (Ideo, ei pvm) (Photos 21 and 22)

The last method the team used was called paper prototyping which Kelley calls: “thinking with your hands”. (Brown, ei pvm) Similar to what Säde (2001, p. 50) writes, prototypes “answer to a specific question or a set of questions or perform another kind of task”. Prototyping is an inexpensive and quick way to sketch and put up the concept in order to test design functions, interactions
and shapes. I see that in many cases a particular issue can be tested and demonstrated quicker and more effectively by prototyping than when using CAD or calculating it. Teams worked in pairs and prototyped models using steel wire, foil, tape, paper and cardboard resulting in very good prototypes of concepts and sub-concepts (photos 23-30). I agree with Säde that basic visual design is a good way to compare alternatives and hence helpful in the evaluation.
Evaluation of gut feeling

I was not able to get the contradicting first evaluation out of my mind. I found it too complex for the workshop I organized. I thought that evaluation results from the day’s concept generation could be used, as a visual tag to give some insights of the “gut feeling”, the immediate feeling or reaction that participants had during the evaluation. A visual mark could give an idea of the impressions participants had in the workshop, for the people who re-evaluate the concepts later.

I decided to develop a rough evaluation method inspired by those three constraints that I used for the design brief. I made this evaluation method, presented in figure 19, which we used with the three constraints as criteria. All teams had 6 points to give for others’ ideas as they wish and the aggregate average of each criterion formed the visual tag. I called it Snowflake, because each snowflake is unique and the objective for concepting should always be finding the ideal one. Depending on the amount and weight of each criterion it is possible to add a coefficient to them. In the figure 20, there is an example of Snowflake, where the orange lined hexagonal, is the ambition and the blue figure is the actual tag of the evaluation.
Results of the 2nd workshop

I used the simple questionnaire (Appendix 3), (which worked very well in the first workshop) for collecting the feedback. Although the answers for the question: why are we doing this, which was asked in the beginning of the concepting were relevant, they were also different. I wanted to emphasize the question and asked it again in the questionnaire after the workshop.

Why were we doing this?

All the answers were fairly similar to each other’s, although I asked five whys, before I went through the agenda of the workshop. The answers were mainly pointing out what we were achieving, the understanding of the market needs and new fresh ideas in order to match the demand with an improved propulsion product. Two participants answered that we were looking for the shared understanding.

What worked?

In general, participants were happy about the workshop. Two participants answered that the briefing was good and two of them said that everything worked. All the methods, but more specifically the scenario/customer journey method was appreciated the most. Also some participants found the proto making and the flow analysis efficient and useful.

What did not work?

Some people answered that prototyping took too much time and gave relatively less new ideas. Contrary to the above mentioned answer, some answered that they did not have enough time for the prototyping method. Generally there should have been more time given or a more flexible schedule planned. Some participants answered that it would have been more beneficial to concentrate more in error analysis and flow analysis, and some found those two methods did not work at all. Two participants found the concepts that were developed during the day too similar to each other’s.

Did we achieve something?

Generally answers showed that we achieved good ideas for further development. Especially, clarification of the user needs and the big picture were achieved. Participants found the new approach and new methods relevant and a refreshing addition for the process.
Suggestions on next steps and other thoughts

Ideas and concepts should be evaluated, ranking them against the project targets. A smaller group could develop ideas further to more detailed and then select the best ideas to continue in the process. Limitations of the design and of the previously developed concepts and ideas should be presented in the beginning of the workshop. This kind of session should be quicker and organized more often. One answered that “The methods should be more practical and ideas should be more realistic in order to implement them in practice.” One wrote “great session, well managed!”

In my opinion we brought the shared understanding onto a level that was not achieved previously. The big picture became clearer – at least with most of the participants. Personally I am surprised how well the workshop went and how suitable the methods actually were. Next time I would not try that many methods during a one day workshop and I surely agree that the prototyping method requires more time than we had (one hour). Regardless, it seemed to influence the team and was apparently refreshing. This kind of prototyping is very useful for testing ideas in practice and a good way to increase team spirit – even though this time it was more like testing the method itself.

It is difficult to notice if some teams are working on similar ideas or concepts during concepting, and even if they were working on similar concepts, it could be harmful to interrupt the process. This could also limit creativity during the workshop. One possible solution for this could be to make teams discuss more about their ideas during the prototyping and perhaps the results might get better. I also got the feeling that the Error analysis and Flow analysis could contribute more than they did this time. I also realized that although I tried to make the introduction of the methods very clear and simple, it really was not so. The Introduction needs to be clearer.

For me this workshop gave lots of new insights into the project and I really started to feel that design methods can affect the process. The 3 overlapping criteria worked pretty well and I thought that it could be used later on, giving a simple visual grade and insight of the evaluation set by thoughts of the team in the end of the workshop. We managed to create 10 sub-concepts and around 10 new ideas -more or less useful.

Examples of scenarios appendix

A little notion, in the first workshop we used A4-size papers. This time we tried A3-size. It came up that the team drew small drawings on A3-size papers and used the whole area of A4.
The team was changed a little bit again. There were ten participants, nine engineers and one industrial designer. I used Brown’s model of creating and making choices to support my own view of how to take the process forward. I think that the rational mindset follows a similar model. In the figure 21, every subsequent iteration is less broad and more detailed than the previous ones. I think that in the fuzzy front end the team can create as many solutions and possibilities as possible and we could continue doing so until the schedule or other limitation set by management stops it. In the project we were creating new choices of two specific areas within the product; cooling system and the frame structure.

Figure 21. Subsequent iterations.

each subsequent iteration less broad and more detailed than the previous ones
Shuffle discussion & double team

This workshop was only three hours long, so I decided to use the double team method together with a method called Shuffle discussion. It has one rule: to create a preliminary concept. I changed this rule. Instead of a preliminary concept we wanted to create more ideas and preliminary sub-concepts.

