

Product Portfolio Management

– Managing a Mix of Customized and Standardized Products

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Abstract

Title: Product Portfolio Management – Managing a Mix of Customized and Standardized Products

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Background and problem description:

ABB Machines in Västerås, Sweden develop, sell, and manufacture generators and large electric motors worldwide. During the past years new competitors have emerged from a lower output range and some customers have reduced their demands in order to reduce the generator costs. In order to meet these changes in the market ABB Machines has developed a new pre-engineered standardized generator that allows for easier purchase and more efficient production. This new generator, here referred to as Basic, will have less flexibility compared to the current range of generators but provide the same robustness and quality.

ABB Machines needs help with integrating the new product range into its existing product portfolio. There are a number of challenges with regards to marketing the new product both internally and externally that need to be covered by this thesis.

Purpose: The purpose of this thesis is to answer the question; How should the new product range, Basic, be integrated into ABB Machines existing product portfolio? The aim is to provide useful recommendations to ABB Machines of how, in the most successful way, manage this product integration.

Methodology: After some background information about ABB Machines in Västerås was gathered through interviews a theoretical framework was created from various books, articles, and journals related in different ways to the subject. The theoretical framework was used as a foundation for several case studies conducted at different companies. The companies were selected due to their successful product introduction and similarity to ABB Machines' situation either based on product, market position, branch or other. The case studies were based on interviews and the companies were analyzed with regards to their processes and their ability to overcome the obstacles that ABB Machines is facing.

The case studies together with the theoretical framework were used to determine the preferred company behavior and after an analysis of ABB Machines in Västerås they were used to make recommendations of how to act in the situation that ABB Machines in Västerås was in at the time of writing.

Delimitations: A few potential issues have been left out of this thesis for various reasons. The risk that the new product would cannibalize on the existing products' volumes is one of them. Another issue, strongly related to the above, is to what extent the standardized generator should be sold in terms of how large part of the total sales should consist of Basic orders in the long run. This is a question for ABB Top Management and will also be left out of this thesis. Lastly, how to select new suppliers related to the new product and ensure their appropriateness is an issue of importance, but will not be discussed in this thesis.

Conclusion: In order to manage both standardized and customized products the internal processes need to be separated and clearly documented. If the same processes are kept for both products ABB Machines risks that the standardized products will be too time consuming and therefore too costly. Without separated processes it will also be difficult to maintain the standardized products' lesser flexibility and stay within the borders of the limited options, which is essential for product success.

When it comes to external marketing the limitations of the standardized products must be clearly communicated to the customers and what is included in a standardized order must be stated in an obvious way in the sales process to prevent discussions and confusions later in the project. If the above is managed properly and no confusion about the differences between the standardized and the customized products arises the price difference between the two can be explained through the advantages of standardization, which according to the studied companies should be well known among companies within ABB Machines industry.

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1 Introduction

1.1 Background

ABB Machines in Västerås, Sweden is part of the global corporate group ABB Ltd. with headquarters in Zürich, Switzerland. ABB Ltd. is mainly operating in the power and automation technology areas and is one of the largest engineering companies in the world.

This thesis is written on behalf of ABB Machines in Västerås. ABB Machines develop, sell, and manufacture generators and large electric motors worldwide within the output range 100 kW – 70 MW. It has about 3 300 employees out of the 120 000 employees of the ABB Group.

ABB Machines has manufacturing facilities in Sweden, Finland, Italy, Russia, Estonia, Czech Republic, India, South Africa, and China and has sales offices in over 90 different countries. Most of the production is for export and the generators are used for industrial size power generation. The product line and product portfolio is used by large industries and all sales are done to large global OEMs or industrial end users. ABB is currently the market leader for this size of generators.

During the past years new competitors have emerged from a lower output range and some customers have reduced their demands in order to reduce the generator costs. This is especially true for the lower output powers. In order to meet these changes in the market ABB Machines has developed a new pre-engineered generator range that allows for easier purchase and more efficient production. This new generator range, here referred to as Basic, will have less flexibility compared to the current range of generators but provide the same robustness and quality.

1.1.1 About Basic

One of the main purposes with the Basic generator is to increase ABB Machines' sales volume through, from a customer's perspective, a more attractive price. In order to offer a more competitive price, significant reduction of the total production cost of the product needed to be made. These saving has been made through standardization of the generator which will reduce the time spent on mechanical design, electrical design, and project management to name a few. The generator will also be easier to produce and have shorter lead time, which will reduce the tied up capital and the direct production cost.

The shorter lead time is a positive attribute that can be used to attract new customers. The reduction of lead time will be significant compared to ABB Machines existing products, the AMS.

Basic has been developed with a base design and numerous additional options to correspond to 80 percent of the identified customer needs within that machine size. The generator has primarily been designed to fit gas turbines but will also be offered on the steam turbine market.

1.2 Problem Description

ABB Machines in Västerås needs help with integrating the new product range, Basic, into its existing product portfolio. There are a number of challenges with regards to marketing the new product both internally and externally in order to keep the price-level of the existing products while offering a competitive product when the demands from the customers are lower. Some of these potential issues can be quite costly if they are not handled properly.

The customers do not realize the differences between Basic and ABB Machines previous products AMS

When the customers do not fully understand the limitations of Basic there is a risk that they will order a standardized generator even though they really need a custom designed generator. In those cases ABB Machines will not be able to fulfill the customers' needs and complications will arise.

There is also the case when the customers are aware of the limitations but order the Basic generator with the aim of getting a customized generator at the price of a standardized.

- How should ABB Machines explain the price difference between Basic and AMS, i.e. the price difference between a standardized and a customized generator?
- How should ABB Machines act when the customer tries to make an ordered Basic generator customized?

ABB Machines has difficulties with managing the different products internally

When ABB Machines' employees do not fully understand the differences between Basic and AMS similar issues can arise. Also in this case an ordered Basic generator can end up being a customized generator, which will lead to significantly lower profit margins and difficulties with keeping the promised delivery time. Delivery delays can in turn create other problems for ABB Machines in the form of disturbance in the production flow that can affect other projects because of reprioritization.

- How should the ABB Machines management assure that Basic is managed properly internally?

The general problem that this thesis aims to solve is:

How should the new product range, Basic, be integrated into ABB Machines existing product portfolio?

1.3 Purpose

The purpose of this thesis is to answer the question; How should the new product range, Basic, be integrated into ABB Machines existing product portfolio?, by creating a theoretical foundation relevant for the purpose and investigating how different companies have managed similar situations successfully in practice. The result from the theoretical framework together with the finding from the case studies is to be used as a basis for recommendations to ABB Machines.

This thesis is primary for students and researchers interested in standardized product integration in a business-to-business environment and for the management and employees of ABB Machines in Västerås.

2 Methodology

2.1 Research Strategies

According to Robson (2002) all different research strategies can be divided into two different categories, fixed and flexible strategies. The fixed strategies are pre-decided procedures of how the research is supposed to be executed and what information is to be gathered. When this type of research is performed the result can often be presented in form of numbers. The flexible research strategies' structure will instead appear slowly as the information is being gathered and it is not possible to on beforehand decide how to carry out the study. This type of research will be presented in words rather than numbers (Robson, 2002).

When this study was carried out it was not in advance decided exactly what information was to be gathered or how the study was to be structured, so accordingly a flexible research strategy was used. The initial gathered information has highly affected the continued work in many different ways. As various theories were studied more possible approaches to answer the research question were formed just as the lack of certain information created the need for alternate approaches. The results of the study has been presented in words, which also indicates the flexible research strategy used.

One of the most common research strategies is the case study (Denscombe, 2000). This strategy is often used in small-scale studies, where one object is studied in depth. According to Denscombe (2000) case studies are preferable when complex situations, relations, or processes that cannot be covered by other methods are studied. This is one of the reasons that case studies are included in this thesis. Due to the highly complex problem that ABB Machines is facing, case studies was the most relevant way to study the situation and bridging the gaps that the theory left open.

2.1.1 Method of selection

The method of selection used in this thesis is subjective selection, which according to Denscombe (2000) can be defined as when the units are picked by hand based on what is known about the target population. These units are considered to be the one that can contribute the most valuable information and are seen as relevant for the research topic.

Subjective selection was made when the interviewees at ABB Machines were chosen. The interviewees were handpicked based on my supervisor at ABB, David Bjerhag's suggestions of who would be able to contribute by sharing his or her expertise within a certain area.

Also when choosing companies to study subjective selections were made. The companies were handpicked to suit ABB Machines' situation so that each and every one of the case

studies would add value to the thesis in its own individual way. This selection of companies was unfortunately limited due to some companies' unwillingness to contribute and the lack of time that is always a limiting factor for these types of researches.

2.1.2 Generalization of Case Studies

It is easy to understand that a selection has to be large enough to be generalizable. This is an issue for case studies where the selection often is relatively small, which makes generalizations of case studies easy to question. The following questions are commonly asked in those situations (Denscombe, 2000):

- How representative is the case?
- Are not the results specific for this particular case and its circumstances?
- How can a generalization be done based on a small selection of units?

Case studies, as opposed to survey research, are not statistically generalizable, but analytically generalizable. It means that a case study is compared to compiled theories and when a similarity is found, the results are analytically generalizable (Yin, R. K., 1994).

In this thesis, which consists of several case studies, the cases have been compared to theory to find similarities and through them finding generalizations. The highly complex case of ABB Machines did not leave the possibility open to find a lot of applicable theories since the most theories within the areas sought were in first hand in regard to companies offering consumer products and not business to business relations as in the case of ABB. Therefore, three case studies conducted by other authors were at first used to find generalizations. These generalizations among with other potentially successful theories created the foundation for four other case studies conducted by the author of this thesis. Those four cases, in which the companies were carefully chosen due to their individual similarity to ABB Machines' situation, were compared to the previous three cases and the theory to generate recommendations for ABB Machines.

2.2 Types of Information

All research are generally divided into two categories; qualitative and quantitative research. It is not always easy to part the two and many research projects use both types of research. What determine the difference between the two is where the emphasis of the research is put and how the data is analyzed. The two categories can be described as follows:

- Qualitative research – The analysis is presented in words and often gives a detailed description of the reality. The level of details that is included determines the

possibility for outsiders to interpret the researchers result and determines whether the result can be applicable in other situations. Qualitative research is also flexible and the method tends to have a holistic view (Denscombe, 2000)

- Quantitative research – The analysis is presented in numbers so that comparisons and relations can be studied with statistical methods. This type of research is often fixed, as opposed to the flexible qualitative research, and has an atomistic view instead of a holistic (Denscombe, 2000).

This thesis that results in, with words described, recommendations to ABB Machines of how to manage the introduction of a standardized product, gives a holistic view of the complex situation. The above supports the choice of a qualitative research.

2.2.1 Written sources

When it comes to scientific research it is important that the researcher investigates what findings within the area has been made by other researchers. At this stage the written sources commonly constitute the main part of the information sources. The reason for that is to avoid repeating already performed research, to complement other research, and provide understanding for the reader of what theories lie behind the research.

The above-mentioned procedure was applied in this thesis for the very reason explained among other reasons. The written sources that were used in this thesis were books, journals, Internet sources and articles.

Books

The books used as information sources should be carefully selected since not all the books have credibility. One thing that indicates the credibility of a book is the reliability of its publisher. If a book is published by a well-known and well-established publisher, chances are good that the content of that book is reliable. It is also a good sign if the book has been released in many editions or if the book is referred to by many other sources.

The books referenced to in this thesis are all published by well-know publishers and some of them are used as course literature at Lund University. One Doctorial Dissertation and one Master Thesis were evaluated with reference to their credibility and carefully chosen as information sources to this thesis.

Journals and articles

There are numerous academic journals, which create the need for careful selection and assurance of the journal's reliability. A journal that has been around for a long time is a sign of credibility, but not a certainty. It is also, like for the books, that articles that have been referred to many times is an indication of reliability.

All the journals and articles referenced to in this thesis have been found reliable due to

the fact that the journals are well-known and show signs of credibility. Many of the articles referred to in this thesis have been referred to in other related academic articles and journals. The articles were found through the electronic search-engine ELIN, Harvard Business Review and as references in other related articles.

Internet Sources

When using Webpages from the Internet as sources it is important to evaluate the credibility of the information. The only Webpages used as sources in this thesis were the interviewed companies' Webpages from which the information gathered were only used as background information that could be confirmed during the interviews.

2.2.2 Interviews

There are three main types of interviews according to Yin (1994).

Structured interviews – Where a written manuscript is strictly followed for all interviews, where all the interviewees get identical questions.

Semi structured interviews – Where a written manuscript is prepared that can be slightly modified during the interview.

Unstructured interviews – Where the interviewer is allowed to ask questions freely with regards to a beforehand chosen topic.

In the beginning of this thesis a few informal interviews were held with ABB Machines employees to gain further knowledge of the sales process, the company and other general information of importance for the upcoming research.

The interviews that created the foundation for the case studies, i.e. the interviews with Volkswagen Commercial Vehicles, Scania, Solar Turbines Inc., and Siemens Industrial Turbomachinery, were all of the semi-structured type. The same interview questionnaire was used as a starting point in all interviews, but had to be modified slightly in order to suit the company interviewed.

The interviewer effect is always an issue when it comes to the reliability of the interviews. According to Denscombe (2000) the interviewer effect is when the interviewer affects the interviewee's responses. Since reliable responses are sought the strive is to minimize this influence. Factors that can affect the interviewee are gender, age, ethnicity, and language-skills. Non of these factors can be changed which is why in the cases that the differences between the interviewer and the interviewee are significant, it is of high importance to make the interviewee feel comfortable in order to receive reliable answers. That can be arranged by being well prepared, polite and neutral as an interviewer.

Three out of four interviews, the ones with Volkswagen, Scania and Siemens, in this

thesis were face-to-face interviews in Swedish, which is why the “interviewer effect” can be considered negligible. The interview with Solar was conducted over the telephone in English, the interviewers second language, which is why the risk for the interviewer effect is slightly higher. It is however, still considered very low due to the interviewee’s and the interviewer’s experience of dealing with the English-Swedish language-barrier.

2.3 Criteria of Quality

2.3.1 Validity

To be able to determine to what extent this thesis is valid an external observer should be able to follow the different steps that led to the result. This has been made possible by explicitly presenting all the interviewees and all other sources from which information is gathered.

To further ensure the validity all the interviewees has been asked to double check the compilation and the results of the interviews to make sure that nothing is lost in translation or misinterpreted.

The number of sources is also of high importance for the validity. As many relevant sources as possible has been used in this thesis but they were however limited due to the complexity of ABB Machines situation, which limited the possible sources and also due to some companies unwillingness to contribute. The lack of time that is always an issue in these temporal researches was also a factor that limited the number of sources used. This is where the validity of this thesis can be questioned.

2.3.2 Reliability

The reliability is supposed to ensure that if a researcher follows the same procedure for the same study, the same result will be acquired. According to Denscombe (2000) the first step of achieving this is to clearly describe the aim of the research and to minimize possible errors by carefully documenting the procedure.

The purpose of this thesis is clearly stated to ensure the reliability and the procedure is described later on in this chapter.

2.4 Procedure

The initial phase of this research was to gain background knowledge and relevant information about the company that this thesis was preformed on behalf of, namely ABB Machines in Västerås. The contact person at ABB Machines in Västerås Mr. David

Bjerhag, Manager of Sales and Project Execution, helped to recommend various key persons at the company that shared their expertise and their knowledge of the company. Mr. Bjerhag also contributed personally with his view of the situation. Several sales persons at ABB Machines were interviewed to gain a better understanding of the sales process, which was essential to be able to compare to other companies' processes.

After that short introduction it was time to create the theoretical framework for the thesis. This was done by gathering relevant information from books, journals, and articles within the carefully selected areas; product introduction, standardization, product positioning, market segmentation, line extension, customer behavior, and mass customization. The theoretical framework was not only created for the purpose to enlighten the readers, but also to find possible best practice companies that could be studied in the next phase of the thesis.

Through the gathering of information to the theoretical framework the author came across three highly relevant case studies within mass customization. These cases were analyzed and added as sort of an introduction to the next phase of this thesis, namely the case studies. The cases, which were found in a Doctorial Dissertation, were both a complement to and used for comparison to the case studies that were to be conducted by the author of this thesis.

When the three above-mentioned cases were analyzed a good foundation was created for the next phase of the thesis, the authors own case study. The initial problem at this stage was to select suitable companies to study. Seven companies were chosen due to their successful product introduction and similarity to ABB Machines' situation either based on product, marked position, branch or other. Due to unwillingness to contribute three of the companies had to be left out of the study but however, the remaining four gladly agreed participate.

The four companies were interviewed one at the time and analyzed with regards to their processes and their ability to overcome the obstacles that ABB Machines in Västerås is facing today. The results found from the different case studies were compared to each other and analyzed. At this stage a clear picture of how a "best practice company" should act had appeared.

After the case studies were conducted and analyzed a deep and extensive analysis of ABB Machines in Västerås had to be made. Since the preferred company behavior was known, the actual company behavior was sought in order to make recommendations. The analysis of ABB Machines in Västerås was based on the author's own experience together with informal interviews of ABB Machines employees. Various ABB Machines employees have supervised the analysis in order to ensure its accuracy.

When ABB Machines in Västerås had been analyzed both the preferred behavior and the actual behavior were known. The road from ABB Machines' behavior today to the preferred company behavior constituted the recommendations and brought this thesis to a final result.

2.4.1 Delimitations

One issue with the introduction of the new standardized product at ABB Machines in Västerås that was left out of this thesis was the risk that the new product would cannibalize on the existing products' volumes. The reason that this was omitted was because it was of lower economical risk than the issues that was brought up in this thesis and partly due to limitations of time. By limiting the options of the standardized product ABB Machines controls the market demand for that product and can therefore adjust the options before the situation gets out of control. It would however, be interesting for future researchers to seek an approach how to avoid cannibalization in the most effective manner.

Another issue, strongly related to the above, is to what extent the Basic generator should be sold in terms of how large part of the total sales should consist of Basic orders in the long run. The author believes that this is a question for ABB Top Management and will for that reason be left out of this thesis.

With the introduction of a new standardized product comes a potential need for new suppliers. How to select new suppliers and ensure their appropriateness is an issue of importance for product success, but is however too extensive to be covered in this thesis and is therefore left for other researchers to investigate.

2.4.2 Alternative methods

One alternative method is to divide the theoretical framework into two parts, where one is focusing on the internal communication while the other focuses on the external communication. The part that brings up the internal communication could cover how to manage the change of internal processes and how to ensure that the ABB Machines employees fully understand the new product and manages it in the most preferable way. The other part could cover the communication with the customers and how to ensure that the customers fully understand the differences between the old products that they are used to buy and the new standardized product, explain the new pricing, and explain the consequences with the lower flexibility.

This method was discussed on beforehand as a possible method of choice but was however rejected due to the fact that the focus of such a thesis risked being too heavy on organizational behavior and organizational change instead of on the problem itself that ABB Machines in Västerås needed a solution for, i.e. how to include the new standardized product into its existing product portfolio consisting of customized products.

3 Theoretical Framework

3.1 Introduction

In the theoretical framework various theories will be brought to the readers attention that each and every one will, in its own individual way, be relevant for the situation that ABB Machines in Västerås is in at the time of writing. All theories in this chapter will create a theoretical foundation that will be useful when investigating how to integrate a new standardized product into an existing product portfolio consisting of customized products.

