LUNDS UNIVERSITET
Lunds Tekniska Högskola

Department of Industrial Management and Logistics
Division of Engineering Logistics

Supplier Capacity at IKEA

Capacity planning from an outside-in perspective

Authors: Johanna Larsson
Johanna Viklund

Supervisors: Jan Olhager (LTH)
Paul Björnsson (IKEA)

Acknowledgement

This thesis is written during the spring 2012 as the final part of our Master's degree in Industrial Engineering and Management at Lund University. The thesis was originated by IKEA and Paul Björnsson, the Process Owner of Plan and Secure Logistics, to be a part of a global roll-out of a new project regarding capacity planning.

We would like to thank our Supervisors at IKEA, Paul Björnsson and Björn Sunesson, as well as the process team for their engagement, guiding, coordination and support during this project. We would also like to express our gratefulness to the local Trading team in Shanghai and Shenzhen, China, for their cooperation and commitment in the implementation process. A special thank is directed to Julie Ma for her engagement and support. Finally we would also like to thank our supervisor at LTH, Jan Olhager, for his support and help with the Master's thesis report.

Lund, June 2012

Johanna Larsson and Johanna Viklund

Abstract

Title: Supplier Capacity at IKEA – Capacity planning from an outside-in perspective

Authors: Johanna Larsson
Johanna Viklund

Supervisors: Jan Olhager, Department of Industrial Management and Logistics, Lund University
Paul Björnsson, Process Owner Plan and Secure Logistics, IKEA

Background: IKEA has, during a long time, experienced problems with incorrect capacities registered in their system. There is no standardized way of working with registering and updating the information regarding capacity today. Therefore, the information regarding the suppliers' capacities does not reflect the reality. Furthermore, the company does not have a clear picture of how the capacities are allocated. They have an insufficient overview of their capacities since they often are registered in different units which make them difficult to compare. If IKEA has enough capacity available but have allocated it wrongly, there is a possibility to utilize the capacities better and improve the planning process. Therefore One Supplier Capacity Process has been created in order to standardize the way of working regarding supplier capacity planning.

Purpose: The purpose of this Master's thesis is to contribute to and support the global roll-out of One Supplier Capacity Process in the Lighting Category in Trading Area Greater China as well as to evaluate and suggest improvements to the project. The thesis will contribute to the field of research in capacity planning from an outside-in perspective. The deliverables can be divided into four parts:

1. Map and analyse how IKEA is working with capacity planning today (As-Is)
2. Implement the common way of working with One Supplier Capacity Process (To-Be)
3. Evaluate and prove savings
4. Contribute to improve One Supplier Capacity Process

Method: This thesis will have some similarities with action research methodology since analysis and research has been conducted during implementation and used as a basis for decisions. Interviews have been done with the personnel at IKEA to map the current way of working with capacity planning. Embedded case studies have been used when implementing the process in terms of supplier visits. This means that both quantitative and qualitative data has been used in the project.

Delimitations: This Master's thesis will be connected to the global roll-out of One Supplier Capacity Process in the Lighting category in Trading Area Greater China. During the project, all 23 lighting suppliers will be introduced to the concept but this thesis will only concern seven selected suppliers. The thesis will focus on operational and tactical capacity planning. The limited amount of time will affect the extent of the analysis and it will mainly be based on soft measurements.

Conclusion: The implementation of One Supplier Capacity Process has worked well, followed the original time plan and the objectives with the Master's thesis have been fulfilled. Several savings have been found with the new way of working such as a global overview, transparency and steps toward a common way of working. Furthermore, the utilization of the capacities has been analysed and it can be concluded that IKEA's utilization of their capacity is around 70-75%. To further improve the process it has been suggested to for example create explicit guidelines, develop the allocation tool and improve the handling of extra capacity.

Key words: Capacity Planning, Supplier Capacity, Process implementation, Process evaluation

Sammanfattning

Titel: Leverantörskapacitet på IKEA – Kapacitetsplanering från ett utifrån-och in perspektiv

Författare: Johanna Larsson
Johanna Viklund

Handledare: Jan Olhager, Avdelningen för teknisk logistik, Lunds Universitet
Paul Björnsson, Processägare Plan and Secure Logistics, IKEA

Bakgrund: Ikea har under en längre tid upplevt problem med felaktiga kapaciteter registrerade i deras system. Idag finns det inget gemensamt arbetssätt för att registrera och uppdatera kapacitetsinformation och därför reflekterar inte informationen i systemet leverantörernas verkliga kapaciteter. Detta gör det svårt för företaget att kunna ha en överblick över kapaciteterna och hur de är allokerade. Om företaget har tillräckligt med tillgänglig kapacitet men har allokerat den felaktigt så finns det möjlighet för bättre kapacitetsutnyttjande och en förbättrad planeringsprocess. För att standardisera kapacitetsplaneringen har man nu skapat ett globalt arbetssätt genom en process som kallas "One Supplier Capacity Process".

Syfte: Syftet med detta examensarbete är att bidra och hjälpa till med den globala utrullningen av "One Supplier Capacity Process" i belysningskategorin på IKEA och hos leverantörerna relaterade till denna. Under arbetet kommer också arbetet och processen att utvärderas och förbättringsmöjligheter kommer att föreslås. Examensarbetet kommer även att bidra med studier av kapacitetsplanering från ett utifrån-och in perspektiv. Arbetet är uppdelat i fyra huvuduppgifter:

1. Kartlägga och analysera hur IKEA arbetar med kapacitetsplanering today (As-Is)
2. Implementera det gemensamma arbetssättet i enlighet med "One Supplier Capacity Process" (To-Be)
3. Utvärdera och bevisa fördelar med det nya arbetssättet
4. Bidra till att förbättra "One Supplier Capacity Process"

Metod: Detta examensarbete har inslag från aktionsforskning eftersom analyser och beslutsunderlag till företaget har gjorts under implementeringen. Intervjuer med personalen har använts för att kartlägga det nuvarande sättet att arbeta. Under implementeringen av det nya arbetssättet har en typ av fallstudier varit ett viktigt verktyg och använts i form av leverantörsbesök. Det innebär att både kvantitativ och kvalitativ data har använts under analysen.

Avgränsningar: Detta examensarbete är relaterat till implementeringen av "One Supplier Capacity Process" i belysningskategorin i Kina. Under examensarbetet kommer alla 23 belysningsleverantörer i Kina att introduceras till konceptet men analysen kommer bara att behandla 7 utvalda leverantörer på grund av tidsbrist. Detta projekt kommer endast beröra operationell och taktisk kapacitetsplanering. Den

korta tidsperioden kommer också att påverka analysen som mestadels kommer att utföras baserat på mjuka mått.

Slutsats: Implementeringen av "One Supplier Capacity Process" har fungerat bra och målen med examensarbetet har blivit uppfyllda. Flera fördelar med det nya arbetssättet har identifierats så som global överblick av kapaciteterna, transparens och steg mot ett gemensamt arbetssätt. Kapacitetsutnyttjandet har även analyserats hos 7 leverantörer och det kan konstateras att utnyttjandet ligger på 70-75%. För att förbättra och utveckla arbetsprocessen ytterligare vore det lämpligt att skapa tydliga och globala riktlinjer, vidareutveckla verktyget för allokeringen av kapaciteter samt förbättra hanteringen av extra kapaciteterna.

Nyckelord: Kapacitetsplanering, Leverantörskapacitet, Process implementering, Process utvärdering

Table of content

List of figures

List of tables

1 Introduction

This chapter will present the background and purpose for this Master's thesis. It will also describe the problem definition, target audience as well as the scope and limitations of the project.

1.1 The IKEA group

IKEA is a global home furniture company and was founded in 1941. IKEA of Sweden is the heart of the company and it is located in Älmhult, Sweden, which is the village where the company was established. Today, the company has 335 stores located in 41 countries all over the world. (IKEA-webpage1) IKEA's mission is to offer a wide range of home furniture and interior decorating articles to such a low price that as many as possible can afford them. The company's focus has always been to try to cut costs through optimizing the utilization of their resources. (IKEA-webpage2) The company is continuously working with improvements for the human being and for the environment (IKEA-webpage3).

The recent years, IKEA has continuously worked with reducing their supplier base and today they have approximately 1000 suppliers in 53 different countries. IKEA has a number of Trading Areas all over the world and have approximately 9 500 articles in their product range. Their goal is that the number of articles never shall exceed this amount and therefore they are continuously phasing in and out products. The total revenue for the company in 2011 was EUR 25, 3 billion. (IKEASystem, 2011) IKEA is organized in different ways, in Home Furniture Businesses (HFBs) and in categories. The HFBs are connected to product ranges such as Workspace, Cooking, Bathroom and Children's IKEA. The category dimension is central from the purchasing perspective. The categories cross several HFBs and consist of groups of articles that share similar materials, productions techniques, and/or the same supplier base. Examples of categories are for example Lighting, Mattresses and Plastics. This means that products connected to for example bathroom can belong to different categories like Plastic and Rugs & Carpets. (IKEAInside, 2010-2011)

IKEA consists of three main processes: Creating the Home Furnishing Offer, Communicating & Selling and Supplying, see Figure 1.1.

Figure 1.1: IKEA's main processes; Creating the Home Furniture Offer, Communicating and Selling and Supplying.

The Supplying process consists of several different core processes and the process that is concerned with this Master's thesis is the Plan & Secure Logistics process. The process regards demand-, supply- and capacity planning and it is divided into four sub-processes, see Figure 1.2. In Plan Demand, Demand Planners work with developing demand plans which can be described as a forecast of what IKEA expect to sell during the concerned period. There is a process called Optimize Supply Chain Network in parallel with the Plan Demand process and it includes for example lead time. The demand plan together with the Optimize Supply Chain Network process, trigger the Plan Supply where Need planners carry out need plans. A need plan is a plan for IKEA's need the coming 84 weeks and this plan will then be the input for the process Plan & Secure Capacity. The Plan & Secure Capacity process is concerned with capacity planning which essentially means balancing the need and access to capacity and it regards for example supplier-, transport-, distribution center- and retail capacity. (Björnsson, 2012a)

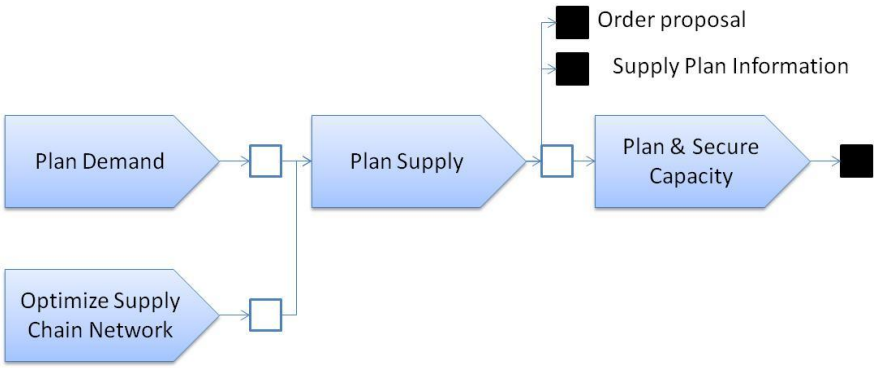

Figure 1.2: The Plan & Secure Logistics Process

1.2 Background to the problem

The need plans are compared to the information about the concerned suppliers' capacity when planning the capacity at IKEA. The information about the capacities is found in their Global Purchasing System (GPS) and there is no standardized way of updating the information in the system today. The suppliers have difficulties in fulfilling the actual need since the information about the capacities in the system does not match the actual capacities. Practically this means that the information in GPS does not reflect the reality and that IKEA does not know what the suppliers can and cannot deliver. The uncertainty creates a vicious circle since it triggers safety stock levels, creates high stock levels and affects the availability in the stores. (Björnsson, 2012a)

The problem with the system not reflecting the reality is illustrated in the example in Table 1.1. The registered information about the suppliers' capacity can for example be 100 pieces of an article. IKEA sends a planned need of 80 pieces to the supplier which should be possible for the supplier to deliver according to the given capacity information. However, when the orders are placed a scenario with an actual need of 120 pieces may occur. At the same time, it turns out that the supplier only has the capacity to deliver 90 pieces. Therefore two problems occur; the need plans are not correct and the planned capacity does not reflect the actual capacity. (Björnsson, 2012a)

Table 1.1: An example of the difference in need and capacity in the system compared to the reality

	Planned	**Actual**
Need	80	120
Capacity	100	90

Furthermore, IKEA does not work proactively enough with balancing need and supplier capacity. Therefore, they do not have a clear picture of how their capacity is determined. The grouping of the products is done by the suppliers and is not done in a standardized way. This creates difficulties when planning the capacity levels, lack of overview and makes it hard to compare the capacity information. Capacities are also often registered in different units of measure, for example purchasing value and pieces. That makes it even more difficult to compare the capacities to each other. In many cases, IKEA might have access to enough capacity but they have not used it in an optimal way. This provides an opportunity for better utilization of their capacities and possibilities to, in a later stage, improve the planning process. All in all, these issues lead to IKEA working more with fire fighting rather than working proactively with planning their capacities. (Björnsson, 2012a)

1.3 Problem formulation

IKEA wants to establish a process to secure that they are working proactively in balancing capacity versus need and this is a problem that the company has tried to solve since the 1990s. They also want to make sure that they act upon supplier capacity exceptions. The goal is rather to have the supplier capacity in balance with the need in order to secure agreed availability to lowest cost than planning the production at the suppliers. IKEA also wants to make sure that the capacities in the systems are defined, registered and maintained correctly. Therefore, IKEA has developed a concept called One Supplier Capacity Process. (Björnsson, 2012a)

One Supplier Capacity Process will establish an operational and tactical planning level for the capacities. The implementation of the process will result in a common way of working through for example introducing a new grouping structure and standardized units of measurement. This will lead to more efficient handling and possibilities to get a better overview of the capacities. (Björnsson, 2012a)

The project has been tested in a pilot during 2011, where 93 of IKEA's biggest suppliers, representing approximately 45% of total purchase value, were included. The first evaluation of the pilot study has indicated good results and the next step is therefore a global roll-out. (Björnsson, 2012a) This Master's thesis project will work as a support to the global roll-out.

1.4 Purpose of the Master's thesis

The purpose of this Master's thesis is to contribute to and support the global roll-out of One Supplier Capacity Process in the Lighting Category in Trading Area Greater China as well as to evaluate and suggest improvements to the project. The deliverables can be divided into four parts:

1. Map and analyse how IKEA is working with supplier capacity planning today ("as-is")

The first part of the thesis will concern mapping the current way of working with supplier capacity planning. It will involve information gathering through for example interviews with the personnel. By analysing the information, the mapping will lead to an understanding of what capacities IKEA has in their system today and how they are defined, registered and maintained. By comparing the previous way of working with the new, there will also be possibilities to find further improvement possibilities of the new process.

2. Implement the common way of working with One Supplier Capacity Process ("to-be")

The new concept will be implemented at the Lighting suppliers related to the Trading Area Greater China. One important part of the implementation will be to visit suppliers. During the visits, the aim will be to explain, educate and clarify the concept to the suppliers to be able to identify and map the resources related to IKEA's production. The products and resources will be grouped according to the concept and the consumption rates will be gathered for the groups. Based on the new grouping, the updated capacities can be calculated and prepared for registration in the system.

3. Evaluate and prove savings related to One Supplier Capacity Process

The evaluation of the concept will be done by comparing the previous way of working to the new, for example analysis of the capacity values, the working process and the grouping. There will also be an evaluation of the work related to the implementation and this will lead to identification of some issues that affects the capacity planning. Finally, a discussion regarding the savings that are related to the new way of working will be done.

4. Contribute to improve One Supplier Capacity Process

The results and the evaluation of the implementation will be used as a basis to suggest further improvements of the process. The frame of reference and discussions with the personnel involved will be used to find opportunities for development of the concept and the new way of working.

1.5 Scope and delimitations

Since IKEA's biggest supplier base is located in China and that the pilot project has shown best results in China, the global roll-out will start there to establish a common way of working. This Master's thesis will be connected to the global roll-out in the Trading Area Greater China. The first part of the global roll-out will be limited to a specific range of categories and the selected category that has been chosen by IKEA for this Master's thesis is Lighting. All 23 suppliers that are included in the Lighting category in Trading Area Greater China will be involved in this process but this Master's thesis will only cover seven selected suppliers. The suppliers were chosen by the trading team to cover at least one supplier for each team. The aim was to introduce the concept to everyone in the personnel in order for them to continue the roll-out for the other Lighting suppliers by themselves. It was not possible to manage additional supplier visits because of the limited time period. After the first implementation in China, the global roll-out will continue step by step with other Trading Areas in the world.

This thesis will only concern the way of working with capacities and capacity planning. It will not regard improvements of the suppliers' production or capacities. Furthermore, the thesis will not concern the strategic planning of capacities. It will instead focus more on the operational capacity planning. The limited amount of time will affect the number of supplier visits and therefore also the extent of the analysis and improvements. Since IKEA is planning their future orders up to 8 months in advance, it will not be possible to see the final result of the project within the time frame for this project. A qualitative, soft analysis and assumptions regarding improvements will be made in order to evaluate the efforts of this thesis.

1.6 Target audience

The target audience for this Master's thesis is IKEA and the people in the company involved in the planning and purchasing at the company. The thesis can be used as a reference case in the continuation of the global roll-out of the project. The report is also targeted to students at the university interested in the area of capacity planning. Therefore it is assumed that the reader has basic knowledge in Supply Chain Management and there will not be emphasis on explaining basic terms and theories in the report.

1.7 Structure of the thesis

This thesis will be divided into seven chapters according to Figure 1.3.

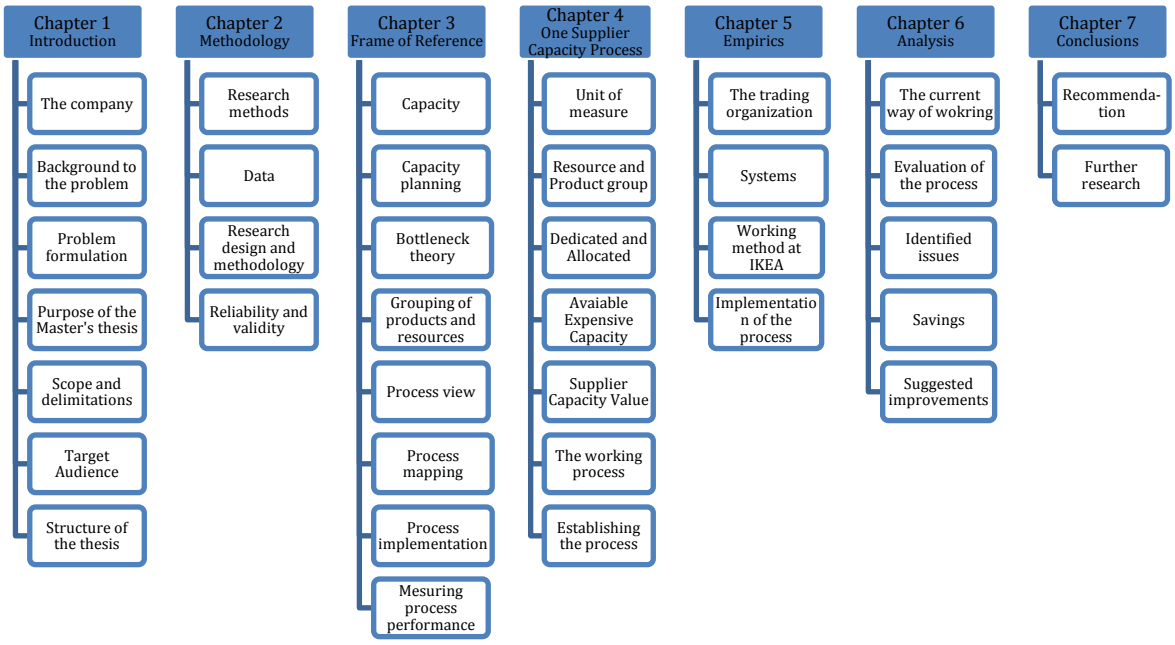

Figure 1.3: The structure of the thesis

2 Methodology

To be able to secure a valid and reliable result, it is important to use an appropriate methodology and to have a well formulated approach to the research. This chapter will explain the research methodology and approach for this project.

2.1 Research methods

The methodology for a project is used as help for creating knowledge around the area of research. Therefore the choice of methodology should be based on the goal and the character of the research. There are different purposes of projects; descriptive, exploratory, explanatory, normative and problem solving. Descriptive studies aim to describe how the study object works. Exploratory studies are more focused on understanding the study object rather than just describing it and are used when there is little knowledge within the area. Explanatory studies aim to find causality and explanations to the way something works. (Höst et al., 2006) Normative studies are undertaken when there is knowledge in the area and the goal is to give guidance and suggests improvements (Paulsson, 2003). Problem solving studies focus on solving an identified problem. A project can be divided into subprojects with different purposes and then different research methods can be used. (Höst et al., 2006)

There are four basic research methods for data collection; survey, case study, experiments and action research. The methods, its purpose, design and data can be seen in Table 2.1 and further descriptions of the methods follows. (Höst et al., 2006)

Table 2.1: Resume of the main research methods and its main purposes, data and design

Method	Main purpose	Primary data	Design
Case Study	Explorative	Qualitative	Flexible
Survey	Describing	Quantitative	Fix
Experiment	Explaining	Quantitative	Fix
Action research	Problem solving	Qualitative	Flexible

2.1.1 Case study

A case study is used for deeper descriptions of a phenomenon, for example to understand the way of working in a company. One of the characteristics of a case study is that it is done in a limited extent, at one or a few units. This provides an opportunity to make a deep study, to develop unique knowledge about the object for the investigation and to explain why things happen. It is important to carefully choose the study object in a case study to make sure that it is appropriate for the research. (Denscombe, 2000) There are different types of case studies, for example holistic or embedded case study. A *holistic case study* is based on a thorough qualitative approach. The *embedded case study* is not limited to a qualitative analysis alone and it includes more than one unit or object for analysis. There are other characteristics of case studies such as number of cases included and whether to conduct a single or multiple case studies. (Scholz, 2002)

2.1.2 Survey

A survey can be used when the aim of the project is to describe a phenomenon. The survey is usually done on a sample if the population is big. The sample can be chosen in several different ways, for example randomly or systematically. There are also different approaches for conducting a survey, for example lists, questionnaires or interviews. A predefined list of

questions can be appropriate when gathering quantitative data and to be able to get qualitative data, open fields for comments can be used. When having interviews there is a possibility to get clarifications from both sides and the risk of wrongly answered questions gets reduced. However, interviews are more time consuming to perform rather than questionnaires or lists of questions. It is important to be well prepared when conducting a survey since it is not possible to add questions when the survey is done. Based on the information from the surveys the data can be analysed through statistical methods (Wallén, 1996).