The name for the Shuffle discussion comes from the shuffling of participants between groups. A person from each team joins into another group. The group explains the concept to the new participants, the new person then asks questions and gives advice. Also a concept presenter can be substituted in every loop, in a session. Then the sent person keeps visiting all the groups and eventually returns to the home team. During the shuffle the ideas and concepts are shared, explained and redefined many times. (Satoshi, 2009) (photos 31 and 32)

I thought that the Shuffle discussion can work well together with the Double team method which was also experienced earlier. This time we also used the method, part of the Double team, called “lypsytekniikka” (Eng. milking technique) which reflects a multi staged presentations and regeneration of ideas and cross-evaluation ensuring qualitative and quantitative relationship with solution proposals. (Luomi, 2008) (Nikkanen, 2012)

In the end of the workshop we also tested a concept grouping method which I have modified from the Nominal group technique, which allows more discussions of reasons for choices made and creation of hybrid ideas – combinations of two or more ideas. (Wikipedia, 2012)

Together we discussed about the concepts and found similarities between them. We grouped and named each group by an understandable name based on appearance or function. In the end we had groups of sub-concepts such as; “fan”, “liquid” and “braces”. We used the cross-evaluation from the Double-team discussed above. In addition
my supervisor proposed that we could give one different colored post-it vote only by cost- criteria. It came pretty clear that the best ideas, ideas that got the most votes, were not the cheapest. (Photo 33), (Questionnaire - Appendix 4)

Results of the 3rd workshop
The questionnaire from the first and second workshop worked well so I didn’t want to change it.

What worked?
Almost every participant found the workshop successful - especially the combination of the methods. The team found the workshop consistent and well scheduled. They found it also very fruitful and it was mentioned a few times that it resulted in many good ideas.

What did not work?
Some people didn’t find concept grouping meaningful. Although the workshop was well scheduled, eight of the nine participants answered that there was not enough time for the Shuffle discussion. There was no time to properly visualize the ideas during the Shuffle discussion.

Did we achieve our set goals?
During the workshop we achieved good ideas for the cooling but not generated that many for the strut. Two participants asked for more focus on modularity. Some participants were worried about the similarity of the ideas that we got. Considering the project objectives, especially cost criteria, there was not that much use for the ideas we got.

Suggestions on next steps and other thoughts?
There should be more time and more of this kind of concepting sessions. Also hydrodynamics engineers should participate in this phase. Methods were good and they should be developed in this way. Further development and evaluation of ideas should be done in a smaller group – ten persons groups are too large. There should be a new concepting session considering the frame. There should also be more focus on cost and production methods. There is also need for more detailed concepting – also in groups not only in pairs. The concepts should be made clear and should be collaborated with the customer.

In my opinion this workshop was the most consistent and clearest so far – even if the schedule was tight. Double team and Shuffle discussion proved to
be a really good combination and I would definitely use it again. I agree that the timing for shuffle was clearly not enough. I gave the groups only five-to-seven minutes for each shuffle and it should have been around 15 minutes at least. I also admit that I had some problems managing the shuffling. There wasn’t any certain rule for how the shuffle circulated. I didn’t pay attention and in one point, there was the same sent person in a team that was already visited. I also changed the visiting pair in the middle of the concepting because I wanted, that both members of pairs would explain the own concept and cooperate with the others’. Some people liked this exchange and some people did not.

I did not find the ideas and concepts too far away from the project targets, maybe because I don’t have the understanding of the technology- and the production price. Nonetheless, I found it important that the used methods really started constructive discussion. I even noticed some passion and real dedication in the discussion when some pairs started to draw new ideas during the Shuffle. It opened new doors for the product development process. In addition, after the “milking technique” we got the idea that gained most of the votes in the post-it evaluation in the end.

We generated 30 ideas and sub-concepts for further evaluation.
Design consultant agency

As a quite felicitous coincidence I had a chance to participate in a two days concepting training at a design consultancy. I was allowed to join a team of 10 lead engineers from different departments that are responsible for the development of the bigger Azipod products. At the same time I got a chance to learn how a professional design consultant operates. The agency has over 10 years’ experience of concept design in a wide range of big companies in different industries. (Photo 34)

The two day agenda included, learning of different kind of design methods, such as function analysis; benchmarking which is used to compare a target of the concepting with existing products from other fields and morphologic analysis which refers to exploring multidimensional solutions in problem solving.

The concepting followed the basic flow from problem definition to idea generation and concept evaluation and selection. In the very beginning I realized that concepting and the various methods can also function for the concepting of smaller details. This answers also the demand that was pointed out in the feedback I had received from the workshops in the CX-project.

As a pre-work assignment we all ideated 10 different ideas for the case which was given by a supervisor of our team. It seemed to be a good premise for concepting. Sometimes with cases similar to this, quantity is better than quality. When most of the around 100 ideas that we had were useless, some people may think that it would be better to concentrate in quality instead. The consultant explained that if there were only three ideas required, then we had some 30 ideas in total but many of them being similar to each other’s, probably the same
first ideas that comes up to minds. One of the greatest chemist in history, Linus Pauling, has said “to have a good idea, you must have lots of ideas”. Of course ideation of ten ideas takes more time than the ideation of three. Now we came up with some 40 different good ideas (and 60 pointless and alike.)

It became clear that working methods between different people differ a lot. Some people need more time to think about a possible solution. Some people are pleased to start sketching and prototyping ideas immediately. I prefer to have some time to progress ideas and then I start generating them. I suppose that for this kind of an assignment, which requires workers’ spare time, it is better to give a week or more if possible. This time we were allowed to use one hour of working time for the homework.

I had a few concerns with regards to the workshops, I had previously organized. I see that when it comes to details the experience of the concepting organizer, leader and the concept design team are very crucial. Considering this, generally multidisciplinary teams with wider perspective to the problem, gives the best result in the earliest phases of a product concepting process. This should happen in the phase where the project objectives, vision and the focus are defined. When it comes to the smallest details it is reasonable that both the concepting organizer and the team have a deep understanding of the system or of the product they are concepting. I think that this is the thin line between concepting and product development.

When concepting with the consultant continued further, we also tested a method called, classification-tree, similar to flow analysis and system-mapping used in service design. (Photo 35) It is a good method to visualize and/or name all the factors and their connections when considering the whole system. In this case when we were thinking about the whole Azipod system, the task became really complicated. Using the method showed us that this kind of task requires very deep understanding of the system which requires a special knowledge and
experiment with the product. The other thing what occurred when using the classification-tree, is that it demonstrated to the team that the system worked as it was designed and the biggest problem was not in the system but more in acts set by classification department in the industry. (Those may change over years.) The system worked as it was designed but did not match with new classifications. In this case it was clear that reaching the big picture of the system would be too difficult to compose without a team of multi-expertise, of mechanical engineers, electronic engineers and software engineers. In risky product development processes it is essential to have all the aspects and perspectives taken into account.

Some wicked problems cannot be solved by random multidisciplinary or multi-expertise teams, which do not have a proper understanding of the problem. This two day concepting workshop taught me that some cases really do require an absolute understanding and comprehensive knowledge of the targeted goal. Nonetheless, it was also showed that sometimes it is also beneficial to have some people without an understanding (that was me) of the project in the team.