Some general theories about new product introduction will be followed by theories about product introduction in extended enterprises keeping in mind that one of ABB's customers will be a part of the product introduction. Since the new product will be a standardized alternative based on a previous product some general theories about standardization will be brought up.

Product positioning is the next topic to be covered. It will be covered due to the fact that ABB Machines will have to position its new product correctly to be able to reach new customers, which brings us to the next topic to be covered namely market segmentation. By introducing the new product ABB Machines will try to reach new customer segments on new lower output markets where its previous products have been to expensive. The new product will also be a form of line extension, which is why theories within that subject will be covered too.

One of the author's initial concerns was if a standardized product in any way would affect the customer behavior. Therefore, some theories regarding customer behavior will be included.

Lastly, the theoretical framework will cover some theories about mass customization. At first sight it may be difficult for the reader to understand what mass customization has to do with ABB Machines' situation, but it is in fact highly relevant. To be able to offer the standardized product a type of mass customization is required due to the complexity of this particular product. ABB Machines' standardized product will include a product platform with several available options and can therefore be seen as a mass customized product as well as a standardized product.

3.2 Introducing a New Product

According to M.N. Abd Rahaman and M.R. Muhamad (2004) the winning new product strategy is to use company technological strengths in pursuing new product opportunities in new markets. To be able to do that the management must understand the company's microenvironment and macroenvironment. Such understanding is received through analyses.

3.2.1 Microenvironment analysis

A microenvironment analysis studies a company's internal resources in terms of strengths and weaknesses. A company's strengths should utilize while its weaknesses become the boundary condition for the strategy. Successful new product development projects are associated with quality performance either in production, technology, financial resources or marketing, according to a study by Miller (1998), which is why evaluation of internal resources and skills within these areas are critical for a relevant picture of the company's capabilities.

3.2.2 Macroenvironment analysis

A macroenvironment analysis studies the external factors that might affect a company's situation. This analysis will result in a scan of the industry's environment and the competitive condition within this industry. It is important for the management that, through this analysis, receive a clear perception of the following key factors:

- The drivers of industry change
- The intensity of competition
- The key industry traits
- The market position and strategy of competitors
- The industry future profit outlook

The results from these two analysis coupled should provide an indication on how to create a product strategy that leverage the company's strengths through the new product and therefore creates competitiveness.

3.2.3 Should the new product strategy be market or technology driven?

From the findings of the micro- and macroenvironmental analyses the conductor will investigate if the decision is influenced by the market, i.e. a market driven strategy, or if it is influenced by the company's technological leadership (i.e. technology driven strategy). In the strive for the strategy characteristics that increase project success Loach (2000) argued that emphasis must be put on both internal technological competencies and the market needs in defining the winning product strategy. This approach is called dual drive strategy and was proved the most successful in a study by M.N. Abd Rahaman and M.R. Muhamad (2004). Their study also showed that this was true regardless of company size.

3.2.4 Key factors contributing to new product failure

Potential technical problems are a key factor. If the product is badly designed, has poor performance and quality or in another way fails to fulfill its purpose it will not be a long-lived product. Market research is also an essential factor. If insufficient or incorrect market research is performed a company may overestimate the market's potential or misinterpret the customers' demand (Classen and López, 1998). The timing of the market entry is also critical for the new product's performance. If the product introduction is too hasty there is a possibility that different preparations have been rushed and are not sufficiently done. On the other hand, a late product introduction may make the company miss out on potential profit and there is also a risk that when the product is introduced the customer demand on the market is shifting, in other words, the product is introduced late in its own life cycle.

3.2.5 Importance of communication in product introduction

The importance of extensive communication and collaboration between manufacturers and suppliers during the product introduction process cannot be neglected (May and Carter, 2001). A case study performed by May and Carter showed the following three points regarding product introduction:

- There is a complexity of the collaborative relationships, both within and across company boundaries.
- There is an ad-hoc and informal nature of much of the communication and collaboration between engineers.
- There is a lack of formal procedures for interactions between different members of the supply chain.

The conclusion that communication is essential for smooth product introduction was also drawn by Classen and López (1998). Keeping these observations in mind we can see that there is an obvious need for close collaboration and communication.

3.3 Product Introduction in Extended Enterprises

3.3.1 Trust-based relationships

The extended enterprise is a new phenomenon that rose in the late 20th century. According to Dyer (2000) the extended enterprise is defined as companies working together in intimate, trust-based relationships to develop, produce and deliver complex products. Dyer argues that compared to arms-length relationships, trust-based relationships saves money, however, building such collaboration requires lots of time and commitment.

The two companies must be willing to invest in people that are dedicated to each other and share both implicit and explicit knowledge. Susman et al. (2003) argue that open communication between partners increase the degree of trust among team members, which increases their cooperative behavior.

3.3.2 Communication within extended enterprises

A key requirement for companies continued survival is tight interaction and co-ordination among all the participants in the supply chain (Azevedo and Sousa, 2000). As new forms of organizations are established, for example the extended enterprise, co-ordination of the supply chain becomes more strategically important. Therefore, integration must be from one end of the business chain to the other, i.e. from one company's supplier all the way through to its customers (Somers and Nelson, 2003).

The use of IT is common within integrated firms to alter linkages with suppliers and customers, to establish new standards of performance in their industries and to create new services (Johnson and Carrico, 1988). However, Malhotra et al. (2001) stresses that just using IT is not enough to overcome the problems such as those which are cross-functional, cross-organizational, and cross-cultural, since these can raise conflicts that results from incompatibility between communication norms and practices. The success of an extended enterprise, such as a strategic alliance, depends on intensive information sharing, which is why it must be noted that standardized communication, which minimizes human interaction might harm two companies' strategic advantage.

3.3.3 Collaborative tools

Collaborative technology in form of collaborative tools encompasses a variety of functions to support group work (Cooper, 2003). According to Cooper collaborative tools include "product data and document management systems that provide the capability to store, retrieve, share, and maintain configuration and version control over text- or file-based products, such as requirements documents, plans, and specifications, and often provide additional lifecycle management, traceability, or reporting features; and groupware systems that facilitate communication and coordination between team members". Cooper also argues that a combination of collaborative technology and the strategy of designing modularized products will support collaborative product realization within an extended enterprise. This strategy can use collaborative technology supporting design in form of computer-aided design (CAD), by enabling the user to simulate their design (Cooper, 2003). In this case collaborative technology can reduce potential misunderstandings between two companies and therefore simplify the communication.

To conclude the discussion regarding collaborative technology in product introduction O'Sullivan (2003) argues that earlier research has over-emphasized the technical aspects of a product, such as design rules, and neglected the non-technical aspects, the face-to-face interactions, i.e. the aspects that collaborative technology cannot replace. Therefore,

it is crucial to note that the use of collaborative technology is encouraged to facilitate face-to-face interactions but not to replace them.

3.3.4 Possible goal conflicts

When working in strategic alliances all participants must strive for a business approach that is built on reliability and respect for each other's competence at all the levels in the organizations. However, since all participants are individuals they may focus on different goals, when it comes to product introduction. The importance of a common goal is even more vital in a strategic alliance. If the alliance fails to achieve a shared goal, there is a risk that each goal will dominate each company's process and the differences will make it difficult to reach optimal product introduction.

Some potential differences in focus:

Designer:

Functionality
Robustness
Specification protocols
Low component cost

Production engineer:

Reuse of production processes
Short production cycle time
Few components
Low refinement cost

Project management:

Low project budget
Efficiency in work
Efficiency in process
Short time schedules
Guaranteed deliverables

Marketing:

Short time to market
Low price
Volume flexibility
Customer satisfaction
Attractive product design

In two case studies performed in the mechanical engineering industry by Kerstin Johansen (Linköping University 2005) there were several material suppliers and components involved in the product introduction of the redesigned product. Both these cases indicate that managing the product introduction, i.e. supporting the communication between product designers and product engineers, requires a defined, supported, and communicated process. This is particularly important when one company is responsible for the product's design and another company handles the product introduction.

3.4 Product Positioning

Product positioning is the customer's perceptions of a product's attributes relative to the attributes of competitive products. Rather than allowing the customers to position ABB's products independently, ABB must try to influence and shape customers' perceptions in a favorable way.

Product positioning steps

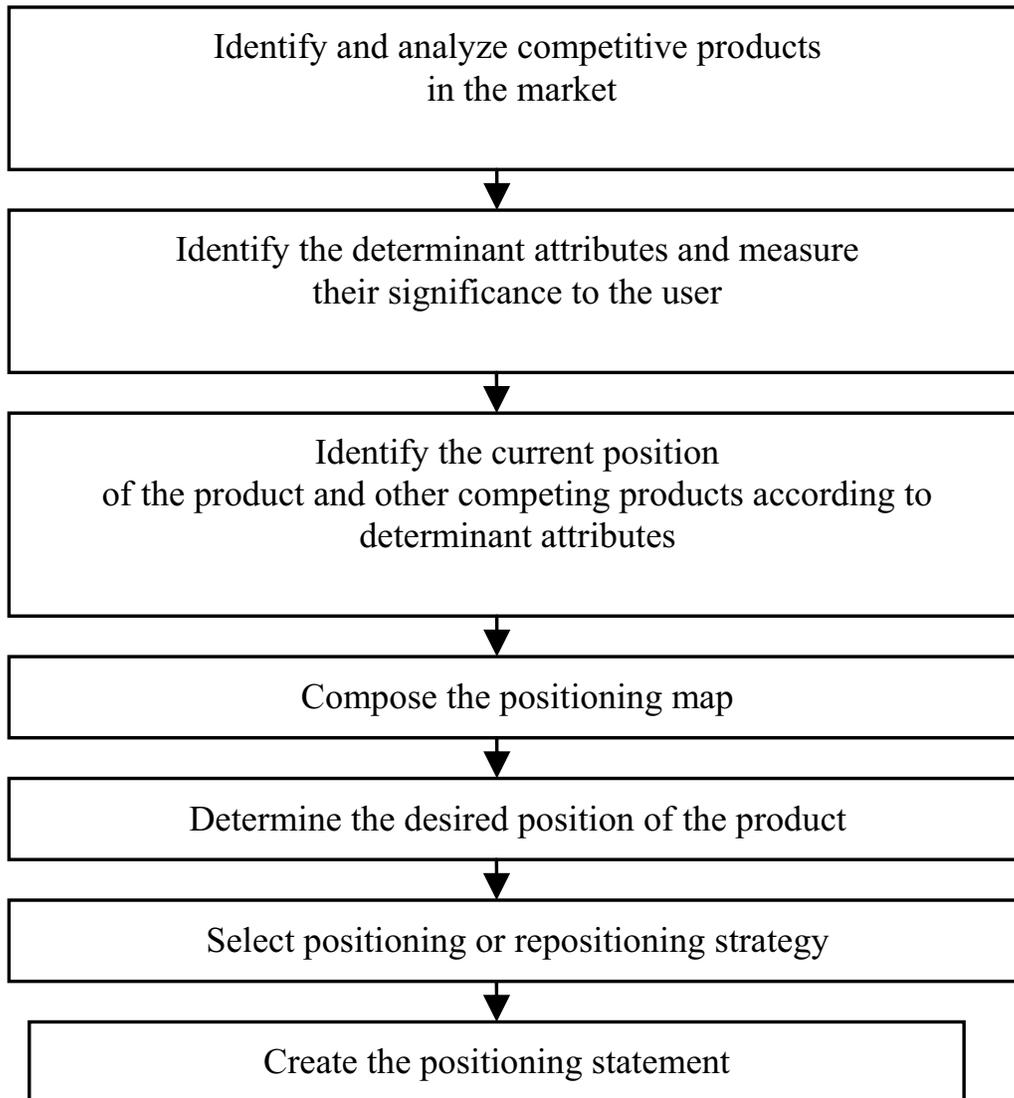


Figure 3.4.1 *The product positioning steps. Source: Ostaseviciute, Sliburyte (2008)*

3.4.1 The product positioning steps

Identify the relevant set of competitive products – needs to be done in order to draw the position frames for a product. This can be done by either a quantitative customer survey or a more qualitative approach, such as deep drawing interviews.

Identify the determinant attributes and measure their significance to the user – is the next step. According to the authors Hooley, Saunders, Piercy (2005), a qualitative approach is the most effective way to determine these attributes and therefore suggest a discussion group.

Identification of the current position of the product and other competing products according to determinant attributes – Since ABB introduces a new product that does not have a position on the market yet this is not directly applicable. However, it is instead useful to note the position of ABB's current product, the AMS, in order to compare and avoid cannibalization.

Composition of the positioning map – can be done with the information gathered in the previous steps. A positioning map graphically illustrates customers' perceptions of the competing products with based on two different attributes, for instance price and perceived quality. It is an important tool in product positioning since it enables managers to identify gaps and opportunities in the market.

Determination of the desired position of the product – It would be ideal to place the product on the point on the positioning map that represents the combination of attributes that the customer desires the most. What the positioning company should do is to place its product as close to this point as possible and therefore offer a customer-preferred product. It is however significant to observe that according to Sheinin (1998), companies should avoid segments, where they do not possess differential advantage.

Selection of positioning or repositioning strategy – is one of the most crucial steps. Positioning strategy is according to Doyle and Stern (2006) defined as the choice of target market segments, which determines where the business competes, and the choice of differential advantage, which dictates how it competes. Products very often fail because of initial positioning mistakes. Brooksbank (1994) states that a product may be inadequately positioned for three reasons:

- The segment in which it is targeted might have become unattractive because it is too small, declining, too competitive or otherwise unprofitable.
- Positioning might be inadequate because the quality and features that the product offers do not appeal to the segment to which it is targeted.
- It might be wrong because the product's costs are too high to allow it to be priced competitively.

Creation of the positioning statement – is probably the most difficult element of product positioning. From the data obtained and the positioning strategy developed it is necessary to formulate a positioning statement that is in tune with the objectives. These positioning statements provide guidance for the firm that can help the organization's employees to understand the strategy of this product. According to Kalafatis, Tsogas, and Blankson

(2000) positioning statements play a vital role, both internally and externally, to guide and coordinate the firm's efforts in the marketplace.

To summarize: Product positioning plays a key role when trying to reach a place in the mindsets of potential and existing customers. In the opinion of various scholars, it is obvious that product positioning is a complex, continuing, and chain process that should at least go through the above steps in order to be successful.

3.4.2 Risky Positions

Under-positioning – Some companies discover that buyers only have a vague idea of the brand and its benefits and features. Customers may not be aware of anything particularly special about that brand.

Over-positioning – Customers may have too narrow a view of the brand. Therefore a customer might think that a particular company only produces luxury items that retail at high prices. However, it may produce a variety of cheaper products as well.

Confused positioning – Customers could be confused about that position of the brand. This confusion may result from the company making too many decisions about the brand or changing the brand's position too frequently.

Doubtful positioning – Customers may find it hard to believe the claims made by the company about its brand with regards to the individual product's features and promoted benefits, the price and the name of the manufacturer.
(Ostaseviciute and Sliburyte, 2008)

3.4.3 Exemplar-based positioning

Exemplar-based positioning is a strategy that is used to accomplish brand consideration by direct comparisons with the market leader or another of the major players on that specific market. The similarities can be seen in either product attributes or design as long as it helps the positioned brand to be judged with reference to the comparison brand (or exemplar) and therefore creating a place for the positioned product in the potential customers consideration set.

3.4.4 Abstraction-based positioning

According to Trout and Ries (1986) head-on competition with the market leader is not likely to succeed in many instances. With abstraction-based positioning the aim is to facilitate an entry in the potential customers consideration set without direct comparison but through association with a hypothetical brand in the category. Research indicates that if the brand successfully portrays itself as belonging to the sub-category of competitors'

brands this association will be achieved (Grewal et al., 1997; Keller, 1998).

A way of practicing abstraction-based positioning is to present all the products attributes without comparing to competitor's products. This is particularly advantageous when there is no competitive brand that offers all the best features.

3.4.5 Reverse positioning

What ABB is trying to do is to use a positioning strategy called reverse positioning to force customers' mental shift. By stripping product attributes while adding some new ones, for instance shorter lead time and lower cost, ABB can alter the product's competitive environment.

3.5 Market Segmentation

Due to the necessity to balance customer needs with the capabilities and resources of competing organizations, market segmentation arises. One of the most widely cited benefits of segmentation is that it leads to a better understanding of customers' needs and characteristics. The gained understanding can be used to develop fine tuned marketing programs and provide a greater insight into the competitive situation (Powers, 1991). Market segmentation also helps companies to identify new opportunities in under-served customer groups, which can be highly profitable.

3.5.1 Implementation problems

There are numerous different theories of why market segmentation tends to fail. According to White (1992) some of the problems arise because organizations are unfamiliar with how to handle the segmentation process. This is partly a result of that academic literature in general focus on segmentation variables and techniques while offering relatively little guidance on how to handle the process and deal with the outputs. However, some general advices about the segment's qualities are mentioned by Kotler (1991). He argues that in order to be useful a segment must be measurable, substantial, accessible, and actionable. If a segment lacks one of above characteristics companies may find it difficult to enter that market segment.

3.5.2 The stages of market segmentation

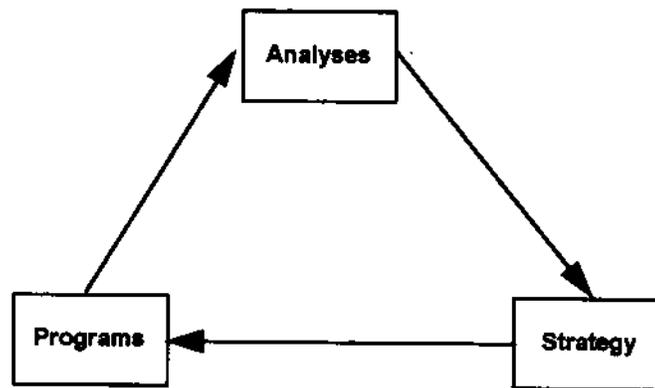
For market segmentation to be profitable, a series of steps must be followed according to Kotler (1991). However, it seems that true market segmentation, in academic sense, is rarely used in practice. Companies instead structure their markets on historical, product-based lines. Since the academics try to identify, statistically validate and test the existence of alternatives, and the practitioners' real test for a particular segment solution is the marketing program that must be developed, the differences in priorities can be

explained.

There are three distinct steps in an effective segmentation process (Dibb and Simkin, 1997):

- (1) Marketing analysis – to gain current marketing intelligence or knowledge
- (2) Strategy development – to formalize ideas
- (3) Marketing programs – to action the determined segmentation strategy

These three steps form a loop as in the picture below. It is important to note that in each link of the loop there are risks of process break down, which causes the segmentation to fail and the organization to revert to the existing status quo.



The three-stage analysis, strategy, and program process takes the core analyses and updates managers' views of their business and marketplace. The understanding received from this analysis will create the platform for managers' reexamination of which segment or segments the organizations should target. Feedback during the process is crucial to ensure that neither the analysis nor strategic thinking is lost.