2.1.3 Experiment

Experiments are a research method where unique factors are isolated in order for the scientist to be able to study the effects of these. The purpose can be to discover new relationships, explain an observed change or to test existing theories. Experiments are done through a standardized way of working and that enables possibilities for repetition of the experiments, e.g. mathematical modulations and simulations. (Denscombe, 2000) In order to get as much knowledge as possible from the research it is important to do a systematic research plan. This is also important since it is not possible to affect the way of working when the experiment is started. (Höst et al., 2006)

2.1.4 Action research

Action research can be used when the study object will be improved during the research. Action research starts with an observation of a situation or a phenomenon to identify or clarify a problem to be solved. A survey study can be appropriate to use to do this. After the picture of the current situation is clarified the next step is to try to find a solution to the problem and to implement it. Finally, it is important to conduct an evaluation of the solution through observing and analysing it in its context. Since observations are done in parallel with improvement efforts the objectivity in the research may be affected because of problems in being critical to your own handlings. This can be handled through a clear plan for the evaluation from the beginning. (Höst et al., 2006)

2.1.5 Research approach for this project

The research approach for this Master's thesis will have some similarities with actions research since it will contribute with analysis and research during an implementation and will be used as a basis for decisions. The project is divided into different parts with different purposes and therefore will different research methods be used in the different parts of the project. Since one of the purposes of the project is to describe and understand the situation today, it is important to have a descriptive and explanatory approach to create a representative picture of the reality. This means that interviews, data analysis and case studies will be important in order to map and fully understand the situation. Structured interviews will for example be done in the Trading team. Case studies are an important part of this project and will be undertaken for each supplier included in the project. It is decided by IKEA to include between seven and ten suppliers in order to establish the process within the Trading team and to be able to get a true picture of the reality. Since both quantitative and qualitative data will we gathered and analysed and multiple cases will be included an embedded case study will be undertaken for this project. The second part of the project is concerned with implementing the new way of working and to evaluate and suggest improvements of the process.

2.2 Data

When choosing the strategy for conducting the research there are trade-offs in control, realism and generalizability. It is important to have a structured plan and way of gathering data. (Mangan et al., 2004)

2.2.1 Quantitative and qualitative approach

There are two major types of research approaches; quantitative and qualitative approach. Quantitative data is appropriate when there are previously conducted studies to base the research on. The data collection is often a numerical study and the results can therefore be presented in figures and tables.(Kotzab et al., 2005) The advantage with this type of data research is that it is a scientific approach where the analysis can be based on objective laws rather than on the researcher's personal values. Since the research is based on data, it is relatively easy to analyse and present it. The disadvantage with this method is that you need to be careful with the collection of the information to ensure that the quality of the data is good enough. It is important to be well prepared before the data collection to get the right data in a limited amount. (Denscombe, 2000) Qualitative data is appropriate when the variables are difficult to define and when there are few theories that can be used to conduct the research (Kotzab et al., 2005). The researcher's identity and personal values are included in the study and that is important in the analysis of the data. The advantage with qualitative data is that it is easier to get data about complicated situations and it gives opportunities to find alternative explanations. The disadvantage with this research method is that it is less generalizable than the quantitative method since the study often is based on less but more deep investigations. There is also a risk of the data getting affected by the researcher. (Denscombe, 2000)

A combination of the quantitative and qualitative research method is the Balanced Approach Model, see Figure 2.1. This model consists of two loops, one quantitative and one qualitative, where the methods are used interchangeable. The qualitative approach is used to generate information about the theory and the quantitative approach is used as a complement to test the formal theory. (Kotzab et al., 2005)

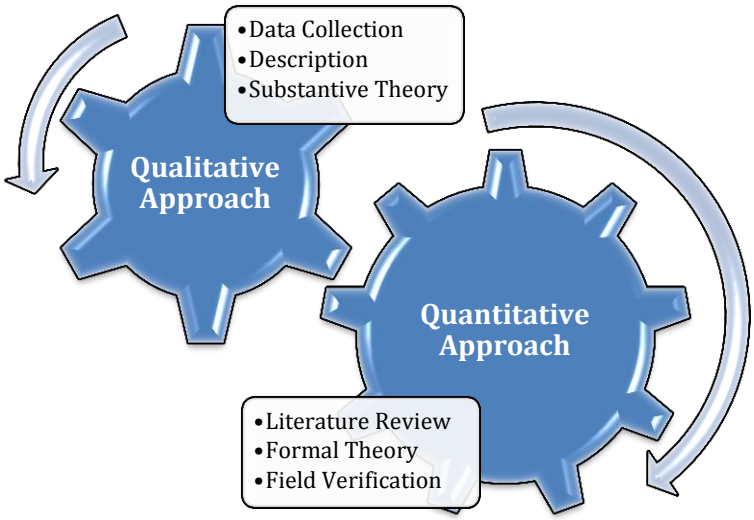

Figure 2.1: The Balanced Approach

2.2.2 Induction, deduction and abduction

When the general conclusions are based on a set of data, the approach is called induction. In the deductive approach, the theory is more important than in an inductive approach. In this approach, the methodology is based on a hypothesis that will be proved by empirical research. Therefore it is important to have an extensive theory to make a comparison. A deductive research approach is more suitable for testing existing theories rather than developing new science. (Kovács and Spens, 2005) The abductive approach combines both inductive and deductive approaches and starts with empirical observations before theoretical studies, see Figure 2.2 (Paulsson, 2003). Therefore it is important to have good knowledge about the area of research. In this approach relationships are investigated through varying different factors and then investigating the effects (Wallén, 1996).

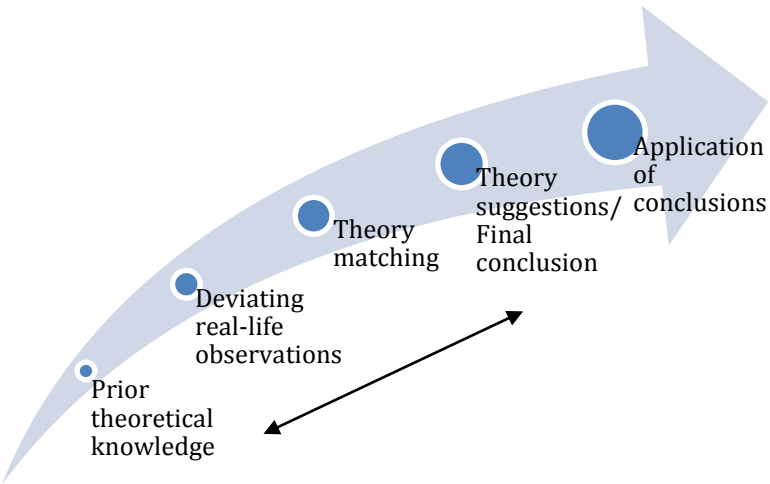

Figure 2.2: The Abductive research approach

2.2.3 Research approach for this project

This project will include embedded case studies which include both quantitative and qualitative data. There will for example be quantitative data gathering and qualitative interviews. The combination of the two methods will enable a picture that well reflects the reality. The final evaluation will mostly be based on qualitative information since the final result of the efforts of this project will not be shown directly because of the time limitation. The Balanced Approach Model, seen in Figure 2.1, is therefore suitable for this project since it combines the two types of data. This project will also be handled through an abductive research approach since an existing method/process will be implemented while real-life observations will be made and the information will be connected to the theory to be able to suggest improvements.

2.3 Research design and methodology for this project

As explained in chapter 1 *Introduction*, this project has four deliverables. The first two are concerned with understanding and explaining the situation today and it will be done through both qualitative and quantitative studies. The implementation of One Supplier Capacity Process will be done through supplier visits and data analysis. The third and fourth part of the thesis will be to evaluate One Supplier Capacity Process, prove savings and suggest improvements. The evaluation part will be done through gathering and analysis of data as well as interviews. The focus will be on soft facts due to the time limitations. Improvements will for example be suggested through comparing the reality to the frame of reference. Further explanation of the different steps follows and the overview of the project can be seen in Figure 2.3.

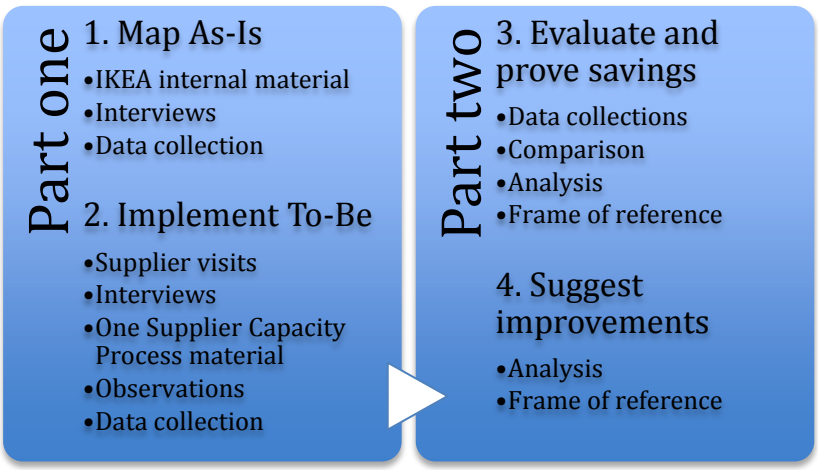

Figure 2.3: The two different parts of this project

2.3.1 Map As-Is

Mapping the current situation and understanding how IKEA is working today with capacity planning involves:

- Study the current grouping of the products
- Investigate what capacities are registered in GPS
- Compare planned and actual capacities versus planned and actual need
- Make interviews to understand how the Trading team and suppliers work with capacity planning in their daily work

This includes collection of both qualitative and quantitative data. The qualitative data will be collected through interviews with personnel that will be prepared with interview guides. Quantitative data will be collected from GPS and by studying internal material at IKEA. The goal is to understand and find possibilities for improvements by analysing the current way of working and comparing it to the frame of reference.

2.3.2 Implement To-Be

In this step a common way of working with capacity planning will be established through implementing One Supplier Capacity Process. The implementation process will consist of education of the team and the suppliers as well as developing explanatory material. Supplier visits will also be an important part of this step and information that will be gathered during the visit will be used to:

- Map production processes and identify resources needed for each Product group
- Verify the Product groups that are predefined by IKEA or, if needed, suggest changes of the grouping
- Identify the consumption of each Product group in every Resource group
- Identify the Dedicated Capacity in each Resource group related to IKEA's production
- Identify bottleneck resource
- Allocate capacities
- Prepare for registration new capacity value in GPS

During the supplier visits, observations and interviews will be undertaken. It will be important to prepare control questions to ensure reliability of the data. It will also be important to prepare the suppliers in advance of what information that will be needed during the visit. To ensure that the information in GPS will be updated with the right numbers, validation of the data will be required.

2.3.3 Evaluate and prove savings

When the implementation part of the project is done, it will be evaluated. The main parts of this step are:

- Compare previous capacities to the updated
- Evaluate the grouping
- Bottleneck analysis
- Evaluate the working process and the related material to One Supplier Capacity Process
- Interviews with persons involved in the implementation to understand what possibilities and saving they anticipate
- Analyse changes and improvements

The focus on the evaluation and analysis will be on soft facts but there will also be some hard analysis. A static quantitative analysis will be done in terms of studying the figures in GPS. This means that the previous values will be compared to the updated values. As mentioned in 1.5 *Scope and delimitations*, it is not possible to see all improvements due to the time limit and therefore a qualitative evaluation of what improvements and changes that is likely to occur will be performed. This includes interviews with the people involved in the implementation, analysis of the gathered information as well as a comparison of the frame of reference.

2.3.4 Suggest further improvements

In this part, improvements of One Supplier Capacity Process and the implementation process will be suggested as well as improvement possibilities of IKEA's work with capacity planning. This will be done through using experience from this and other projects as well as comparing the actual situation with the frame of reference.

2.4 Reliability and validity

There are different ways to estimate the quality and credibility of a study. Quality in reliability is the trustiness in the data collection process and the analysis regarding random variations. To ensure good reliability it is important to be careful in the data collection process and in the analysis. (Höst et al., 2006) Reliability can also be improved by using control questions in surveys and interviews (Paulsson, 2003). Quality in validity means that there is a clear connection between the object of research and the measurements. Triangulation, when an object is studied with several different research approaches, can be used to improve both the validity and reliability in a research. The representatively is judged on the generalizability of the conclusions and it is highly dependent on the selection of data studied. (Höst et al., 2006)

To ensure good reliability in the analysis, seven suppliers were included in the project. Otherwise it would be difficult to draw any conclusions of how the suppliers and the Supply planners at IKEA are working with capacity planning today. When it comes to the quantitative data, it was based on different group levels which made them difficult to compare. This has been solved by using a more aggregated level for comparisons and therefore this is not assumed to affect the reliability and validity of the results. The interviews regarding the current way of working has been conducted with several Supply planners and control questions were used in order to ensure the reliability in the information since the answers were highly dependent on the knowledge and experience of the personnel. All interviews have been done by two persons to increase the objectivity and decrease the risk of misunderstandings.

3 Frame of reference

To be able to do a good analysis it is important to have a good theoretical base. This chapter explains the definition of capacity, capacity planning and capacity planning on different levels as well as techniques of working with capacity planning. It will also relate to some areas connected to One Supplier Capacity Process such as Theory of Constraints and grouping of products. To be able to evaluate and suggest improvements of One Supplier Capacity Process, process measurement as well as process implementation will be described.

3.1 Capacity

Capacity can be defined as an upper limit of the throughput in a production process. Two types of capacity can be defined: *volume capacity* and *throughput capacity*. Volume capacity is the number of hours, or other unit of capacity, that a resource can perform per time period, for example the number of working hours a production group can accomplish per week. Throughput capacity gives information of how many hours per time period that can be devoted to perform a certain production operation in a resource. (Mattson and Jonsson, 2003)

Capacity can be calculated per production or resource group and measures how much it can produce. Common units of measure are man-hours or machine hours per time period. The capacity can be defined on different levels, see Figure 3.1. The *theoretical maximal capacity* is the capacity that can be achieved if the production group runs day and night, every day of the year. In practice this is rarely achievable. Instead the available capacity can be calculated by using the capacity normally needed as a starting point. This is called *nominal capacity* and it consists of four variables: number of machines or other production units, number or shifts per day, number of hours per shift and number of working days per period. The nominal capacity is also difficult to achieve and it is therefore important to take different types of losses into consideration. These losses can be consequences of for example machine breakdown or sick leave. The remaining capacity is *gross capacity.* The gross capacity includes indirect time, for example waiting time, which is difficult to avoid. The rest is then the *net capacity* which is the capacity that is disposable. (Mattson and Jonsson, 2003)

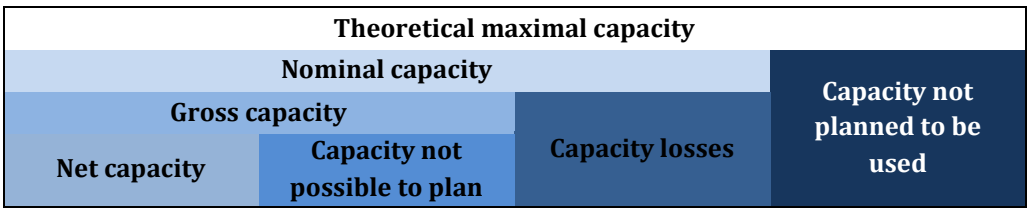

Figure 3.1: Different capacity levels

3.2 Capacity planning

Capacity planning has got increased emphasis in management of operations because of the financial benefits that can be gained from efficient use of resources and capacities (Xia et al., 2011). Capacity planning is concerned with balancing need of capacity and access to capacity as well as distributing capacity requirements over time and most of the literature concerning capacity planning is from an inside-out perspective. The shortage costs and cost of delayed deliveries must be compared to the cost of improving the capacity. In a long-term perspective it is possible to adjust the capacity to the capacity requirements, but it depends on for example financial restrictions. (Mattson and Jonsson, 2003)

Four types of planning situations can be identified by differing between accumulated and periodical balanced capacity. *Accumulated balanced capacity* means that the accumulated available capacity corresponds to the accumulated capacity requirement during the planning horizon. *Periodical balanced capacity* means that there is a balance between the available capacity and the needed capacity within each planning periods. Decreasing and increasing capacity can for example be done through decreasing or increasing the number of shifts or hiring capacity from another part. Decreasing the capacity need might involve deliberately planning smaller volumes than requested on the market. Marketing campaigns can be a way to increase the capacity need. The four planning situations are presented in Figure 3.2. (Mattson and Jonsson, 2003)

Periodical balanced		Yes	No
	Yes	Ideal capacity plan	Decrease/increase capacity Decrease/Increase capacity need
	No	Redistribute capacity Adjust capacity Redistribute capacity need	Combination of decreasing/increasing and redistributing capacity and capacity need
	Accumulated balance	Yes	No

Figure 3.2: The characteristics of accumulated and periodical balanced capacity

Redistributing and adjusting the need of capacity can be done in different ways, Figure 3.3 illustrates the principle. The figure shows two periods with capacity problems, period three and five. The need of capacity exceeds the available capacity in these periods. The problem in period three can for example be solved through postponing or frontloading capacity requirements to period four respectively two. In period five the capacity problem can be solved by using temporary extra capacity and the total capacity will be adjusted to a level that is enough to handle the need. (Mattson and Jonsson, 2003)

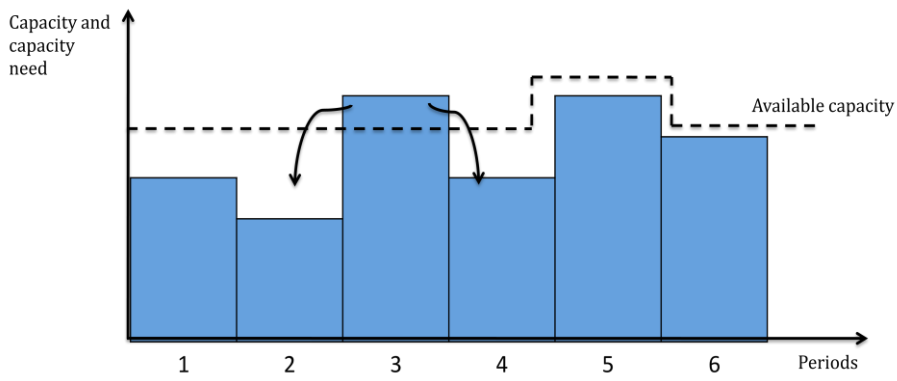

Figure 3.3: Redistribution of the need of capacity over different time periods

Capacity planning is essentially about matching the need of capacity to the access of capacity. Therefore, one important part in capacity planning is to understand and forecast the demand and the accuracy in the demand forecast has big impact on the capacity planning. (Rowbotham, 2007)

3.2.1 Leading and lagging

In a long-term perspective and since that capacity comes in large discrete steps, it is important to decide whether to work proactively or reactively. Working proactively means that the capacity should be changed before the demand changes. The alternative is to let the capacity follow the demand. (Olhager et al., 2001) These two main strategies for changing capacity are called *leading* and *lagging*. A leading strategy means working proactively and adjusting the capacity before the demand increases or decreases. A lagging strategy is a more reactive strategy and means that changes in capacity is done when changes in demand are detected (Mattson and Jonsson, 2003), both strategies are illustrated in Figure 3.4. In some literature a third strategy is suggested, a *tracking strategy,* which is a switching strategy where the difference between capacity and demand is kept at a minimum level (Olhager et al., 2001). There is a trade-off between having a capacity surplus and focusing on having high capacity utilization. A leading strategy provides high flexibility since there is extra capacity in case of a sudden increment in demand. On the other hand it increases the risk of not utilizing the capacity that has been invested in. A lagging strategy provides less flexibility in volume but gives higher capacity utilization and decreases the risk of having high cost related to unused capacity (Mattson and Jonsson, 2003).

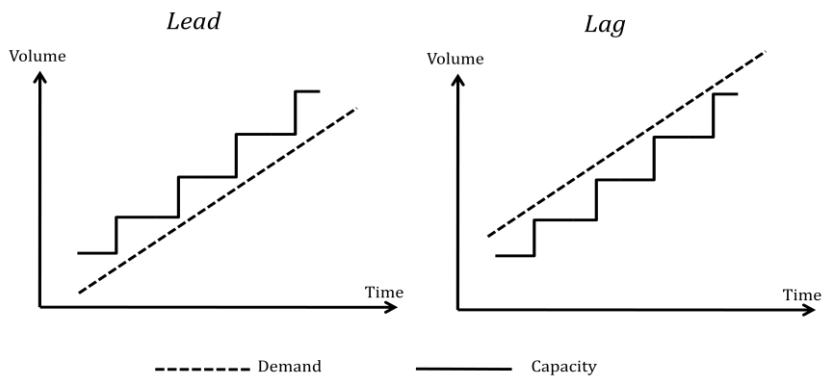

Figure 3.4: Illustration of leading and lagging strategy

3.2.2 Capacity planning on different levels

The general approach to capacity planning is to create production plans for the planned orders with the capacity taken into consideration. It is the availability of the resources in the activities that limit the overall capacity. Capacity planning can be done on different levels. It can be done on a selling- and business level which have a longer and more tactical perspective. Decisions on this level can include investments in new equipment and production facilities. On this level, it is important to decide how the relationship between the capacity and demand should be. If the capacity should exceed the anticipated demand, be less than the demand or exact equal to the demand. Having capacity that exceeds the forecasted demand introduces extra costs but decreases at the same time the risk of not having enough capacity. It is also important to decide how the network structure should be constructed. For example, if one facility/supplier should handle the total demand or if it should be split and in that case how the capacity should be distributed. The next level of capacity planning is short-term capacity planning and there are different ways of working with this type of planning. One alternative is *Level Capacity Planning* where the amount of resources and the out-put rate is kept constant regardless of the demand pattern which usually is set to the average demand level. This method is for example useful when resources are expensive since it is then difficult to vary the capacity level. Another method

is *Chase Demand Planning* which can be compared to a lagging strategy and the goal is to match the demand pattern as closely as possible. The advantage of this method is that it reduces the risk of building up inventory. On the other hand it requires continuously change of the workforce levels which can introduce costs of for example hiring and educating new personnel. A third short-term planning method is *Demand Management* where the strategy is to change the demand so that it suits the operation the best. (Rowbotham, 2007) There are different techniques for performing the short-term capacity planning. The techniques can for example be a master plan of resources which is focusing on the production, order level which is concerned with the already existing capacity and finally the execution and control of operations. (Mattson and Jonsson, 2003)

3.2.3 Capacity planning methods

It is important to differ between planning and scheduling. Scheduling is more related to the people who perform the work. There are different methods of capacity planning. It is relatively easy to calculate the available capacity and therefore capacity planning methods mainly concerns methods for calculating the capacity requirements. The basis for the calculation is different for the different methods. (Mattson and Jonsson, 2003)

- *Capacity planning using overall factors*
  One of the easiest ways of handling the capacity requirements is to use the same unit of measure in the production plan as in the production. The production plan gives the exact amount of capacity required and it is often expressed in units like pieces, area or volume. The capacity plan is based on the end product. Since the capacity requirements are based on production units, detailed information about how the product is constructed is not needed. The method is mainly used on the selling- and business level.