The homework assignment, requiring 10 ideas, was successful and the amount of required ideas could be even more. When presenting individual ideas it popped up that it is better to have an interaction between the presenter and the team. It was mentioned that it is hard to add anything to another’s notebook, and easier to extend the drawing made by someone else on a whiteboard, for example.

Concepting works best when it is crucial to perceive an understanding of the whole picture. This demands the expertise outside the design field. It requires both rational and aspirational thinking. There might be unexpected problems that can be changed to match to opportunities: Sometimes the problem can be situated somewhere else other than in a certain product. Can we design something other than the system as planned? Can we change people’s attitudes or activities? Can we change classifications and acts, or can we create new meaning for them?

Within one task we were looking for a simpler or smarter solution for the existing Flow cover which is a replaceable cover enabling the replacement or maintenance of the Steering sealing from below the ship hull. It was pointed out that we couldn’t find any simpler solution until someone asked something related to the fact that if there is nothing to make it simpler, could we then add something? Another person added his idea onto it and eventually, we achieved a solution for a problem – a solution which can be produced using the waste material from the production.
Internal and external communication

I was lucky to participate in the first rough concept evaluation. Before it I went through all the ideas and sub-concepts we had in that phase. In total, there were around 70 of them. I redrew some of the ideas that were unclearly expressed. In the evaluation together with the team leaders we printed them on A4-sized papers and put them on the walls of a meeting room. (Photo 36) Then the project leader and the lead engineer reviewed the concepts and roughly selected the best ones for the further development and evaluation. It was time to start thinking how to communicate the concepts?

Loughborough Design School has created the taxonomy of design representations called ID cards (Photo 37) to support communication and understanding of a new product development process. (Loughborough, 2013) The cards name and describe the categories of every representation during the industrial design process. Those are useful, especially for non-designers to understand the differences between the representations. I agree with Takala, et al., who state that ideas developed in the early phase of concepting, such as brainstorming can be expressed with simple visuals or short phrases. ID cards call these, Idea sketches or study sketches. I think that the same level
is appropriate for expressing all the ideas from early concepting workshops where the number of ideas can be relatively high. They continue that later in the process when the ideas are more defined and detailed, concepts can be presented by creating physical or computer aided 3D models. (2006, p. 65) ID cards name physical models as functional, operational and appearance models, and 3D models as Presentation renderings or Technical illustrations. (Loughborough, 2013)

From my experience in user-centered and service design processes use-scenarios and storyboards are a good way to express concepts. So are they when representing anything connected to use, usability, ergonomic and experience. These are the activities where design is generally involved in product development processes, closer or included in the product development phase. In my opinion, this kind of activities should be involved in the concepting but unfortunately in the CX-project they were not in focus yet. As I understood they are normally considered in later stages of the process where more accurate details of technological and mechanical solutions, including structures and engineered systems are defined and decided in a certain level. Although I wanted to, unfortunately due to the schedule and the objectives for this thesis I could not include those activities in the thesis.

In a product development process such as the CX-project where the product is as large as a building, appropriate representation of concept is normally made by visuals and scale models. According to Säde (2001) good representations of concepts provide a common language for participants from many backgrounds. In my opinion this common language supports the development of the shared vision and understanding as well. I agree with Takala & al. who write that the consistent and clear presentation is an essential part of concept development. Even if concept presentation is only a rough version of the targeted future product its fundamental characteristics are evidential. (2006, p. 64)

In this particular project I was still missing the first representation of the possible outcome. Some of the product development team had a rough vision of what kind of product we were designing, considering its features and technological requirements but from my point of view there was no common understanding of the message the product is going to deliver to the customers in the market? How does ABB Marine wanted to be represented? I think this is also the area where design takes part. In my opinion design language communicates the significance and uniqueness of the outcome. Examples of this can be a distinctive form, as French watch company Bell&Ross has done
with watches and Porsche with cars; color that some companies have renowned, as mobile network operator Orange and Ferrari; meaning as Apple has done with iPod and Volvo when launching the very first three-point seat belt; use of material like knife manufacturer Global; or even a use of a company’s name as Virgin Airlines has done; or a sound a device makes or the car door leaves when you close it. In my opinion, design language is crucial when communicating a product identity and image outside the company but it can also help in the general communication internally. I clearly see that this aspect needs to be considered already within concepting of a new product or business because it can bear the shared understanding and vision.

**Internal communication**

I was not sure how to communicate the outcome. I still desired to create holistic views of the concepts that we had generated. But because of the large amount of sub concepts and variations in them, I did not know where to start. In my opinion we were still missing the shared vision and because of this, it seemed to be obvious to divide the product in sub-concepts. Engineers were searching for new solutions to convince and match the project plan. I was suffering of not having a clear whole vision of the outcome.

With the project leaders we basically started to collect all the sub-concepts and the alternatives of each module and their technological features. I created the first rough poster of the collection (Photo 38) in order to have all ideas arranged by their position and function within the product. Later on, team leaders used the poster as a check list to define the next tasks in the project i.e. what have we got and which sub-concepts are in need for further research.

Within some sub-concepts there were detailed CAD-drawings made by mechanical engineers. This was crucial in order to clear up and determine the
compatibility and dimensions. For understandable internal communication it was already noticed by team leaders that technical drawings are too detailed and not the best way to communicate the concepts for a variety of experts from other fields. Together with my designer colleague we created a concept leaflet (Photo 39) that simply represented all the variety of sub-concepts. Sub-concepts were categorized by their function and each sub-concept had a descriptive name. The leaflet also included the ship segment where they fit in together, along with most important explanatory sentences. Team leaders used the leaflet for the internal communication e.g. with management, marketers and the steering committee.

External communication

We were aiming to visit some customers, ship design companies in Norway. The plan was to present our new concepts for them in order to get feedback and insights – i.e. to test our concepts in the early phase before the specification engineering and product development could start. This collaboration with customers is really valuable in this stage of the project, where relatively cheap changes on the concepts can be done and perhaps the collaboration gives some perspective that can even change the objectives of the project. I see that this kind of collaboration and feedback loop should happen both internally and externally. As mentioned in the design thinking constituents; the process should be open for new perspectives and influenced by active collaboration. By emphasizing and feeling the customers’ and end users’ needs and problems, new insights and opportunities can be identified.

I really enjoyed having an opportunity to participate in the trip. It became clear that I had a chance to be in responsible for creating the presentation material, but at the same time I was able to be there witnessing the first impression of customers, regarding our concepts. The feedback in looks and gestures that cannot be captured ever after.