The three stages of segmentation in points:

Core Analysis (Now)

- The existing situation
- General trends/marketing environment
- SWOT (strengths, weaknesses, opportunities and threats)
- Buyer behavior
- Competitive strategies
- Product positioning
- Balance of product portfolio

Strategic thinking (The future)

- Identification of new segment criteria
- Determination of new market segments
- Selection of new market segments
- Determination of product positioning strategies

Implementation programs (How)

- Marketing programs
 - Product range and portfolio
 - Pricing and payment issues
 - Promotional strategies and tactics
 - Distribution and control
 - Service levels and personnel
 - Sales force
 - Internal communications and organization
- Resources and scheduling
 - Budgets
 - People and responsibilities
 - Activities
- Ongoing requirements
 - Product development
 - Marketing research
 - Training
 - Communications
 - Monitoring and performance

3.6 Line Extension

Line extensions consist of introducing additional items in the same product category under the same brand name. This involves risks and has provoked a heated debate among marketing professionals, about its ups and downs (Kotler, 2003). On the downside, line extensions may lead to the brand name losing its specific meaning. It is not difficult to imagine that when a high quality brand launches a low-price product the brand name is affected. This is called the line-extension trap. It can do substantial harm if the fit is inappropriate, but if it is well managed it can be an enormous benefit.

When looking at the case when Mercedes-Benz launched its low-price 190 model in the mid-1980s, a classic case of intelligent product line extension is shown. The launch made it possible for Mercedes-Benz, which was associated with luxury, to reach farther down

in the sub-luxury-buyer segments than ever before. The company took an obvious risk, namely, would the 190 model degrade the image of the established Mercedes brand? According to John Quelch and David Kenny (1994), we are supposed to think of brand image in terms of three components: maker image, producer image, and user image. Mercedes could have played it safe by introducing a new brand and positioned it as “by Mercedes”. This would have been a costly strategy, but it would have leveraged the maker image while insulating it from any possible degradation associated with offering a less prestigious car. However, that strategy would have limited the attractive features that the Mercedes 190 had and ruled out the possibility to donate them to the parent brand. This turned out to be one of the most successful line extensions ever, since Mercedes-Benz managed to reach new customer segments while keeping its reputation of being a luxury-brand. However, if Mercedes-Benz would have failed the low-price model could have seriously damaged the brand name and the customers’ perception of Mercedes-Benz as a high-end car supplier.

3.7 Customer Behavior

When a new product is about to be introduced the customer behavior must be taken into account. Since the new product is standardized it might influence the decision-making unit in the buying organization. A lower level of complexity of the product can reduce the need for a technically experienced buyer.

In general the organizational buying process involves a set of smaller decisions influenced by several individuals. The industrial salesperson must therefore address three questions when selling the new product.

- Which organizational members take part in the buying process?
- What is each member’s influence in the decision?
- What criteria are important to each member in evaluating prospective suppliers?

Depending on which organizational member the salesperson want to influence, he can choose to enhance different attributes of the product. In some cases a low price might be more important than a short lead time and the other way around.

Another important factor is how the new product will influence the buyer’s risk in the purchase decision. Research highlights the importance of perceived risk in shaping the structure of the decision-making. Individuals tend to make the decisions when the perceived risk is low, while higher risk decisions generates the following:

- The buying centre becomes larger and comprises members with high levels of organizational status and authority.

- The information search is active and a wide variety of information sources are consulted. As the decision process unfolds, personal information sources (such as discussions with managers at other organizations that have made similar purchases) become more important.
- Buying center participants invest greater effort and deliberate more carefully throughout the purchase process.
- Sellers who have a proven track record with the firm are favored – the choice of a familiar supplier helps reduce perceived risk.

3.8 Standardization

Strategy revolves around product innovation and improvement until the product characteristics that once were unique become commonly expected and accepted. That is when standardization occurs. In a rapidly changing product market standardization is not likely to occur since a low-cost strategy most certainly will be overtaken by the next step in the product's evolution.

In the overwhelming majority of industries the rate of innovation progressively slows, and a standard emerges.

According to Xavier Gilbert and Paul Strebels (2007) the standardization of a market signals that it becomes safe for new entrants to offer either the product itself or a look-alike. They also suggest that a company that has developed a standard must create a productivity reserve by investing in process improvement, in order to sustain competitive advantage. It is also critical that the company initiates a shift towards cost reduction.

In the case of Autologic, an early entrant in the office automation field, the importance of process improvement is shown. Its product was highly regarded technically, but Autologic had to withdraw from the market due to its lack of ability to provide support for its product as a potential standard. This was a consequence of its failure to invest in process improvement.

When standardization occurs the market is generally characterized by price competition. Those who cannot follow the successive price decreases (or the customer demanded prices) are eliminated. The ability to make substantial investments in manufacturing process improvement is essential.

3.8.1 Outpacing strategies

The establishment of a standardized product requires sensitivity to the market. Bridging the gap between evolving technology and market sensitivity requires, according to Xavier Gilbert and Paul Strebels (2007), an outpacing strategy based on pre-developed capacity to

find the common denominator in the expanding demand for the product.

Once the product is standardized the outpacing strategy becomes a function of improving productivity by reducing costs. Research shows that a company that is able to maintain a high perceived value while effectively reducing costs outpaces its competitors.

It can be quite radical for an organization to handle the transition from innovation to standardization. Creative and innovative organizations often find it very difficult to reorient their operations internally to be able to keep up with the new entrants once a product is standardized. Xavier Gilbert and Paul Strebel argue that the problem is often a form of cognitive dissonance, which means that a person acts against his own original values. The original entrepreneurs, or the organizations technically skilled personnel, have difficulty accepting the shift in the characteristics of the competition.

In the case of Apple the internal change required was too great which forced the original founders of the company to resign. The pharmaceutical company Ciba Geigy Corp. was in a similar situation when the new drug discovery had slowed. Instead of changing management Ciba Geigy created a wholly owned subsidiary as a low-cost reserve strategy, which operated outside the mainstream organization.

“Success comes to those capable of eventually inducing a fundamental change in the buyer’s perception of the product on the one hand, and on the other hand, by the internal systems of the company so that product features can be enhanced”, as Xavier Gilbert and Paul Strebel so elegantly put it.

When strategic emphasis shift from innovation to standardization there is a trade-off between perceived value and delivered cost. Only the very best companies can hold superior performance constant while lowering costs.

3.8.2 The managerial implications of an outpacing strategy

Three important points is required for a successful outpacing strategy. Firstly, a thorough understanding of the industry and the pattern of the industry’s evolution must be performed. Secondly, the initial strategic focus must be sharp on building a competitive advantage for either perceived product value or low delivered cost. For ABB the focus will be on perceived value. Even though ABB is launching a standardized product it will not be able to cut the costs as much as its competitors, and therefore its product will still be a little bit more expensive than its competitors’ products. Lastly, the cash flow received from the competitive advantage needs to be reinvested to continue the lowering of costs to preempt competition.

There are several difficulties that need to be noted regarding using an outpacing strategy in practice. One important factor to note is that an outpacing strategy is not a middle-of-the-road strategy. In the standardized phase it is important that the product is a pure standard handled strictly separated from other flexible products, which puts a lot of

pressure on the management.

Another important point to be noted is that an outpacing strategy may be hard to implement because of the organizational requirements for creating value are frequently opposite of those needed for lowering costs. A company that is used to focus on quality and high-value products might have difficulties adjusting to a low cost production.

3.9 Mass Customization

While companies seem to be making great strides in quality by focusing on continuous improvement, many firms are already moving beyond this to mass customization. In this business model, stable but very flexible and responsive processes provide a dynamic flow of goods and services, enabling companies to achieve both low cost and high variety. The organization's primary thrust is to identify and fulfill the individual wants and needs of every customer.

3.9.1 The product platform

Product platforms are foundations for products targeted at different derivatives (Asker & Helgesson, 2003). When a platform has been developed it proves its usefulness if it corresponds to the markets expectations and meets the customers needs. The reason that a product platform is considered instead of a single product is because it creates the opportunity to release numerous alternatives aimed at different customers (Asker & Helgesson, 2003). According to Asker & Helgesson (2003) it is difficult to develop platforms, however, efficient developing of platforms balance the market value of product differentiation against the economic advantage of using standardized products.

3.9.2 Methodological enablers for mass customization

There are numerous authors that have presented their views on how to accomplish mass customization. Most of them have the same ideas but put them in different wording, which is why only a few of the most relevant theories will be brought up. Anderson (1997), for instance, suggests modular design, proactive versus reactive customization, just-in-time, parts commonality, advanced product development methodologies, setup reduction, and flexible manufacturing. On the other hand, Pine (1993) says that mass customization is enabled by customizing services around standard products and services, and to provide a quick response though the value chain.

3.9.3 Time-based manufacturing

A critical part of mass customization is the ability to simultaneously achieve customer responsiveness, cost efficiency, and high volume production in the manufacturing system

(Tu et al. 2001). There are different stages of customization that will vary in lead time. According to Hill (1995) the table below consists of alternative responses to markets and their lead time implications.

Initial Positions	Length of Lead Times
<i>Design to order</i> : a new product response where companies design and manufacture a product to meet specific needs of a customer.	Long
<i>Engineer to order</i> : changes to standard products are offered to customers and only made to order. Lead times include the relevant elements of engineering design and all manufacturing.	
<i>Make to order</i> : concerns manufacturing a standard product only on receipt of a customer order or against agreed schedule or call process.	
<i>Assemble to order</i> : components and subassemblies have been made to stock. On receipt of an order, the required parts are drawn from work-in-progress and assembled to order.	
<i>Make to stock</i> : Finished goods are made ahead of demand in line with sales forecasts. Customers' orders are met from inventory.	

3.9.4 Customer Elicitation

Pine's (1993) definition of mass customization is: "developing, producing, marketing, and delivering affordable goods and services with enough variety and customization that nearly everyone finds exactly what they want". The process of obtaining the above mentioned could be considered customer elicitation. In the definition above, the word nearly is crucial, since an unlimited choice would be needed to satisfy the exact needs of everyone, which would generate unreasonable costs.

Propitiously, endless choice is not what most customers want. Providing customers with too many options makes them, according to Huffman & Kahn (1998), confused with the complexity of multiple choices. Instead, the role of mass customization is to offer "easy-to-choose options that can sacrifice the gaps of mass production" (Berman, 2002).

3.9.5 Modularized production

To move to mass customization it is required that products be modularized to provide unique combinations for any customer. “An inventory or database will be kept for recognition of the components” (Pine, 1993). Further, the tightly coupled processes created through continuous improvement should also be broken apart and modularized, so that ideally, any process can link to any other process to create the unique end-to-end value chain that will best satisfy each individual customer.

Mass customization organizations also have to be able to renew themselves. This is essential when they realize that they cannot satisfy a particular customer or cannot go after a particular market opportunity with their current variety of offerings. This is where a carefully developed product platform comes in hand together with a modularized production system, which combined generates the opportunity to create new products expeditiously at a relatively low cost.

3.9.6 The organizational enablers for mass customization

One of the less noticeable enablers is the sometimes overlooked dimension concerning the human and his or her organization. An organizational structure characterized by a “dynamic network of relatively autonomous operating units, learning relationships, integration of the value chain and a team-based structure” is included in the key features of mass customization according to Sahin (2000). She also describes a workforce management situation characterized by “empowerment of employees, high value on knowledge, information, and diversity of employee capabilities, new product teams, and broad job descriptions”, as other important features. According to Wobbe (1994), the complexity of managing customized manufacturing can be facilitated by the use of certain methodologies and organizational structures. For instance, programs that educate the employees to manage the increase of complexity can be used to promote their empowerment and their success as teams. The more customized the products are, the more human intervention is necessary to make sure that the changeover, adaption and control are managed.

It can be understood from above cited authors that human and organizational-related factors have impact on the success rate of mass customization. So what is the optimal organizational culture in this matter? In the article “*The Crucial Interrelationship Between Manufacturing Strategy and Organizational Culture*”, written by Bates et al. (1995), the importance of aligning manufacturing structure with organizational culture is discussed. Summarily, the authors concluded that a well-aligned and implemented manufacturing strategy, i.e. one that includes formal planning processes, communication of strategy, contribution to competitive position, and a long-range orientation, was found to coexist with an organization characterized by the use of teams.

The article stresses a few implications of the study. One of the main implications was that multiple decision makers at different organizational levels should be involved in the

implementation of manufacturing strategy in order to successfully guide decision makers in the high complexity arena of manufacturing plants (Bates et al., 1995). It was also stated by the authors that when a management attempts to benefit from a manufacturing strategy it is essential that the management have a legitimate image of their organization. Otherwise, it is not possible to manipulate the organizational culture in the desirable way.

Included in the dimension of organizational enablers there are associated technological enablers. These technological enablers might include collaborative communication systems or user-friendly interfaces in the manufacturing system to assist the human in managing the added complexity that increased information and material flows with mass customization might entail.

3.10 Summary in Points

- The importance of communication
- The importance of collaborative/supportive tools
- Let the company position its product in a favorable way and not let the customers position it
- The need for a positioning statement
- Line extension can change the customers' perceived value of the company and its products
- Standardization can change the purchasers' behaviors
- Normally standardization leads to price competition. However, in this case a highly complex and expensive product is concerned, which is why lead time and quality may work as competitive factors
- The theory of outpacing strategies indicates that the mix of customized and standardized products is "impossible". Therefore the two activities should be separated
- Modularized production is essential to enable mass customization
- Empowerment of employees is an organizational enabler when moving from standardization to mass customization. When moving from customization to standardization the opposite may be appropriate. Also true for more human intervention when moving from standardization to customization.

4 Case Studies

4.1 Introduction

Theory does not always correspond to how things work in reality, which is why the following chapter is included in the thesis. It will cover how different companies manage various parts of the problem description; how a mixed product portfolio consisting of both standardized and customized products is managed, in practice.

The first three case studies have been gathered from a doctoral thesis in mass customization. The conclusions from the cases in mass customization together with the theoretical framework will create the foundation for the interview questions that will lead to the case studies to be conducted by the author of this thesis. Those four case studies will investigate four different companies that in their own specific way have experience of a mixed product portfolio that consists of both customized and standardized products or in another sense has experience of standardization that can be of interest for ABB Machines in Västerås.

4.2 Mass Customization Case 1

Title: Enabling Mass Customization through Customer Elicitation and Concurrent Engineering – Reflections from a Best Practice Case in Swedish Industry

Conducted by:
M. Combstock
Linköping University, Linköping, Sweden
S. Bröte
Jönköping University, Jönköping, Sweden

4.2.1 Introduction

This case was carried out using the method that Creswell defines as a study “in which the researcher explores a single entity or phenomenon (the case) bounded by time and activity and collects detailed information by using a variety of data collection procedures during a sustained period of time”.

In this case study from a Swedish industry, the company’s industry leading approach to customer elicitation and concurrent engineering and how these two are combined to create competitive advantage, is described. This is only a part of a much more extensive research and in this part the main research questions were:

- How does the company enable customer elicitation?
- How does the company develop its products?
- How does the company’s practice compare to the literary state-of-the-art in the areas of customer elicitation and concurrent engineering?

The case study was conducted during the winter 2002-2003 at a Swedish manufacturer.

4.2.2 About the company

The object of the case study was a medium-sized company specializing in the production of different types of mechanical products, which sells in two primary markets. One of the markets consists of OEMs and the other consists of customers that are represented by engineering or construction consultants.

The company’s products are designed for use in different settings and are made to order after the customers’ specifications. However, all the products are similar. Only 10 years before this study was made the company offered almost entirely standard products, which makes this company interesting to study.

The main sources of competitive advantage, for this company, are its abilities to offer customized products with relatively short lead times, high quality and reasonable, yet

premium, prices.

4.2.3 Results from the case

Customer elicitation and product configuration

The principle enabler for customer elicitation at the company is its computer-based product configuration program referred to as its “product selection program” shortened PSP. The PSP began as an internally used engineering program, but it was soon realized that the program had potential to be used as a product catalog for the customers. Now the PSP provides the customers with the possible choices of products and the best product choice for different requirements by guiding them in the selection of alternative designs. The PSP also archives data from previous orders to simplify the re-order process.

All the customers do not use the PSP. Some customers still prefer the traditional way of interacting with a sales representative at the company. In those cases the sales representative uses the PSP to retrieve the information and suggests a suitable product for the customer. For some regular customers it is possible to order products directly via the PSP, however, this is not common.

From the company’s point of view, the most important output from the PSP is an external product code describing the product in detail. When fed into the order handling system this code is translated into an internal code and a bill of materials. It describes the product type and all the other information required for production. The program also generates an operation card including production instruction, drawings and barcodes for equipment changeover.

Concurrent engineering and order design

The company separates what is seen as standardized and customized products. Both the standardized and the customized products can be ordered via the PSP, however, the customized orders need to be manually reviewed while the standardized orders automatically contain all the information needed for production. In the PSP, there is a window where customers can write their customized requirements in text form. These orders are marked as customized to flag that the order has to be manually reviewed. After the customized order has been reviewed it is sent to production planning before being made available for manufacturing.

Future development

The company is striving to increase its variety of standardized products, since the customized product orders are problematic and resource-intensive. In one of the company’s markets approximately 50 percent of its orders are customized and can therefore not be processed in the automatic production program, but has to be reviewed and managed manually. These manual changes may not be time consuming per se, but together they will extend the lead time and affect the cost of the product. Hence, the big motivation for making these orders standardized.

4.2.4 An analysis of practice vs. theory

Questions related to customer collaboration answered based on the case

Q1. Is care taken to avoid unnecessary choices and options for the customer?

Answer: Yes. The options available have evolved over the 50-year period that the company has operated. Now when the options are available in the PSP it is possible to offer some “extra” options just in case. Many of these extra options will never be ordered but because of the company’s automatic, parametric design, the cost of offering these options are negligible. However, the extra options do not seem so excessive that the customer becomes confused.

Q2. What is the level of collaboration with the customer now, and what are the plans for the future?

Answer: Extremely high. Nearly all the company’s products are customized in some way, requiring close collaboration with the customer from the early design. The PSP is the principle enabler for the collaboration, along with the sales support that depends on the level of customer knowledge. The OEMs are the most knowledgeable and know what they want. Therefore, they prefer to use the PSP with minimal assistance from the sales staff. In the future the PSP might be moved to the Web, but due to the size of the program it is now available only on CD-ROM distributed to selected customers.

Q3. If collaboration is used, are quotes and manufacturing specifications automatically generated?

Answer: Yes and no. The customer automatically receives a quote for standard products, but the manufacturing specifications will be delayed. The customer must select an external code from the PSP that needs to be translated by the company in order to receive the manufacturing specifications.

Practice vs. theory in concurrent engineering

Expanding organizational boundaries: At the company, customer elicitation is one way of expanding its organizational boundaries, as it incorporates each individual customer into the product development process. Additionally, the development of new standardized products integrates representatives from all the different functional areas of the company.

Optimizing reusability: Reusability and commonality among the designs was exemplified through the core product design. The core product supports modularity and provides a high degree of common material flow in manufacturing.

4.2.5 The authors' conclusions

The company in this case is viewed as an example of “best business practice” for mass customization, given its leadership in efficient, customized production within its industry. However, when compared to the literature it can be seen as a “less than best business practice” company.

Firstly, the area of customer elicitation can be perfected. The company is the industry leader thanks to a wise investment in its product configurator (the PSP). The product configurator that is described in the case is the company's primary source of competitive advantage as it adds value for both the company and the customer by enabling a high level of customizable design. This situation will not last since the competitors will start to develop similar systems and therefore the company will lose its competitive advantage in customer elicitation. What the company can improve is to strive for the seamless links of communication that Zipkin (2001) brings up. At the moment of the case study the company had to manually transfer the external code to internal codes, which is an example of where improvement could be made.