- *Capacity planning using capacity bills*
  Capacity bills can be used if the products do not use the production resources in proportion to their capacity requirement in volume. Capacity bills express the accumulated capacity requirement per piece for a product in terms of the resources required to produce it, see Figure 3.5. This is often expressed in man-hours or machine-hours per production department.

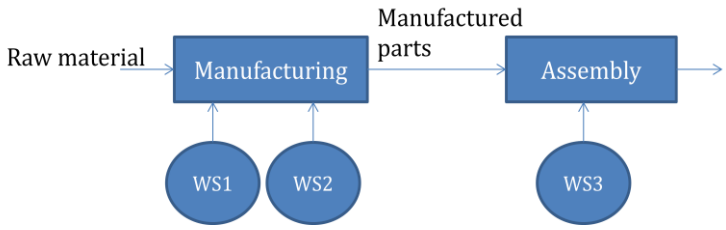

Figure 3.5: Capacity planning using capacity bills. The capacity bills are shown as a value in the work station in the picture.

- *Capacity planning with regards to capacity requirements*
  The capacity requirements planning method is useful if the purpose is to calculate the capacity requirement based on planned and released orders. Therefore it is not used as often on higher planning level.

Resource Requirements Planning

Resource Requirements Planning (RRP) has a long-term perspective and is a process of determining capacity requirements over time. The planning method includes decisions regarding for example land, facilities and equipment and the goal is to get knowledge about the available capacity. The information is then used as a parameter in the more aggregated planning. (Hopp and Spearman, 2008)

Rough Cut Capacity Planning

Material requirements planning (MRP) is a method for systematic planning and procuring of material to production and is a type of push system. MRP has some problems dealing with for example capacity infeasibility and long lead times. This has been incorporated in *Manufacturing Resource Planning* (MRP II). A part of MRP II is capacity planning and *Rough Cut Capacity Planning* (RCCP) which has a medium to a long-term perspective. The goal of RCCP is to ensure the feasibility of the master production schedule by checking the capacity of a few critical resources. (Hopp and Spearman, 2008) Capacity planning using overall factors is one type of RCCP (Bakke and Hellberg, 1993). RCCP provides a less detailed plan compared to *Capacity Requirements Planning* (CRP) which performs a more detailed capacity check (Hopp and Spearman, 2008). The steps that a production manager may take in the RCCP, when the productivity is constant, can be seen in Figure 3.6.(Xia et al., 2011)

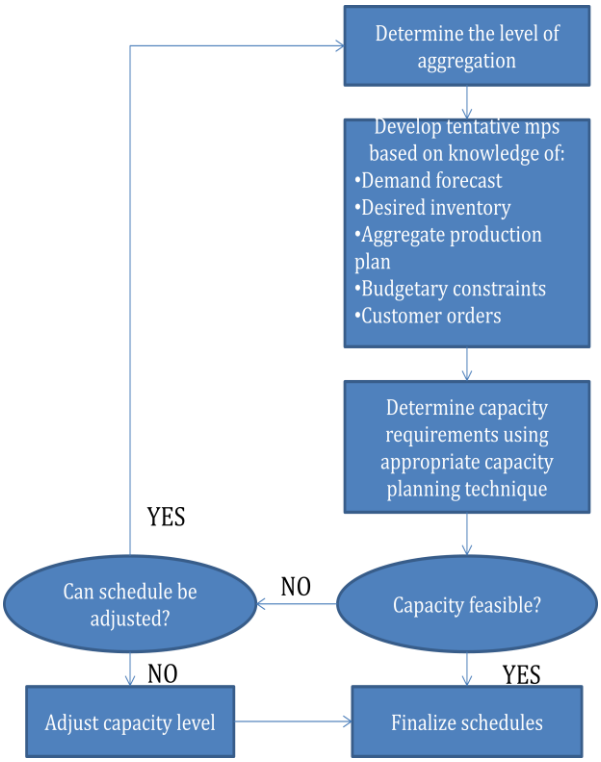

Figure 3.6: The steps that a production manager takes in the Rough-Cut Capacity Planning where the productivity is constant over time.

Capacity requirements planning

Capacity Requirements Planning is mainly concerned with short to medium range planning. It provides a detailed capacity check and includes information such as planned order releases, workforce and lead time. (Hopp and Spearman, 2008) The planning method can be used to make corrections if it is not possible to reach the level of requirements (Björnsson, 2012b).

3.2.4 Supplier capacity planning

An *Enterprise Resource Planning* system (ERP) is a system that supports the information sharing and information flow across the organization. The ERP system can be used to compute supplier capacity requirements. To do so, *capacity groups* must be integrated. This means that a capacity limit should be applied to a group of parts. It is also necessary to gather all relevant information about the capacity limits and how the various parts are associated with respectively limit from the suppliers. There are two different ways of expressing capacity, by volume or available time at the workstation. (Ding et al., 2007)

1. *By volume for a set of parts at a supplier.* This means that the capacity limit for each defined family or group is to be identified. This capacity limit should be expressed in terms of volume. The capacity limit is determined by the bottleneck since the bottleneck restricts the production capacity.
2. *By the available time at the workstation for each period at a supplier.* This method includes capacity requirements in terms of time at each workstation for every part. Then the total time for each workstation can be calculated for each period.

3.2.5 Capacity planning connected to contracting

Suppliers need to invest and build up capacity to be able to meet demand and fulfil orders. This might in some cases include high investments and high costs. There is often a long lead time related to building up capacity and the capacity is often directly to certain products. To cover some of the risks, the suppliers might want to have some purchase commitment from the manufacturer or customer before doing the investment. Contracts are good instruments for sharing risks and to create incentives. It is important to design it so that the two parts involved can ensure return in proportion to the risk and bargain power. (Mathur and Shah, 2008) There are different contract mechanisms that can be used to share demand and supply risk in a decentralized supply chain. One is that the buyer reserves capacity and the suppliers promise to be able to deliver up to that level. Another type is where the buyer places orders and the supplier builds up capacity but does not guarantee delivery if any disruptions occurs. The first type guarantees reduction of the disruption risk for the buyer and the supplier faces most of the demand and supply risk. (Xia et al., 2011)

3.3 Bottleneck theory

One of the challenges in a company is to organize and structure the resources. The reason for this is that there almost always is some limitation in the production, a bottleneck. A bottleneck can cause higher stock levels, longer lead times and problem with customer service since the company want high effectiveness in all of their resources. There are three general rules for maximal usage of the bottleneck. (Lumsden, 2006)

1. One hour lost in the bottleneck is one hour lost in the whole process
2. One hour work overtime before the bottleneck will have no effect on the output
3. It is optimal to add raw material according to the resource's need

3.3.1 Identifying bottlenecks

Inventory and waiting times can often be a physical sign of a bottleneck. Large inventory in connection to a process often means that the next step is a bottleneck resource. However, bottlenecks might not be obvious since the inventory and other waste might be hidden. This can make the identification of a bottleneck more difficult. A bottleneck can be short-term, long-term

or moving. Variability in equipment reliability and over all equipment efficiency can for example be the reason for a non-bottleneck becoming a bottleneck during a short period of time. Depending on the product mix and product type, the material that is used in the production can be changed and then the bottleneck can move. Moving bottlenecks are often difficult to identify and handle in a planning perspective. (King, 2011, Wang et al., 2005) Common causes for bottlenecks are limitations in equipment capacity, long changeover times and inappropriate scheduling (King, 2011).

Apart from the physical signs of bottlenecks there are different ways of detecting and identifying bottlenecks (Wang et al., 2005).

1. Measure the average waiting time and identify the resource with the longest waiting time. This includes for example measurement of the queue length.
2. Measure the average workload and define the resource with the biggest workload as the bottleneck.
3. Measure the average active duration and find the resource with the longest average active time.

3.3.2 Bottlenecks and capacity

The capacity of a process is highly dependent on the capacity of the bottleneck resource since the bottleneck limits the throughput. It is often the bottleneck that is the cause of differences between promised and actual ability to deliver. Therefore, it is important to identify the location of the bottleneck as well as identifying possible increments of the process efficiency. The capacity of the process can be increased in two fundamental ways. (Laguna and Marklund, 2005)

1. Add resource availability at the bottleneck
2. Reduce the workload at the bottleneck

The resources in the bottleneck can be increased by investments in equipment and labour or by adding additional working hours. The approach of reducing the workload at the bottleneck can be connected to process redesign by for example shifting activities. Therefore the first alternative might induce higher costs in terms of additional investments. (Laguna and Marklund, 2005)

3.3.3 Theory of Constraint

Theory of Constraint (TOC) emphasizes the need for identifying bottlenecks within a process and provides a theoretical framework for managing flows, see Figure 3.7. The concept can be summarized in two components. (Rahman, 1998)

1. *Every system must have at least one constraint*. A constraint is something that limits the performance of a system. It is not possible to not have a constraint in a system because then an organization would make unlimited profits.
2. *The existence of constraints creates possibilities for improvements.* A constraint determines the performance of the system. When gradually elevation of the constraint is done it creates possibilities for improvements of the system's performance.

Figure 3.7: The figure is an illustration of the Theory of Constraint; a chain is never stronger than its weakest link.

The general working method according to the TOC concept consists of five steps, see Figure 3.8. Working with TOC is a continuous process because a system will always have a constraint. At some point the constraint may be moved from the production to the market. (Rahman, 1998)

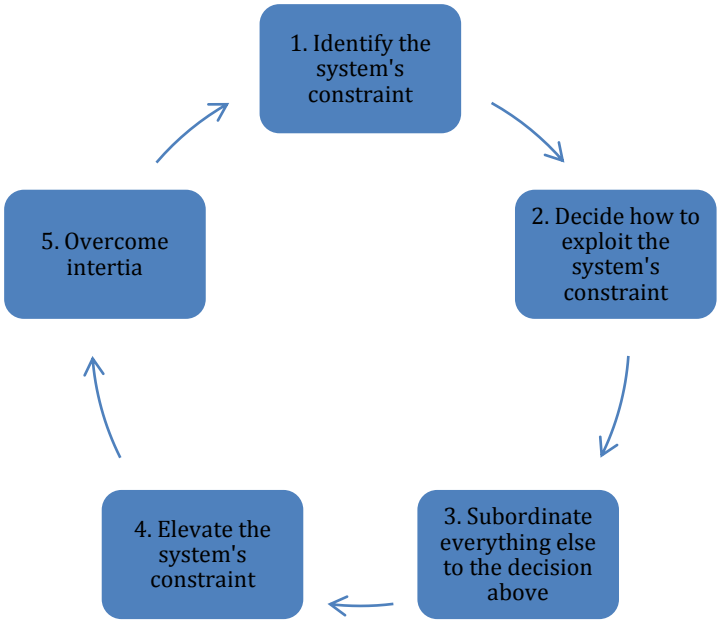

Figure 3.8: The working process when working with TOC

TOC can in many cases lead to an operating philosophy which in many ways is similar to *Just-in-time*. In order to create profit, the company must focus on throughput, inventory and operating expenses. (Laguna and Marklund, 2005) To maximize the throughput rate, the bottleneck should be utilized by 100 % (Goldratt and Cox, 2004).

3.4 Grouping of product and resources

Grouping and grouping technology is an important tool in production planning and it can enhance the possibility of using *flow production organization* rather than *batch manufacturing*. There are different grouping techniques and it can include both grouping of machines and grouping of products. (King, 1980) When grouping products and resources there are some characteristics that are good to have in mind (Burbidge, 1977).

- *The team* – A specific team of workers should be connected to the group
- *Products* – The group should be connected to and produce a specific family of products
- *Facilities* – A specific set of machines are connected to the group and used solely or generally in the group.
- *Group layout* – A specific area is reserved for the group and they are placed together.
- *Target* – The workers in the group share a common product output target.
- *Independence* – The groups should be independent of each other.

- *Size* – The size of the groups should be limited in order to restrict the number of workers in the group.

3.4.1 Product grouping

From a delivery and production point of view, it is often good to work with Product groups rather than separate products since it enable improvements in production efficiency. (Mattson and Jonsson, 2003) Through grouping products with similar characteristics, it is possible to make the production and planning process easier and to shorten lead times. Product grouping is also important in capacity planning as described in section 3.2.3 *Capacity planning methods*. The grouping technology procedure is an extensive process and the actual grouping methods only constitute the starting point for the group technology process. There are several aspects to consider during the implementation such as manufacturing design, organizational problems and human factors. One common problem among companies is that the process of product grouping is not fully implemented or has not full commitment in the organization. (Hollier, 1980)

When grouping products, it is essential that the products in the group has similar pattern of demand, characteristics and need of resources in order to have a well working capacity planning process. (Mattson and Jonsson, 2003) The grouping process gets more advanced when having a product range and mix that is unstable and a capacity that is dependent on the change of the products. It is also important to consider how the grouping will function in the production processes. For example it is usually difficult to manufacture components with different levels of quality in the same plant. A well-functioning grouping of products may reduce lead times, stock levels and improve the planning process. However, the concept does also have some disadvantages as for example costs of implementation and problems with product changes, see Table 3.1 for a detailed list of advantages and disadvantages with product grouping. (Hollier, 1980)

Table 3.1: Advantages and disadvantages with Group Technology

Advantages
Reduced manufacturing lead time and more reliable delivery promises
Reduced WIP levels
Better utilization
Reduced Materials handling
Improved production planning and control
Improved quality levels
Improved job satisfaction
Disadvantages
Implementation costs
Rate change of product range and mix
Difficulties with out-of-cell operations

3.4.2 Resource grouping

Resource grouping enable shorter lead times and lower stock levels but it may affect the utilization in some of the machines in the manufacturing process. The reason for this is that high utilization often is wanted in the limiting machine and therefore the complementing machines get lower priority. Therefore it is often the limiting machine that is the bottleneck in the manufacturing process and limits the overall capacity. (Olhager, 2000)

3.4.3 Production Flow Analysis

Production Flow Analysis is a technique for identifying the groups and families for group technology (Burbidge, 1977). It includes grouping of products as well as resources. The aim with this method is to try to find patterns between products and resources so that products with similar characteristics are manufactured by resources with similar characteristics, see Table 3.2. (Olhager, 2000) Production flow analysis is often an important first step when introducing group technology. (Burbidge, 1977)

Table 3.2: One example of how to conduct a Production Flow Analysis

	Resources					
Products		R1	R2	R3	R4	R5
	P1	X		X	X	
	P2	X	X	X		X
	P3		X	X	X	
	P4	X	X	X		
	P5		X	X	X	X

Production flow analysis can be divided into four different techniques which are used as an introduction to Group Technology (Burbidge, 1977).

1. *Factory flow analysis*. Plans the division into departments or other major groups.
2. *Group analysis.* Divides the departments into smaller groups.
3. *Line analysis.* Is used in the groups to plan the most efficient layout of machines.
4. *Tooling analysis.* Is used to compute the best way of loading the parts in a family on the machines in a group.

3.5 Process view

A process can be defined as "*A collection of linked activities that transforms an input to an output".* It is important to see processes in its context and to have an overview of activities, resources, roles and tasks. A process usually contains four parts, object in, object out, information and resources, see Figure 3.9. (Larsson and Ljungberg, 2001) Key features of a process are that it should have predictable and defined inputs as well as predictable and desired outputs. It should consist of a linear and logic sequence of flow with a set of clearly definable tasks and activities. (Baker and Maddux, 2005) Process orientation is often referred to a horizontal organization and can be interpreted as organizational effort to make business processes the platform for organizational structure and planning (Kohlbacher and Gruenwald, 2011).

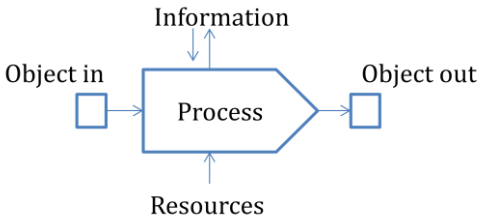

Figure 3.9: A process with its objects, information flow and resources

Key aspects of managing processes are to establish sub-goals, obtain feedback, provide resources to support each individual process and its contribution to the overall process and finally, contribute to the integration between the processes. (Baker and Maddux, 2005)

The *Process Change Cycle*, see Figure 3.10, illustrates four important steps when changing a process. The key steps together forms the process change cycle (Baker and Maddux, 2005):

1. Measure the process – Often focused on aggregated result such as productivity.
2. Characterize the process – Describes how processes work and an important tool is process mapping.
3. Analyze and understand the process – Distinguish between activities that are truly essential from internal or external customer's perspective and those who are not.
4. Change the process for improved performance – Acting upon proposals from process analysis.

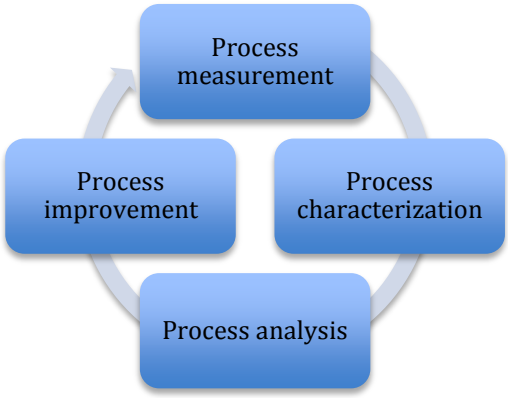

Figure 3.10: The Process Change Cycle

3.6 Process mapping

One way to divide the manufacturing process into several basic steps is through creating a process map. In a process map, the different steps or sub-processes describe the activities and show information as for example names, lead times and personnel requirements. (Linton, 2007) Process mapping can be used to explain the relationships within an organization and how to cooperate to deliver value for the customer. The mapping process can be a way to highlight some of the activities that previously were hidden and to create an overview of the company. The map can also be a help to concretize where and in sometimes why problems occur in the organization. (Jonsson and Mattson, 2011)

3.6.1 Steps in process mapping

There are three major steps in the process mapping process; creating the As-Is map, creating the To-Be map and closing the gap between the two scenarios.

Creating the As-Is map

The As-Is map is a description of the current situation and it is used to understand how the company is working today and why they are working in that way. The map should show all activities in the company, both value adding and non-value adding. It is important to make an accurate and careful analysis when mapping the activities to make sure that no value adding activities are missed. That can be dangerous when the process is optimized in a later stage. (Okrent and Vokurka, 2004) There are some different methods for mapping processes in an organization; *walk through, virtual walk through* and *process design.* The walk through approach includes one or more persons who are responsible for the mapping of the processes. These persons walk through the production and make interviews with personnel in the different processes. The virtual walk through approach includes gathering all people responsible for the different processes and let everyone explain their part. Process design is used when there is no formal process to map, for example project lead processes. (Larsson and Ljungberg, 2001)

There are two tools that can be used for mapping and analysis of processes, a *process analysis scheme* and a *flowchart*. The process analysis scheme can be used to map and document all activities, the order of their performance and their time requirements, see Table 3.3. When all activities are identified the map needs to be analysed critically. This can be done through questioning why, what, when and how for every process. (Jonsson and Mattson, 2011) This way of analysing the production gives a good summary of the chain. (Linton, 2007)

Table 3.3: One example of the design of a process analysis scheme in tabular form

Operation	Transport	Inspect	Delay	Storage	Description of processes	Time (min)

A flowchart is another kind of scheme over the production where all activities are mapped, the order of them as well as who is responsible for them, see Figure 3.11. This way of mapping is especially good to get an overview of the number of activities and individuals involved in a process as well as to get an understanding of the complexity of the process. (Jonsson and Mattson, 2011)

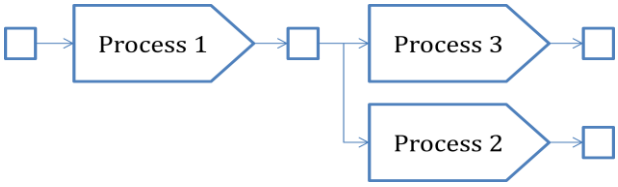

Figure 3.11: A flowchart with one incoming and two outgoing objects

Creating the To-Be map

The first step in creating the future picture of the production is to evaluate the processes that are critical to the business. An ideal production process can be obtained through for example modification of current or future limitations and simplification of the production through eliminating non-value adding activities.(Okrent and Vokurka, 2004)

Crossing the chasm and closing the gap

There is often a gap between the As-Is and the To-Be map and it can be an extensive process to close this gap depending on the implementation strategy chosen. There will probably be temporary decline in the production as the new way of working takes time to be implemented.(Okrent and Vokurka, 2004)

3.6.2 Value Stream Mapping

Value Stream Mapping (VSM) is a benchmarking tool for comparing a process current state with how good it can be. In other words, the non-value adding activities are identified and compared to a state where these are removed. (Hines et al., 1994) The method is closely connected to the lean approach of manufacturing and is a tool that can be used for visualizing a complex production system, identify waste and to find improvement areas. The basis of the VSM tool is to create a map of the current production as well as material and information flows. This map can also be complemented with a time line showing the lead-time in each activity. Compared to other mapping methods, VSM has several advantages and disadvantages, see Table 3.4. (Braglia et al., 2009)

Table 3.4: Advantages and disadvantages with Value Stream Mapping

Advantages	Disadvantages
Show link between production and information flow	A paper – and pencil technique which leads to a limited number of versions
Include lead times and inventory levels	Does not show the inefficient material flows
Visualize at a plant level, not only at a process level	Does not work in high-variety and low-frequency companies
Gives managers and employees the same language to communicate	Lack evaluation possibilities for what-if analyses that is needed when comparing alternatives