It was also sure that the presentation and external communication would be handled by neat visuals, either sketches or renderings, but for me it was not completely sure that what are we going to present there? Among the lack of the shared vision that I felt in the project we were still lacking the design language. We were not absolutely aware of the message we wanted to deliver with our products? For me and my design colleague, the image of how we wanted to be represented and how we wanted to be differentiated from competitors was unclear.

Forms of the products are mainly dictated by hydrodynamics and the laws of physics. From the design perspective the aesthetics of the form is not the only aspect, as engineers often think. Besides the technological solutions it covers
many other critical aspects such as structure, modularity, manufacturability, maintenance, etc. The aspects that were already roughly considered by the engineers, but in my opinion it was not completely thought through, that the concepts will create the first impression for the customer. Some of the marketers were aware of that and they desired more attractive products that are obviously easier to sell.

ABB Marine has measured and tested the hydrodynamics with different kinds of methods such as physical model tests and virtual CFD (Computational fluid dynamics) to solve and analyze numerous problems occurring from the interaction of fluid flow and surfaces. The existing products are hydrodynamic, but in my opinion, they cannot be the optimal and the only solution. I desired for more testing and experiencing.

Likely, this desire by this thesis project, and the continuous notation of the importance of industrial design by me and my design colleague affected the CX-project. Eventually those aspects began to be considered as a possible advantage – at least in a small group within the team. Together with my design colleague we created some visuals showing how little changes can make a difference on the visual appearance (Photo 40). This fostered a conversation within the Solutions Development team and we started to go through the values and mission statements of ABB. From my point of view, a product should represent what is promised by the company and soon it became clear that this aspect was not too clearly thought through in the project. I think it was also a part of the missing shared vision.

In order to clarify to our team the design language what we wanted to use, we needed to determine it for ourselves. Together with my design colleague we created three different design cues that we used for, so called value matrixes.
and a method called positioning which became familiar to me at Swinburne University in Melbourne. (Engeler Newbury, 2011) Figure 22, shows an example of positioning that we made using some car brands in order to show the idea to the management. Eventually there were four members from the management level participating in the practice: Business Manager, Brand Manager, Product Manager and Project Manager. Together we were able to position our existing and the forthcoming product beside competitors’ offerings and search for the shared understanding of how we wanted new products to be represented in the future markets. This was a good example of multidisciplinary and collaborative work. (photo 41)
Together with the project leader and product manager we went through all the sub-concepts that we wanted to present for several ship design companies in Norway. We agreed to have concepts that fulfilled the project objectives with a wide range of power values. From my experience sometimes when a concept, or a design language of a concept, is something totally new and radical to be represented for the first time, it may be appropriate to have realistic, even photorealistic 3D renderings in order to make it understandable and to more credible. In some occasions it is also expected. Normally photorealistic 3D renderings are used when the outcome is more developed and detailed, as mentioned by Takala et al., earlier.

Loughborough ID cards mention that “rendering contains high level of realism to fully define product appearance [and is] particularly useful for decision making by non-designers.” This time I proposed to have visuals that were not too realistic. This view was supported by the project leader and product manager’s experience. By the nature of the meetings in Norway it was better to have informative sketches that effectively communicate the product features and are easier to comment from the customers’ side, instead of showing too realistic visualizations of the products, that do not exist yet. An example of the informative sketch of a random concept that I made is visible in the figure 23. According to the Project manager sketches can nurture the discussion in the meetings. (2013)

The meetings in Norway were also a chance for me and the design colleague to test (only little) changes in the product appearance in order to make our
concepts represent a more congruent product family. That was partly made according to the results of formerly used method positioning. Based on those results I composed a questionnaire which with we could gain insights of our customers’ immediate feeling and the first impression that is perceived of the presentation and the concepts. (photo 42) To be honest, from my point of view it was obviously too late for any bigger changes on the product’s appearance in that phase. Some technological decisions defined the product appearance too much and as usual, design language was meant to be added to the product in the very end of the process or it was not supposed to be considered at all.

We had four meetings with customers in Norway. For me it was a good opportunity to be involved and get the real experience of the external collaboration. These kinds of meetings are not only about the customer relationships and communication but vital for sharing ideas and making them to meet market needs together with customers. With some of the solutions we hit the ”bulls eye” and answered the demand or solved an existing problem. With some solutions there were some concerns that have to be reconsidered in the project before the product development begins.

Nevertheless we gained a lot of good feedback and insights that will be crucial for the further concept- and product development. All the customers considered our CX-concepts as one product family and our own expectations from positioning were not too far away from customers’ impressions. We also had a great discussion of the latter future R&D collaboration with a customer. Photo 42.

Questionnaire, opposing criteria, for example non reliable – reliable.
Prototyping and model making at Design Factory

Because of effective 3D-modelling softwares, and their analyzing features, methods such as prototyping and model making do not get enough notations in today’s processes. Method Paper prototyping was only slightly tested, in the second workshop and in my opinion it could have been taken into more consideration.

A smart friend of mine once listened to my explanation, related to prototyping which is quite often used among designers. He compared it to how new things develop in the nature, such as new species of flora and fauna, and how they generate new ways of living, existing and surviving. With this kind of complex “systems” it is about consequences and the matter of continuous generation and testing. I believe that there are things, that we are not able to measure, and we cannot always assume something by relying to what has been done or proved earlier. We also have to forecast and seek for something that does not exist.

I think that there are aspects such as construction alternatives and aesthetics that you cannot test or figure out so easily by virtual simulations. My supervisor has experienced the advantages of prototyping. He suggested that if I could come up with some idea of this kind of activity we could add this opportunity onto my thesis. Immediately I contacted Aalto Design Factory (ADF) which is open for companies and with its workshops, it provides extremely appropriate facilities for such activity. The ADF welcomed us, and I organized one day idea generation, where we could experience model making and prototyping methods.

I named the day’s agenda as “generating the next big idea” – related to ship propulsion. The plan was to start thinking about something which is totally new. There were the Solutions Development team and a Lead Hydrodynamics Engineer participating. The Lead engineer’s participation was really valuable, as it helped to preserve a connection to the reality and feasibility of the product. He had a wide understanding and background related to hydrodynamics. In the beginning of the workshop he gave us a short introduction to the principles of hydrodynamics, the laws of physics and the evolution of ship propulsion, similar historical analysis is also one of the IDEO-methods. (Ideo, no date)

I continued with the method that can be considered as benchmarking. I showed examples of nature from birds to whales. I also showed examples from other fields such as aerodynamics of formula1 and airplanes (Appendix 5. Benchmarking - workshop 5). None of these examples have been created by a sudden stroke of inspiration but instead they have needed a long time to mature and generate to become successful – continuous prototyping for so
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called “eureka-moment”. Prototyping and model making, is what Kelley called “thinking with your hands” is in my opinion the best way to get creative. It is the way to experience and examine, the way to learn from children, like Brown suggested and the way that enables those small hunches and ideas that have incubated in our heads to form something bigger, like Johnson proposed.