Regarding the concurrent engineering, the company showed its proficiency at expanding organizational boundaries, where one way of doing that was to incorporate each individual customer into the product development process. However, the company lacks integrated “X” tools, in which “X” represents a series of engineering functions such as manufacturing, assembly, testability, and cost prediction that according to Tseng & Jiao (1998) are essential.

The company has excelled despite lacking some, according to theory, state-of-the-art behaviors. Nevertheless, these shortcomings must be taken into consideration, as they might be found crucial to stay competitive in the long run.

4.3 Mass Customization Case 2

Title: Coordination in Collaborative Manufacturing Mega-Networks – Observations from a Case in the Commercial Aerospace Industry

Conducted by:

K. Johansen & M. Comstock

Linköping University, Linköping, Sweden

M. Winroth

Jönköping University, Jönköping, Sweden

4.3.1 Introduction

The case study was conducted during the spring of 2003 at the Saab Aerospace manufacturing facility in Linköping, Sweden. Prior the interviews that this case study is based on, the respondents were provided the following research questions to consider for the analysis of an existing collaborative manufacturing network:

- What is the design (structure) and organization of the network?
- How does the network coordinate and plan resources, material and competence?
- How do companies in the network relate to external partners such as suppliers, final customers and other units?

4.3.2 About the company

For its important role in one of the largest consortiums in the world, Saab Aerospace was chosen as the case study example. Its experience in the industry is extensive with 65 years of business, more than 4 000 aircrafts, and serving more than 500 regional airliners at the time this case study was conducted (Saab Website, 2003). As Saab Aerospace was given its role in the A-380 consortium, the authors found it suitable for a case study that could help illuminate the inner workings of a large collaborative manufacturing network.

International cooperation with different companies, including the two largest aircraft manufacturers in the world, Airbus Industry and Boeing has been a long tradition for Saab. In the concept phase of the A-380's development, Saab played an important role participating in several studies. The project is one of the largest investments ever made by the aerospace industry, and has led to extensive cooperation among various companies.

4.3.3 Results from the case

Application of networks strategies

Saab's strategic choice of becoming the sub-system supplier for system integrators enforced the company to participate in various collaborative networks. It negotiated with

other companies within the Airbus consortium in order to minimize the risks while creating an opportunity to receive parts of future profits. Some of Saab's benefits from the alliance were shared risks, exchanging resources, accessing new markets and achieving economies of scale.

It is important to note that commercial aircraft such as the A-380 consist of a number of separate functions that are integrated throughout their structure. To support this integration, decisions are managed through a formal information and decision network. Therefore, a great deal of coordination is required in the areas of information and knowledge sharing together with a clear structure for decision-making. Moreover, supporting tools and a superior organization is entailed in order to achieve the desired results, which are: high quality, at the right time, with required functionality, and traceability for future maintenance.

Network structure in the case

The aircrafts are manufactured through complex manufacturing networks, including numerous companies from numerous countries. Each Airbus Industrial Consortium (AIC) branch is responsible for different sub-assemblies. The next sub-level in this integration consists of subsystem suppliers that are responsible for developing and manufacturing subsystems for the aircraft, which in order has suppliers under them. In figure 4.3.1 this relationship between companies are shown together with a percentage representing the estimated profit margins for companies in each hierarchical order. The higher a company climbs in the pyramid, the larger profit margin it will benefit and in effect take higher risks.

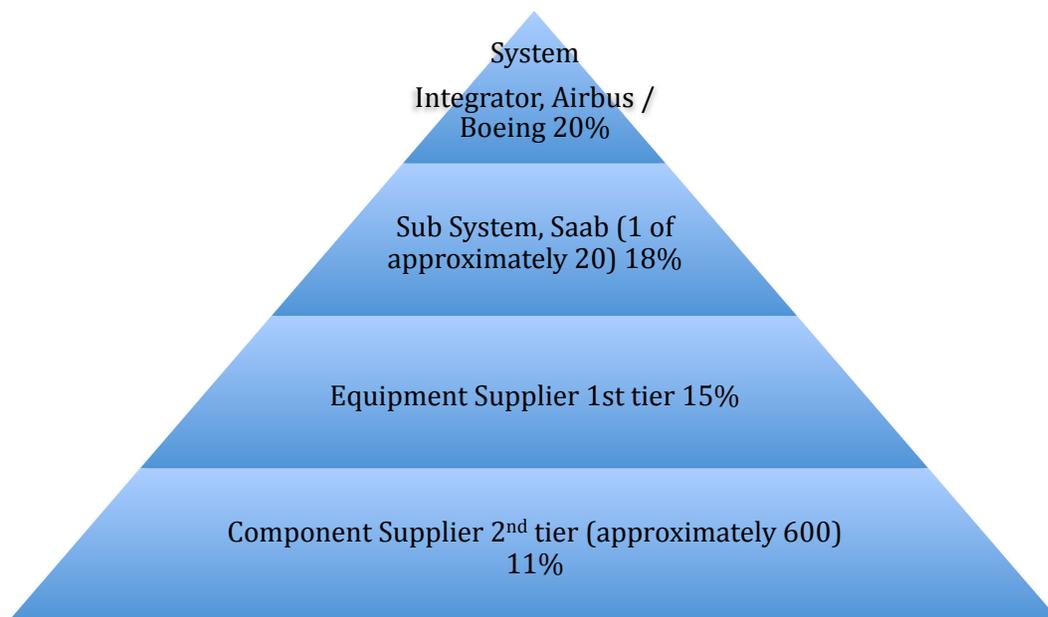


Figure 4.3.1 *The hierarchy of an Airbus Industrial Consortium.*

Saab's strategy for its participation in collaborative manufacturing networks has been to step down from system integrator to sub-system supplier. Therefore, Saab moved from a vertically integrated structure to a horizontal. In this case horizontal structure implies that Saab is now but one of many suppliers for a product that is ultimately assembled by Airbus. This shift lowers Saab's risk significantly with only a minor decrease of the profit margin.

Cultural issues and knowledge sharing in the case

During the shift from vertical to horizontal structure, Saab sources estimated that up to half of all problems and misunderstandings had some sort of cultural link. Mostly, the problems were connected to preconceived ideas about behavioral norms of different countries. The organizational hierarchy varies from country to country, which was an obvious problem. For instance, in Sweden it is common to empower the employees and pass on the decision-making to the lower level management. Sending such a representative to, for example the U.K. could potentially cause problems, because decisions there are usually made among managers at the same level.

As the project progressed, the misunderstandings declined, as the collaborating partners became familiar with each other's cultural uniqueness. The experiences of this case show that cultural understanding in the beginning of the collaboration is the most important factor to avoid problems and misunderstandings.

Customization issues

According to Saab's Website (2003), Saab Aerospace boasts a culture of providing customized solutions, seeking to provide "customized technology at your service" through the offering of "state-of-the-art capabilities and resources that make Saab Commercial Programs the premium aerospace partner for the future". Even though this mindset of customization exists within the company, customization was not applicable in the A-380 project.

To aid mass customization in the final A-380 project, new developments in information technology are suggested, enabling knowledge sharing and facilitating communication throughout the whole collaborative manufacturing mega-network. The fact of the matter is that Airbus Industries is currently deploying such a system. The system will include 15 000 definition phase drawings, 3 000 CAD workstation drawings, 150 000 parts in different configurations, and data from a global supply chain. The aim is to make the management of the plane's structure, changes, the release process, 3D visualization, and connectivity to legal systems easier by applying the system across the partners and to the supply chain.

4.3.4 Summary of important factors

- Companies in CMMNs should be prepared for and open-minded to different types of inter-organizational collaboration.
- Strategic choices made by collaborative partners are influenced by early participation in the concept phase, unique technology competence, and the level of shared risk.
- Companies should see the trustful, win-win relationship that can arise with participation in a CMMN through the strategic utilization of each partners' competencies.
- Communication systems are strong tools that support work processes and mutual decision-making, provided that employees are trained in using these communication systems in the most suitable way.
- CMMN participants should receive cultural awareness training from the start to avoid potential problems during latter stages of the project.
- For the CMMN system provider, the ability to plan for the future products can be an important factor for future viability.

4.4 Mass Customization Case 3

Title: From Mass Production to Mass Customization: Enabling Perspectives from the Swedish Mobile Telephone Industry

Conducted by:

K. Johansen & M. Comstock

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M. Winroth

Jönköping University, Jönköping, Sweden

4.4.1 Introduction

This case study was conducted during the spring of 2001 at a Swedish mobile telephone company's factory. The primary objective of the study was to determine the implications of a radically new manufacturing initiative for the company, namely the production of a customized entry-level mobile telephone. The authors also sought the differences between the mass production of standardized product at the company and that of the customized products.

4.4.2 Product perspective

Gilmore and Pine (1997) describes their "Four faces of customization" framework that consists of adaptive, cosmetic, transparent and collaborative customization. With adaptive customization, customers receive one standardized product that they can customize themselves. An example of that in this case is a standardized mobile phone built with the user's ability to snap-on accessory covers and to personalize the telephone settings. In cosmetic customization, a standard product is presented differently to different customers. The third "face", known as transparent customization, is apparent when customers are provided with unique goods or services without their explicit knowledge. For instance, in the mobile telephone industry, when the factory installs different communication systems to serve different geographical markets, such as GSM frequencies or CDMA. Lastly, the collaborative customization is where the user helps to define the type of product differentiation together with the manufacturer. An example of that in the mobile telephone industry is the thermal printing of a unique customer required front cover logotype. In the above discussion the phrase "customers" refers to both end-users and the mobile system operators and retailers.

4.4.3 Process perspective

Initially, the company's manufacturing process could be described as a combined make-to-stock (push) and a make-to-order (pull) system. It is in the late assembly of the production process that the customization takes place. The customized orders are rarely individual, but rather orders from large retailers.

To be able to realize customization in the future the company introduced an internal program focusing on time to customer (TTC). An extreme market situation, where the products had extremely short life cycles, drove the implementation of the TTC program. The program goals was to streamline the supply chain, ensure that the time from order to delivery was as short as possible, focus on business value, take the customer's perspective, and simplify wherever and whenever possible.

One TTC initiative, called the product data handling (PDH), was the driving force behind the customized production. The PDH was, according to the company, a re-design and simplification of product data and variant handling needed to reduce costs. The company's customization offerings were divided into four categories:

Data setting customizations: start-up show, SIM lock, frequencies and languages.

Shell customizations: front and back covers.

Label information: manufacturing information, bar codes.

Kit and kit content: accessories, portable hands-free.

4.4.4 System perspective

Zipkin (2001), describes many enablers of mass customization in his discussion "the three main elements of mass customization", customer elicitation, process flexibility and logistics, all of which are connected by powerful communications.

For the customized mobile telephone, the complexity of handling a great number of customization possibilities is managed by a streamlined information handling process. The product information is divided between the shop floor information system and the business information system. The shop floor system includes the entire process up to and including the production of a generic core module. Generally, the production is standardized up to this point. During production, the shop floor information system provides the assembly line with assistance, based on input from the business system.

Another systematic enabler is the assembly system itself. In this case both the assembly principle of the new customized products and the assembly principle of the standardized products are in focus. At the time of the case study the company has its production in high labor cost countries, such as Sweden and the U.K., where the assembly process has been highly automated. However, during 2001 the company decided to outsource its complete manufacturing function, which signaled a trend back towards manual assembly. The authors make that assumption, because with an external assembler it is expected that the manufacturer will shift towards a low-wage country, where the assembly primary is manual. This shift could have important implications for the introduction of mass customization due to the increased level of flexibility facilitated by manual assembly.

4.4.5 Implications from the case study

Even though the PDH solution was successful, according to company sources, the product achieved only limited success in the marketplace. One reason for that is that the customized telephone was, from a design point of view, still not what the customer wanted. It seems that, in this case, the efficient production and adaptive customization were overshadowed by an unsatisfactory basic design.

4.4.6 Concluding remarks by the authors

The determination of the mass customization status at the studied company depends significantly on the perspectives taken. The product may be individually customized from the customer's perspective, but from the company's point of view it could be seen as the production of standardized modules for final configuration by the customer or customized orders.

Today, the individual configuration and ordering of personal computers via the Internet are available thanks to pioneers like Dell Computers. In the future, mobile telephones could evolve into similarly configurable products. At the time of the study, the customized mobile telephone scope was still limited, but it cannot be ruled out that customization could become more relevant in the future and could drive the need for corresponding planning, control and manufacturing systems which could enable the "order size one".

To summarize, this case study has highlighted a number of issues that need to be considered when implementing a mass customization strategy:

- Significant gains in efficiency can be made through an automated product data handling process.
- With adaptive customization, manufacturers can reduce their requirements for manufacturing flexibility, moving some of the final assembly to the value-added resellers or even the end-user.
- Mass customization initiatives may involve the mass production of standardized modules that make the production process even easier than for the original products.
- Efficiency gains from proactive mass customization initiatives may be neglected by poor product design and an extensive time-to-market.

4.5 Conclusions From the Mass Customization Cases

The cases; *Enabling Mass Customization through Customer Elicitation and Concurrent Engineering – Reflections from a Best Practice Case in Swedish Industry*, *Coordination in Collaborative Manufacturing Mega-Networks – Observations from a Case in the Commercial Aerospace Industry* and *From mass production to mass customization – enabling perspectives from the Swedish mobile telephone industry*, were mainly studies of mass customization best practices, however, from the third case a highly important point was observed. Namely, that whether a company has implemented mass customization or not depends on the perspectives taken. The product may be individually customized from the customer's perspective, but from the company's point of view it could be seen as the production of standardized modules for final configuration by the customer or customized orders.

The three cases above resulted in a few interesting conclusions that will be used in the upcoming case studies by the author of this thesis. Firstly, all three cases showed that some kind of computer-based system is essential for top performance within this area. It is however unclear to what extent the computer-based system should be used. If it should be used by some customers or if it should be mandatory, if it should be used by the customer to create and order the product or to be used as a supporting tool, if it should be used for communication or for documentation, is yet to be determined in each individual case. One can only draw the conclusion that some kind of computer-based system is needed to aid the difficulties to manage both standardized and customized products.

From the first case above, where the studied company is considered a best practice company, it was shown that in order to manage a product portfolio with customized and standardized products combined, the processes had to be separated. The company used its computer-based system to separate the standardized orders from the customized orders that needed more care and some extra review. This conclusion will be kept in mind when conducting the upcoming case studies.

From the second case it was observed that being part of a collaborative network reduces the risk significantly with only a minor profit reduction. It was also observed that when the collaborative network consists of members with different cultural backgrounds, cultural awareness training is essential in the beginning to avoid unnecessary misunderstandings. This is important points for ABB Machines for various reasons. The fact that ABB will be a part of a collaborative network with its new standardized product and it may have to include new suppliers, most likely not from Sweden, into its network due to possible material cost savings, are only two of the many reasons.

From the third and last case a very important point was brought up, namely that efficiency gains from introducing a new standardized product may be neglected by poor design and an extensive time to market. Even though a company successfully manages the internal changes and the new processes that come with a new standardized product, the product introduction itself can still fail. Therefore, it is crucial to question the product design and make sure that it is adapted after the customers' needs.

4.6 The Volkswagen Commercial Vehicles Case

Title: Managing a Mixed Product Portfolio – A Case Study of Volkswagen Commercial Vehicles

Conducted by:
H. Jansson
Lund Institute of Technology, Lund University

4.6.1 Introduction

The case study was conducted during the fall of 2009 at Volkswagen Commercial Vehicles' head quarter in Södertälje, Sweden. Prior the interview that this case study is based on, the interviewees were provided following research questions to consider for the analysis of a product portfolio consisting of both standardized and customized products.

- How are customized and standardized orders separated internally to ensure that both processes are optimized for their purposes?
- How do you explain the possible price differences between the standardized and the customized products?
- Did the introduction of the customized products, in any way, affect the standardized products? Did the customers' perception of the products change?

4.6.2 About the company

The Volkswagen Group with its headquarters in Wolfsburg is one of the world's leading automobile manufacturers and the largest carmaker in Europe. In 2007, the Group increased the number of vehicles delivered to customers to a 9.8 percent share of the world passenger car market. In Western Europe, the largest car market in the world, almost one in every five new cars (19.5 percent) comes from the Volkswagen Group according to Volkswagen Group's Website (2009).

The Group is made up of nine brands from seven European countries: Volkswagen, Audi, Bentley, Bugatti, Lamborghini, SEAT, Skoda, Scania, and Volkswagen Commercial Vehicles.

Each brand has its own character and operates as an independent entity on the market. The product range extends from low-consumption small cars to luxury class vehicles. In the commercial vehicle sector, the product offering spans pick-ups, busses, and heavy trucks.

The Group operates 48 production plants in thirteen European countries and a further six countries in the Americas, Asia and Africa. Around the world, more than 360 000 employees produce almost 25 400 vehicles or are involved in vehicle-related services each working day. The Volkswagen Group sells its vehicles in more than 150 countries.

It is the goal of the Group to offer attractive, safe and environmentally sound vehicles which are competitive on an increasingly tough market and which set world standards in their respective classes (Volkswagen Group Website, 2009).

History

In 1937 the company “Gesellschaft zur Vorbereitung des Deutschen Volkswagens mbH” is founded in the German city Wolfsburg and in 1938 it is renamed “Volkswagenwerk GmbH”.

During the Second World War Volkswagenwerk’s production is switched to armaments. Around 20 000 forced laborers, prisoners of war, and later also concentration camp prisoners, work at the plant.

After the end of the Second World War, in mid June 1945, responsibility for Volkswagenwerk is placed in the hands of the British Military Government.

In 1950 the company expands its product range by putting the Volkswagen Bus into production. The “VW Bully”, soon creates rising demand thanks to its multifunctional capabilities and in 1956 a separate manufacturing base for the Transporter is established in Hanover. This was the beginning of today’s Volkswagen Commercial Vehicles brand. (Volkswagen Group Website, 2009)

4.6.3 Interview Volkswagen Commercial Vehicles

Interviewees:

Lisbeth Hansson, Marketing and Information

Joakim Hög, Product Manager

Q1. How does your sales process work?

Most of our cars and busses are sold via our authorized resellers, which is our main focus. We also sell a small part of our cars and busses directly to some large customers. A special sales division handles these sales.

In those cases the process are as follows: The customer contacts our sales division and explains its desires through a specification. The sales representative offers the customer the most suitable product, with reference to the specification that hopefully fulfills the customer’s needs.

Q2. Did you start with standardized products and introduced customized or the other way around?

The origin is from standardized products, since the car industry was very standardized 60 years ago, when only one product was offered. Back then you were lucky if you, as a customer, got to choose the color of the car. For Volkswagen Commercial Vehicles it began the same way. I am not sure exactly when, but it was in modern time customization became an issue in the transport business. It has obviously been possible to “customize” ones car by choosing between motor sizes, but we see this as part of our standard products.

When we speak of customization, we mean for example to build in a large cooler or a big crane, i.e. in first hand functional customizations. During the last years we have also seen the customer demand for customizing the commercial vehicles visibly by, for instance, using larger rims.

Q3. How are customized and standardized orders separated internally to ensure that both processes are optimized for their purposes?