3.7 Process implementation

There are many factors that will decide whether an implementation is a success or not. Common reasons for projects failing are for example (Wetterauer and Meyr, 2008):

- The process design and deployment were not aligned with the business strategy
- The expectations of the user was not fulfilled

- Implementation took longer time than expected
- Cost of implementing became higher than expected

The IDEAL model can be used as a guide when working with process implementation, see Figure 3.12. It can also be connected to the important steps of implementing processes: project definition, solutions design, solutions details, execution and deployment and finally closure. (Wetterauer and Meyr, 2008) The IDEAL model starts with Initiating where it is important to identify current and future states of the process. It is also important to identify roles and responsibilities as well as assign proper resources. The next step is Diagnosing where recommendations are developed and when the action plan is initiated and aligned with the business strategy and vision. In the third step, Establishing, it is important to prioritize what issues that will be addressed and develop an approach to how to address these issues. After that, a pilot is created and deployed during the Acting phase. The last step, the Learning phase, is important in order to improve the process and to be able to improve the next process implementation. (Borjesson and Mathiassen, 2004)

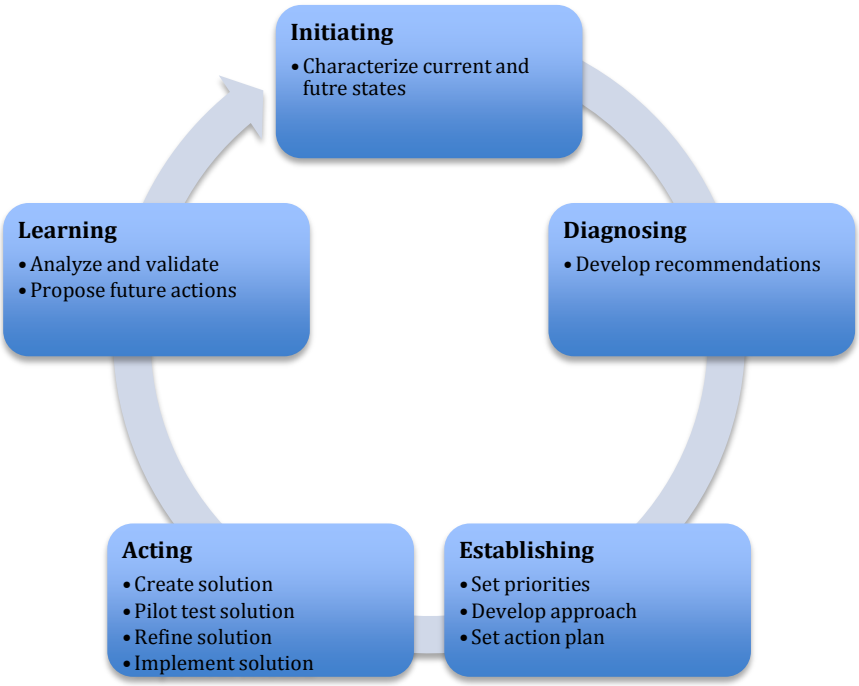

Figure 3.12: Illustration of the IDEAL process

During the process implementation it is crucial to create engagement, acceptance and commitment in the team, project environment and the supporting management. It is important to have kick-off meetings and trainings as well as periodical workshops to preserve and improve the commitment. (Wetterauer and Meyr, 2008) To successfully implement a process it is important to (Borjesson and Mathiassen, 2004):

- Ensure stakeholder commitment
- Support organizational learning
- Manage and distribute available resources over different activities
- Manage customer relations (both internal and external)

To avoid problems in later stages of the project it is important to develop sufficient documentation system as well as to insist on complete and precise documentation including professional document and management system from the very beginning of the implementation. This will support the implementation and the organization. The training team should provide the team with training material such as reference manuals and training exercises. (Wetterauer and Meyr, 2008)

3.7.1 Change management and training

When implementing a process it is essential to understand the area of change management and the change dynamics related to processes and teams. Some of the characteristics are: (Wetterauer and Meyr, 2008)

- *Shock* – Related to the confrontation of a new situation or environment
- *Refusal* – No acceptance for the need of change
- *Rational understanding* – Understanding the need of change but there is an unwillingness to change own behaviour
- *Emotional acceptance* – Necessity for change is accepted
- *Training* – New form of behaviour is tested
- *Knowledge* – Gained experience helps to decide what behaviour fits best according to the system
- *Expertise* – New behaviour is fully integrated and accepted in the daily work

3.8 Measuring process performance

The performance of a supply chain can be measured in qualitative and quantitative terms. Quantitative measures are for example costs and resource utilization and qualitative measures are for example quality, flexibility and trust (Chan, 2003). Process performance measurements concern monitoring the agreed performance indicators to determine if a process meets the planned target levels. Process performance indicators for business processes are metrics that capture the performance of a business process. It is important that these indicators are aligned with the strategy and goals of the business and derived from the business objective. It has also been proven that there is a close connection between process performance and the role of the process owner (Kohlbacher and Gruenwald, 2011). It is important to include financial, non-financial, internal and external measures (Bourne et al., 2003).

The *Process and Enterprise Maturity model* discusses two important characteristics to ensure that processes become more mature, these are process enablers and enterprise capabilities. Process enablers include: *Design*, which is connected to the specification of how the process should be executed. *Performers,* mean the people that execute the process and their skills and knowledge. *Owner and Infrastructure, are* connected to the information and management systems that support the process. Finally, the model includes *Metrics* that the company uses to track performance. The enterprise capabilities include four aspects: *Leadership, Culture, Expertise* and *Governance.* (Hammer, 2007)

3.8.1 The SCOR model

The Supply Chain Council, a non-profit global organization, has established one of the world's most accepted frameworks for evaluating and measuring the performance of supply chain activities. The framework is called SCOR, Supply Chain Operations Reference. The Supply Chain Council defines five core supply chain performance attributes: reliability, responsiveness, agility,

costs and asset management. Each attribute and examples of metrics that can be used is further described in Figure 3.13. (SCOR)

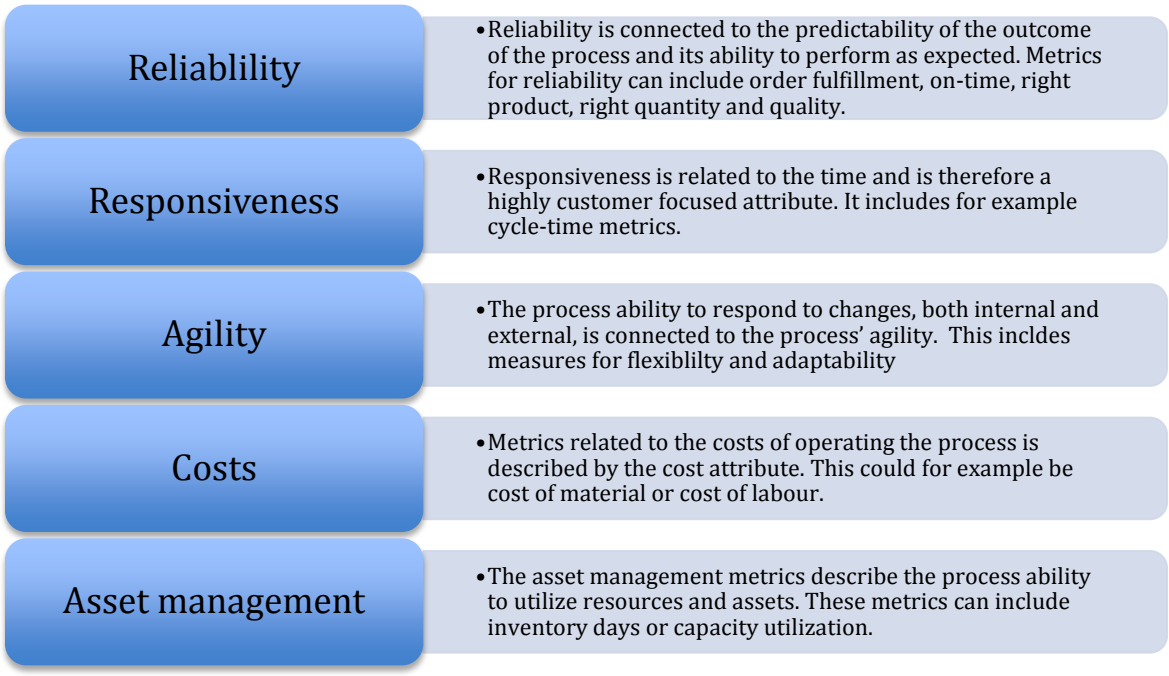

Figure 3.13: Performance attributes defined by the Supply Chain Council

3.8.2 Measuring Supplier Relationships

Supplier Relationships has got more attention in the Supply Chain Management area during the last years. The reason for this is partly related to deeper understanding of the importance of well-functioning co-operations today. Many studies have been performed regarding the outcome of the relationship but a good outcome is not necessary related to a good relationship. Supplier Relationships can be difficult to measure since the relationship often is complex. A possible beneficial relationship can be neglected because of no possibilities to define the performance indicators. (Giannakis, 2007)

There are four types of variables that can characterize and assess Supplier Relationships. (Giannakis, 2007)

1. *Trust.* The contribution to development of trust between the partners
    a. *Trustworthiness.* Characterized by keeping promises and having confidence in the partner
    b. *Normative.* Characterized by mutual understanding of expectations and responsibilities of the involved parties based on industry or society norms
2. *Power.* The level of power they possess in decision making
    a. *Authority.* Responsibility for taking decisions and issuing orders
    b. *Control.* Arises from access to critical resources that give contextual pertinence to those that hold them
3. *Involvement.* The involvement in Supplier Relationships
    a. *Complexity.* The number and level of individuals involved
    b. *Scope:* The amount of resources devoted and the capabilities that are transferred between partners

4. *Commitment.* The contribution to commitment to the Supplier Relationships
    a. *Effort.* The tendency of the partners to continue their business relationship
    b. *Loyalty:* Repeated interactions and attachment to trading partner

3.8.3 Process evaluation

It is important to evaluate a process to be able to improve the process that is being implemented but also to learn for next step in the implementation. When evaluating a process there is often a focus on the implementation. The focus is often on the implementation part when evaluating a process. Typical questions when evaluating a process are for example: (Sullivan, 2009)

- Is the process being implemented as planned?
- Who actually participated?
- Is the process involving the people that it is supposed to involve? Are the participants engaged? How many dropped out?
- How does the process fit into the environment?
- What problems were encountered? Did they lead to changes in delivery or objectives?

Project success factors can be used as a way to learn from past projects. The information can also be used to analyze why a project became a success or a failure. However, it is difficult to use the information to decide the degree of success for a project. There are six success criteria that is frequently used to measure project success; budget performance, schedule performance, client satisfaction, functionality, contractor satisfaction, project manager/team satisfaction. (de Wit, 1988)

4 One Supplier Capacity Process

IKEA has worked towards establishing a process that will secure that the capacity information is defined, registered and maintained in a standardized way. The goal is to make sure that IKEA can verify and have accurate information about the supplier capacity and also to be able to work in a more proactive way together with the suppliers. This process is called One Supplier Capacity Process and it will be described further in this chapter.

4.1 Unit of measure

One of the issues IKEA is struggling with is the usage of different units of measurement, in some parts of the organization the unit of measurement is for example kilos and in other parts it is money. This causes problems since it will be difficult to compare different numbers in the system; it is like comparing apples and pears. To avoid misunderstandings, a common language must be used as well as a standardized unit of measurement. Therefore, a common unit of measurement is important in the establishment of the process. Since the forecast and need is expressed in pieces the Supplier Capacity Value, the value registered in GPS, will be defined in pieces as well. However, the capacity in each resource is calculated in the unit of the resource. Through putting the information into a consumption table it is then possible to convert the capacity information to pieces and register it in GPS. (Björnsson, 2012b)

4.2 Resource group and Product group

To be able to have a good overview and handle the capacity in an efficient way, the articles will be categorized into Resource and Product groups. A *Resource group* is defined as production resource/resources with similar characteristics. Resource groups provide capacity and are defined on a local level, meaning that they can differ between different suppliers. An example of Resource groups can be seen in Figure 4.11 below. (Björnsson, 2012b)

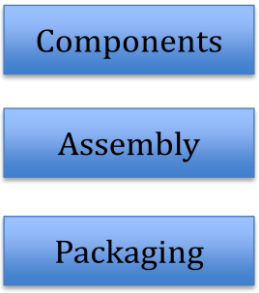

Figure 4.1: Example of Resource groups common in the Lighting business

Product group is defined as article/articles with similar characteristics <u>and</u> shares the same Resource group. The Product groups consume capacity and are defined on a global level. This means that the Product groups shall be the same for all suppliers. A Product group shall be restricted to one segment and one HFB. See Figure 4.2 for an example of Product groups. (Björnsson, 2012b)

Figure 4.2 Example of Product groups in the Lighting Business

4.3 Dedicated and Allocated Supplier Capacity

Dedicated Supplier Capacity is defined on Resource group level and is defined as the total local capacity need in that resource for connected Product group/groups. The Dedicated Capacity can be defined in different units of measurement and is valid under a determined time period. This capacity is then allocated between the Product groups connected to the resource. *Allocated Supplier Capacity* is therefore defined as the capacity that is allocated to a given Product group within a given Resource group. An Illustration of Dedicated and Allocated Supplier Capacity can be seen in Figure 4.3. (Björnsson, 2012b)

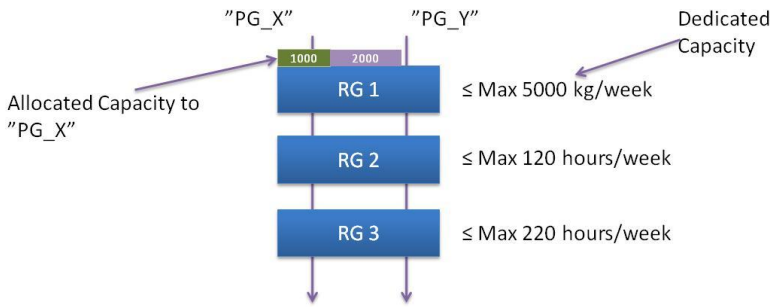

Figure 4.3: Illustration of Dedicated and Allocated Supplier Capacity

4.4 Available Expensive Capacity

If IKEA does not allocate 100% of the capacity they have dedicated at the supplier, the difference between the Dedicated Capacity and Allocated Capacity is defined as *Available Expensive Capacity*. This can also be seen as unutilized capacity, which can be good to have since it increases the flexibility. However, too much unutilized capacity is expensive. See Figure 4.4 for an illustration of Available Expensive Capacity. (Björnsson, 2012b)

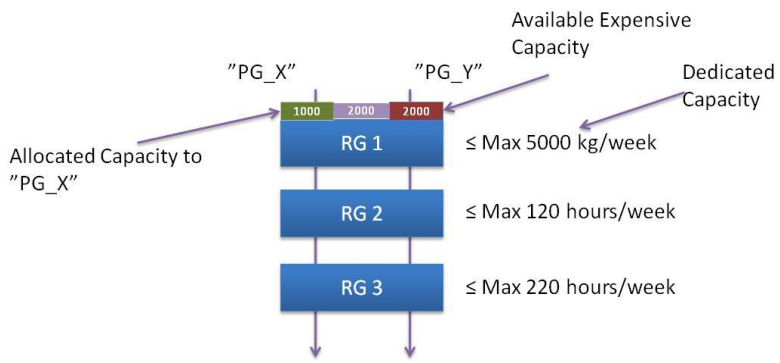

Figure 4.4: Illustration of the different types of capacity; Allocated, Dedicated and Available Expensive Capacity

4.5 Supplier Capacity Value

The operational supplier capacity is defined as the capacity that is allocated to a given Product group within a *bottleneck*, see Figure 4.5. The purpose of One Supplier Capacity Process is that this value is to be registered and maintained correctly in GPS. If one or more Product groups share the same Resource group and/or bottleneck the sum of the allocated capacity can never be more the total Dedicated Capacity in the resource. (Björnsson, 2012b)

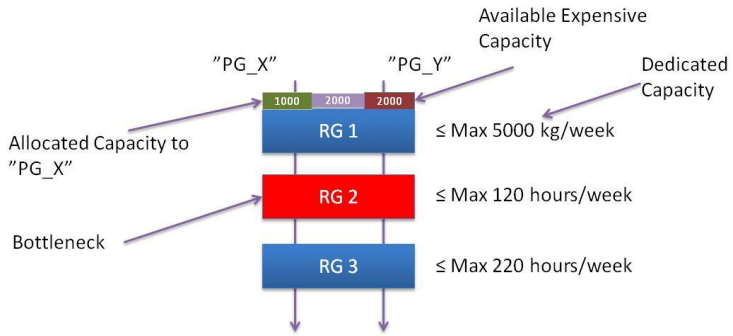

Figure 4.5: Illustration of the different types of capacity; Allocated, Dedicated, Available Expensive Capacity and the bottleneck in the system

4.6 The working process of defining and registering the capacities

One Supplier Capacity Process is divided into six steps, which will be followed during the implementation phase at every supplier. The different steps are illustrated in Figure 4.6. (Björnsson, 2012b)

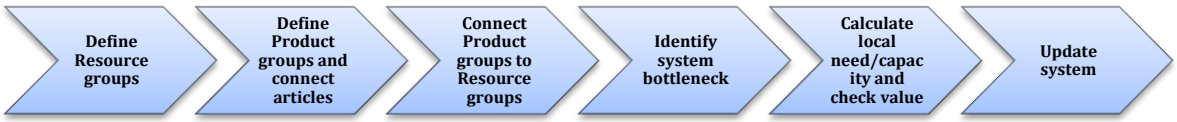

Figure 4.6: The process of defining and registering capacities

The process starts with defining the Resource groups, which means identifying the different resources in the supplier's manufacturing process. The two following steps include defining the Products groups, connecting them to the Resource groups and understanding the flow at the supplier. The Product and Resource groups will be gathered in a consumption table, see

Table 4.1 and Appendix B – Preparation guide to the consumption table. The table includes the consumption for every Product group in every Resource group as well as the Dedicated Capacity in each Resource group, the unit of measurement and the validity period for the information. The Dedicated Capacity is the net supplier capacity which is the capacity that is disposable, it is further described in chapter 3.1 *Capacity.*

Table 4.1: The structure of the consumption table template including Product groups, Resource groups, Consumption, Dedicated Capacity, unit of measurement and the validity period

	Product group 1	Product group 2	Dedicated capacity (week)	Unit	From (week) To (week)
Resource group 1	*Consumption*	*Consumption*	*Dedicated Capacity*	*Unit of measurement*	*The period that the information is valid*
Resource group 2	*Consumption*	*Consumption*	*Dedicated Capacity*	*Unit of measurement*	*The period that the information is valid*
Resource group 3	*Consumption*	*Consumption*	*Dedicated Capacity*	*Unit of measurement*	*The period that the information is valid*

In order to do the allocation correctly and in an efficient way, a capacity allocation tool has been developed by one of the Process Developers for Plan and Secure Capacity that is involved in One Supplier Capacity Process. It is a tool built in Excel that calculates the *system* bottleneck based on the information from the consumption table and the average need from the Supply Plan Information, see Figure 4.8 and *Appendix C – Capacity Calculation tool*. The Supply Plan Information is sent to the supplier and contains for example information about the planned need for the coming 32 weeks. The tool allocates the capacity in the bottleneck between the Product groups. When having three Product groups the tool looks like the example in Figure 4.7. In some cases the Product groups might share some Resource group but since they might not share all Resource groups they can have different bottlenecks. In the example, Product group 3 does not use the system bottleneck Paper shading, which means that it has its bottleneck in another Resource group. This means that the capacity for this Product group can be increased more than the suggested value without affecting the system bottleneck. The user can do these adjustments manually.

Resource Group	Product group 1	Product group 2	Product group 3	Unit	Weekly Need 1 in Unit	Weekly Need 2 in Unit	Weekly Need 3 in Unit	Weekly Net Capacity	Unit	Utilization with average Need	Utilization with registered Capacity value
Paper shading	2	1,5	0	min	5000	3000	0	9000	min / Week	88,9%	99,9%
Pre-assembly	0	0	2	min	0	0	3000	6000	min / Week	50,0%	66,7%
Assembly 1	1	1	1	min	2500	2000	1500	8000	min / Week	75,0%	88,3%
Assembly 2	2	2	2	min	5000	4000	3000	20000	min / Week	60,0%	70,6%
Packaging	0,5	0,5	2	min	1250	1000	3000	15000	min / Week	35,0%	43,5%
					0	0	0		/ Week		
					0	0	0		/ Week		

Average for 17 weeks from SPI, starting from the first week after the Lead time+1		Suggested Allocation Value to be registered in GPS		Actual Allocation Value Registered in GPS
Avg Weekly Need Product Group 1	2500	Registration Value Product Group 1	2810	
Avg Weekly Need Product Group 2	2000	Registration Value Product Group 2	2250	
Avg Weekly Need Product Group 3	1500	Registration Value Product Group 3	2000	
Dedication of IKEA Net Cap:	100%	Available Expensive capacity in bottleneck	5	min / Week

Figure 4.7: Print screen of the capacity allocation tool

When the capacities are allocated, the information can be registered in the Global Purchasing System, GPS, through a predefined structure which includes Product group, Resource group and type of bottleneck with a ";"- sign in between. The reason for this structure is that there is only

one field that can be filled in GPS and One Supplier Capacity Process has been adapted to that. With the new naming registered, it will be possible to see information about eventual limitations when studying the capacities in the system. The bottleneck types are predefined and numbered, see Table 4.2. (Björnsson, 2012b)

Table 4.2: Predefined bottleneck types

Number	Bottleneck type
01	Components
02	Raw material
03	Labour
04	Electricity
05	Machinery
06	Tool
07	Packing
08	Storage
09	Maintenance
10	Others

4.7 Establishing One Supplier Capacity Process

The One Supplier Capacity framework will be executed and supported by the Trading Operations. The framework is also connected to and structured in the Category dimension. Therefore the implementation will also be conducted in the Category dimension, see Figure 4.8. The establishment of the process has been broken down into four steps: (Björnsson, 2012b)

1. Define/register/maintain – Make sure that the new definitions is understood, implemented and used
2. Measurement system – How to analyse and follow up.
3. Operational Capacity Planning – Start with the operational work
4. Tactical Capacity Planning – Add the tactical perspective

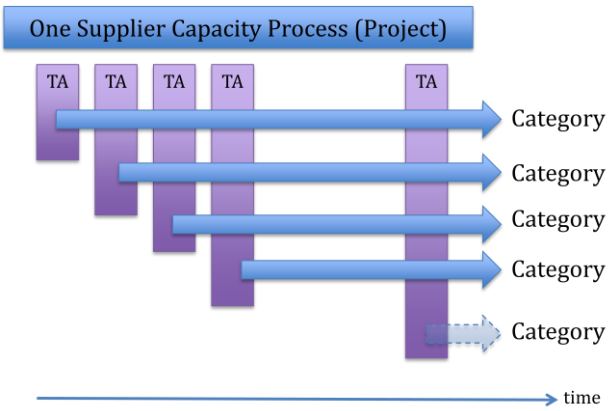

Figure 4.8: Structure of the establishment of One Supplier Capacity Process

5 Empirical study

This chapter will describe the current way of working with capacity planning at IKEA in Trading Area Greater China including the structure of the trading organization and the systems that are used. Then, the implementation of One Supplier Capacity Process will be described together with two examples from the supplier visits.