After a small ideation session we moved to the workshop and had a small but rich introduction for the secrets of model making and prototyping by ADF staff. Together and individually we generated and prototyped visions of the future that we could examine already today. The day at Design Factory was really productive and fruitful. (Photos 43-48, pages 94-95) I have to mention that two invention that were created led to invention disclosure.

One other consequence during the project was that there was another student working on his Master’s thesis, related to open collaboration facility providers, such as Design Factory. He interviewed me and ABB Marine’s Product Manager regarding to our experiences and interests towards such activities. After the meeting it came out that the concept generation like we had in Design Factory could be a habit for ABB Marine in the future.

There were a few more concepting sessions organized for the more detailed parts. Several experts participated in those sessions. I participated into one of those as an observer. In the workshop, regarding the Slip ring unit I ended up visualizing ideas by others. On the level of ideation I had nothing to offer –perhaps only those “stupid” questions. It was an honour for me, when I was asked to give some tips for suitable concepting methods for an engineer colleague who organized this three hour workshop. I recommended the combination of Double team and Shuffle discussion.

In the project, engineers analyzed and conducted the research of possible technological solutions. Also the criterion was clarified. Generally they had an unbelievably good understanding of the required components, performance, loads, manufacturing solutions and the product construction related to the cost.
The Result chapter incorporates a proposal for the sponsoring party based on the findings and insights gained in the three previous chapters.
To summarize; the research included the organizing and managing of three concepting workshops with the R&D team, one with the extended Solutions Development team and one with the management. It took part in concepting training at a design consultant agency, and also participated in few rough evaluation loops and one specific evaluation with project leaders. The research also included the development of concept presentation material for, both internal and external use, and a trip to Norway for customer meetings and collaboration. Due to the confidentiality I can not evaluate or show complete results of the CX-project. However, it was not the purpose and I am glad that I got the change to conduct the research within it.

I was aware that there are differences between the perspectives. I also assumed so when I formulized the hypothesis in the very beginning of the thesis. This research made these differences facts to me.

As previously mentioned, both approaches have similar goals and there also exists similar opinions and thinking. Both approaches are also equally creative in their unique way when using the right tools. It is difficult to express the differences of those two approaches in a process model form, because they are similar to each other’s. It is apparent that there are similarities, to top-down and bottom-up descriptions in them, and differences, as dividing them in analytical-logical and interpretative-intuitive mindsets as was proposed earlier. The process itself from both perspectives includes almost the same content, however these may pop up in different ways and in different stages within the project. I have listed all the activities within both approaches (figure 24, page 102-103), according to my experiences and findings from the CX-project. These lists are not the optimal solutions and factors in them can vary depending on a process. The concepting process is always unique and some factors get more emphasis, case by case.

But there are three entirely differing factors within those two approaches. Those occur in the building of the big picture and vision. The lists of activities and those differences that impinge on the big picture and vision are showed in the same figure 24. Examples of these differences were clearly emerged in the process. Within the concepting workshop we stepped away from the conventional technology driven process and started to develop the big picture after I explained the different approach, that enhanced the process leading us closer to the shared understanding. The use of the design brief showed, that the process does need the design perspective to simplify the objectives and re-brief the team. In the end of the process it became clear that the design language should have been carried on with the early concepts and it is complicated to be added afterwards.
The rational, technology driven approach has a strictly defined plan. This leads to problem division and to a vision which is created by the made solutions during the process. In the rational approach, the design language is established in the very end. The process does not have as clear big picture as it should. Big picture develops during the process. The process may have a vision but it is not shared one, until the concepting process comes to the end, when all the possible solutions and matters have been tested and the insight has been gained. However, this technology driven approach leads to feasible concepts.

The aspirational design approach shapes the big picture and the loose vision including the design language in the beginning of the project. Doing so, it establishes the communication in the project and gives it a loose and flexible plan. Nevertheless it holds the better understanding of the desired outcome. By re-briefing the team the shared understanding and the vision is clarified and carried on. Solutions made reinforce both, the shared understanding and vision. It provides a better premise for what should be done in the latter stages of the process. Reflecting upon the cover picture of this thesis; all the trees do not have to cut down in order to getting there. The result (the right direction) can be seen before, which simultaneously cut-down the number of work as well. Therefore the resources and time can be used for something else in the project, making it more effective.

The problem with the aspirational design approach, instead is, that only with the vision it does not have the sufficient knowledge for the right solutions in order to achieve the consistent end within the process. It cranes for a groundbreaking radical new solutions but it is lacking capabilities for specific problem solving, which is the field of engineering. It is crucial to have the means and tools to execute and accomplish the vision.

For me it is pretty clear that this design perspective can be one element to improve the concepting process in the Maritime industry. Inspired by the above mentioned findings I composed these two progress circles (figure 25, page 104-105) where the differences of those two perspectives can be seen. There are three colors; gray, blue and orange representing phases of planning, generation and specification, in the concepting process. It can be seen that processes are different and the aspirational design approach does not reach the end.

Regarding those findings I composed a model that I call, the New Joint Concepting Model, which incorporates the both equally important perspectives. (Figure 26, page 106-107) I believe that the proposal also visualizes the importance of a design perspective for the process in the maritime industry, also time-wise. In doing so, it answers the demand that
was showed in the Intro chapter (where projects cumulatively prolong time and resource wise.) I claim that with the clear big picture in the beginning of the process, it is easier to select the right solutions in the concepting, and hence to make it easier to focus on what is really relevant to choose and go with in the process.

The findings show that the concepting process should start using design methods with participants from the management level involving perspective from as many areas of expertise as possible. Also customers’ perspective and partners’ competences should be recognized and considered in the very beginning. The meetings in Norway reinforced the opportunities and advantages of the external collaboration. Their contribution, even in the earlier phase, would be invaluable and could save R&D team from conducting extra work.

Earliest workshops with multidisciplinary teams, helps to create the shared vision if it does not exist in the beginning. It is crucial to develop a rough shared understanding and shared vision in the beginning of the concepting phase, because that is when it matters most. If they are achieved only in the end of the process it does not improve the outcome.

Within the very first concepting sessions the design language should be developed to match with the strategic positioning, building the basis for the shared understanding. Design language which can be a form or another unique matter, such as new meaning, should be clarified as early as possible. In my opinion a smaller group of experts should be in responsible for creating the early representations of the vision (expected outcome). A significant design language can inspire a whole forthcoming concepting project and helps in the communication and finding of the shared understanding of the desired outcome. As I previously stated, in this particular project it became clear in the end that the design language should have been carried on with the early concepts and it was complicated or even impossible to be added afterwards.