Today, we have two completely separated processes for handling the customized and the standardized product orders. From an organizational point of view the employees are still part of the same department, however the tasks differ. In the beginning all the orders were handled the same way, but it was soon realized that the processes had to be split in order to handle the increasing sales volume. One of the main contributing factors of the increase in sales was the Government’s procurement. Large shipments of cars were made to various government authorities, for instance to the Swedish Armed Forces. This was over 30 years ago.

Q4. Were there any difficulties with changing the internal processes?

It is difficult for us to say because this was a long time ago and a lot has happened since then.

Q5. Have the processes changed a lot over the years?

Yes, since the sales volumes grew some adjustments of our processes had to be made. Logistically, a lot had to be changed to be able to manage the larger quantities, but also the development of IT has made some improvements of the way we work at Volkswagen. Even though the communications has developed, we still keep the sales process as it was before with separate salesmen for standardized products and others for customized products.

Q6. How do you explain the possible price differences between the standardized and the customized products?

Sometimes it might be difficult, when the customers thinks the minor changes are very costly while some visibly larger changes are relatively cheap. However, from our point of view it is always possible to see whether a product can be mass-produced or not, which has an obvious impact on the price. This is something that our customers are well aware of and therefore, it is almost never an issue.

At least from what we know, Volkswagen has never had any trouble with this and we do not see the need for a product separation using different names for the product. Volkswagen Transporter is available both as standardized and as a customized product. We do, however, insert an addition to the product name to clarify what makes the product special, for instance VW Caddy Harley Davidson, for the Harley Davidson edition.

Q7. How is the documentation managed for the different products?

The documentation for our standardized products is always the same and therefore, there is no need to prepare documentation for each individual order. In the cases we sell customized products, we use the standardized documentation as a foundation and we add the documentation for the customized parts later on. Since external suppliers often do the customizations, they provide their documentation, which we add to our documentation.

Q8. How do you handle a customer that has ordered a standardized product and asks for documentation beyond the standard documentation you usually offer?

Honestly, I have never received such a request, but if it would happen I am sure that we would provide it. It would not be that costly to do occasionally, but to a greater extent it could be a problem. Besides, we are obligated to provide some documentation to workshops to make sure that they have to proper information to handle the service and maintenance on our vehicles.

Q9. Are you using the Internet to distribute documentation?

We are posting the brochures for the standardized product online, but not the technical drawings. In Germany, it is possible to request documentation via the Web, but I do not believe that this is used here in Sweden yet. In those cases, you can specify what documents you want and they will be sent to you for some kind of fee.

Q10. Did the introduction of the customized products, in any way, affect the standardized products? Did the customers' perception of the products change?

It is not easy for us to answer that but our understanding is that the introduction of the customized products added value to Volkswagen because it shows that we are competent, we can offer a wide range of products, and we can adapt to the market's demand. So the way we see it, we do not lose anything on the introduction, we only complement our existing products and add value to the brand.

Q11. Since the options are infinite and the purchasing process of your products is more complicated with customized products, did you experience any change in the purchaser's behavior? When more technical knowledge is needed the opportunity for other decision makers is created.

That is one of the great dangers with this introduction and it is something that we have been trying to work on recently. The danger is that the possibility of endless choices delays the sales process and unnecessary time is spent until the sale is closed, and not that more technical knowledge is needed.

Here we would like to separate our customers into two categories. The large customers are often clear in their specifications and state their requirements distinctly, while the smaller customers see the opportunity to customize their car to their joy. We are mainly thinking about the customers who both buys and drives their cars themselves. In those cases we can see a clear change in the purchaser's behavior. The customers who drive their cars themselves spend more time and money to invest in comfort and styling than the customers who see the vehicle as a tool.

Q12. Imagine the scenario when you receive a specification from a customer that fits one of your standardized alternatives. When all the papers are signed you discover a point in the specification that shows that this product is in fact a customized product and therefore more expensive and requires more time in production. How do you manage a situation like this?

That was an interesting scenario. I can say that unfortunately this happens sometimes. It is not easy to answer this in a general case but the starting point has to be that the customer is supposed to get the product he ordered at the price according to contract. The cost of the mistake has to be weighted before we decide to take the whole blame, and perhaps a compromise can be discussed. It is important to estimate how much a good relation to this particular client is worth.

I guess the general answer, despite all, is that some kind of compromise is the aim. After that it is up to our judgment to decide if we can take 95 percent of the cost or a 50-50 solution.

4.6.4 The author's conclusions

Volkswagen Commercial Vehicles introduced a customized product to offer a wide range of products and to add value to the company. It has successfully managed to offer a mixed product portfolio by separating the sales processes between the customized and the standardized products. By doing that, Volkswagen ensured that the sales staff became specialized in selling either standardized or customized products and therefore both product categories are sold and managed correctly. The processes have changed a lot over the years, but the separated sales processes remain the same, which indicates that they are well thought through and have been working satisfactory.

Volkswagen has not experienced any difficulties with customers complaining over the price differences between standardized and minor customized products, because of the customers' awareness of the cost reductions of mass-producing. This is a good sign for other businesses worrying about customers' incomprehension in this matter.

A system for customers to order documentation via the Internet is available at Volkswagen in Germany, but at the time of the interview it was not available in Sweden. When this is introduced in Sweden, the order management will be unburdened and their workload will decrease. Introducing an efficient system to transfer some work tasks from your company to the customer, will lead to substantial cost savings.

4.7 The Scania Case

Title: Introduction of a Standardized Product – A Case Study of Scania

Conducted by:
H. Jansson
Lund University

4.7.1 Introduction

The case study was conducted during the fall of 2009 at Scania's head quarters in Södertälje, Sweden. Prior the interview that this case study is based on, the interviewee were provided following research questions to consider for the analysis of introducing a standardized product into a portfolio consisting of customized products.

- How are customized and standardized orders separated internally to ensure that both processes are optimized for their purposes?
- What were the main reasons for introducing the standardized product?
- What risks associated with the standardized product introduction did you identify?

4.7.2 About the company

Scania's vision is to be the business leader through creating remaining value for its customers, employees, shareholders, and other stakeholders. Today Scania is the leading manufacturer of heavy trucks, busses, industry engines, and marine engines. It also provides service related products and financial services.

Scania is active in about 100 countries and has 35 000 employees. Local purchasing offices in Poland, Czech Republic, USA, and China complement its purchasing department. The production is located in Europe and South America. In addition, Scania has around 20 000 persons working in its independent sales and service organization.

Since Scania is a business leader, it cooperates with administrative authorities, customers, and organizations to provide reliable, energy efficient products and solutions that enhances customers' value and contributes to the society.

(Scania Website, 2009)

History

In the late 19th century the company "Vagnfabriksaktiebolaget i Södertälje", shortened Vabis, was founded. It started out as a railway carriage manufacturer that later on also started to develop cars and trucks.

In 1900 another company was founded under the name Maskinfabriksaktiebolaget Scania that manufactured bicycles in the south of Sweden. Scania, which means Skåne in Latin,

also started to produce cars and trucks.

Scania and Vabis merged in 1911 in an attempt to meet the competition in Europe, under the name Scania-Vabis. The merger is successful and the company expands its business in Europe and later on enters the South American market.

Scania-Vabis merges with the Swedish airplane and car manufacturer Saab under the name Saab-Scania in the end of the 1960ies, but breaks it up after only 16 years and Scania once again becomes a freestanding company.

In 2008 Volkswagen becomes the main owner of Scania with about 69 percent of the voting rights.

4.7.3 Interview Scania

Interviewee:

Sigvard Orre, Manager Market Introduction & Pricing

The modularized system

Scania is working with a modularized system that consists of a variety of modules, which can be combined to tailor make a product fitting a customer's needs. The modularized system has been more and more difficult to manage as the environmental requirements become more rigorous. For instance regarding the engines, a larger engine now needs a higher cooling capacity to meet the requirements and therefore, more limitations of the system had been created. Besides, the system causes the need to balance between optimal functionality and the opportunity of many choices.

A-order

The combinations of various modules that have been built and tested by Scania are referred to as A-orders.

S-order

Then there are combinations of modules that mechanically can be mounted in theory. By looking at the drawings one can see that these combinations are possible, but they have never physically been assembled or tested by Scania. These orders are referred to as S-orders. The S-orders have their own production line in case such an order is placed and highly customized vehicles are to be assembled and tested in small volumes. The S-orders creates the possibility to get a fully tailor made product.

Scania Ready Built

With its modularized system as a starting point, Scania has introduced a product line called Scania Ready Built, where the possible choices are limited to suit a few body builders (the attachment to the truck) on beforehand chosen by Scania. The modules still electable by the customer do not affect the body builder such as color, cabin size, and engine. When a customer buys a Scania Ready Built the body builder is mounted by

Scania to shorten the lead time, which is not the case for A-orders or S-orders, when the body builder is mounted by the body builder's supplier.

Scania Complete

Scania Complete is Scania's fully standardized alternative. There are no possibilities to change the design of this product, not even minor changes such as the color (it is only available in white). The Scania Complete is a ready-made truck including the body builder for the customer to buy. There are approximately ten different Scania Complete based on the most common specifications received in the past.

The markets (Sweden, The Netherlands, Spain, and Asia)

Scania's offered product range differs between the various geographical markets. On the Swedish market, the whole selection of products is available from the highly customized S-orders to the completely standardized Scania Complete. For Scania Ready Built there are three types of body builders available and there are seven types of Scania Complete.

On the Dutch market, approximately the same products within the S-orders and the A-orders are offered as on the Swedish market. However, neither Scania Ready Built nor Scania Complete is offered.

On the Spanish market the salesmen have been provided with 10 to 20 base specifications that correspond to the S-orders and the A-orders. They also have the possibility to sell two types of Scania Complete.

The Asian market is even more limited. The salesmen are here provided with only ten base specifications that correspond to the A-orders and one type of Scania Ready Built. Scania Complete is not available on the Asian market at the time of writing.

Q1. How does your sales process work?

It varies a lot between the different markets. On the Swedish market the salesman sells the whole truck including the body builder. The salesmen are in these cases very technically competent and are able to handle advanced computer systems that can compute, for instance the draught power of the vehicle, and place the order. In 90 percent of the cases the salesman buys the body builder from a supplier and sells it to the customer. The body builder can be, for example, a crane or a loading platform. In the remaining cases the customer buys the body builder from the supplier himself. One salesman can sell both S-orders and Scania Complete on the Swedish market.

If we review the Dutch market, we can see that the sales staff are still very technically competent, but the culture in the Netherlands is that the customer buys the body builder himself. This makes the process less complicated, from a salesman's point of view, which gives him more time to work on other sales and therefore sell more trucks.

In Spain, the process differs a little bit more. The Spanish sales staff is not as technically competent as the Swedes or the Dutch. They are competent salesmen, but might not have any previous experience in selling trucks in particular. One can say that they are more like salesmen than sales engineers. The general agent has selected the various base specifications for the salesmen to sell. In these specifications certain possible choices have been left for the customers. For example, engine size, gearbox, and cabin interior are selectable by the customer. The Spanish salesman cannot combine the modules in whatever way he wants, but he must stick to the specifications provided by the general agent. If a Spanish customer wants to buy a customized product he will have to contact the general agent directly, who can place orders from the whole product range like the Swedish sales staff. It is also possible for the Spanish salesman to sell the body builder, but to simplify the procedure the general agent has selected a few predetermined body builders for the salesman to choose from.

Q2. Did you start with standardized products and introduced customized or the other way around?

On the Swedish market the customers were used to buying customized products and had a habit of changing some details in the order as late as right before the freezing point. Despite of that, we at Scania chose to introduce a standardized alternative that we call Scania Complete. This was done approximately two and a half years ago. It was about the same time as we introduced our semi-standardized alternative Scania Ready Built.

Q3. What were the main reasons for introducing the standardized product?

Yes, why introduce standardized product in a market environment like that? There are several reasons. One thing was that our lead times were terribly long at the time, and this was a way to shorten the lead time and reach out to the customers in a hurry to get a truck. The lead times are usually two to three months, but at the time they were almost as long as one whole year, which is why we saw extra potential in the standardized product.

Another thing was that among our customers we have a lot of small customers, with one or two trucks. Some of these companies are family businesses where a recent shift in generation has been made. The younger generation has not always been a fan of driving the trucks, but instead been more business-oriented. When these customers have been looking for possible ways to expand, and they lack the technical knowledge to be able to specify the details of the truck needed, the standardized product will be favorable.

It is also a positive factor that the second-hand market for a standardized product is better, which the customers appreciate.

Q4. What risks associated with the standardized product introduction did you identify?

Let me put it this way: we saw risks both with introducing a standardized product, but also with not introducing one. One risk with not offering a standardized product is that the salesman may avoid certain customer categories. For instance, if a salesman has never sold a timber truck and lacks the technical knowledge he might avoid this customer category to avoid difficult technical questions that he does not know the answer to. However, if a standardized timber truck is available, the salesman can always offer that one and he might not lose the sale.

We also saw the risk in not being able to cater the customers who need a truck really fast. If one of their trucks broke down and they needed a new one rapidly, this customer is great to do business with, since they are in a poor position to negotiate the price. Without a standardized product we would not be able to serve these customers.

One of the risks we saw with introducing the product was that since the lead time was extra long at the time (approximately one year) the demand for the standardized alternative would decrease, and perhaps disappear completely, when the lead times went back to their normal length (two to three months).

We also saw the risk that this would lead to an overproduction of the standardized trucks and that we would have to sell them at a reduced price. Actually, we saw some tendencies to that now when the economic situation shifted. To have lots of products in stock are not profitable, because of warehousing costs and that will not be good way to gain from the flexibility provided by our other products. Our philosophy is that every order has to be sold before it should be built, but if we do not stick to that then there might be a problem. When we had too many Scania Complete in stock we managed to stop the production, but if this would not have been done correctly the prices of our products would have gone down and we certainly did not want that to happen.

Q5. How large part of the sales consists of standardized product versus the customized products?

Today, approximately 10 percent of the sales are completely standardized, i.e. Scania Complete. We are talking about around 250 trucks out of the 2500 we sell on the Swedish market each year.

Q6. How do you explain the possible price differences between the standardized and the customized products?

On the Swedish market, we tried to not lower the price, and instead emphasized the shorter lead time and the optimized specification. If the sales volume rises over 10 percent of the total sales we might have to give some discounts, but now we cater to the

customers that for the same price as the customized products choose Scania Complete because of the simplicity.

We understood that the larger customers were expecting a price reduction as soon as we mentioned the word standardized, but we managed to hold the prices relatively high. At the same time we could buy standardized components from our suppliers at a reduced price and therefore, our margins went up on Scania Complete.

We are expecting the competition to lower the prices in the long run, but until it is absolutely necessary, we try to keep our prices up.

Q7. How is the documentation managed for the different products?

As for Scania Complete, that always looks the same, the documentation has been prepared on beforehand. There is also documentation available for Scania Ready Built that show the various combinations of modules possible. These are posted on the intranet, for the salesmen, and on the Internet for the customers or the possible customers.

For the remaining products, that are customized, all the information is stored in a large database, in which you later can find the information needed. In this database it is possible to use spreadsheet applications to calculate various data of the product, for example the climbing ability, and then consider if a larger engine is needed. With the same database you can generate the documentation for the product presented in a favorable looking way to ease the use of it for the salesman to show his customer.

Today, it is only possible for Scania's employees to enter the database, but in the long run we are hoping that the customers themselves should be able to login and customized their own products. The problem today, is that our database is way too complex and all users need education to be able to use it. However, if we could develop a user-friendly system optimized for customer use, it would be possible.

Q8. Did the introduction of the standardized products, in any way, affect the customized products? Did the customers' perception of the products change?

No, not really. But it has brought up a very interesting discussion – how the interface between the truck and the body builder can be made more efficient. Now when we started to mount the body builder ourselves we discovered that the process to do so is far from rational. A lot of time is wasted when an external supplier is mounting the body builder, which brought to our attention that with the standardized way of thinking this part of the chain can be a lot more efficient and a lot more profitable. I believe that our competitors are of the same opinion.

Q9. How do you manage a customer's demand for a product that is based on the standardized alternative, but has a minor deviation from the standard?

We do not see a big difference between the customized and the standardized product in this particular case. The salesman's commission is about the same, since the prices are about the same, but the workload that comes with a customized product is way heavier than for a standardized product. That fact alone is enough incentive for the salesman to try to sell the standardized product. In the cases where the sales man cannot sell the standardized alternative, we simply see it as the customer's will for a customized product was too strong and therefore we have to settle for the lower margins.

Q10. How are the customized and the standardized orders separated internally, to ensure that the orders are managed properly?

Scania Complete is a complete truck with no possible options, and is therefore automatically managed differently. For the remaining products we do not separate the process other than that the S-orders have their own assembly line.

I believe that in time we will find different sales processes more suitable for the different products and that will lead to the use of different sales tools for support. Just like in other branches it is good to let the customer do some of the work, because if the customer is well aware of what truck he wants to buy, price and delivery can be agreed upon and then the sale can be closed, without unnecessary time consuming activities. To let the customer design his own truck using our computer program is desirable, but more realistically this might be possible for a program with limited options.

I also believe that we are heading for a separation, where some salesmen are working with technically advanced orders and some are focusing on the standardized products. This way of working will become more efficient when the customers tend to get bigger and the small companies are getting fewer.

Q11. Is there anything you could have done differently to make the product introduction more profitable?

Yes, if we would have left some minor options for the customers on Scania Complete, we would have been able to sell more trucks and since we have greater margin on those we would have earned more money. Today, 10 percent of our total sales consist of Scania Complete, but I am sure that with only a few options added we could have increased the sales to 40 percent. With our modularized system it would have been possible to do so perhaps we should have done it.

Q12. Since the options are limited and the purchasing process of your products is less complicated with standardized products, did you experience any change in the purchaser's behavior? When less technical knowledge is needed the opportunity for other decision makers is created.

It is mainly among the smaller companies that have never worked within a certain market segment before, and therefore lack the knowledge about what is needed from the equipment, in this case the truck, and therefore find it difficult to purchase a suitable truck, that we have seen a change in behavior. I will give you an example to simplify. One of our customers in Nyköping started to distribute newspapers. He heard that help was needed with driving sand to the ironworks in Oxelösund, and to take the job he needed a special truck. The customer did not know enough data to make a specification on a truck like that, he did not know how much the truck would cost and were therefore unable to quote the job to his customer. However, because of our standardized product range, we offered a standardized truck that could get the job done, he could see the price of it on our Webpage and he was therefore able to quote the job to his customer.

Among the larger customers, we have seen two types of behavioral differences. In the cases where the purchaser of the company did not have a lot of authority their superiors have stepped in and decided that they should go for the standardized alternative. We have received a lot of positive feedback from the larger road carriers that they are happy with the standardization, because it saves them a lot of discussion with the chauffeurs, who want extra large and comfortable cabins and so on. Now, they can give a short answer to kill that discussion, "Everybody will get the same standardized truck".

We also get positive feedback, because the standardized products simplify the negotiation of framework agreements.

In the remaining cases, where the purchasers are strong-willed and have decided that customization is the only option it will continue that way and the standardized products did not have any impact on their behavior. It usually does not cost that much effort for us, thanks to our modularized system, but we do have lower margin on the customized products.

Q13. Imagine the scenario when you receive a specification from a customer that fits one of your standardized alternatives. When all the papers are signed you discover a point in the specification that shows that this product is in fact a customized product and therefore more expensive and requires more time in production. How do you manage a situation like this?