5.1 The Trading organization

As mentioned before, IKEA is divided the purchasing into different Trading Areas and have 41 Trading Service Offices in 30 countries. There are three Trading Areas connected to Lighting, Trading Area Greater China, Central Europe and South Asia. Trading Area Greater China produces 22% of all IKEA products and today there are 23 lighting suppliers in China. IKEA has expansion plans for the Chinese markets and will during the coming years more than double the amount of stores in the country. The Category is the central level in purchase development at IKEA. A Category is a group of articles that share similar materials, productions techniques, and/or the same supplier base. The Categories are grouped under Material areas. The Material areas are based on raw materials or other strategic areas. The Category is divided into segments, which is going down on a more detailed level to be able to create strategies and develop capacities. The connection between Material area, Category and Segment is illustrated in Figure 5.1. (IKEAInside, 2010-2011)

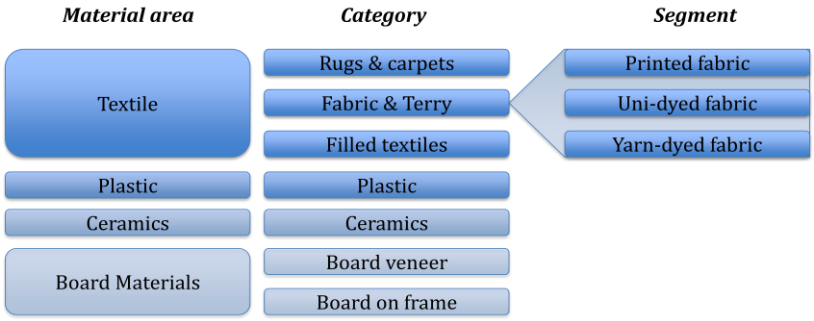

Figure 5.1: The relationship between the Material area, Category and Segments in IKEA

IKEA is divided into nine Trading Areas, where Trading Area Greater China constitutes the largest value of purchase. The left side of Figure 5.2 illustrates how the Trading Area is organized into 38 Category areas. Examples of Category areas at IKEA are: Carbon Steel, Lighting, Stainless Steel, Textile, Upholstery Frame and Mattresses, Work chairs and Plastic. One Supplier Capacity Process is rolled-out in the Category dimension in order to secure a common way of working and since the Trading Areas are structured and working according to the categories. The Trading Areas main assignments are to ensure everyday product quality, make sure product availability, create optimal sourcing, work with product development close with suppliers and enable IKEA expansion. The product range is also structured into Home Furnishing Businesses, for example Workspaces, Cooking, Bathroom and Children's IKEA. The Category dimension crosses several HFBs, see the right side of Figure 5.2. This means that products connected to for example bathroom can belong to different categories like Plastic and Rugs & Carpets.

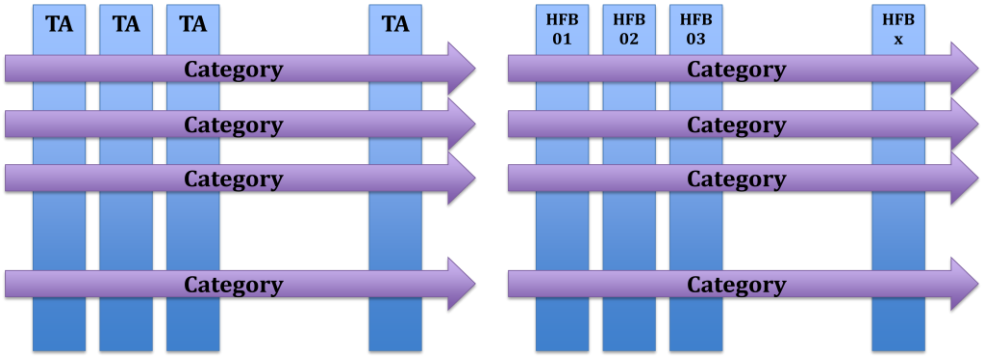

Figure 5.2: The relationship between the Trading Areas and the categories can be seen to the left and the relationship between the HFBs and the categories can be seen to the right

At the different Trading Areas there are purchasing teams connected to different categories. The purchasing team is lead by a Business developer manager and consists of Business developer, Technician and Supply planner. Each of these roles will be described further as well as the Need planner that is highly involved in the capacity planning. (IKEAInside, 2010-2011)

5.1.1 Business developer

The Business developer is a direct link to the supplier and is responsible for managing and developing suppliers as well as organizing and managing all contact and work with the suppliers. They are responsible for the total business, from start to end, with the suppliers in the given area. They are also responsible for monitoring the market in the given material/geographical area. The Business developer is in charge of the price development and the service and availability level.

5.1.2 Technician

The Technician is responsible for the specifications of the products and has a good understanding of the products and the production processes. The Technician is responsible for securing that IKEA's product quality requirements are fulfilled and contribute to development of IKEA's business by initiating more efficient production methods, packaging solutions and utilization of raw material.

5.1.3 Supply planner

The Supply planner is a key player who secures that agreed business set-ups are running and continuously improved with regards to lead-time and cost-effective deliveries. The Supply planner follows up orders and handles the daily work with the supplier and is responsible for the flow from the supplier. The Supply planner is also responsible for performing capacity evaluations as well as monitoring and securing that capacity is synchronized with demand. The Supply planner is a mirror of the Need planner, which is located at IKEA of Sweden.

5.1.4 Need planner and Demand Planner

Need planner and Demand planner belongs to IKEA of Sweden. The Need planner has a close contact to the Trading team and is responsible for securing the availability on a global perspective. He/she is creates business plans and strategies for the given area of responsibility. The Need planner is also responsible for supplier capacity together with Trading. The Demand planner has more of a retail perspective and has a global responsibility to secure that the sales planning is translated into sales forecast on article level.

5.2 Systems

There are different systems that are being used when working with capacity and capacity planning at IKEA. The systems that are available and how they can be used has had big impact on the design of One Supplier Capacity Process and its implementation. There are three main systems that are connected to capacity and capacity planning: Global Purchasing System, Fulfillment and Cognos, each of them will be described further. The information is gathered from IKEA internal website and interviews with the process team. (IKEALearningPlatform)

5.2.1 Global Purchasing System

The Global Purchasing System (GPS) is a collection of applications used by the Trading Service Offices and mainly the Supply planners and the Business developers. GPS is used in the Trading workers daily work to administering the purchase of IKEA products. Some of the applications in the system are web-based and other terminal based. GPS contains functions such as managing orders, supplier and article information, purchase agreements as well as capacity information and it is possible to register periods with lower capacity levels through the Dispatch Availability Calendar in GPS, which is a calendar used to define which days a supplier is open to ship goods. The different functions in the Trading team use the program differently, see Table 5.1.

Table 5.1: The difference in usage of GPS for Supply planners and Business developers

Supply planners	Business developers
Maintain supplier information	Register purchase agreements
Work proactively using order reports	Update articles and prices on a purchase agreement
Update order information	Maintain commitment information
Maintain consignments	Register details about suppliers
	Register details of a supplier present and coming production capacity

Figure 5.3 is a view from the capacity tool in GPS. Capacities are handled and registered on group level in GPS, which means that capacity is registered for defined group and not for each article. Capacity must be registered for the coming 104 weeks. It is not possible to register capacity on shorter time periods without getting warnings from the system. When registering capacities, it is not possible to revise the information if it gets wrong. Then it is needed to redo the registration for the Product groups. As can be seen in the picture there is only one field available for entering resource information such as bottleneck type.

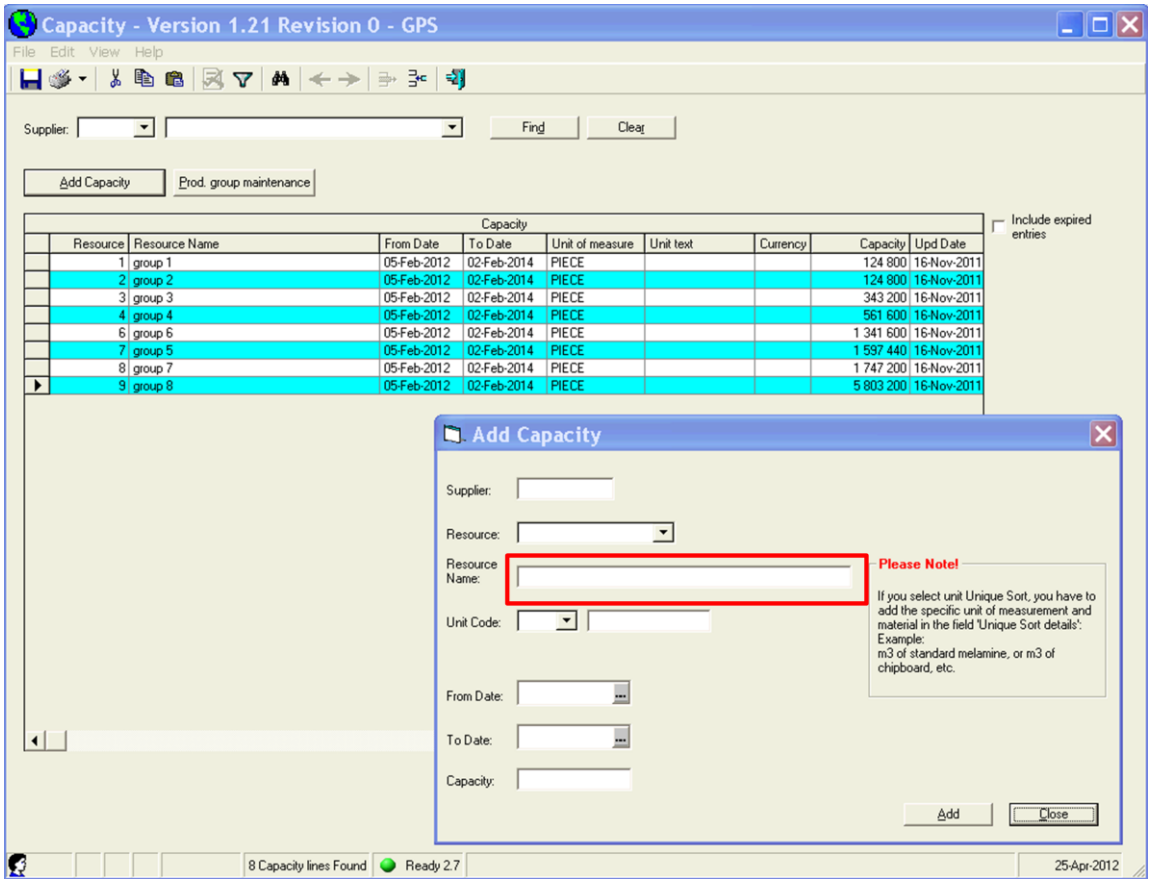

Figure 5.3: A view for registering capacities in GPS where the red box highlights the field for registering resource information

In addition to the resource name, the supplier number, validity period and capacity value needs to be filled in when registering the updated capacities. The limitation of one field has affected the design of One Supplier Capacity Process and it is for example therefore the reason for the naming with Product group name, Resource group and bottleneck type with a ";"-sign in between, see Figure 5.4

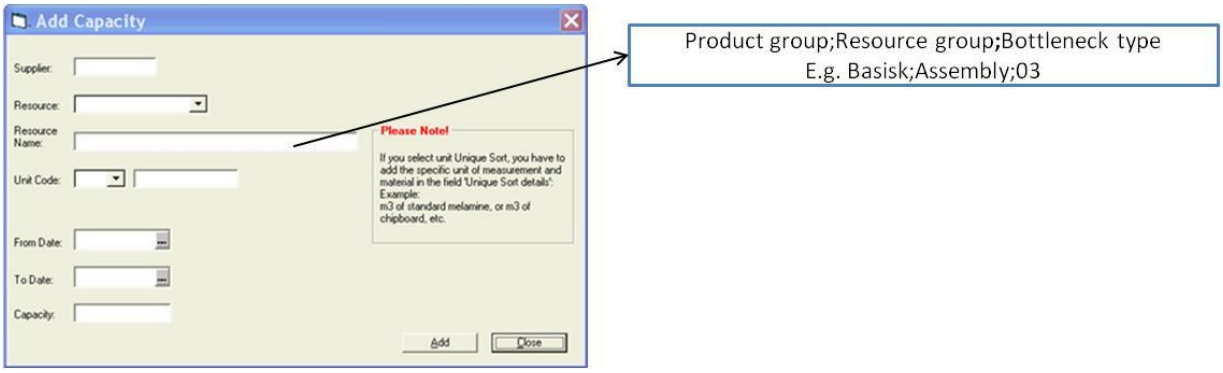

Figure 5.4: A view from GPS for registering updated capacity information

5.2.2 Fulfillment

The main tool for capacity planning and defining needs is the Fulfillment application. It provides support for handling supply chain problems such as high/low stock, living up to commitments and quality holds. The system calculates needs, required safety stock levels and capacity

requirements. The Constrain Production Planning tool, CPP Toolkit, can be found in the Fulfillment system and it is central in the capacity planning at IKEA. It is a supply-planning tool that creates a plan that is possible to execute by considering constraints related to capacity and commitment at the supplier. The capacity information is maintained in GPS and transferred to Fulfillment every day. The capacity information can be registered on three different levels; total supplier level, product group level and item level. The commitment information are also registered in GPS and transferred to Fulfillment every day. This information is used to compare the needs with the capacities. Figure 5.5 is a view from CPP where the planned need can be compared to the capacity registered in GPS. CPP has a medium-long term planning horizon.

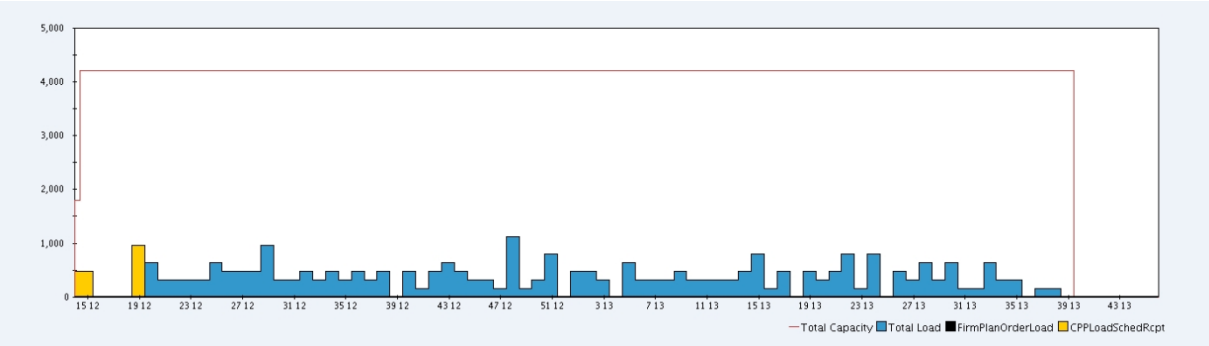

Figure 5.5: A view from CPP from one of the studied suppliers. The histogram shows the planned need and the line shows the capacity level registered in GPS

5.2.3 Cognos tool

The Cognos tool contains reports and dashboards that have different target groups. The purpose of the reports is to take the right actions to reach the IKEA goals and to follow up results. To simplify the usage of the tool, the reports are divided into different folders for example availability and product quality. The advantage with the Cognos tool is that it is possible for all people within the global organization to work with the same information. The Cognos tool is central in a tactical planning perspective.

5.3 Working with capacity planning at Trading Area Greater China - As-Is

Three views have been used to describe the current way of working with supplier capacity at IKEA: IKEA of Sweden, Trading Area Greater China and the Suppliers. The information has been gathered by for example interviews with each part and a summary of the relationship between the three and how they work with capacities and capacity planning is presented in Figure 5.6. Each part will be described further below.

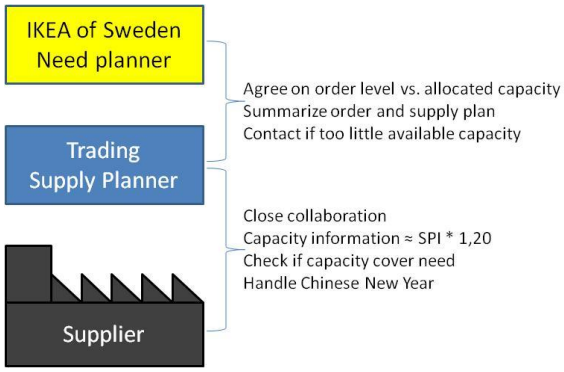

Figure 5.6: The relationship between IKEA of Sweden, trading and the supplier

5.3.1 IKEA of Sweden

At IKEA of Sweden, the Need planner and HFB Sourcing Developer have a tactical responsibility over the capacity values and capacity planning. In the Lighting Category the tactical planning handles capacities in a time horizon between 84 weeks and 7 years. This includes for example investments, new factories, new range and new type of material. When the capacity is not corresponding to the total need for all the Product groups it is the Category's responsibility to prioritize, find new potentials and align capacities.

The Need planner uses the program Constrained Production Planning (CPP) to view the need and capacities. The program is used on a weekly basis to check the capacity versus need and align the orders to the capacity at the suppliers. They also try to work proactively with avoiding orders exceeding the maximum Dedicated Capacity by accepting orders before the capacity constraint period. This work is done closely with the Supply planners at the Trading Areas where they agree on allocated capacity versus order level. In the tactical planning the Need planner also has a responsibility to see the overall picture of the capacities. They summarize and follow up with the Trading teams, which follow up order and supply plan versus capacity every week and adjust the GPS accordingly. According to the Need planner the majority (approximately 60 %) of the capacities are updated in GPS twice per year, which is also the recommendation today. Unfortunately the capacity information is in many cases inaccurate. This problem is caused by both IKEA of Sweden and Trading. The problems at IKEA of Sweden often occur due to changes in forecast and order and sales variation. The problems at trading are caused by for example changing circumstances at the supplier affecting capacity, lack of proactive planning and not registered holiday interruptions in production. The accuracy in the figures can also be much dependent on the level of competence of the Trading team and the supplier since they are responsible for how the capacity is defined and calculated.

According to the Need planner it is difficult to get a good overview of the capacities when using the current system. This especially concerns products that are sourced from more than one or two suppliers and it makes the tactical planning more difficult. The Need planner thinks that IKEA has both too much capacity at some suppliers as well as too little capacity at some. There are for example cases where the suppliers only are utilized by 30 % during a six month period, caused for example by seasonality. The category has decided that deviations of the capacity utilization within the scope of +/- 25% do not need to be handled. If the capacity utilization gets lower or higher than that level actions need to be taken.

5.3.2 Trading Area Greater China

Figure 5.7 is an illustration and summary of the working process regarding capacity and capacity planning within the Lighting Category and with focus on Greater China. Further explanation will follow.

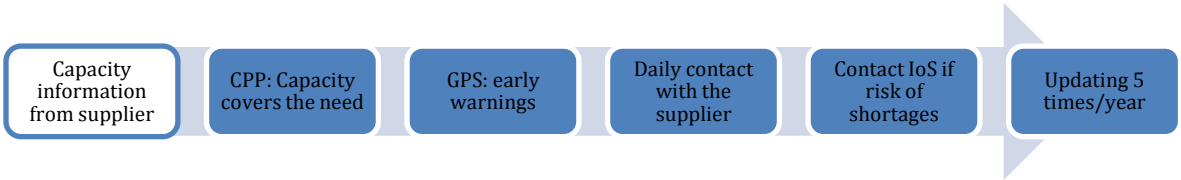

Figure 5.7: The working process for the Trading team in the Lighting Category

The Supply planners at IKEA use capacity information in their daily work. The information is used to make sure that the capacity covers the needs of the products by using CPP. The Trading team has close collaboration with the suppliers and it has been observed that the relationship in some cases can become more friendlier than business related. The relationship develops through daily contact with the suppliers, for example, by the Supply planners checking GPS every day to see if there are some warnings for future capacity problems. The team also expresses that the work in the system can be inefficient.

There is no standardized way of how the work should be undertaken or how the capacities should be defined. According to the Supply planners, the capacity figures in GPS are updated approximately five times per year. Today, the capacities and capacity information is defined by the suppliers. The suppliers define capacity groups and give a value of the related capacities. The capacity groups are seldom reviewed or changed. The accuracy in the capacity information is depending on the suppliers' and the Trading team's knowledge as well as the suppliers' capacity calculation method. The suppliers aim on basing their capacity calculation on their information regarding bottlenecks and throughput time. According to the Supply planners, the suppliers use the information from the Supply Plan Information as a basis for the calculations. The Supply Plan Information is sent to the suppliers weekly but is changing every day. There are also continuous changes in the product range, which affects the Supply Plan Information as well as the capacity information. The capacity is given by the supplier in number of pieces for each capacity group. This capacity information is often only valid when the production runs smoothly and without problems. For example, when quality problems occur it will lead to delivery problems, which implicate updates of the system.

The communication between the Supply planner and the Need planner is crucial in the daily work with capacity planning. The Supply planner is contacting the responsible Need planner at IKEA of Sweden if they have too little capacity available and think that there is a problem with the capacities. There may be available stock that can be used to cover the need. Too little available capacity is only allowed during shorter periods of time and in those cases, the communication with the supplier is important. The Supply planners think that they are working proactively in some ways, for example regarding the Chinese New Year. Since they know that the capacity levels will be reduced drastically during this period they use frontloading, planning the orders three months in advance and prepare stock. Table 5.2 summarizes the long-term and short-term alternatives to handle capacity problems.