After the earliest loops, where the shared vision is achieved, the process can be shifted to the product design team which enables the vision to come true.

Concepting is the phase where design methods, collaboration between different departments and outside the company, improve team skills, team spirit and customer relationships. Concepting is the phase where design language, shared vision, design brief and design criteria together create the big picture that helps ideas and concepts to generate in shared understanding.

The New Joint Concepting Model incorporates all the objectives of concepting whether it is regarding concepting for product development, expectation management, competence or innovation.
Posters 1, 2 and 3 include a flow of the New Joint Concepting Model where each phase of concepting is presented. This design perspective does not exclude the technology or any other perspective, however it works as an example of how a design approach can be taken into consideration in the maritime industry. With this proposal for ABB Marine, I map all the important stages of concepting, pointing out; what is the outcome of each phase, what could be the relevant method to use and who should participate in order to achieve the big picture and hold the vision in shared understanding.
Figure 24.
The list of activities in the process.

ASPIRATIONAL DESIGN APPROACH

BUSINESS & PRODUCT STRATEGY
MARKET STUDY
ENVIRONMENTAL & SOCIETAL ASPECTS
OWN COMPETENCES
STRATEGIC POSITIONING
IDENTIFICATION OF CUSTOMER NEEDS
UNDERSTANDING THE CUSTOMER
UNDERSTANDING THE FINAL USE
PARTNERS COMPETENCES
DESIGN LANGUAGE
DESIGN BRIEF
TECHNOLOGICAL OPPORTUNITIES
EXPLORATION OF NEW MATERIALS
NEW PRODUCTION METHODS
INFORMATION TECHNOLOGIES
IDEA/CONCEPT GENERATIONS
IDEA/CONCEPT EVALUATIONS
IDEA/CONCEPT SELECTIONS
USABILITY & ERGONOMICS
SPECIFICATION DESIGN
FINAL REPRESENTATION

A. BIG PICTURE AND DESIGN LANGUAGE CREATED IN THE BEGINNING OF THE PROCESS
REINFORCE THE COMMUNICATION AND THE SHARED UNDERSTANDING

B. SOLUTIONS REINFORCE AND RE-FORM THE VISION

C. LOOSE PLAN WITH RE-BRIEFING
RATIONAL TECHNOLOGY APPROACH

BUSINESS AND PRODUCT STRATEGY
ENVIRONMENT AND SOCIETY
IDENTIFICATION OF CUSTOMER NEEDS
PROJECT PLAN
DIMENSIONAL TARGETS
PRELIMINARY LOADS
MARKET STUDY
EXPLORATION OF NEW MATERIALS
NEW PRODUCTION METHODS
NEW TECHNOLOGICAL OPPORTUNITIES
OWN COMPETENCES
INFORMATION TECHNOLOGIES
IDEA/CONCEPT GENERATIONS
SPECIFICATION ENGINEERING BEGINS
IDEA/CONCEPT EVALUATIONS
IDEA/CONCEPT SELECTIONS
USABILITY & ERGONOMICS
SPECIFICATION ENGINEERING
DESIGN LANGUAGE
FINAL REPRESENTATION

C. STRICT / WELL DEFINED PLAN

B. PROBLEM DIVISION AND SOLUTIONS
BUILD THE VISION

A. DESIGN LANGUAGE CREATED IN THE END OF THE PROCESS
ASPIRATIONAL DESIGN APPROACH

Figure 25. Two progress circles.

note: great vision but project remains unfinished, goals are not met
note: lack of big picture and shared vision prolongs the generation-phase
Figure 26. The New Joint Concepting Model.

**PARTICIPATORS**
MANAGERS & DESIGN TEAM & EXPERTS
CUSTOMER & PARTNER COLLABORATION

**OUTCOME**
DESIGN LANGUAGE
STRATEGIC POSITION vs COMPETITORS
LOOSE PROJECT PLAN
VISION

**PARTICIPATORS**
EXPERT TEAMWORK
CUSTOMER & PARTNER COLLABORATION

**OUTCOME**
INFORMATIVE SKETCHES
RENDERINGS, TECHNICAL DRAWINGS
3D SCALE MODELS, COMPLETED PLAN
THE NEW JOINT CONCEPTING MODEL

PARTICIPANTS
MULTIDISCIPLINARY TEAMWORK
STUDENT & PARTNER COLLABORATION
SPIN OFFS, PATENTS, TEAM SPIRIT

OUTCOME
INCUBATED PROJECT EXPECTATIONS & PLAN
OUTCOME: SKETCHES, PROTOTYPES, SPIN OFFS, PATENTS, TEAM SPIRIT

TIME SPAN / PROGRESS
start
goal

TECHNOLOGICAL REQUIREMENTS
MAINTENANCE AND SERVICE
USABILITY
IDEA/CONCEPT SELECTIONS
IDEA/CONCEPT EVALUATIONS
IDEA/CONCEPT GENERATIONS
INFORMATION TECHNOLOGIES
EXPLORATION OF PRODUCTION METHODS
NEW TECHNOLOGICAL OPPORTUNITIES
PROJECT PLAN REVIEW
DESIGN BRIEF
DESIGN LANGUAGE
PARTNERS’ COMPETENCES

OUTCOME
DESIGN LANGUAGE
STRATEGIC POSITION vs COMPETITORS
LOOSE PROJECT PLAN
VISION
PARTICIPATORS
EXPERT TEAMWORK
CUSTOMER & PARTNER COLLABORATION
OUTCOME
OUTCOME: SKETCHES, PROTOTYPES, INCUBATED PROJECT EXPECTATIONS & PLAN
SPIN OFFS, PATENTS, TEAM SPIRIT

THE NEW JOINT CONCEPTING MODEL

OWN COM
PETENCE
STRATEGIC POSITION
MARKET STUDY
IDENTIFICATION OF CUSTOMER NEEDS
UNDERSTANDING THE FINAL DESIGN LANGUAGE
PARTNERS’ COMPETENCES
DESIGN BRIEF
DESIGN LANGUAGE
NEW TECHNOLOGICAL OPPORTUNITIES
PROJECT PLAN REVIEW
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IDEA/CONCEPT GENERATIONS
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INFORMATION TECHNOLOGIES
EXPLORATION OF PRODUCTION METHODS
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THE NEW JOINT CONCEPTING MODEL