The principle is: the agreement with the customer will be honored. In this scenario the customer has made a favorable deal. This is something that has happened and we managed to follow our principle even though it is difficult.

There are examples when the board has been meeting with customers to build a relationship and has promised a lot. Later we discovered that what the board promised could not really be built and we have to take the blame for that. But when the agreement has expired we adjust it to make sure that the same mistake is not done twice.

4.7.4 The author's conclusions

Scania, known for its modularized system that enables the successful production of customized products, introduced a standardized truck named Scania Complete. With its standardized alternative Scania managed to reach out to a new customer segments while increasing its margins for some existing customers interested in the shorter lead times and in the comfort of purchasing the new product.

The documentation for the standardized products is prepared in advance and is partly available for customers on the Internet and the rest is available only for the salesmen. The database that generates the documentation for the customized products has a lot of potential to be used directly by the customers to build their own product, gather the information and data needed (such as documentation), and calculate a product price. The system Scania is using today can already perform all the desired operations for such a customer database. The problem lies in the complexity of today's system. If Scania would develop a user-friendlier spinoff of the old system, it would decrease its workload both in the sales process but also in the order management process, by letting the customer do some of Scania's work.

The pre-identified risks; low demand for standardized products and overproduction that leads to raising warehouse costs, indicates that Scania saw this product introduction as a low risk operation. It had the knowledge and production processes to perform the product introduction successfully and with the modularized system, Scania avoided the dangers of drastically increasing costs when a product sold as standardized turned out to be customized.

At the time of this case study, Scania had the same process for selling and managing both the customized and the standardized products. Since the standardized product is still young the author believes that Scania is yet to find its proper processes to manage a mixed product portfolio. Both the author and the interviewee agree that in time Scania

will find different processes for the different product categories and that would generate the need for different sales tools for support. The most likely outcome is that the processes will be separated and some salesmen will handle the technically advanced customized sales and some will handle the standardized sales.

Regarding the purchasers' behavioral changes associated with the less complex products, Scania has only positive experience thus far. The new product alternative has only been viewed as a new opportunity that is taken if it creates some kind of value for the customer, and avoided if the customized products still are the more desirable choice.

4.8 The Solar Turbines Inc. Case

Title: Letting the Customization Revolve Around a Standard – A Case Study of Solar Turbines Inc.

Conducted by:
H. Jansson
Lund University

4.8.1 Introduction

The case study was conducted during the fall of 2009 based on a telephone interview with Solar Turbines Inc. in San Diego, California. Prior the interview that this case study is based on, the interviewee was provided following research questions to consider for the analysis of a product portfolio based on a standard product.

- What were the main reasons for introducing the standardized turbine skid?
- How do you explain the possible price differences between the standardized and the customized products?
- How are the designed and the standardized orders separated internally, to ensure that the orders are managed efficiently?

4.8.2 About the company

Solar Turbines is a world-leading producer of mid-range industrial gas turbines for use in power generation, natural gas compression, and pumping systems. It provides full product support, equipment supply, financing, plus installation and operation and maintenance capability.

Products and Services

Solar Turbines offers six gas turbine product families, Saturn®, Centaur®, Mercury™, Taurus™, Mars®, Titan™, and eight centrifugal gas compressor product families including both pipeline and multi-stage compressors. Gas Turbine Products range from 1-22 MW (1500-30,000hp). Services offered by the Company cover gas turbine and gas compressor overhaul, parts replacement, field service, package refurbishment, and asset management.

Solar sells, manufactures, and services its products in more than 96 countries from over 30 worldwide locations. Business is conducted through these offices with sales and service employees plus sales representatives and selected distributors. Although 80 percent of Solar's employees and 85 percent of the physical assets are located in the U.S., Solar exports more than 70 percent of its products, which makes it one of the 50 largest exporters in the United States.

Markets

Solar participates in two major market segments: Oil and Gas Production and Transmission (O&G) and Power Generation (PG).

A crucial requirement for market success is operating effectively in every global region. Solar is a domestic company competing and winning internationally through a marketing strategy of deploying processes within the culture of the region. By placing people in specific geographic areas and driving decisions down to their locale, Solar is able to operate effectively within the common practices of the region.

Another important requirement for market success is providing the necessary after-sales service and support in any global location. Because gas turbine installations operate for decades, service for the life of the product, overhaul, and refurbishment are critical components of market success.

Supplier and Partnership Relationships

Solar's suppliers are classified into three categories: approved, certified, and partners. Suppliers undergo a rigorous process to achieve these ratings. For instance, annual quality, cost, and cycle-time reduction goals are established and monitored and direct point-of-use deliveries provide both Solar and these suppliers with quality and cost benefits.

Supplier partnerships exist where there is a critical dependency on supplier technology, part performance, and/or part lead times. A few select partners have demonstrated the highest quality and performance standards, participated in shared risk-taking, and assigned people in Solar's facilities to participate on new product development teams.

Solar's supplier strategy is to optimize the number of suppliers by basing selection on core competencies, value added, and dedication to continuous improvement. Its Supplier Quality Management System provides suppliers with monthly status of their delivery and quality performance. Solar also hosts Supplier Symposiums and training to strengthen relationships.

History

Founded in 1927 as Prudden-San Diego Airplane Company, the firm built all-metal airplanes. The company was later renamed Solar Aircraft Company and produced aircraft/aerospace hardware, such as jet engine afterburners and rocket components.

In 1950 the U.S. Navy placed an order for development of a 750-kW (1000-hp) engine for high-speed boat propulsion. The result was the Saturn gas turbine, which is still in Solar's scope of supply.

Solar recognized that to win over customers from reciprocating equipment, the company would have to offer fully factory-assembled-and-tested turbomachinery packages, such as

complete gas compressor sets, pump-drive packages and generator sets, rather than bare gas turbine engines. This made Solar Turbines the company it is today.

Another milestone in Solar's history was the procurement of the firm. In 1981, Caterpillar purchased the company, and today Solar Turbines Incorporated is a wholly owned subsidiary.

(Solar Turbines Inc. Website, 2009)

4.8.3 Interview Solar Turbines Inc.

Interviewee:

Martin Habel, Manager Oil & Gas Strategy

Q1. How does your sales process work?

We have a couple of different organizations; industrial power generation (PG) which sometimes is referred to as non-oil-and-gas such as universities and hospitals, which I am not too involved in, and one for oil and gas (O&G). The processes for the two organizations are fairly similar.

We also have a group called application engineering that does the proposal and specification review support for the sales people. The main part of them is located in San Diego, California.

The sales people work directly with the customers that can be both end-users and other engineering companies. Solar also sells a lot to what so called EPCs, Engineering Procurement Construction. The sales person contacts the customer, or vice versa, when a potential job has come up. Lets say that the customer is going to put in a compressor station and needs some preliminary sizing information. The sales person will then send that information to the application engineers, most of the time to us in San Diego, and we will run the performance of the turbine and the compressor and make recommendations of the equipment. This will go back and forth many times before we even get a formal inquiry from the customer.

Once the inquiry comes in the sales person is assigned an application engineer and they work together to review the specifications and to put together a proposal. Then the sales management team will put together the pricing level and we submit the bid. This is a long process and even if the bid is accepted there can still be changes along the way.

In terms of the standardized products we have an online document called the Application Check Sheet ACS that is basically sort of like a menu of pre-engineered and pre-priced systems and components that would go to create a turbine package. In this ACS there are numerous options to choose from, for instance different engine sizes, electrical systems, lube oil systems and fueling systems.

Most of the times the options in the ACS are not exactly what the customer needs, and in those cases we have to make some customizations to the product. The application engineer works together with the engineering department to create these custom features. The possible price and delivery implications that the custom features will have go into the ACS.

The ACS generates for instance the bill of material and other useful information and the engineering department picks up from there.

Q2. What were the main reasons for introducing the standardized skid?

When we hand over a project from the ACS to the engineering team, approximately 70-90 percent of the package is standardized. So technically they only need to work on the remaining 10-30 percent creating the engineering for those custom features. So they spend a lot less time engineering the product for that particular project. They are basically taking the standardized product and slightly tweaking it based on these custom features.

What that does is instead of every time the engineer having to start from scratch and build a complete package, they are really only doing the engineering on a small portion of it. That keeps our engineering hours down, which in turn keeps the costs down. Another thing it does is that it allows us quicker delivery, since we can pre-order long-lead items. One of our main advantages at Solar is that we can often do quicker delivery than our competitors.

Q3. What risks associated with the introduction of the standardized solution did you identify?

The biggest risk is that some of our customers sometimes can see us as a little inflexible, that we try to push are standard package on them instead of giving them a completely new package.

Our competitors are using that against us and they'll say: "Tell me what you want and we will build it. Those guys at Solar are just going to try to get you to buy their standard". But what they do not tell the customer is that giving the customer everything they want is going to cost them a lot more and it is going to take longer to build.

Q4. How large part of the sales consists of standardized products versus the designed products?

I would say that 90 to 95 percent of the packages that we deliver are not completely standard. There are a few customers that have worked with us for a long time and are willing to accept our standard as it is but they are a small percentage. Almost any job will

get some kind of customization.

Q5. How do you explain the possible price differences between the standardized and the designed skid?

That is pretty easy. Take our lube oil coolers as an example. In our lube oil system we have to have heat exchangers to cool the oil after it has gone through the engine. We have standard heat exchangers that we offer, but in some cases the customer might want special material or multiple cooling fans with transmitters and switches on them. By the time the customer is done with its customizations he might have taken a 100 000 dollar standard piece of equipment and driven it up to 600 000 dollars.

So what we do is that we typically include our standard in the base price and then we add on option for a fully compliant oil cooler for an addition of 500 000 dollars. We also add that there might be an impact on the delivery. So we clearly try to explain to the customers that we can do these things you ask for but it is going to cost you in both time and money.

We also go: look, we been delivering turbine packages since the 1960s and we are one of the largest suppliers of turbines within our size frame. We are very well known in the industry and we have used our standard in over 6 000 packages that are still out there running so you may want to consider using our standard instead of spending all that extra money. Besides, our service engineers are very used to our standard so when they get out in the field they will not know the customized alternatives as well.

Q6. How is the documentation managed for the different solutions?

Well we have the all documentation ready for the standard stuff that is pre-engineered. If we take the example with the customized lube oil cooler here too, then the documentation for the standard oil cooler will be included in the documentation from the beginning. The application engineers will have to go into the bill of material and remove that, and request a drawing from our vendor of oil coolers to replace the standardized one in the documentation.

Q7. Is there any way for the customers to request the documentation online?

Yes, we have a Web-based system where we manage our projects. Each one of the projects gets its own Website where we allow our customers and sometimes even our suppliers to login with passwords. On the project's Website the customers and the suppliers have the option to upload or download documents. They can mark up the documents and make comments and upload them again for us to revise.

Some customers prefer to use the Website and others do not. There are still customers who prefer the documentation in paper form.

The Website is set up when we have the actual order so before that the exchange of drawings is only in paper form or electronically via e-mail.

Q8. Did the introduction of the standardized skid, in any way, affect the designed skids? Did the customers' perception of the products change?

Some of the customers will say that we are not flexible and are trying really hard to push our standardized solution on them, but in the end they still end up buying our equipment. They might say that Solar is inflexible but in the end they can save a lot of money by buying Solar and they get, not exactly what they initially asked for, but almost everything and they will get it one year before everyone else and they can start producing oil while the rest are still waiting for their product.

In fact, our competitors are imitating us and moving towards the way we are doing business so that is a good sign that we are successful.

Q9. How are the designed and the standardized orders separated internally, to ensure that the orders are managed efficiently?

Each project gets its specific project number to which all documents numbers will refer. We do not have a specific line working only with the standard orders and one that works with the others, since the standardized orders are such a small part. So all orders go down the same assembly line.

However, because of the standardization, our assembly line knows what to expect from the standard scope. What they do when they review the drawings from the engineering is looking for the special stuff. What are the differences from the standard? What do we need to have separate planning for? What special drawings do we need to help us put this together, and so on?

What we also do is that we assign a complexity to the projects. We have the grading from A to C where A is close to a standard project and C is a highly complex project. Obviously the engineering time, the manufacturing time and the overall delivery time will increase when you go from A to C. So when the manufacturing and engineering people see that it is an A job, then they know that they will not have to spend as much time on it and can instead focus more on the B and C jobs. The same project manager can manage the A, B and C projects and the processes internally do not differ.

Q10. Is there anything you could have done differently to make the product introduction more successful?

No, not really. There are only a limited number of customers for us out there. I would say that there are 70-90 customers over all, and most of them have bought our equipment before. Only very few of them have never bought our equipment.

When we come up with a new product we do a lot of “voice of the customer”. We go out and talk to the customers and we say: “these are some of the things we are considering adding to our standard, what do you think?”.

Another way of doing it is the following. Years ago our standard piping was carbon steel and we were getting many customizations for stainless steel piping we soon realized that it did not make any sense to have to order and stock two kinds of piping. So we made stainless steel our standard and now we are buying one pipe, we get volume discounts and we never have to wonder how many carbon steel versus stainless steel pipes is it going to be this year and we get savings that way. The pipe was just one example, this has happened with other parts too. We listen to our customers and a lot of their customizations will later be integrated into our standard.

Therefore, I do not believe that we could have done anything differently because if the design needs to be updated we have the possibility to do that successfully and in a way adapt the standard product to the customers demand.

Q11. Since the options are limited and the purchasing process of your products is less complicated with standardized skids, did you experience any change in the purchaser’s behavior? When less technical knowledge is needed the opportunity for other decision makers is created.

What we have seen in many cases is that the customer will in fact change its specifications and rewrite them more around our equipment. The customers that buy from us regularly have their specification well suited for our standard and some even put our name in there.

Even customers that only have bought a few products from us are changing their specifications. They may be rather negative and wonder why we tried to push the standard on them so hard, but after they have had several of them up and running, they see the benefit.

Q12. Imagine the scenario when you receive a specification from a customer that fits one of your standardized alternatives. When all the papers are signed you discover a point in the specification that shows that this product is in fact a designed product and therefore more expensive and requires more time in production. How do you manage a situation like this?

This does happen once in a while. When we discover it, and hopefully we discover it fairly early in the project because the later you discover it the more expensive it becomes, we will say: “Oops Mr. customer, we made a mistake. We did not realize that you really wanted this cooler to be blue. We missed that and we apologize. We can still provide the blue cooler but it is going to cost a little more money and it may have some delivery impact. If you continue on with our grey cooler there will be no extra charges and no delivery impact”.

After that it just becomes a negotiation. Some customers will go back and take a look at it and say: “You know, we are so far along that we do not want any changes and we will accept your grey cooler”.

Others will say: “Absolutely not, we must have the blue cooler. You made the mistake and that is your problem”. In those cases we will say that we will do what we can to get them their cooler on time and that we will eat the cost. But these situations tend to solve themselves. A project takes from nine to twelve months and as you go through that period the customer will come back with some changes. When the customer wants to make changes there will be a series of bargaining chips, which makes the situation described easier to handle. If the customer wants a faster delivery or wants to make some changes and still keep the scheduled delivery, then Solar can say: “We may be able to do this for you, but we cannot keep the scheduled delivery with the customized cooler. If you are willing to go back to our standard grey cooler we can make this happen”.

4.8.4 The author’s conclusions

Solar’s standardized solution has allowed them to offer the product at a much quicker delivery than its competitors. Some customers have complained and claimed that Solar is inflexible and tries to push its standard on them. That may sound like a big problem but according to Solar those customers often end up buying the product anyway, due to the advantages that comes with it.

The price differences between the standardized and a customized product are not considered to be an issue. Solar’s customers are well aware of the cost and delivery impact that a deviation from the standard will cause. The key is most likely the clear communication that Solar uses to make sure that all the customers fully understand the consequences of an order variation.

A computer-based system is not yet used by Solar to enhance the communication between the company and customers or the communication between the company and the supplier. However, a Website is set up for each project where the customer and suppliers can log on with a password and load and pull information from.

Solar does not see any problems with changing in the purchasers' behavior. In fact, the changes have all been to the positive. For instance, many of the customers are now rewriting their specification to better suit Solar's standard. Some of the customers even put in Solar's name in the specifications.

The processes between standardized and customized orders have not been separated. One of the reasons for this is that not enough orders are completely standardized, but have at least some minor customization. Solar does not offer a mixed product portfolio consisting of standardized and customized products per se. It rather customizes its products by tweaking the standard, which may be an explanation of how Solar can manage this without separating the processes. Solar does however indicate the level of complexity on each project in order to regulate the time spent on the project, and that seems to be enough regulation in this case.

4.9 The Siemens Industrial Turbomachinery Case

Title: Customizing Parts of a Standardized Product – A Case Study of Siemens Industrial Turbomachinery

Conducted by:
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4.9.1 Introduction

The case study was conducted during the fall of 2009 based on an interview with Siemens Industrial Turbomachinery in Finspång, Sweden. Prior the interview that this case study is based on, the interviewees was provided following research questions to consider for the analysis of a product portfolio based on a standardized product.

- What were the main reasons for introducing the standardized turbine skid?
- How do you explain the possible price differences between the standardized and the customized products?
- How are the designed and the standardized orders separated internally, to ensure that the orders are managed efficiently?

4.9.2 About the company

Siemens Industrial Turbomachinery is a part of Siemens AG, one of the worlds largest companies within electronics and electrical engineering. Siemens AG has around 400 000 employees (2009) in 190 countries, who are working with developing products, installing systems and offers custom made solutions.

Siemens Industrial Turbomachinery AB is located in Finspång, Sweden, and manufactures steam and gas turbines. Its products are used all over the world to generate electricity, steam, and heat as well as to run pumps and compressors, mostly in the oil and gas industry. The 2 300 employees also projects complete power plants, with the Siemens turbines as the heart.

(Siemens Industrial Turbomachinery Website, 2009)

History

The turbine manufacturing began in Finspång in the early 20th century, when STAL ("Svenska Turbinfabriks Aktiebolaget Ljungström") bought an industrial district and started its business. STAL manufactured steam turbines at the time but an enquiry from the Swedish air force, led it to develop gas turbines as well.

In the end of the 1950ies STAL merges with another steam turbine manufacturer, De Laval, under the name Stal-Laval and its operations are concentrated to Finspång. The

company started to develop steam turbine driven airplanes with great success until the oil crisis in 1973.

The company today known as Siemens Industrial Turbomachinery AB has had a lot of different names in the past - Stal-Laval, ASEA Stal, ABB Stal, ABB Alstom Power, and Alstom Power. This is of importance since there are still employees at Siemens that used to work under the name of ABB, which can affect their company loyalty.

4.9.3 Interview Siemens

Interviewees:

Magnus Klingberg, Purchasing Manager

Patrick Johansson, Electrical and Control Engineer

Lars Arvidsson, Manager Electrical Design

Q1. How does your sales process work?

Initially we have a possible project. The sales staff is in contact with the customer to try to get information about upcoming projects. Sometimes the customer contacts us and sometimes it is the other way around.

There is a group of people that screens the projects to decide if it is a project for us. They may advise that we turn down a project due to a financial troubled customer or too technically complex project that generates unreasonably high risks.

The project goes to what we call the technical sales support, the application department. The application department is the one that generates the technical data that will be the foundation for the quotation. The budget quotation is then generated and sent to the customer. If the customer is still interested in doing business with us the next step is to make a new more detailed quotation, which can if accepted can lead to an order.