Table 5.2: Summary of alternatives to handle long term and short term capacity issues

Long-term capacity issues	Short-term capacity issues
Maintain Supplier capacity	Move load in time – utilize spare capacity
	Move load to alternative supplier
	Reduce planned orders to align with existing capacity

Overall, the Supply planners think that the capacity planning is working well today. They think that they have good knowledge of their supplier's capacities and claims that they trust the figures in GPS. On the other hand some of them think that there is a lack of transparency in the figures. The Supply planners think that there might be available capacity at many of the suppliers and in many cases it might be too much available capacity.

5.3.3 Observations from Supplier Visits

The visited suppliers in the Lighting business have big unutilized areas, unused machines and unused assembly lines in their production facilities. The suppliers are expressing a need for more order and do not see the importance in calculating their capacities in a certain way since they seldom have delivery problems due to the available capacity. However, some of the suppliers see possibilities with this way of working and want to apply it to their own suppliers as well.

The capacity information that IKEA gets from the supplier today is based on Supply Plan Information. The supplier uses the information to plan their production and they usually have between four and eight week planning horizon. The capacity is calculated through using the Supply Plan Information and the supplier then adds approximately 20%. The suppliers are working with allocation of the capacities directly rather than defining the available capacities in their resources. This has caused some problems when trying to define the Dedicated Capacity at the suppliers. The suppliers experience problems with the Supply Plan Information for some products since there can be big variations between the forecasts and the actual orders. The suppliers express a wish to improve the Supply Plan Information and make it more accurate to be able to have a shorter planning horizon.

The suppliers use stock to cover the variations in the orders. In average they have approximately three weeks stock of finished goods, but the number depends on which product it concerns. They also produce to stock in order to be able to have a steady flow in the production. Since products the Lighting Category experience seasonality, the suppliers want to have the production running in order to keep the workers at the company. It is time consuming and too expensive to fire and then teach new workers several times a year.

5.3.4 Overall performance

When studying the figures for planned and demonstrated need respectively capacity it is clear that the demonstrated need is higher than the planned need while the demonstrated capacity is much lower than the planned, see Table 5.3.

Table 5.3: The summarized overall performance of the seven visited suppliers during week 49-8 in pieces

Total Sum PN	Total Sum PC	Total Sum DN	Total Sum DC
3 318 495	7 654 155	4 896 111	4 678 301

For the suppliers included in this study the total demonstrated need was 48% higher than the planned need. The aim is to not have any difference between demonstrated need and capacity. The suppliers have managed to fulfil most of their orders by having a difference of 4%, see Table 5.4.

Table 5.4: The summarized planned and demonstrated need and capacity for the seven visited suppliers during week 49-8 in pieces

Total Sum PN	Total Sum DN	Difference PN/DN	Difference PN/DN %
3 318 495	4 896 111	1 577 616	48%
Total Sum DN	**Total Sum DC**	**Difference DN/DC**	**Difference DN/DC %**
4 896 111	4 678 301	-217 810	-4%

When comparing the figures for planned and demonstrated capacity it is clear that the planned capacity is much higher than the demonstrated, see Table 5.5. The rate between the total planned and demonstrated capacity is 39%. However, it is important to notice that the demonstrated orders not always can reach the planned capacity levels since it is not possible to deliver more than the need.

Table 5.5: The summarized planned and demonstrated capacity for the seven visited suppliers during week 49-8 in pieces

Total Sum PC	Total Sum DC	Difference PC/DC pc	Difference PC/DC %
7 654 155	4 678 301	-2 975 854	-39%

Chinese New Year

The Chinese New Year is a big holiday in China and it affects the output at the suppliers to a great extent. The majority of the workers are taking vacation and the suppliers experience lack of labour for approximately four weeks. According to the Supply planners, IKEA are working proactively with this holiday and plan the orders for this period several months in advance. In the end September they evaluate the need and in October they talk and prepare the material in order to get the orders on time. However, when studying data for a shorter time period covering the Chinese New Year it is clear that the capacities registered in the system for this period does not reflect reality. During this period the suppliers in the Chinese regions have less capacity than during the rest of the year. The reduced capacity levels are unfortunately not shown in the system, the planned capacities in the system are much higher than the demonstrated capacities. This leads orders being placed which the supplier cannot deliver. Instead, the registered capacities for this type of periods when there is a major change in capacity should be changed according to reality. In the case of Chinese New Year, the capacities in the system should perhaps be ramped down gradually one or two weeks before the holiday and the ramped up after the holiday. This would reflect the reality more.

5.4 Implementation of One Supplier Capacity Process – To-Be

The implementation process of One Supplier Capacity Process is illustrated in Figure 5.8 and a summary of the steps is described below.

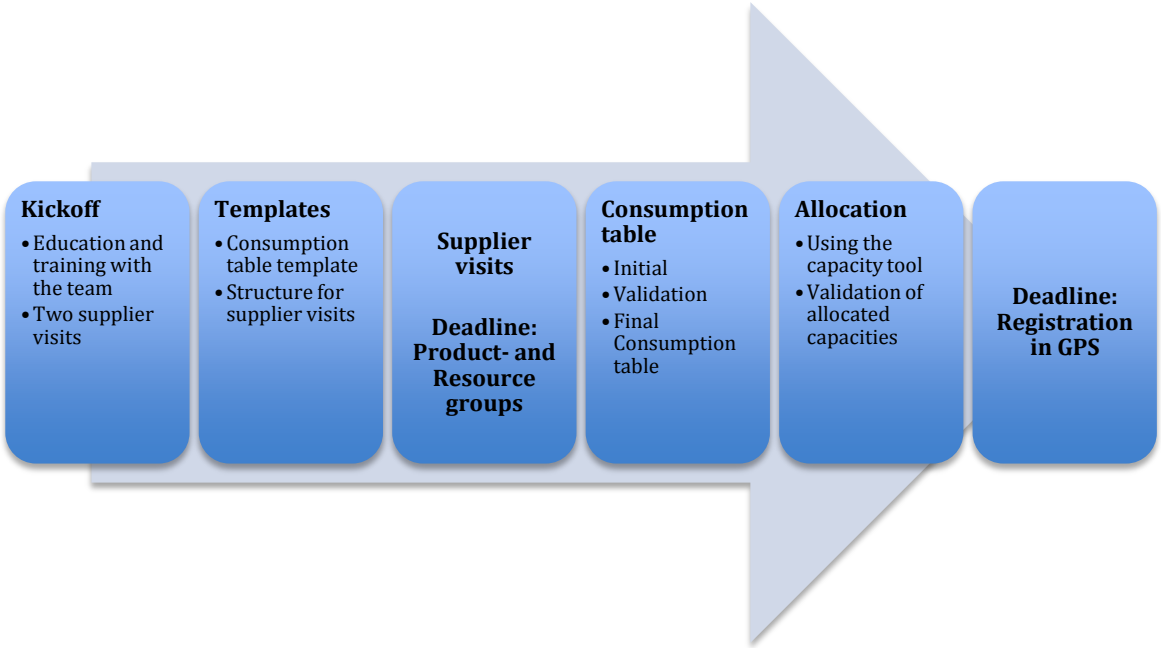

Figure 5.8: The implementation process of One Supplier Capacity Process in the Lighting Category at Trading Area Greater China

Participants

The local Trading team has participated during the whole implementation process and been committed to the work. One of the Supply planners in each Trading Area was assigned to be the implementation leader in the teams together with the Deputy Logistics Manager that was responsible for implementing the process in Trading Area Greater China. The implementation at the Lighting suppliers has mostly been performed by the Supply planners in each Purchase Team. The Supply planners have been engaged and committed to the new way of working as well as willing to cooperate to get the best outcomes of the implementation. The Business developers have participated in the verification of the groups and the numbers but it has been the Supply planners that have done the operative work. The involvement of the Technicians in the Purchasing Teams has been limited during the implementation. At some occasions, for example when the production process has been unclear, the Technicians have been consulted. The experience is that the management team in the Lighting Category, except the Deputy Logistics Manager, has not been so engaged in this new process and has limited knowledge about the process.

Kick-off

The implementation of One Supplier Capacity Process in the Lighting Category at Trading Area Grater China started with a kick-off week. The aim was to present the material and educate the employees that were going to be involved in the process. The process team had developed training material in advance and it was worked out in detail. The material should cover all definitions and all possible questions and is based on a substantial theory. There are several definitions as well as reference cases for different scenarios, which can be used to define specific

situations at the suppliers. During the kick-off week, all Supply planners and Business developers connected to the Lighting Business in Trading Area Greater China, two Supply planners from Trading Area South Asia and the project team from IKEA of Sweden participated. The kick-off included training in accordance to the material as well as two supplier visits to get practice on real cases. The capacity allocation tool was explained and deadlines were decided, for example the deadline for when the Product and Resource groups should be finished as well as the deadline for the registration in GPS. Throughout the project, additional training sessions have been arranged with the team to educate them further on the concept and the tools related to it.

Material and templates

There is extensive material and theory connected to One Supplier Capacity Process and there is a step-by-step approach to follow when implementing the process. However, when the implementation started in Trading Area Greater China, there was a limited amount of templates and guidelines available that could be used during the visits. There was for example no standardized and finished template for the consumption table or finished tool for calculating the allocated capacities. The capacity allocation tool that has been used has been developed by the project team continuously throughout the project. Guidelines for how to do the manual adjustments or further analysis after having the initial solutions were also missing. It has been up to the Supply planner to decide in how to proceed with the solution. Additional material and templates besides from the capacity calculation tool have been created at Trading Area Greater China in order to continue the implementation in the Category. One example is a template for the consumption table and a guide for how to use it, see Appendix B – Preparation guide to the consumption table. The material were created in order to secure that the team worked in the same way and to make sure that everyone understood what data that was needed, both the suppliers and the Trading team. Additional improvements of the material have been done continuously throughout the project. This material is only shared and adapted for the Lighting Business in Trading Area Greater China.

Supplier visits

After the templates were created, the suppliers were visited. It was decided by the Category to work with all suppliers in parallel and to decide on the global Product groups at all suppliers before continuing with calculation and registration of the updated capacities. The goal of the visits was to educate the suppliers so that they could be able to fill in the consumption table. Big efforts were required to introduce the concept to the suppliers and to make them understand the purpose with the new way of working. This was done to be able to ensure accurate figures and to establish a long-term perspective on capacity planning. There have been several challenges during the visits, for example language and competence differences both internally and externally as well as difficulties in changing the previous way of working. Every supplier visit included a factory tour and the information from the tour was used to validate the information in the consumption tables.

Deadline: Product- and Resource groups

After having instructed the concept at each supplier the information regarding the Product and Resource groups was collected. The Product grouping was sent to the Need planner at IKEA of Sweden for approval. Since the Product groups will be global it is important that the groups are aligned and the same, especially for products that are being produced at more than one supplier.

The Resource groups, which are defined on a local level, were not discussed with the Need planner, they were confirmed by the suppliers instead.

Consumption table

When the Product and Resource groups were decided, the suppliers could fill in the consumption table. For this step it was critical that the suppliers had understood the concept, especially the idea of Dedicated Capacity and Resource groups. When the tables were received it the next step was to verify the numbers. This was done together with the Supply planners through comparing the information in the table to the information from the supplier visits as well as using the Supply planners' previous knowledge regarding the suppliers' production. If needed, the Business developers were consulted for advice as well.

Allocation and Registration in GPS

After the validation of the information in the consumption table, the capacity allocation tool could be used for allocating the capacities. In some cases, all Product groups do not use the system bottleneck and then it is sometimes possible to allocate more capacity to these groups in allocation tool. After the allocation, the capacities needed to be validated by the suppliers. There was a continuous discussion between the Supply planners and the suppliers to find the right capacity levels and the information in the consumption table needed to be updated several times. In some cases, the Need planner had to be contacted before the new numbers could be verified and prepared for registration in GPS.

5.4.1 Working process of One Supplier Capacity Process

Seven different suppliers has been visited and included in this Master's thesis. A summary of the visits and the implementation of One Supplier Capacity Process at these suppliers will be described below. The steps that are illustrated in Figure 5.9 were used when implementing the concept at the suppliers. Two of the supplier visits, supplier one and three, will be used as examples for each step. They are chosen since they represent one simpler and one more complex case. Further description of all the suppliers can be found in Appendix D – Supplier visit descriptions.

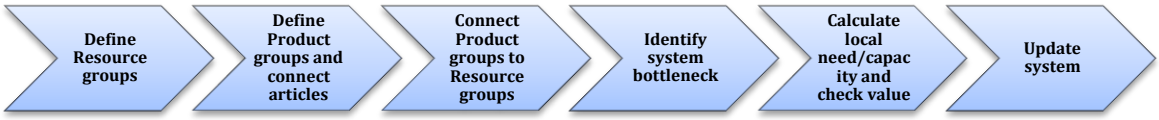

Figure 5.9: The process of defining and registering capacities

A short summary of all the suppliers included in the study can be seen in Table 5.6. All supplier except for one are producing lamps or/and LED lighting, the other supplier is producing accessories such as sockets and adaptors. Some of them have in-house production for some of the components, otherwise they are mostly working with assembly. IKEA is the biggest customer to most of the visited suppliers with more than 80% of the business share. Two of the suppliers are dedicated 100% for IKEA. As mentioned before, it can be concluded that six of the seven suppliers are basing their capacity planning on the Supply Plan Information. In general, the impression was that there was available capacity at all suppliers.

Table 5.6.: Summary of the seven suppliers included in the study. The table describes the type of products that is being produced, how much of the business that is dedicated to IKEA and other general facts

Supplier	Products	Dedication to IKEA	Other
Supplier 1	• 129 number of articles • Mainly Non-LED	90%	• Good control over production • Plan capacity based on sales forecast and history • Simple production flow with two flows in two different assembly resources
Supplier 2	• 87 number of articles • LED and Non-LED lighting	85%	• Difficulties understanding the concept • Uses Supply Plan Information and adds 20% when planning • Suspected unutilized available capacity • Four different Resource groups for components included (glass, plastic, steel and LED chip). Otherwise a quite simple flow
Supplier 3	• 110 number of articles • Non-LED and Lamp shades	95%	• Uses Supply Plan Information and adds 20% when planning • Suspected unutilized available capacity • Paper shading production highly dependent on tooling made the flow complex with many Resource groups
Supplier 4	• 14 number of articles • Sockets and adaptors	9%	• Uses Supply Plan Information and adds 20% when planning • Simple flow with only two identified Resource groups
Supplier 5	• 78 number of articles • Mainly LED	100%	• Good control and knowledge of production • Uses Supply Plan Information when planning • Suspected unutilized available capacity. Expressed need for more orders • In-house production of plastic components. Simple flow and shared assembly lines
Supplier 6	• 88 number of articles	100%	• Suspected unutilized available capacity. Expressed need for more orders • In-house production of metal components Several Resource groups
Supplier 7	• 99 number of articles • LED and Non-LED	80%	• Quite small supplier compared to the others • Suspected unutilized available capacity Expressed need for more orders

Step 1 - Resource groups

The manufacturing process at the concerned suppliers has mostly been line production. In some cases, the suppliers have had in-house production of components, but for Lighting the main part of the production is concerned with assembly. This means that they are working with sub-suppliers. Three main Resource groups have been identified at most of the suppliers: Components, Assembly and Packaging, see Figure 5.10.

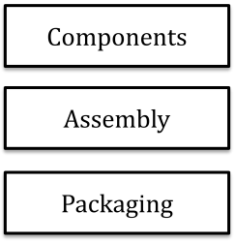

Figure 5.10: The main Resource groups identified at lighting suppliers

In some cases the supplier has had different assembly lines for different Product groups, for example LED and Non-LED, which mean that there have been additional Resource groups added. Generally there were many Product groups sharing the same assembly line and other Resource groups. All suppliers have packaging of the products in their production facility but at some supplier packaging was included into the assembly and therefore not defined as a Resource group. At many of the suppliers, they never regarded the components as a problem and therefore components were excluded as a Resource group at these suppliers. However, the capacity for components is dependent on the need information that the supplier receives from IKEA since they need to be able to prepare their sub-suppliers. Additional Resource groups, besides the three described above, were identified at the suppliers that had in-house production for some of the components. A summary of the identified Resource groups at each supplier can be seen in Table 5.7.

Table 5.7: Summary of the Resource group characteristics at each supplier

Supplier	Number of Resource groups	Components included as Resource group	In-house production	Number of assembly Resources	Packaging as own Resource group
Supplier 1	6	Yes	No	2 – Short and long	Yes
Supplier 2	6	Yes	No	2 – LED and Non-LED	No
Supplier 3	26	No	Yes – Paper shading	1	No
Supplier 4	2	No	No	2 – Pre-assembly and assembly	No
Supplier 5	4	No	Yes – Plastic injection	1	Yes
Supplier 6	6	No	Yes – Metal processing	2 – LED and Non-LED	Yes
Supplier 7	3	No	No	2	Yes

Supplier 1

Supplier 1 had two different assembly resources and three different packing resources, see Figure 5.11. However, all Product groups shared the Resource group named Components, which in this case consisted of glass.

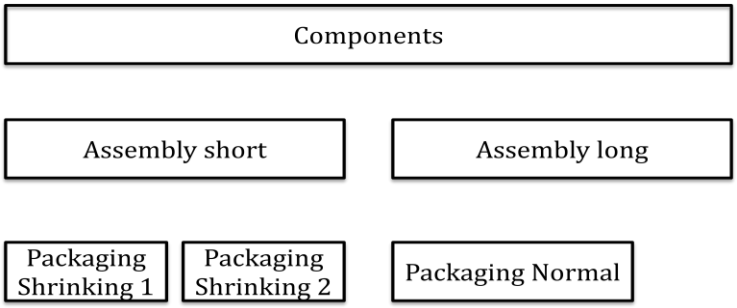

Figure 5.11: Example of Resource groups for Supplier 1

Supplier 3

Supplier 3, which can be seen in Figure 5.12 below, has a more complex production and there were many Resource groups identified. The supplier had for example different tooling for the different Product groups, which constrained the capacity. This meant that additional Resource groups had to be added for every tool. However, all Product groups shared the same assembly line.

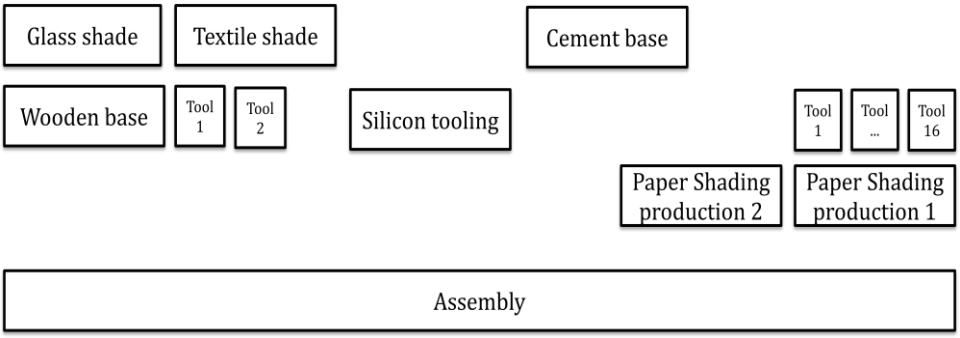

Figure 5.12: Example of Resource groups at Supplier 3

Step 2 - Define Product groups and connect articles

As mentioned before, the past grouping of the products has been defined and performed by the suppliers, internally called *capacity groups*. The grouping and base of the grouping have been different between the suppliers and it has been dependent on the knowledge of the supplier. The new concept has introduced Product grouping and it has required a review of the current grouping. This has been done by the suppliers and the Trading team together. The Need planner made an initial suggestion of the Product groups, which were used as a base for the supplier visits. The goal was to verify the grouping but in many cases changes had to be made due to products not sharing the same Resource groups. For the seven suppliers visited it resulted with 125 Product groups. This can be compared to the 77 capacity groups that were registered before, see Figure 5.13. When comparing the number of capacity groups to the number of Product groups in the figure the number of groups has increased for all of the suppliers visited except for one where the number of groups is equal to what was registered before. In discussion with the trading team their impression is that the new grouping, where the Product groups are the same at all suppliers, will contribute to a better overview. This is also the opinion of the Need planner.

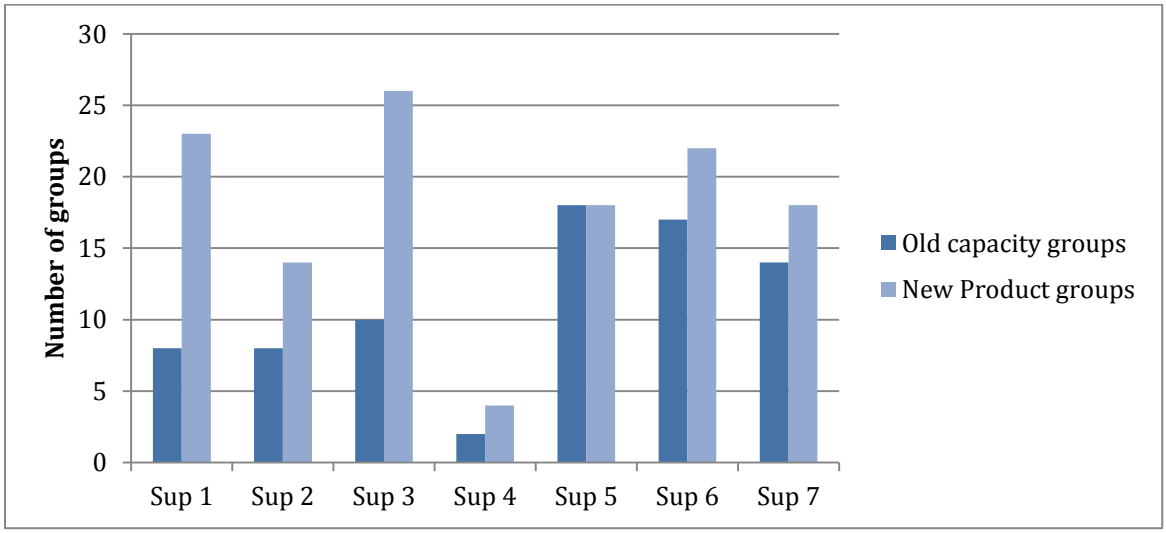

Figure 5.13: The previous and new number of capacity and Product groups at every supplier visited

In order to do a correct Resource grouping and to get the true values of the consumption in every Resource group some of the Product groups initially suggested needed to be split. An example is that the consumption for a pendent lamp and a table lamp is different even though they follow the same flow, therefore they need to be split into two different Product groups. The final grouping of the articles resulted in an average of 10 articles per Product group. The minimum number of articles per group was 1 and the maximum was 126. Most commonly the number of articles per Product group was in the range of 8 to 25.