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IDEA/CONCEPT EVALUATIONS
IDEA/CONCEPT GENERATIONS
INFORMATION TECHNOLOGIES
EXPLORATION OF PRODUCTION METHODS
INFORMATION TECHNOLOGIES
EXPLORATION OF PRODUCTION METHODS
NEW TECHNOLOGICAL OPPORTUNITIES
PROJECT PLAN REVIEW
DESIGN BRIEF
DESIGN LANGUAGE
PARTNERS’ COMPETENCES
THE NEW JOINT CONCEPTING MODEL

The Bulk of Demand
- Generated by the global economy
- Influenced by the composition of the world fleet
- Market requirements
- The need for products and equipment

Market Study and Identification of Customer Needs
- Internal communication barriers
- Strategies, experts

New Concepting Begins
- Strategic positioning
  - The basis for the shared understanding
- Identification of product brand
  - Competitor offerings
  - Management experts

Vision
- Own competencies
  - Realization of own know-how
  - Continuously improving
- Multi-domain concept
  - Conceptual design
  - Multi-team collaboration

Achieving Big Picture
- Understanding the customer
  - Direct, visual, and communicate
  - The design intervention and the outcome
  - Multi-disciplinary teams
  - Customer collaboration

Shared Vision
- Design language
  - Design language
  - Design language

Partner's Competencies
- Recognition of collaborators
- Vision
- Multi-disciplinary teams
  - Multi-domain concept

Project Plan Review
- Design language
- Design language
- Design language
PRELIMINARY EXPECTATIONS AND MEASURMENTS OF PERFORMANCE AND LOADS (EXPERTS)

CONSIDERATION OF NEW INFORMATION TECHNOLOGIES - CRUCIAL FOR STAYING UP TO DATE (MULTIDISCIPLINARY TEAMWORK)

CONCEPT GENERATION - TO SUPPORT ORGANIZATIONAL MEMORY - CHALLENGE WORLDviews WITH OTHERS' POINT OF VIEW - DEFINE AND CREATE MAIN OUTLIERS FOR THE PROJECT - BASE FOR FURTHER DECISIONS (MULTIDISCIPLINARY TEAMWORK)

USABILITY AND ECONOMICS (EXPERT TEAMWORK)
- COLLECTING THE INITIAL DATA REQUIRES MULTIDISCIPLINARY TEAMWORK

REVIEW ON TECHNOLOGICAL REQUIREMENTS (EXPERT TEAMWORK)

INCUBATED PROJECT EXPECTATIONS

NEW TECHNOLOGICAL OPPORTUNITIES - FEATURES, FUNCTIONS, ATTRIBUTES (MULTIDISCIPLINARY TEAMWORK)

EXPLORATION OF MATERIALS AND PRODUCTION METHODS - RAW MATERIAL PRICE - PRODUCTION COST (MULTIDISCIPLINARY TEAMWORK)

CONCEPT SELECTION - DISCONTINUE OR ITERATE FURTHER - ROUGH SELECTION (MANAGERS AND EXPERTS)

CONCEPT EVALUATION - PARTICIPANTS IMMEDIATE FEELING (VARIETY OF EXPERTs INVOLVED)

IDEA AND CONCEPT RE-EVALUATION (MANAGERS AND EXPERTS)

MANTENANCE AND SERVICE - CONSIDER INTEGRATION OF DESIGN FEATURES INTO EXISTING HARDWARE AND OTHER FAILURES (EXPERT TEAMWORK)
- COLLECTING THE INITIAL DATA REQUIRES CLOSE COLLABORATION WITH PRODUCTION AND SERVICE DEPARTMENTS

PRE-PRODUCTION, DEVELOPMENT, SUB-CONCEPT P Butters

METHODS, VALUE ANALYSIS
Redefinition of project targets

Specification design
- Specify forms and functions (expert teamwork)

Representation of concepts
- To communicate and understand (expert teamwork)

Specification
- Model making, informative sketches

Time

Feedback loops with customers
- Face to face meetings
  - Vital for sharing ideas and meeting market needs (managers and experts)

Redefinition of concepts, and project targets (managers, experts)

Completed plan and completed concepts

3D scale model, renderings, informative sketches

Final representation
- To communicate (expert teamwork)

Product development begins

Demand and need from target customers responded

Strengthened business and product strategy

Innovations

Spin off projects

Patents

1st March, 2012

12th March, 2013
The Conclusion chapter concludes the thesis work and analysis.
What could have been done differently?
Was the research question properly addressed?
What are the next steps?
How could the results be implemented?
Firstly, when I think about the project and workshops that I organized, I understand that I was too much in haste in testing all the possible methods and simultaneously focusing in creating new radical solutions. During the process I was able to come up with some unprecedented ideas, but those were not completely suitable in this project, so I should have focused only on the research.

Secondly, I did not calm down to follow the findings from the questionnaire of each workshop. I concentrated more on the thesis. This may have been unfavorable for the CX-project. However, I think that my contribution, including the conventional design work, such as “stupid questions” and visualization of the concepts, was appreciated.

One problem or a weakness in my work was that I could not manage all the data from the workshops, such as ideas on a large number of papers. It will need more research or further development of this thesis for collecting all the answers and ideas in an appropriate way. The existing idea bank in ABB Marine is not sufficient for it. I had an idea of a method bank, that could support this kind of activities in an organization. As mentioned, all the processes are unique and it is hard to say which method works best. I tried to cover the whole process from the design perspective and there was not enough emphasis for collecting the ideas and analysing the methods. Hence, both the idea and method bank would need more consideration and development in the future.

It was also wrong or naive from my side to expect something else than an incremental innovation from the project. This happened because I did not know about ABB’s product strategy and I was not able to identify all the possible risks. However, I believe that we surely reached ideas and concepts that will mature to become innovations in the future.

It is clearly hard to measure the impact and benefit of a design approach in the process. It is even difficult to say how much impact there was of a design approach at all. There is still a long way to get design entirely included in the process as I was secretly aiming for. However, there definitely were collisions of aspirational and rational mindsets during the project. I see that some of the design methods were already taken as advantages within the project. I am sure that all the members in the team widened their perspective – at least a bit. During the process all the design thinking constituents and aspects of different concepting objectives were touched upon and the research question was answered. Through design, it is possible to find and see new means for problem solving and to broaden the perspective for creating new challenging problems for the future. This research showed how design thinking and
design concepting methods can encourage different mindsets, when reaching the shared understanding and wider perspective. Thus design can improve the concepting process in ABB Marine and presumably it would be so with every process in the maritime industry.