It is also worth to mention that the application and the sales departments have rigid restrictions of what they are allowed to quote. It is not so much about pricing the customers specifications, but more try to convince them to buy our standard solution instead. There are still some main options included in the standard that the customer can choose from without any extra modification on our standard design, but if the customer wants to order something outside these options the application department has to get permission to quote that.

When we receive an order our special departments are integrated into the process. First the project goes to the project management department where it is reviewed by the sales staff and the project managers. It is common to discover parts that are not completely clarified yet or receive change orders from the customer, so the order is not final even when accepted by both parts. This is an ongoing discussion throughout the project's

lifetime.

We have two project managers for each project. One external project manager that handles the communication with the customer and one internal project manager that handles the internal communication, for instance with the project team. One can say that the internal project manager has the responsibility for the product until it leaves the factory.

When the product is delivered to site, we still have some work to do. Our personnel will be there to receive the product and make sure that it is handled correctly. The sites can be quite big and contain lots of other products. But we are responsible for our gas turbine and our service staff on site connects it, starts it up and makes sure that is running faultless. After that the product is handed over to the customer.

Q2. What were the main reasons for introducing the standardized skid?

One of the most important reasons is the cost, naturally. Well, it is the most important reason for us. It is difficult to price the customization correctly if you have not done anything similar earlier. It is difficult to estimate the additional time that will be spent on the project due to a specific customization.

Another, highly related to cost reduction, is the strive to reduce the engineering hours spend on each project. With standardization, less engineering time is needed.

The delivery time was not a reason per se, but with standardization we will make better estimations of when the product can be delivered and therefore our delivery accuracy will be better.

Q3. What risks associated with the introduction of the standardized solution did you identify?

The largest risk that we saw with the standardization was not more than the risk that the standardized product would be useless. A lot of our employees were skeptical and they were certain that no one would ever buy a standardized product from us, and because of that all the time and money spent on developing the standardized product would be wasted.

In this development project there was always the option to sell a customized product in case the customer did not accept the standardized product. Our goal was to create a standard that we could sell and if that would not have happened we would have modified the standard until it was suitable for the market. Therefore, we all saw this introduction as a low risk project.

Q4. How do you explain the possible price differences between the standardized and the designed skid?

We explain the price differences with the additional time and cost required from our point of view. A part of the product that we are not used to will create some extra work for us, both in the design process and when the turbine package is assembled. Variations from our standard will also be more expensive, even if the part in reality can be a cheaper solution, due to the discounts we can get when ordering large volumes.

Higher risk is also a good way to motivate the price difference. That is an explanation that is often accepted by the customers. But, it is important to be careful when explaining the extra costs that come with the higher risk. If you are too exact the smart customers will make sure that you spend all that extra money. For instance, if you say that some variation will cause an extra quality control, then the customer may say that they want to attend that control, which can in turn create additional costs.

Another good argument can be used if a customer demands another change on some part of the skid. For instance, they do not want an ABB generator, but a Brush generator instead. Then we can say that this will cost you extra because we do not have a general agreement with them and therefore it will be a lot more expensive compared to if you stick with the ABB generator.

A lot of this is based on the fact that we initially quote our standard to the customer. If the customer then wants to make changes it is easier for us to explain that we can do the changes but it will cost you this much in time and money.

Q5. How is the documentation managed for the different solutions?

There are pre-made drawings and other documentation of the standardized product available on beforehand. The documentation for all the options is also available to make it possible to build the documentation for any standard product.

Even for the customized product a lot of the standardized documentation can be used. I would estimate it to 10 percent of the documentation that is customized and the rest can be used from standardized documentation, in most cases. There are obviously exceptions that are more complex and need more special documents. Not to mention if a different language is requested on the documentation. It is the same thing for the manuals. A large part, I would say 90 percent, is standardized documents that we can just use again while the remaining 10 percent need to be customized for this particular project.

We do not have any computer-based system for the customer to reach the documentation. The documents are sent to the customer upon pre-determined dates. There are at this time no concrete plans of introducing such a system, but the question has been brought up. Some customers do however put up these Websites for us to use in that manner.

We used to have a system where all the documentation that was going to be sent to the customer was stored, but the customer had no opportunity to login there and pull information himself. The system was only used internally to keep track of all the documents.

Q6. Did the introduction of the standardized skid, in any way, affect the designed skids? Did the customers' perception of the products change?

I want to believe that they have changed their perception of Siemens. But it is important to know that we are in a very special business because we do not often have repetitive customers. A customer can buy turbines from us more than once but it may take 20 years between the purchases. The standardization has been more about simplifying the work for us internally.

However, the standardization has made us better because the repetitive work makes us better understand the product and the issues that come with it. When a customer asks for our support we are now able to respond quicker and with better accuracy. Some documents requested by the customer are already done and can be sent instantly. Besides, the repetitive work generates high quality of our products, and makes it easier for the service engineers to perform the maintenance on them.

So I believe that the customers' perception of us has changed to the better and that we now are seen as more competent and have a higher level of service.

Q7. How are the designed and the standardized orders separated internally, to ensure that the orders are managed efficiently?

Even if we sell a completely standardized package, which actually happens sometimes, or a customized package with all possible strange and complicated customized solutions we still operate after the exact same process framework. We use the same project managers, the same supportive tools and same assembly line no matter what complexity the project has. When a project is extra complicated for some reason there will automatically be an awareness of that within the organization but we do not treat it differently.

I have to admit that this is one of our weaknesses. Projects that we thought were simple standard projects have later turned out to be more complex and that has been costly both for us and for our customers.

Q8. Is there anything you could have done differently to make the product introduction more successful?

No, not really. I believe that it is important to know that the standardized products have to be modified from time to time. We have changed our standard many times over the years,

since it was introduced in the middle of 1990ies, to make sure that it corresponds to the market's needs. The standard is influenced of where we operate at certain times. At the moment we have been working in Russia and therefore our standard is well suited for that market because it affects the way we think. If we have sold more to North America, the standard would definitely have been different.

We receive feedback all the time on how we could modify our standard to reach more customers and suit our existing customers better.

To make minor changes in the standard is relatively easy. The difficult part is to analyze the change properly to make sure that it does not have any unpredicted qualities that we do not want.

When we introduced the standardized product we had the aim that with all the options 80 percent of the package should be covered by the standardized solutions and only 20 percent should be customized. We actually managed to reach that goal. So throughout the whole product development process we asked ourselves the question if this option is needed to reach the goal of 80 percent. If not then we removed that option. I believe that it was a good way to do it.

Q9. Since the options are limited and the purchasing process of your products is less complicated with standardized skids, did you experience any change in the purchaser's behavior? When less technical knowledge is needed the opportunity for other decision makers is created.

Yes, definitely. Our customers are very large companies as already mentioned. There is often a "fight" between the purchaser and the technical departments. The purchaser always wants to buy our standard and the technical staff wants to help decide what to buy, because they are used to do that as part of their jobs. And they (the technical staff) have other reasons. They want to buy the same makes as they are used to and they want to watch the same control systems as they are used to. The purchaser on the other hand has to see it all from his perspective, which is to try to keep the costs low and therefore the standardized solution, is always his choice.

Who will get they want depend on how strongly the technical staff can influence the decisions on a higher level. We believe that the technical staff sometimes has too much influence. So you can say that it is vital what part of the company we are in contact with.

Q10. Imagine the scenario when you receive a specification from a customer that fits one of your standardized alternatives. When all the papers are signed you discover a point in the specification that shows that this product is in fact a designed product and therefore more expensive and requires more time in production. How do you manage a situation like this?

This has not been working here at Siemens. At the moment it depends too much on the individual that has to deal with the problem. One project manager might say: “this is not working. We cannot make these changes now”, and then go to the customers and try to explain it to them. Another project manager will argue that whatever is stated in the contract is our obligation to provide and they start to make changes and the customer gets mad at him.

Both within the project management and the technical departments, we have started a process to manage what we call design freeze and internal change order. The keyword here is - analyze. Try to figure out exactly what this means and what the consequences are and make sure that we have read this clause the right way. Will this cost 100 000 or one million?

Then it is time to act based on the analysis made earlier. In some cases it may be appropriate to go to the customer and discuss the situation. When having this discussion with the customer it might be possible to eliminate some changes because they turn out to be unnecessary. But in some other cases we will have to eat the costs ourselves and just follow the contract.

4.9.4 The author’s conclusions

Siemens Industrial Turbomachinery, a competitor to Solar Turbines Inc. in the gas turbine market, has a different strategy than Solar. It has standardized approximately 80 percent of the turbine package and left the remaining 20 percent for the customer to customize. It makes them flexible while still enjoying some of the advantages with standardization.

The main reason for standardization was to reduce the costs. By reducing the engineering hours spent on each project, receive volume discounts from suppliers, and make more accurate cost estimations of the projects Siemens was able to reach the goal of cost reduction from standardization.

Siemens does not see any difficulties with explaining the price differences between the standardized product and minor deviations. The customers are well aware of the advantages that come with standardization and fully understand that deviations from the standard will bring the cost up.

Regarding the documentation there is no computer-based system to support the customers. The discussion has been raised but it does not seem to be a plan for such a system introduction.

Siemens has seen a clear change in the purchaser's behavior with the introduction of the standardized product. Its employees argue that the purchasers' behavior varies because of the differences in opinion between the purchasing department and the technical departments. The technical staff wants customization while the purchasers want standardization for obvious reasons (cost and simplicity). Who will win the battle between the departments varies from company to company and is depending on how much influence the staff has on the higher-level employees.

It is worth to mention that a great deal of the employees doubted that the standardized product would be sold even a single time. It was their perception of the situation that the customer always wanted customization. That might not have been so strange keeping in mind that all the customers bought completely customized products in the past, however, when a less expensive alternative enters the market the customer may compromise his preferences and buy a product that correspond to his needs rather than his wants. That is what happened and all the skeptical employees were proven wrong.

4.10 Conclusions

Through the different cases studied both important similarities and differences has been discovered. The companies operate in different branches and have different strategies but each and every one of them add points of value to this thesis. They have all proven to be successful in a general sense within the area studied, however, their processes still have some flaws and they should therefore not be seen as “perfect performers” nor be directly copied by ABB Machines.

Volkswagen Commercial Vehicles is the only company that has implemented separated processes between standardized and customized orders even though the theory indicates that it is critical for success. One reason for that may be that Volkswagen has worked with the combination of standardized and customized products by far longer than the other companies. Scania, for instance, have not yet separated its processes, because the new standardized products are still young, but believes that the company is heading in that direction.

In the case of Solar, the company has the same process for all its products in spite of flagging the level of complexity of the project to help regulate the time spent on that specific project. Solar has a better chance of being successful working in this way due to its strategy. It is not offering a standardized product and a customized product per se. Instead Solar is creating customizations by tweaking its standard, which makes separated processes not applicable.

Siemens does not separate its processes either. However, in this case the employees admit that treating the standardized and the customized products too similar creates problems late in the projects. By separating the processes the company is forced to clarify whether a product is standardized or customized early in the project. If not separated small issues can go unclarified until late in the project where they can blow up and have a significant affect on whether the product is considered standardized or customized. This has happened for Siemens and its employees see it as a weakness.

Before conducting the case studies, the price difference between a customized product and a standardized product was believed to be an issue in the sense that a standardized product with a minor customization should be so much more expensive that the customers would react. For instance, a standardized car costs \$50 000 and the customer wants a steering wheel outside the standard scope and bumps the price up to \$60 000, which may seem unreasonable at first sight. However, this has not been an issue for any of the companies studied. All companies agreed that their customers have a good understanding of how the advantages of standardization can reduce the price and are therefore well aware of the additional price when deviations from the standard are made. Scania is excluded from the statement above, since it has the same price for its customized and standardized products and does therefore not have to worry about explaining this to its customers.

One of the other findings from the theory and the cases of mass customization was the importance of supportive tools such as computer-based systems to simplify the work and unburden the company's employees. Scania was closest to the, according to theory, preferable way with its highly developed computer system that allowed its employees to create the product with all available options and calculate the price. The computer system is still too advanced to be handled by Scania's customers but with some modifications, such as more limited options, the system has great potential for that purpose.

Volkswagen in Germany has a computer system to aid in the documentation handling. It is not available for the rest of the company at the moment but can be implemented if needed. It should be noted that the demand for drawings and other documentation in the branches of Scania and Volkswagen is not as extensive or as time consuming as in the branch of ABB Machines.

Solar does not have any computer system to handle the documentation. Instead its customers set up a Website for each project that will have the same function as such a system. That Solar also lacks a system similar to Scania's is not surprising due to the nature of its business. One turbine package is by far more complex and costly than a truck and therefore the needs for supportive tools are different.

Siemens, who is in the same branch as Solar, does not have any system for the customer to reach the documentation. Some of its customers do put up Websites, just like Solar's, but otherwise the documentation is sent manually on pre-decided dates. It used to have a system to keep track of the information, however, it was for internal use only.

It is surprising that only one out of four companies have developed such a system as Scania's and none of them has yet a system that aids the sales process. Solar has a detailed description of its standard on its Website, which means that theoretically the customer could look there and get a good idea of what customizations are needed, but it is unclear how useful that really is in practice. A system where the customers themselves could experiment with different options would be ideal, because it would make the customer do a lot of the company's work on their own and therefore reduce the engineering time for the company.

What was similar throughout the four companies studied were that they all understood the value of standardized documentation. Even though the processes of handling the documentation were not preferable, all companies had standardized its documentation. It is best summarized and explained by modularization. When thinking of the on beforehand prepared documentation as modules that belongs to different options of the standardized product it is easy to see how the documentation is put together for a certain product. This way of thinking was shown to be the same among the studied companies and seems to be well working.

When introducing a standardized product into a portfolio consisting of customized products there is a possibility that the decision-making unit in the buying organization will be influenced as stated in the theory section. All studied companies noticed some

type of change but only two of them anything negative. Volkswagen that went from standardization to customization noticed that endless options sometimes delayed the sale, which can be costly. Siemens noticed that the introduction of a standardized product created conflict within the buying organization. The conflict can be described as a conflict of interest between the purchasing department, who wants to buy the cheaper less complicated standard, and the technical departments, who want the customizations.

As for the cases of Solar and Scania nothing but positive changes has been seen in the buyers' behavior. Solar has noticed that some customers have changed their specifications to better suit Solar's standard, which makes the sales process go a lot smoother. Scania has seen that some customers with less technical knowledge buy its standardized product instead of passing up on an opportunity to expand its business.

Another finding from the theory was that the customers' perception of a company or a product could be negatively affected by a standardized, low-price, alternative. This was not an issue for any of the studied companies. They all believed that they were only positively affected by their product introduction and seen as more knowledgeable. The repetitive work made it easier to answer questions from customers and the fieldwork for the service engineers was simplified. Solar, however, admitted that customers sometimes see them as a bit inflexible, because they try to push its standard solution on the customer. But if the customer absolutely wants a completely customized product Solar will provide it, and it is therefore only seen as a minor issue.

In each of the four case studies a scenario was played to see how the different companies react to their own mistakes and how they try to solve the problem. Scania was the only company that would take the whole cost without questions, but that may be due to its pricing, i.e. the standardized and the customized products has the same price. The remaining three companies agreed that it depends on the situation. How expensive this problem is and how the delivery time is affected will be decisive. The companies' standpoint was to discuss the issue with the customer to try to agree on a solution that suits both parts and in that way avoid eating all the cost themselves.

All studied companies agreed that they see these types of mistakes every now and then so it is an obvious conclusion that ABB Machines will take the same risk and therefore needs to be prepared for it.

Some employee disagreements towards the product introduction were discovered in the cases. The doubt mainly consisted of a strong belief that a standard product just would not sell. The clearest case of employee disagreement was found at Siemens. What is important to notice is that in all the studied companies the mistrusting employees were proven wrong. However, it is essential to get as many as possible onboard on the product introduction, because a too large part of disbelieving employees can cause problem in form of antagonism.

5 ABB Machines Analysis

5.1 Products

ABB Machines in Västerås is currently offering its generator product known as the AMS. The AMS is available in various sizes and outputs from the small AMS 710 to the large AMS 1250, where the digits after AMS represents the height from the ground to the center of the shaft in millimeters. The existing products have been offered in the market for many years and are well established and known by the customers. They are high quality products that are in the upper price range and are chosen by customers mostly due to its dependability. The AMS is also offered as a motor, which has contributed to the competence and flexibility that is associated with the AMS.

The new product, here referred to as Basic, is a standardized alternative, based on the AMS 900, that will be introduced to reach new customer categories and to provide a less complicated alternative for the existing customers who desires it. The improvements sought by ABB are to shorten the lead time, reduce the costs, and reduce the amount of work needed associated with the product. Basic has been developed with numerous options to correspond to 80 percent of the identified customer needs within that frame size. There is an obvious uncertainty in that estimation since the customers' demand can change rapidly and therefore, the Basic design might become inadequate over time.

In order to meet the goals with Basic, some new suppliers must be considered, according to the Basic project group. This is a clear issue with the Basic generator as the uncertainty that comes with new suppliers in terms of material quality and delivery accuracy transfers to the product. The fewer variations and the shorter amount of time spent on a project including a Basic generator can however reduce the risks of quality faults. Nevertheless, it is essential that the Basic generator will be handled with the same care, in terms of quality assurance, as the AMS in order for product success even though the overall time spent on the project is shorter.

5.2 Processes

5.2.1 The sales process

ABB Machines has a sales process that is best described by the individually technically competent salesman using his or her creativity to sell a product suitable for the customer's requirements. The company has a well defined sales process, but the empowerment of the employees has led them to drift off towards their own individual processes based on their personal preferences and their customers'. Since the customer's unlimited choice of options with the fully customized products this has been a well working system for ABB. When the Basic generator is launched, the today's sales

process will need some modification. A process change for the sales department will be an obvious obstacle to overcome, however, it is crucial for product success in the long run.

ABB Machines has salesmen at its factory in Sweden but also at sales offices in numerous countries around the world. The technical competence of these salesmen varies from salesmen who basically handle their own sales to salesmen who need lots of support from the Global Product Group's sales staff. It is important to note that a new sales process for the Basic generators may also facilitate the sales for the less competent salesmen and therefore, unburden the Swedish sales staff.

The simplified sales process will also increase the possibility that ABB Machines' can use its organization's local sales units with sales staffs that are not fully qualified to handle such a complex product as the AMS. This will create the possibility of a significantly larger sales force that in turn will benefit the AMS through new customer relations and new possible markets.

5.2.2 The project management process

Much like the sales process, the project management process is associated with technically competent project managers, who manage their projects based on a well-defined framework but with their own individual touch. Some of the project managers have adjusted the process to fit the customers' needs and some due to their own preferences. The project management process, at the time of writing, requires a lot of personal contact with the customers. Whenever a drawing needs to be updated, a problem occurs or the latest delivery status is sought, the project manager will have to be contacted.

With the highly customized products that ABB Machines is offering, this is an almost ideal way of working, despite that the individual touches create problems when explicit knowledge of the process is solely held by the project managers and not written down. That could cause important value-adding knowledge to be lost in case the project manager decides to leave the company.

This process is not optimized, and most likely not even applicable, for the standardized Basic generators. In order for the standardized product to be successful, the time spent on managing standardized orders must be reduced. In case the same care and effort, from a project manager's point of view, would be spent on the standardized projects the actual costs would exceed the expected costs and the projects would not be profitable. Therefore, a new process for the project management of the standardized products must be developed to ensure the success of the Basic generator.