Step 3 - Connect Product groups to Resource groups

When the Resource and Product groups were determined they could be connected to each other and the consumption table could be filled in. During the visits it was, as mentioned in 5.3.3 *Observations from Supplier Visits*, found to be a struggle to get the suppliers to understand what was meant with Dedicated Capacity. The suppliers often want to give the capacity in pieces on article/group level, which means that they are already doing the allocation. Instead it is the information about how much of the Resource that is dedicated to IKEA that is interesting in this process. Maintenance and breakdowns have been taken into consideration when defining the dedicated capacity and it has been up to the supplier to deduct this from the maximum capacity. The experience is also that it is difficult to not connect the Resource and Product groups when defining them in the two first steps in the working process for One Supplier Capacity Process. According to the Supply planners, the mapping and identification of the Resource groups have increased their knowledge and understanding of the supplier's production. Furthermore they experience that they have an increased understanding of the capacity figures and how they are calculated.

Supplier 1

The Product groups were connected to the Resource groups and the result is illustrated in Figure 5.14.

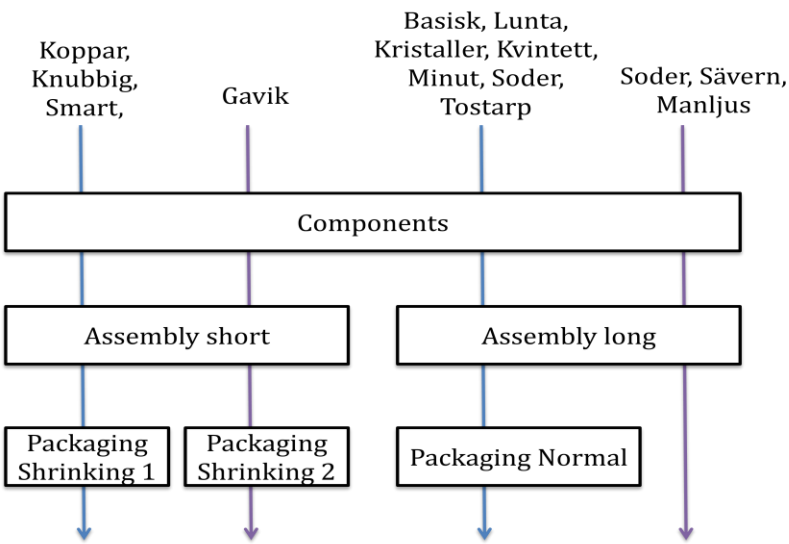

Figure 5.14: Example of Product groups connected to Resource groups at Supplier 1

Supplier 3

At Supplier 3 there were many Product groups as well as many Resource groups. They were connected to each other and the result is illustrated in Figure 5.15. All Product groups are sharing the same assembly resource.

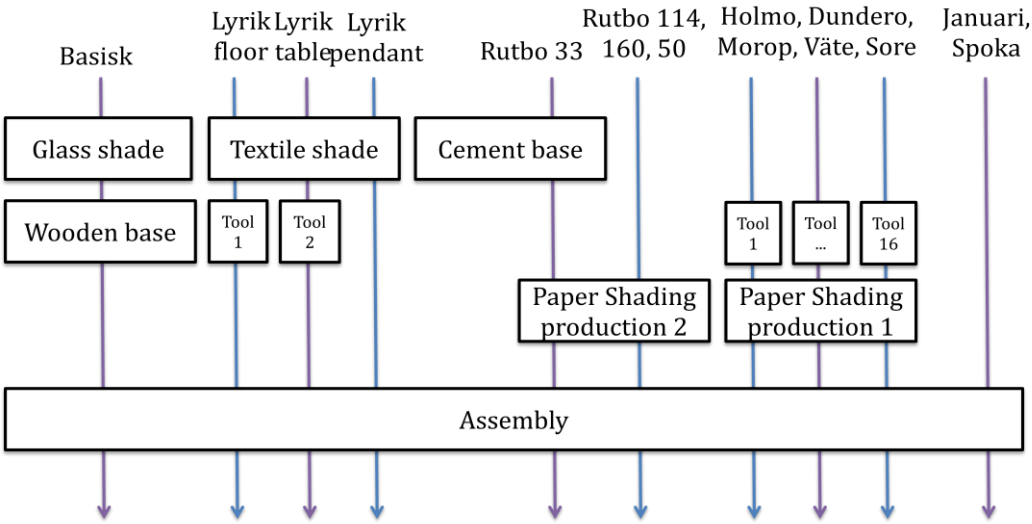

Figure 5.15: Example of Product groups connected to resource groups at Supplier 3

Step 4 - Identify system bottleneck

In many cases the assembly line was identified as a bottleneck, see Table 5.8. Assembly is in all cases very labour intensive, which could be one explanation to why it is a bottleneck. However, since there were many cases with parallel flows and Product groups sharing different Resource groups the bottleneck could vary for the different Product groups and the system bottleneck might not always be the same as the bottleneck that is shared by the most Product groups, see Table 5.8. At supplier 5, which has in-house production of plastic components, the bottleneck was identified in the injection machine. For two other suppliers the bottleneck was identified in components, for these suppliers the "next" bottleneck is assembly.

Table 5.8: The system bottleneck for each supplier as well as the bottleneck shared by most suppliers

Supplier	System bottleneck	Most common bottleneck
Supplier 1	Components (Glass)	Components (Glass)
Supplier 2	Components (Steel)	Components (Steel)
Supplier 3	Paper shade Tooling 15	Assembly
Supplier 4	Pre-Assembly	Pre-Assembly
Supplier 5	Injection	Injection
Supplier 6	Package	Package
Supplier 7	Assembly 2	Assembly 1

Supplier 1

At supplier 1 there was a common bottleneck for all Product groups identified in the Components resource, see Figure 5.16.

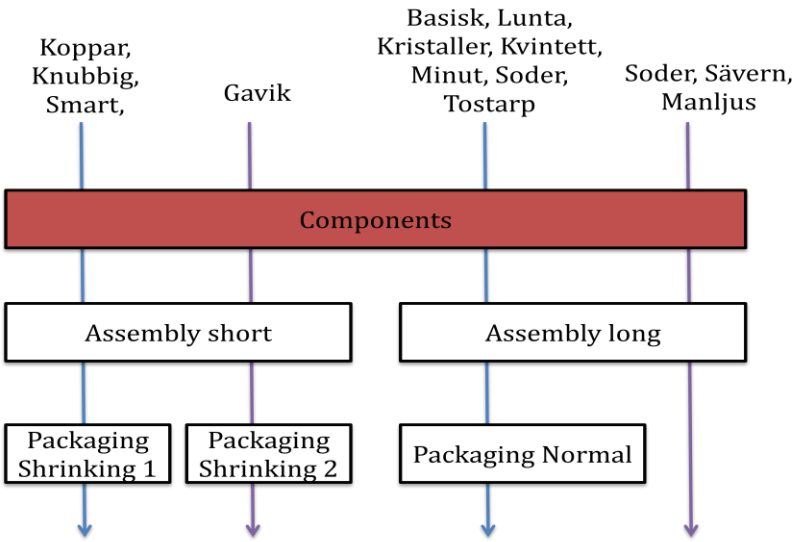

Figure 5.16: Identified bottleneck at Supplier 1

Supplier 3

In the example for Supplier 3, assembly was initially assumed to be the bottleneck since it was shared between all Product groups. Based on the allocation in the assembly further investigation of the five different flows were done in order to find the true bottleneck for each of the Product groups. Figure 5.17 illustrates the identified bottleneck for each Product group. In some cases the bottleneck is in the assembly as assumed and in other cases it in tooling or in the textile shading.

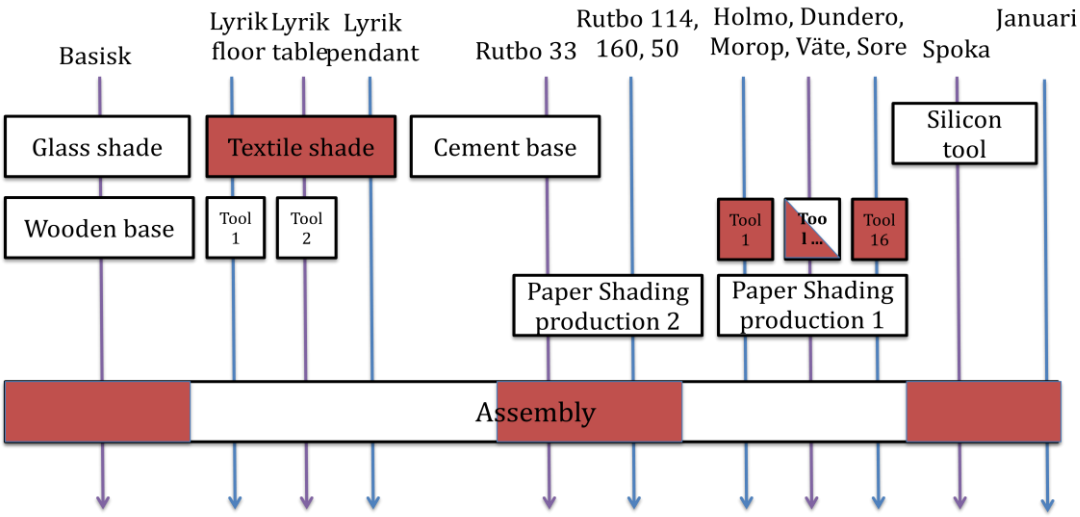

Figure 5.17: Identified bottlenecks at Supplier 3

Step 5 - Calculate local need/capacity and check value

The decision from the Category was to register the maximum capacity under normal circumstances in GPS, even if the need is less. There are often possibilities to get a higher Dedicated Capacity, for example through adding an extra shift in production. However, the Dedicated Capacity considered in the calculations is the capacity that IKEA is able to get in a short time horizon. It is also important to update the capacity information during peak periods to avoid exceptions. The reason for registering the maximum capacity was that the Category did not want to have any hidden capacity since it might disturb the tactical planning. According to the definition, this means that there will not be any Available Expensive Capacity since all the Dedicated Capacity will be allocated between the Product groups. If there is a rest, it will be very limited. When calculating the allocation at each supplier, manual adjustments were needed in several cases since the capacity allocation tool only calculates the system bottleneck. However, it is up to the Supply planner to decide when to do further analysis or manual adjustments since no clear guidelines are given form the Category.

When comparing the previous registered capacities and the updated capacities, the updated total capacity has increased at some suppliers and decreased at others. This can be seen in Figure 5.18. At most supplier there is no big difference between the previous and the updated capacity, approximately 20%, but at one of the suppliers, Supplier 2, there has been a big increment. The total capacity for all seven suppliers has increased, which means that IKEA will have more capacity registered in the system.

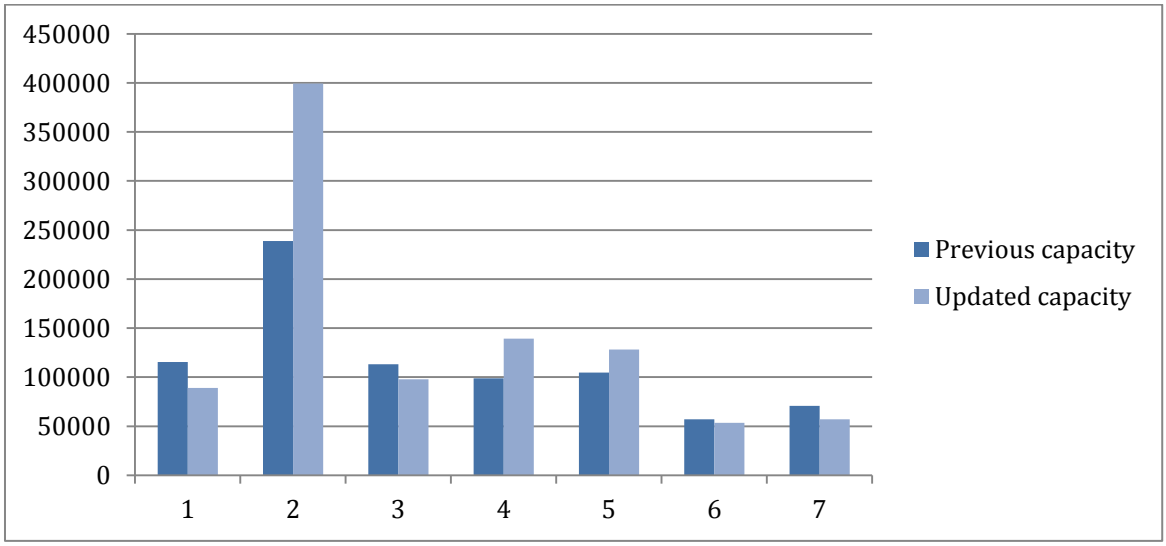

Figure 5.18: Comparison of previous registered respectively updated capacity in pieces at each supplier

Table 5.9 illustrates the utilization rates in the bottleneck with respect to need at each supplier. The utilization rate is around 75% in the bottleneck shared by the most Product groups for four of the suppliers. For the other suppliers, supplier 2, 6 and 7, the utilization is under 70%. The utilization in the assembly resource, which is the most labour intensive resource, is in some cases around 50%.

Table 5.9: Utilization with respect to need

Supplier	System bottleneck	Utilization in system bottleneck	Most common bottleneck	Utilization in most common bottleneck	Utilization in Assembly resource
Supplier 1	Components (Glass)	73%	Components (Glass)	73%	50%
Supplier 2	Components (Steel)	69%	Components (Steel)	69%	58%
Supplier 3	Paper shade Tooling 15	167%	Assembly	77%	77%
Supplier 4	Pre-Assembly	74%	Pre-Assembly	74%	74%
Supplier 5	Injection	73%	Injection	73%	55%
Supplier 6	Package	65%	Package	65%	62%
Supplier 7	Assembly 2	59%	Assembly 1	41%	41%

Supplier 1

The allocated capacities for the Product groups at Supplier 1 can be seen in Table 5.10. If the resources are used according to the need, the utilization of the capacity is approximately 73% for every Product group. Since all Product groups share the same bottleneck, the utilization of each group will be the same and it is almost in the scope of what is reasonable capacity utilization according to the Category.

Table 5.10: The average need and the allocated capacity in pieces as well as the difference between them for every Product group at Supplier 1

Product group	Avg need	Allocated cap	Difference
BASISK pendant 12 & 22	4609	6278	73%
GAVIK	4955	6749	73%
IKEA 365+ LUNTA pend lmp 11 & 20	737	1003	73%
KOPPAR 20 & 22 & 23	6651	9060	73%
KVINTETT pendant & wall	1728	2353	73%
MÅNLJUS table 44	385	524	73%
SÖDER chandelier	761	1036	73%
KNUBBIG 11 & 18	27065	36868	73%
MINUT pendant 25 & downlighter & wall	2982	4062	73%
KRISTALLER chandelier	187	254	74%
MÅNLJUS pendant 41	235	320	73%
MINUT pendant 3 lamps & pendant 32	1864	2539	73%
MÅNLJUS pendant 20	70	95	74%
SÄVERN wall dbl	1158	1577	73%
MINUT floor	822	1119	73%
SMÄRT table lamp	2109	2872	73%
SÄVERN wall	701	954	73%
BASISK track	3830	5217	73%
SÖDER pendant	1885	2567	73%
SÖDER pendant glass/flowers	479	652	73%
SÖDER wall	476	648	73%
SÖDER pendant pearls/flowers	1213	1652	73%
SÄVERN ceiling	344	468	74%
Tostarp	0	0	0%

The utilization in the Resource groups varies, see Table 5.11. The bottleneck resource is used 73% if it is used according to the need. If the Resource groups are utilized in line with the need, there will be two Resource groups that are utilized less than 50%.

Table 5.11: The utilization of the Resource groups based on the need and the utilization if the bottleneck is used to 100% for Supplier 1

Resource	Utilization (need)	Utilization (max)
Glass	73%	100%
Assembly -short line	49%	67%
Assembly -long line	51%	69%
Packaging-normal	51%	70%
Packaging-shrinking 1	63%	85%
Packaging-shrinking 2	40%	54%

When comparing the previous registered capacity with the updated capacity, it is possible to see a difference, see Figure 5.19. The total capacity in pieces has been reduced by 23%.

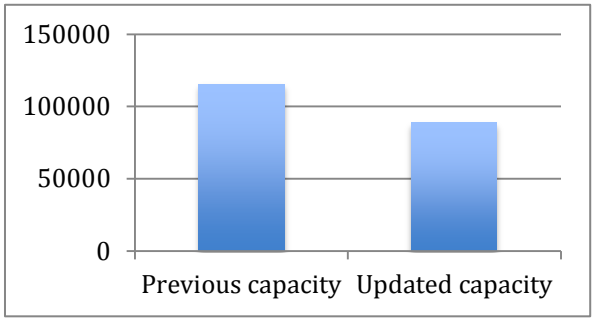

Figure 5.19: The previous respectively new total registered capacity in pieces for Supplier 1

Supplier 3

Table 5.12 illustrates the allocated capacities that will be registered in GPS and the average need. The rate between the two shows the utilization of the capacity for each Product group with the planned need in the Supply Plan Information. The rate is varying between the different Product groups since they have different bottlenecks but it is approximately between 60 and 80%. For three of the Product groups, which have their bottleneck in the tooling, the need is higher than the allocated capacity, which indicates that there is lack of capacity. When discussing this with the responsible Supply planner it became clear that these were relatively new products. When the production is fully running, the supplier will increase the capacity for these Product groups in the near future. If the capacity still is not enough, the Supply planner has to check if it is possible to dedicate more capacity to the related Product groups. Otherwise the Supply planner needs to contact the Need planner to see if it is possible to place orders at another supplier.

Table 5.12: The average need and the allocated capacity in pieces as well as the difference between them for every Product group at Supplier 3

Product group	Avg need	Allocated cap	Difference
BASISK UP	1618	2564	63%
BASISK 40	1757	2783	63%
JANUARI	4712	7467	63%
RUTBO 114	1883	2983	63%
RUTBO 160	1210	1917	63%
RUTBO 50	485	768	63%
RUTBO 33	111	175	63%
HOLMO	14435	12727	113%
DUDERO	2776	4399	63%
MORUP	0	0	0%
VATE 32	630	997	63%
VATE 46	2962	3829	77%
VATE 55	1462	2316	63%
VATE 38	1017	1610	63%
VATE 72	1278	2024	63%
VATE 26	4732	7498	63%
VATE 30	225	355	63%
VATE 93	531	840	63%
VATE 54	103	163	63%
VATE floor	327	517	63%
SORE 164	2284	3619	63%
SORE 100	4865	2909	167%
SORE pendant	4523	3863	117%
LYRIK floor	1131	1288	88%
LYRIK table	2035	2317	88%
LYRIK pendant	2697	3071	88%
SPOKA	19298	24952	77%

When studying the utilization in the different Resource groups in Table 5.13, the utilization varies. The utilization with respect to the need in the assembly, which is shared by all Product groups, is 77%. However, the utilization for some of the tools is extremely low, 5 respectively 8% in two of the cases.

Table 5.13: The utilization of the Resource groups based on the need and the utilization if the bottleneck is used to 100% for Supplier 3

Resource	Utilization (need)	Utilization (max)
Glass Shade	20%	32%
Wooden Base	46%	74%
Paper shade Tooling 1	113%	100%
Paper shade Tooling 2	61%	97%
Paper shade Tooling 3	0%	0%
Paper shade Tooling 4	18%	29%
Paper shade Tooling 5	77%	99%
Paper shade Tooling 6	64%	102%
Paper shade Tooling 7	28%	44%
Paper shade Tooling 8	51%	81%
Paper shade Tooling 9	29%	46%
Paper shade Tooling 10	8%	12%
Paper shade Tooling 11	26%	41%
Paper shade Tooling 12	5%	8%
Paper shade Tooling 13	24%	38%
Paper shade Tooling 14	56%	88%
Paper shade Tooling 15	167%	100%
Paper shade Tooling 16	117%	100%
Paper shade Producing 1	75%	86%
Paper shade Producing 2	53%	84%
Textile Shade	88%	100%
Casting Base Tooling 1	26%	30%
Casting Base Tooling 2	59%	67%
Cement Base	44%	70%
Silicon Tooling	74%	96%
Assembly	77%	100%

When comparing the new total capacity for Supplier 3 to the old, it can be seen that the updated capacity that will be registered in GPS is approximately 16% lower than the old, see Figure 5.20.

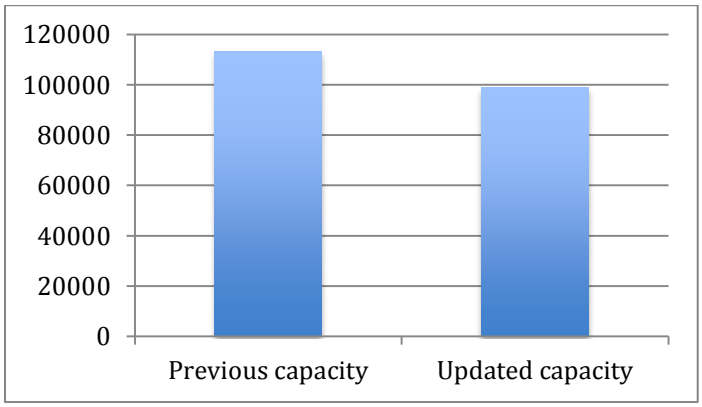

Figure 5.20: The previous respectively new total registered capacity in pieces for Supplier 3

6 Analysis

Based on the As-Is description as well as the To-Be description, an analysis will be done in this chapter. The theory will be used as a basis for the analysis and the goal is to understand and analyze the current way of working as well as to evaluate the new concept to be able to prove savings and suggest improvements.

6.1 The current way of working with supplier capacity planning at IKEA - As-Is

It is important to describe the current situation in order to understand how the organization is working today and why they are working in that way. Through an As-Is description it is possible to understand the problematic in the current way of working and what that will be required to reach the new way of working.

6.1.1 Supplier capacity planning

There seem to be a quite structured way of working with capacity planning at the Trading Area Greater China today, for example the figures are reviewed continuously. The capacity information is used both by the Supply planners and the Need planner in their daily work. The information is used to make sure that the capacity covers the need and the goal is to have a utilization of at least 75%. That can be compared to a leading strategy where the capacity is increased before there is an increment in the demand, see Figure 3.4 in 3.2.1 *Leading and lagging*. A leading strategy increases the flexibility but at the same time there is a risk of having lower utilization of the resources and unutilized capacity. However, the team is not working as proactive as might be possible in relation to for example holidays. The level and accuracy of the capacity planning is highly connected to the knowledge in the team and at the suppliers since there is no explicit method for how the work should be conducted.