The New Joint Concepting Model represents the flow where each phase of concepting is presented. This does not mean that it would be the only order and combination of phases that can be merged in the concepting process. It is my personal view based on the findings from the research. It does not need to be obeyed literally. It can also be changed or developed to become better. The New Joint Concepting Model could also be simpler, the graphic design could be better thought through and more informative. The Model figure where each phase is represented in circle form is not as readable, as it could be with horizontal texts. However, posters sift through the steps. Sometimes it is the matter of taste. I believe that within forthcoming ABB Marine projects the New Joint Concepting Model can suggest; what could be the relevant method to use, what is the outcome of each phase and who should participate. The idea is that the posters can be put on the wall, where the R&D team can monitor whether the suggested activities are reflected in a process. It also indicates the different perspective within the order of activities in the process. The methods are not precisely explained on the posters. That could encourage people to read this thesis and explore the used methods. I hope the New Joint Concepting Model leads to greater innovations in the future.

The working environment and atmosphere at ABB Marine is open. The innovative culture of the company encourages employees to develop themselves which makes it an attractive employer. I also noticed that no barriers exist that could reject the communication between the employees from different departments and the management. However, I see that there are also ways to improve it and make it even more open and more innovative.

I have to admit that the nature of the company culture is technology driven, which will not be changed. Though my thesis shows that there is a little space also for design and aspirations, which hopefully will be considered more in the future.

I also have to mention that if counting the monetary value of my contribution on the conventional design work within the project, it should be evident to include in-house design in each project within ABB Marine. This does not mean that services from design consultants would be unnecessary.

One of ABB Marine’s new objectives for the future development and growth is called cross functional mindset in the Marine house. It is about increasing multidisciplinary teamwork between departments.
Design thinking and design concepting methods can be a right way to conduct the challenge combining different types of mindsets and help the cross functional mindset to exist. Design can also be the key element when holding on to ABB’s own mission and strategic imperatives to drive innovation across every area of the business – not just product innovation. I hope that I was able to change the attitude and understanding towards design in the company, and in turn I learnt a lot from the other actors in the organization.

After this research I understand, that the multidisciplinary teamwork does not mean that all contributing thinkers would merely provide their own differing approach onto the problem. Multidisciplinary teamwork should be sharing efforts and ideas, but primarily to understand the ways of doing and reasoning of others, and learn from those. The expertise of a single person with emerging wicked problems is not sufficient anymore. Todays problems require continuous development and learning from new ways of doing. The future solution development requires the great culture of teamwork – including a design perspective.
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>09:00</td>
<td>Where good ideas come from</td>
<td>Steven Johnson's video 5min</td>
</tr>
<tr>
<td></td>
<td>Why this event?</td>
<td>Generative design space for the design solution</td>
</tr>
<tr>
<td></td>
<td>Framework&amp;Focus</td>
<td>Setting the base based on Hot Spots(ship segments)</td>
</tr>
<tr>
<td>09:30</td>
<td>Presenting pretasks/discussion</td>
<td>Individual presentations 5min!!</td>
</tr>
<tr>
<td>~ 11:00</td>
<td>Lunch break</td>
<td></td>
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<tr>
<td>11:30</td>
<td>Concepting</td>
<td>Collectively, stepping forth &amp; back</td>
</tr>
<tr>
<td>~ 13:00</td>
<td>Coffee break</td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td>Group presentations</td>
<td>Overview, basic functions, 8min!</td>
</tr>
<tr>
<td>14:40</td>
<td>Evaluation</td>
<td>Nominal Group technique +/- investors</td>
</tr>
</tbody>
</table>
Appendix 2. Questionnaire - workshop 1

Questionnaire - CX CONCEPT WORKSHOP 1

What worked?

Uusi menetelmä ideoinnille. Ideoita ja ajattelua heräsi hyvin myös sellaisista asioista, joita on joskus ajateltu tarvittavaksi, mutta joita ei ole viety pidemmälle.

What did not work?

Tehtäviennanto on voinut epäselvä. Jatkokoostotetaan uusia ja vanhoja ideoida, keksitäaksemme uutta kaantumoduullia uusia yleisistä ja. Ideointi on ollut röykäntä, lyhyempilin varaa per-tehtävää.

Did we achieve our set goals?

Mitkä olivat tavoitteet? Ideoita ainakin tuli.

Suggestions on next steps and other thoughts?


Jatkossa kannattaa katsoa myös mitä aiemmissa huittospjäskojissa on ideaa, josko siltä laajensi jotaan käyttökohtelua.
Appendix 3. Questionnaire - workshop 2

Questionnaire - CX CONCEPT WORKSHOP 2

Why were we doing this? 
UNDERSTAND MARKET NEEDS + MATCHING THRUSHER PORTFOLIO

What (method) worked? 
ALL OTHER THAN 5 FLOW ANALYSIS
++ EMPATHY SCENARIO
++ PROTO
+ CARD SORT + FURTHER DEV.

What (method) did not work? 
SEE ABOVE

Did we achieve something? 
YES, "BIG PICTURE" CONCEPTS

Suggestions on next steps and other thoughts? 
"DRAW OUT" THE MAIN CONCEPTS
-RANK AGAINST TARGETS + EACH OTHERS

GREAT SESSION, WELL MANAGED!
Appendix 4. Questionnaire - workshop 3

Questionnaire - CK CONCEPT WORKSHOP 3

What worked?

Hyvä prosessi. Ajatusten suunnittelu hyvin
hinnutamme ja senkin tarvittavat kestävät
helfoiset

What did not work?

Alkusen ei ollut oikein ennenä ilmoitusta
aloitettavissa.

Did we achieve our set goals?

Lyhyt, vuodenkin projektin tavoitteiden nimi
nämä vastaavat eli eivät eli eivät ole

Suggestions on next steps and other thoughts?

Pörrö , painahtavasti pitäisi pitää
ja jatkossa hinnan analysoida. Tämän
tänään ja hän meni perspektiivin mukaan
Appendix 5. Benchmarking - workshop 5

1. Racing car
2. Race car image
3. Graph image
4. Graph image
5. Whale image
6. Whale image
7. Yellow dice image
8. Whale image
9. Swimmers image
10. Swimmer image
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Photo 1. 1:1 prototype of confined space of Azipod in order to experience the situation of the service employee who is changing shaft seal lips from inside. ref.: ABB Marine, 2012

Photo 2. Gaining user experience in Aboa Mare Simulation Center. ref.: ABB Marine 2013

Photo 3. Compact Azipods installed. ref.: ABB Marine 2013

Photo 4. Azipods systems on board. ref.: ABB Marine 2012

[Accessed 2nd February 2012].

Appendix 5. Benchmarking - workshop 5.
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