5.2.3 The documentation

The customer specific products create the need for customized documentation. At ABB Machines a specific department, called the documentation department, puts the documentation together. The documentation is project specific, i.e. all the documents for a project are gathered after all the machines in that project has been tested which is at a very late stage of the project. The delivery of the complete documentation is four weeks after testing, usually that means three weeks after delivery, which is a holding point for invoicing.

As ABB Machines has a history of offering customized products this process has been working, even though cases has been found where the invoicing of millions of dollars has been held up by the documentation alone. It is however evident that the same process cannot be used for the standardized products. With standardized products come standardized documents, which enable the opportunity of a simplified documentation process that is not as time-consuming or as costly as the previous.

5.2.4 The production process

The production process at ABB Machines is optimized for the production of customized products. Highly competent assembly line workers are handling the assembly of the generators manually, which enables the flexibility needed for customization. Manual assembly by competent workers also enables the introduction of new products, such as Basic.

It is obviously comforting to be sure that the technical knowledge to produce Basic is already available within the company, however, that is not where the main difficulty lies in this case. One of the aims with Basic is to reduce the lead time, which also means a reduced time in production. As mentioned above, the shorter time in production leaves less time to discover possible quality defects, both from ABB's suppliers and its own quality faults, which raises the vulnerability.

The shorter time in production may cause managerial problems in the factory. One example of that is that the old routines may not be applicable with the new hastier material flow.

ABB is used to prioritize products in the manufacturing phase due to various delays and different customers' need-dates and are successful in doing so. However, it should be noted that thus far all the products have been customized with approximately the same expected production time. When a new standardized product, with shorter production time, is introduced the shuffling of orders might be obstructed and the company's various planners will get a difficult problem trying to prioritize.

5.3 Organizational Culture

ABB Machines in Västerås has a flat organizational structure, i.e. it is not very hierarchical compared to other companies. In the eyes of a non-Swedish beholder the organization may seem even flatter due to the Swedish culture within ABB Machines. In Sweden, and therefore at ABB Machines as well, it is common to not make any difference between addressing one's superior and one's inferior, i.e. using the persons first name. This is something that would be totally unacceptable in Germany, for instance, and the reason that Swedish organizations may appear flatter than they really are.

ABB Machines, however, does have a flat organizational structure with empowered employees. The employees are not only empowered but have a high technical competence, which has been one of the main contributions to a successful offering of advanced customized products.

When some of the work processes will become standardized with the introduction of the Basic generator and therefore simplified, as stated previously, there are legitimate reasons to count with disapproval among the staff. The technically knowledgeable employees may consider the new standardized working processes as a demotion due to the reduction of their authority and empowerment. They may also disapprove because of the perceived higher level of hierarchy that the standardized processes most likely will induce.

ABB Machines has a long tradition of empowered and technically competent employees. Many of its employees have been working in the company for a long time and left their imprint in the company's processes in various ways. Some have helped forming the different work processes that is used today and some have their names on drawings still used today because they helped to design parts of the AMS generator. This is something that cannot go by unforeseen. When the employees' own ideas and previous accomplishments will be erased in favor of the new product there is an even greater risk for disapprobation. Note that Basic is not planned nor believed to totally erase the need for AMS, however, it will be seen as the new product here to compete with the old AMS on some customer segments.

The above-mentioned issue may be noticeable in the sales process too, since technically competent salesmen see a challenge in selling complex products compared to the standardized products. The technically advanced parts of the job may be the important factors for job satisfaction and the very things that motivate that segment of the sales staff. This has been experienced by ABB Machines Global Product Group for Induction motors.

If the facts that are already mentioned; worry for demotion, declined empowerment, increased hierarchy, and unwillingness to change processes that one has helped to form, is set aside there is yet another issue that lies in the company's organizational culture. ABB Machines has well-established routines that all the employees follow, albeit to varying degrees. Therefore, the general unwillingness to break free from old routines may

be applicable on ABB Machines' employees. This issue alone will most likely not be decisive but the previously stated issues together with not fully understanding the need for the new product may cause this issue to be augmented.

5.4 Customers' Perception

ABB Machines is considered a company that manufactures and offers high-value products. The customers who choose ABB products do that mainly because of the high quality and the dependability and seldom because of the price, since the price of ABB's products rarely are lower than that of its competitors.

Even with the new standardized product with lower price, the ABB aim will be to keep the quality high while reducing the costs. Naturally, that would be the ideal outcome but in reality there is a trade-off between quality and costs. Hence, ABB is still focusing on the high quality for the Basic generators, which results in a slightly higher cost than otherwise possible. That, in turn, will force ABB Machines to price its Basic generators at a higher price than its competitors' corresponding alternatives.

The situation described above is hazardous for ABB Machines in two different aspects. Firstly, a standardized generator compared to a customized has, in a very simplified situation, three desirable attributes; short lead time, less complicated processes and lower price. As mentioned earlier, ABB Machines' Basic generator will not be competing with its price, meaning that there will still be cheaper alternatives on the market for the customers with lower requirements on quality, and will therefore have a disadvantage compared to its competitors from the beginning.

The second aspect is regarding the customers' perception of ABB Machines. Since ABB's products are considered high-value products and the company is associated with dependable solutions at the time of writing, there are strong incentives for the company to maintain that perception. If ABB Machines does not manage to maintain the high quality for the new standardized product there is a risk that the customers' perceived value of Basic will infect the perceived value of the whole company and harm ABB Machines reputation as a high quality offering company.

6 Final Conclusions and Recommendations

6.1 Watch Over the Processes

Investing in process development is mentioned numerous times in the theoretical framework as an essential factor for a standardized product's success. To what extent ABB Machines will do this is a concern from the author's side. As long as the sales volume of the standardized generator is small the need for process improvement may not seem as important as it is in reality. However, when (if) the time comes that the sales volume of Basic increases the processes to manage this must be developed in order to avoid expensive mistakes.

To separate the internal processes may not have been a common factor for the studied companies in this thesis. In fact, only one (Volkswagen) out of four companies has yet separated its processes for customized and standardized products. However, Volkswagen, Scania, and Siemens all agreed that it was preferable to separate the processes and in the case of Solar it is not applicable due to its strategy. Since ABB Machines' Basic generator is supposed to be limited to a certain number of options and does not allow any customization outside of that, it is ideal for ABB Machines to create a separate process to handle that product. The fact that it is relieved from customization significantly reduces the need for human intervention and therefore the time spent on project will be reduced. Hence, two different ways of managing the different products will be needed in order for both of the products to be managed ideally.

When moving from standardization to customization empowerment of the employees and more human intervention are essential factors. In the case of ABB Machines a shift from customization towards standardization is made, which is why a reduction of employee empowerment and human intervention is needed for product success.

Supposedly, in the beginning the same Project Manager can manage both the AMS and the Basic projects but with an increased volume of Basic generators sooner or later the two need to be completely separated. Therefore, ABB Machines is recommended to, in time, assign a Project Manager or Order Handler that focuses only on Basic projects. This type of separation has a lot of advantages that can prevent the standardized product from becoming too costly.

By dividing the project management into one AMS group and one Basic group, where the number of Basic Project Managers or Order Handlers will be significantly smaller, the employees will become more specialized in their area of expertise and therefore manage their respective projects more successfully. The Project Managers will then have the same process for all their projects and will not have to worry about keeping the two kinds of products apart, which rules out one of ABB Machines' greatest concerns with this product introduction at the time of writing, namely that the Basic projects would be treated as the customized projects and therefore become more expensive than expected.

The difficulties with having the two products managed by the same person is extra visual when a Project Manager is in contact with a customer that has ordered both types of products. In that case it may be preferable for the Project Manager to only support the AMS products from that customer and let another employee from the Basic group support the remaining products. If not, there would be a high risk of managing all the products in the same way, which directly means that too much time will be spent on the Basic products.

As ABB Machines implement a new process for managing the standardized generators it is strongly advised to clearly document the preferred process. Today, one of ABB Machines' weaknesses is that its processes for project management varies for each individual project manager, which is also partly true for its sales staff. A clearly documented process will facilitate a uniform behavior amongst the employees as well as it eases the training for new employees. This way the ABB management has a better foundation for educating new salesmen and project managers that will result in a more effective training.

6.2 Implement Supportive Tools

The design of Basic allows a standardized documentation system, where a great deal of documentation can be prepared in advance. By using the modularized way of thinking it is possible to create a system where modules of the documentation are prepared for each available option that can be selected to create the complete documentation for a certain product by compiling the different modules. This would not only unburden the documentation department but also expedite a hazardous holding point for invoicing. Perhaps the greatest benefit of such a system would be in the project management process. Whenever a customer requests a drawing the Project Manager or Order Handler can just use the system to generate the pre-engineered drawing and send it to the customer. This is a tremendous time-saver as opposed to requesting the drawing from a very busy engineer and then reminding him or her until the drawing is completed and received.

It is important to note that a special language requirement on the documentation will have a larger lead time impact on the Basic generators than on the AMS generators, relatively viewed, which can be hazardous if documentation is a holding point for invoicing. Therefore, this is something to be discussed on beforehand to inform the employees about the potential issue.

With limited options available and no additional customization allowed the Basic generator is well suited for another supportive tool, not yet used by the companies studied but highly desired; a computer-based sales system that can be used by the customers themselves. The main idea with this computer-based system is to unburden ABB Machines' employees by letting the customers do some of the work. By creating a sales tool for Basic with all the available options included, a function that generates a price,

some drawings, and perhaps a CAD drawing of the generator, a lot of ABB Machines' employees would be unburdened. Such a system would at first be recommended to be used by ABB Machines sales staff both in Västerås, Sweden and in the rest of the sales offices around the world.

To get a well designed computer-based sales tool for Basic could really aid the less technically competent sales staff in the same way as the standardized products facilitated the less technically competent sales staff in the Scania case. In turn, when the supportive tool is used instead of requesting manual support the burden will be taken off ABB Machines' more technically competent employees. Besides, it will, as earlier mentioned, create the possibility of using ABB Machines global sales units that today lack the technical competence required to sell AMS generators.

When the computer-based system has been proven useful a user-friendly version of it should be developed with the aim that a customer should be able to use it. If a customer is given the opportunity to experiment with different combinations of the options and generate the different prices a lot of the work can be done before ABB Machines is contacted and the sales process, as it is at the time of writing, has even begun.

When the customers get to experiment with the system and configure parts of the generator themselves they will be more committed to the product than if this is done by an employee of ABB Machines. This extra product commitment can be useful in case discussions around the product's design come up later in the project. It will be more difficult for a customer to be critical of the product if he has designed or configured it partly himself.

This system will only be used by some of the customers, most likely the more frequent buying customers, and it is up to ABB Machines to choose which customers that will get the opportunity.

The author's vision of this computer-based supportive sales tool is not that the customer should be able to place an order themselves but more as a preparation for the discussion with the ABB salesperson. A system for direct ordering by customers would be far more complex, however, if it is shown to be requested it will definitely be possible to develop it from the previous system.

6.3 Realize the Importance of Communication

The price difference between a customized product and a standardized product was believed to be an issue in the sense that a standardized product with a minor customization should be so much more expensive that the customers would react. Based on the case studies this turned out to be a false concern since all companies agreed that its customers have a good understanding of how the advantages of standardization can reduce the price and are therefore well aware of the additional price when a deviation from the standard is requested.

Since the human factor can present itself at any time in the form of unfortunate mistakes, one of ABB Machines' fears with a standardized product was that a machine sold as a standardized product turned out to be customized due to a misinterpretation of the customer's specification. The case studies showed that this is a legitimate concern for ABB Machines. In all the four companies studies, this was found to be an apparent problem.

It is most likely that ABB Machines will experience this sooner or later, which unfortunately can be quite costly. Therefore, it is recommended that ABB Machines forms a clear strategy of how to manage such a situation to be prepared for it in the best conceivable manner. To form a strategy for those situations is difficult because it depends on many factors, for instance, what type of variation for the standard scope it is and how late into the project it is discovered. However, if any of the studied companies' strategy is to be copied due to its preferable way of managing these situations the author would suggest that Solar Turbines Inc. is the best performer and should therefore be copied.

When Solar discovers the mistake it will explain it to the customer by saying that it was Solar's understanding that the standard was ordered and it did not realize that the customer wanted that deviation from the standard and apologizes. Solar continues by explaining that the customer could still get the deviation if he desires but it is going to cost more money and have some impact on the delivery. On the other hand, if the customer would continue without the deviation there will be no extra charges and no delivery impact.

There are two possible ways to go from there. The customer will either accept the standard and the project will go on as if nothing would have happened or he will demand the deviation. If the latter occur it becomes a negotiation of who will eat the cost.

Even though it is most likely that this situation will occur, there are ways of trying to prevent it. ABB Machines is therefore advised to create a formal document of the Basic generator that clearly states what is included and excluded in the purchase of Basic to the extent it is possible. This document aims at reducing the confusion and the times that ABB Machines and its customer disagree on what is included in the order.

ABB Machines will have to separate its customers when it comes to positioning and marketing of its standardized product. For the existing customers, that are familiar with the high quality of ABB Machines' products, the shorter lead time, the lower cost, and the simplicity of ordering a standardized product should be emphasized. When ABB Machines is trying to attract new customers that are used to the low price and the short lead time it will have to emphasize the higher quality and in that way position its product differently by intelligent communication. The fact that the Basic generator will be more expensive than its competitors will also work as a clear positioning statement from ABB Machines telling the customers that the higher price represents a higher quality.

According to the theoretical framework of this thesis the customers' behaviors could be affected by the introduction of a standardized product in the way that a shift of the

decision-making unit could be made. This was reaffirmed in the Siemens case study where a clear change of the purchaser's behaviors was discovered with the introduction of a standardized product. Because of the organizational structure of ABB Machines' customers, i.e. they have some technical departments and a purchasing department, it is expected that ABB Machines will experience a similar situation. Therefore, it is recommended that ABB Machines sales staff, in first hand, should be informed of the situation to use it in favor of ABB. If ABB Machines desires to sell standardized generators at a certain time, the sales staff is advised to concentrate on the purchasing department and leave out the technical departments at the customer, to the extent it is possible, as studies have shown that the purchasing department tends to buy the standardized product due to a lower cost and simplicity. On the other hand if ABB desires to sell a customized product the sales staff is instead advised to try to go through the technical departments and in that way affect the customer by using directed communication.

6.4 In the Production

The manufacturing process is, at the time of writing, optimized for customization with manual assembly performed by highly competent assembly personnel. This type of manufacturing will be suitable for the Basic generators too, however, there are other potential problems in the process. As described earlier, ABB is used to prioritize its orders, which may be difficult to do when different orders have different lead times. It is therefore recommended that ABB Machines looks into this further to make sure that the production planners fully understand the new possible limitations for moving orders around. Since ABB Machines used to have the production of induction motors at the factory in Västerås, it is advised that the experience gained from that can be used to prepare for the production planning of Basic.

As previously mentioned line extension creates the risk of damaging the perceived value of a company's other products and that this is hazardous for ABB Machines has also been established since it is considered a high value company. What could harm this perception is poor quality of the new product, which is why the author once again stresses the point that the quality controls need to be as rigorous for the standardized product as for the AMS.

As mentioned in the analysis of ABB Machines the new Basic generator creates the need for new suppliers. There are several potential issues with new suppliers that can be critical for product success. The material quality, the delivery accuracy, the suppliers' ability to handle large quantities, and the possibility of volume discounts are a few of them. How to ensure the appropriateness of the suppliers is left out of this thesis, but it is worth to stress the importance of an extensive review that covers all potential issues as they could seriously damage the production flow and cause lots of harm to the whole factory.

6.5 Employees Should Facilitate Product Success

When it comes to motivate the sales staff to sell the standardized generator it may be incentive enough to just have the less complicated and less time consuming sales process that comes with the standardized product. This was shown to be enough incentive for the sales staff at Scania as the case study proves. On the other hand, it may not be considered challenging enough to sell a standardized generator compared to a customized. Which of the above-mentioned scenarios will be true is most likely depending on the individual's personality and its workload, however, the ABB management must be prepared for both.

One can argue to what extent the Basic generator preferably should be sold. That is a decision for the ABB top management and will not be discussed in this thesis, however, it can be useful to note that if a too large part of the sales should consist of standardized generators the company will lose competence about the technically advanced customized solutions and may in time have to pass on profitable projects because of that particular reason.

It was found in the case studies that there has been a general doubt among employees that a standardized product would not be sold in the customized environment that these companies operate in. Since a similar disbelief has been shown among ABB Machines' employees it is important for the ABB management to get as many as possible to understand the benefits and the need for the new standardized product to prevent antagonism. It is recommended that ABB Machines uses the fact that both Siemens and Solar manage to sell their standard solutions in a, if possible, even more customized environment to its advantage when trying to win over the disbelieving employees.

When it comes to other types of employee dissatisfaction because of perceived demotion, higher level of hierarchy or unwillingness to change processes that is generated by the new standardized product, as mentioned earlier, are unfortunately not covered by the theory or the case studies in this thesis, but if anything is to be recommended to ABB Machines it should be to explain the necessity of a standardized product for the company's competitiveness and in the long run its importance for survival.

In the theoretical framework the importance for a company to be able to renew itself is stated. This is essential when the company realizes that the existing products do not cover a specific customer segment or a specific market. It should therefore be ABB Machines' aim to prepare for future adjustments to the Basic generator. This is where a carefully developed product platform comes in hand. If ABB manages to create a useful product platform it will have the opportunity to make adjustments to the standardized generator by adding or removing options to better suit the existing customers or to reach new customers. It has been shown both in the case of Solar and in the case of Siemens that the standard solution once developed will not remain the same but has to be modified in order to stay useful. As ABB Machines has a lot of experience in running development projects it will have the opportunity to successfully renew the Basic generator as long as the initial product platform is not too far off.

7 Discussion

7.1 Difficulties

One of the major difficulties with this thesis was to find suitable theories in the initial phase. Due to the very complex situation that ABB Machines is in many theories within the sought areas were not applicable in this particular case. For instance, many of the theories found referred to consumer products and had to be left out or modified to suit the business-to-business environment that ABB Machines is in. However, when the first suitable theories were found numerous useful theories appeared.

Another issue became apparent in the phase of the case studies. It turned out that some of the selected companies were unwilling to contribute, which reduced the number of companies included in the chapter case studies than initially desired. Once again due to the complex nature of this case there were not many appropriate companies to choose from, but fortunately Volkswagen, Scania, Solar, and Siemens decided contribute with their experience.

Last but not least the limited time created issues. Throughout the whole process of writing this thesis numerous new important areas to investigate unraveled. Some of them had to be left out due to the time constraints even though it would have been very interesting to dig deeper and make a more thorough analysis of each and every one of them.

7.2 Future Studies

One of the issues related to introducing a new standardized product that was excluded from this thesis was how to prevent cannibalization of existing products' volumes. This is an area that requires investigation and is therefore suggested for other students or researchers.

How to select new proper suppliers and ensure their appropriateness in another issue of importance for product success that was left out of this thesis. The reason for that was mainly the extensiveness of the issue which per se could be the foundation for another Master Thesis. It is the author's belief that such a thesis would be highly desired not only to ABB Machines but also to numerous other companies, which is why future studies within this area also are suggested to be done by other students or researchers.

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