The Supply planners have a quite short-term perspective when working with capacity planning. They are checking the capacity need and the access to capacity and are for example working with frontloading, when orders are placed earlier. This type of actions is also discussed in the theory as a short-term solution to capacity constraints. Instead of the Supply planners, it is the Need planners that have a more long-term and tactical perspective when working with capacity planning. To some extent the way of working with capacity planning at the Trading Area can be compared to Level capacity planning which means that the amount of resources and the out-put rate is kept constant regardless of the demand pattern. However, the theory suggests that it should be set to the average demand level. At IKEA it is rather kept at a constant higher level, approximately 25 % higher. Depending on the bottleneck type, this method can be a relatively safe way to plan the capacity since it might be harder to increase the capacity for some bottleneck types such as machinery. However, there is always a risk of having unutilized capacity and therefore also risks of higher cost.

6.1.2 Supplier capacity values

In the current way of working, it is the suppliers that define the figures regarding the capacities and the information is therefore highly dependent on the knowledge of the suppliers and the team. According to the Supply planners, it has been decided that the calculations should be based on bottlenecks and throughput time. It is appropriate to base capacity calculations on the bottleneck because there is always a bottleneck limiting the system's throughput according to the Theory of Constraint described in 3.3.3 *Theory of Constraint*. The knowledge about a

bottleneck can lead to improvement possibilities of the system's performance. The Lighting Category has much overcapacity according to the Trading team, the Need planner and the suppliers. Therefore, the suppliers do not see the need to calculate the capacities according to the bottlenecks. Instead they base their capacity values on the Supply Plan Information given by IKEA and add approximately 20 %. This method of calculating the capacities can be compared to Capacity Requirements Planning where the capacity requirements are based on planned and released orders. This is not a method that is recommended in a tactical planning perspective since the capacity values given by the suppliers are not connected to the bottlenecks. Therefore, it might not reflect the reality. However, the Supply planners are well aware of the suppliers' way of calculating the capacities. At the same time, the Supply planners think that there might be some hidden capacities at the suppliers. This indicates that the current way of working might have some drawbacks.

6.1.3 Supplier relationships

The Trading team has close collaboration with the suppliers through daily contact and it leads to them developing specific knowledge about the suppliers. The importance of good supplier relationships has got increased attention and the involvement and trust in the supplier relationships indicates that they are working well. However, over time a more friendly relationship can be developed and then it might be difficult for the Trading team to be critical and unbiased against the suppliers. If the team does not question the numbers given by the suppliers, it will be hard to verify them and there will be a risk of the capacity information not reflecting the reality.

There is much specific knowledge regarding the suppliers in the Trading team that is not shared within the organization. Therefore, it can be difficult for persons outside the Trading team to for example understand and rely on the capacity values since they do not know how they are calculated. Specific information about for example downtimes at a supplier can be important information in the tactical planning and the limited information sharing will make the planning more difficult and less efficient.

6.1.4 Current grouping

IKEA uses grouping of products today in terms of capacity groups. The grouping is done by the suppliers and differs between them since there is no standardized way of grouping the products. It is good to have some grouping of products since it makes it easier to plan the production and that is probably the reason for the suppliers to do the grouping today. However, to be able to take full advantage of a grouping in capacity planning, it is important to group according to similar patterns of demand, characteristics and need of resources. The current grouping is not based on these kinds of features and it makes it difficult to use. The Need planner does also express that it is difficult to compare capacities for products sharing matrix, which is understandable since the numbers are not calculated in the same way and the articles belongs to different groups at different suppliers which make them difficult to filtrate and compare.

6.1.5 Supplier capacity information in GPS

IKEA uses the Global Purchasing System (GPS) to register capacities today and the opinions regarding the information in the system differs within the organization. The Need planner in the Lighting Category thinks that the information in the system is incorrect and that it is difficult to get an overview of it. On the other hand, the Trading team believe that the capacity planning works well and expresses trust of the information in the system. The reason to why there are

different views is most likely based on them having different knowledge about the numbers. Through daily contact, the Trading team develops specific knowledge about the suppliers and that is not visible for the Need planner.

When studying the figures for planned and demonstrated need as well as planned and demonstrated capacity it was clear that the planned need was in most cases much lower than the demonstrated need. This can indicate that there might be problems with the forecasts. The planned capacity was also in most cases higher than the demonstrated capacity. However, it is important to notice that if the demonstrated orders do not reach the planned capacity levels it is not possible for the suppliers to demonstrate such high level. This can be an indicator of that IKEA has capacity that is not being used and that the figures in the system are inaccurate.

Regarding the updates of the system, the views differ again. The Trading team says that they update the information regarding the capacities in GPS approximately five times per year. The Need planner believes that the system is updated two times per year. The different opinions are also reflected in the discussion about the Chinese New Year. The Need planner do not think that they are working proactively with for example interruptions caused by holidays while the Trading team describes that they are working with planning and frontloading three months in advance in connection to the Chinese New Year.

6.2 Evaluation of One Supplier Capacity Process

As discussed in 3.8.3 *Process evaluation*, it is important to have some questions in mind when evaluating a process and a process implementation. It is important to consider if the process has been implemented as planned. In this project, the time plan for the implementation has been followed quite well. The new definitions and language has been understood and is being used both by the team and by the suppliers and this has been one important part of the process implementation. The aim of the implementation has been to secure a common way of working and it has been fulfilled quite well for the team in Trading Area Greater China. For example, all the team members are using the same templates, definitions, calculation tool etc. However, many of the decisions regarding the new way of working, for example how to use the calculation tool, have been taken by the team itself. The question is therefore whether it is only a common way of working among the team or if it also will become a common way of working throughout the whole Category and company. Figure 6.1 illustrates the structure of the evaluation and each part will be described further.

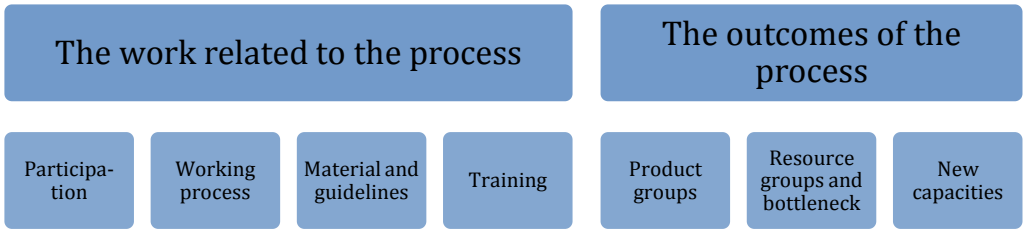

Figure 6.1: Structure of the evaluation of One Supplier Capacity Process

6.2.1 Participation

It is important to analyze the participants and the level of participation when evaluating a process, for example if the process is involving the people that it is supposed to involve and also the level of engagement of the participants. The Lighting team in Shanghai has, as mentioned in chapter 5 *Empiric*, been highly engaged in the implementation of this process and has put effort

and time into it. The process has been rolled-out in the purchase teams and it has mainly been the Supply planners that have been working with it. That is natural since capacity evaluation and securing capacity are two of their responsibilities. The Business developers have also participated in the implementation. That has been important since they are responsible for the business with the suppliers. However, the Technicians have not participated in a big extent during the implementation. One suggestion is to involve the Technicians more since they have good understanding of the products and the production process. Their knowledge can be used to secure the figures in the consumption table and also to improve and make sure that the Resource groups, Product groups and bottlenecks are identified in a good way. The engagement of the management team at the Trading Area can also be discussed. As mentioned, the management has little involvement in the process. This is a disquieting sign since it is important to make sure that a process has full support from all functions in the company in order to do a complete and successful implementation.

6.2.2 Working process

To follow the working process suggested in One Supplier Capacity Process has worked well. It follows a clear logic that is easy to adapt to the Category. The biggest difference between the suggested and actual working process is that the first three steps have been performed at once, by working with all Lighting suppliers in parallel, see part one in Figure 6.2. Since the data collection and validation has taken much time, this has been appropriate. Additional validation of the information has been needed between each step in the process. This way of working has also been valuable since changes of the Product groups has been required at almost every supplier and therefore it has required less rework in the capacity calculation as well as in the preparation for the registration of the updated capacities.

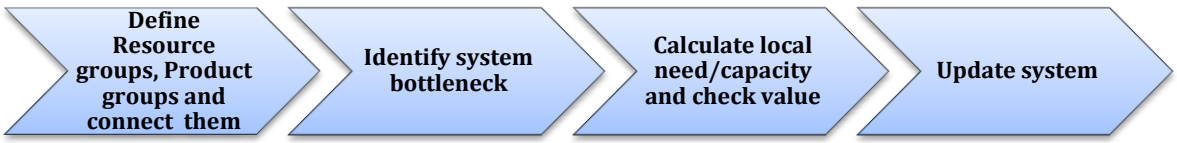

Figure 6.2: The flow of the working process used during the implementation in the Lighting Category

6.2.3 Material and guidelines

The material created by the project team for One Supplier Capacity Process has been useful for the implementation. However, when the implementation started some additional material needed to be created within the Category in order to proceed with the introduction of the new process. In a long-term perspective, it would be better to have standardized templates for all categories within the company. One reason for this is to support organizational learning but also to secure a common way of working. During the implementation there were guidelines and Category decisions missing, for example for when to do manual adjustments in the capacity allocation. If these had been predefined, confusion could have been avoided and a more standardized way of working could have been achieved. As mentioned in 3.7 *Process implementation*, it is important to develop sufficient documentation and management systems from the very beginning of the implementation in order to avoid problems in later stages. Furthermore, to ensure that the process becomes mature, it is according to the Process and Enterprise Maturity model important to have the design and the infrastructure in mind since these are defined as process enablers. This means that it is important to have a comprehensive specification of how the process should be executed and also have a good information- and

management system that supports the process. Comprehensive material and guidelines contribute to the process becoming more mature.

6.2.4 Training

The kick-off week constituted a general start for the project in the Category and enabled a common understanding of the process. Since the implementation of the process has been dependent on the teams' knowledge, the kick-off and training sessions were a good start. The scope and structure of the training was sufficient and gave the team a thorough introduction to the concept. In order for the team to understand the concept completely and to be able to ask questions, they had to work with it by themselves. Therefore, additional training sessions were needed after the kick-off week to explain the concept further. Kick-off meetings and trainings are important to preserve and improve the commitment in a project and therefore it will be important to continue these in order to both secure a common way of working and constant commitment within the team. The performers are also one of the process enablers in the Process and Enterprise Maturity model and further training will contribute to increasing their skills and knowledge. It will probably also be appropriate to assign a person to be the concept leader in the team even after the implementation process to make sure that the work will continue in the new way of working.

6.2.5 Product groups

The new grouping was based on the suppliers and the Trading team's knowledge about the production of the products. The new product grouping may require some more daily work since there are more groups than before and it is important to make sure that they are aligned at all suppliers. This means that if one group needs to be split at one supplier then it must be reviewed and split at all suppliers since the Product groups are global. According to theory there are some drawbacks with product grouping, for example costs of implementation and difficulties when the product ranges change. The gains from implementing the process, which will be further explained under savings, will hopefully make up for these drawbacks. The theory suggests that a product group should have similar characteristics and need of resources in order to have a well working planning process. The new grouping with Product groups takes the use of resources into consideration since it is based on the Resource groups and all products within a Product group must share the same Resource groups. A group of products should also have similar patterns of demand, characteristics and use of resources as well as a clear grouping process. In comparison with the definition of Product groups in One Supplier Capacity Process, the definition is in line with the theory since it consists of "article/articles with similar characteristics and share the same Resource groups…". However, this can be interpreted in different ways and there is no further explanation for how to actually perform the grouping. Overall, the new grouping in the Lighting Category reflects the production flow and the capacity figures better and will therefore hopefully reflect the reality better and make the planning process easier.

6.2.6 Resource groups and bottleneck

The working method of One Supplier Capacity Process where resources and products are grouped can be compared to and have similarities with Production flow analysis. The identification process of the Resource groups was conducted through a factory visit and discussions with the supplier. The consumption table that has been used in the project is similar to the Process Analyze scheme discussed in theory. When doing the Resource grouping, it is only

an overview that is required and therefore this method is suitable. Studies of the production on a lower level would not contribute more to this process. In the Lighting business, the production flow has similar structure for different products but there have been some cases that have been more complicated than others. For some of the suppliers, the production flow was simplified according to the suppliers' wishes and the Supply planners' knowledge regarding the most common bottlenecks. When identifying the bottleneck this was done according to the theory where the average workload was measured and the bottleneck with the biggest workload was defined as the bottleneck. In the Lighting business, the bottleneck is often related to labour since one of the most common bottlenecks are the assembly and packaging resource. For labour intensive resources, it can in many cases be relatively easy to adjust the capacity levels through hiring more people. At most of the suppliers it was discussed whether to include components as a resource. According to many of the suppliers, components were not really seen as a problem. However, at the suppliers where components where included it was identified as a bottleneck. The capacity in components are highly dependent on the accuracy in the need plan and the information given to the supplier. The suppliers have to order the components and prepare their suppliers in order to get the amount needed. If the need plans are accurate and sent to the suppliers on time, the components will not be a capacity issue for the suppliers. Therefore it can be a good idea to include the components as a Resource group at all suppliers since it might otherwise become a problem in the future. For the suppliers that have in-house production, the bottleneck was found in that Resource group. Since the machinery often is expensive and dependent on specific tooling, it is reasonable to have the bottleneck in that resource when having in-house production. This is information that is important from a tactical perspective.

6.2.7 Updated capacities

Comparing the previous total registered capacities with the new, it can be seen that the updated capacity information have increased at some suppliers and decreased at some others. However, the total capacity for all the seven suppliers has increased which means that IKEA will have a higher total capacity registered in the system. It is not possible to find a clear trend for how the capacity information has changed at the seven visited suppliers. This indicates and confirms that there has not been a common way of registering the capacities before. Since there was no standardized way of calculating the capacities, it is also understandable that it has been difficult to compare the suppliers to each other. The difference in the allocated capacities can also be related to the suppliers calculating the Dedicated Capacities differently. The guidelines for the suppliers have been to calculate the Dedicated Capacity as the capacity that IKEA is able to get within in a short-term perspective, which means that it might be possible to get even more capacity. The interpretation of the guidelines can differ between the suppliers and that is probably visible in the numbers.

The utilization of the capacities in the "bottlenecks" is around 75% for half of the suppliers and for the others it is below 70%. This can be compared to IKEA's goal of having a minimum utilization of 75% and it can be concluded that some of the values are lower than the goal. Furthermore, the utilization of the assembly resources is quite low at almost all suppliers. The relatively low figures can indicate that IKEA has unutilized capacity at the suppliers. As mentioned before, the capacities that are registered in the system are the capacity that IKEA is able to get during normal circumstances. This means that there are most often opportunities to get more capacity. In the continuation, it is important for IKEA to consider if they have dedicated too much capacity at the suppliers and what cost that is related to the unutilized capacity.

6.3 Identified issues related to One Supplier Capacity Process

There is always a challenge when introducing a new way of working. When trying to close the gap between the current and the new working method regarding capacity planning at IKEA, some issues that affects the capacity planning and One Supplier Capacity Process have been identified. In the future, it could be appropriate to try to solve these issues in order to make the capacity planning work better and to make sure that One Supplier Capacity Process can deliver what is expected.

6.3.1 Systems

The systems' structure and limitations has had big impact on the previous way of working but it has also affected the structure of One Supplier Capacity Process. The GPS, the system that will be used when registering the updated capacities, is a relatively simple system. For example there is only one field for filling in the information and that is the reason for the structure with the three semicolons in the registration of the capacities. With this structure it is not possible to register additional information regarding the suppliers' capacities such as possibilities to increase the capacities in a longer time perspective than what is registered. It can be valuable in for example the tactical planning to be able to note and share such information in the system. The team also expresses that the system is not optimized and that improvements can be needed to increase the efficiency in their work. Therefore, it can be crucial to further develop the current system or create a new system that supports the capacity planning in a better way to be able to fully utilize the advantage with the new way of working.

Today, there is no system that supports the allocation calculation and the updates of the system in a good way. The Supply Plan Information is changing every day and there are continuous changes in the product range. There is much manual work involved when entering the need and group information in the system since the need has to be recalculated or the consumption table has to be updated. Therefore it would be good to have systems that support this in a better way in order to facilitate the daily work and also to make sure that the information and the figures are correct. One example of a possible improvement is to have the Supply Plan Information automatically linked with the calculation tool.

6.3.2 Unstable need plans and capacity differences

When studying the previous figures for planned and demonstrated need respectively capacity, the problematic described in 1.2 *Background to the problem* was verified. There seem to be two different problems regarding the capacity planning at IKEA today; unstable need plans and difference between demonstrated and planned capacities. It seems like IKEA is systematically preparing the suppliers for too low need. Big variations and differences in planned and demonstrated need make it difficult for the suppliers to plan their production in a good way. Even though they should have enough capacity and be able to handle the need, they prepare and plan for a lower level. The levels are based on the Supply Plan Information, and if the need increases too much, the supplier will not be able to handle it. Then, accurate numbers and high capacity figures in the system will not solve the problem since the supplier is not given opportunities to handle the demand. One example can be when the bottleneck is in the component resource. If the supplier gets the correct need in the right time, there will seldom be problem with ordering components from sub-suppliers. In a few cases, too high need is registered which might lead to IKEA committing on higher capacity levels at the suppliers than is actually needed. The problem with incorrect registered capacity makes the planning more

difficult since it is not clear what the supplier can and cannot deliver and fulfil. The combination of the two issues creates problems in the long run. Implementing One Supplier Capacity Process will hopefully contribute to reducing of the amount of incorrect registered capacities. However, in order to better optimize the planning, it will also be important to improve the need plans and better prepare the suppliers for the coming need.

6.3.3 Overcapacity

The Trading team's impression was that the Category has overcapacity. This impression was confirmed during the visits through observations of free space in the production facilities, machines not running and through listening to the suppliers' wishes for more orders. The average utilization of the most common Resource groups used was between 40% and 75%. This also indicates that there is some unutilized capacity at the suppliers even though the suppliers with the highest utilization are within the scope that is acceptable within the Lighting category.

It is important for IKEA to consider if they really need all the Dedicated Capacity and/or what they should handle it. Having unutilized capacity dedicated at the suppliers introduces unnecessary costs and it is also negative for the suppliers who can use the capacity to other customers instead. One suggestion is to further study the suppliers that have shared matrixes to investigate if it is possible to reduce the amount of Dedicated Capacity somewhere. On the other hand, IKEA is planning for expansion in China in the coming years and therefore it can be good to have more capacity dedicated than needed at the moment. However, it is very important to have knowledge and be aware about the actual capacities at the current suppliers before sourcing additional suppliers in accordance to the expansion.

6.3.4 Close collaboration between the Trading team and the suppliers

As mentioned before, the Trading team often develops close collaboration with the suppliers through long-term relationships. The drawback with this way of working and when the relationship gets friendlier is that the team becomes less objective and critical to the numbers and opinions given by the supplier. The experience is that when the relationship gets too friendly, the team is more defending than questioning the supplier. This is a dangerous pattern when trying to get the correct information to put into the system and also when it comes to putting requirements and developing the supplier. To only trust the supplier will lead to less control over the numbers and the capacity planning process will suffer since the figures will still not be accurate. It is important that the data is correct when doing the allocation and registration for One Supplier Capacity Process. To implement the process without accurate data will not create any difference to the previous way of working.

6.4 Savings

According to the Supply Chain Council and the SCOR model, it is important to consider reliability, responsiveness, agility, costs and assets management when evaluating the performance of a process. However, there are other things that can be taken into consideration when analysing the performance, for example supplier relationship with regards to trust, power, involvement and commitment. The identified savings related to the SCOR model can be seen in Figure 6.3.

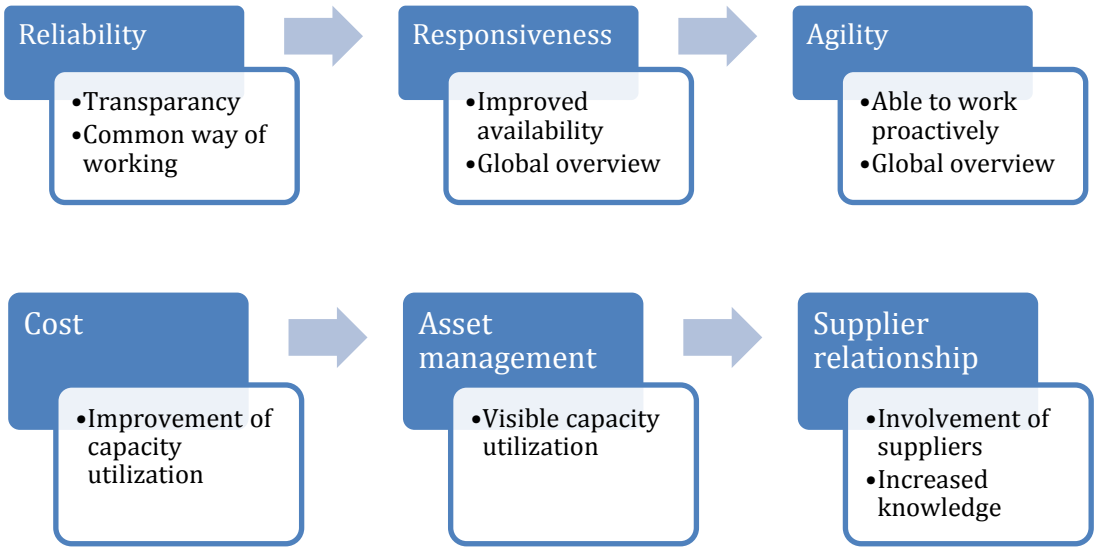

Figure 6.3: Illustration of saving derived from One Supplier Capacity Process

The concept of One Supplier Capacity Process is based on some general guidelines such as common language, definitions and units. There are some savings identified that are connected to the implementation of the process, for example transparency, global overview and better capacity utilization. Further descriptions of the savings will follow below. The savings will lead to some direct outcomes from different perspectives such as improved planning through more accurate information and easier identification of bottleneck types. The relationship between the process, the savings and the outcomes can be seen in Figure 6.4.

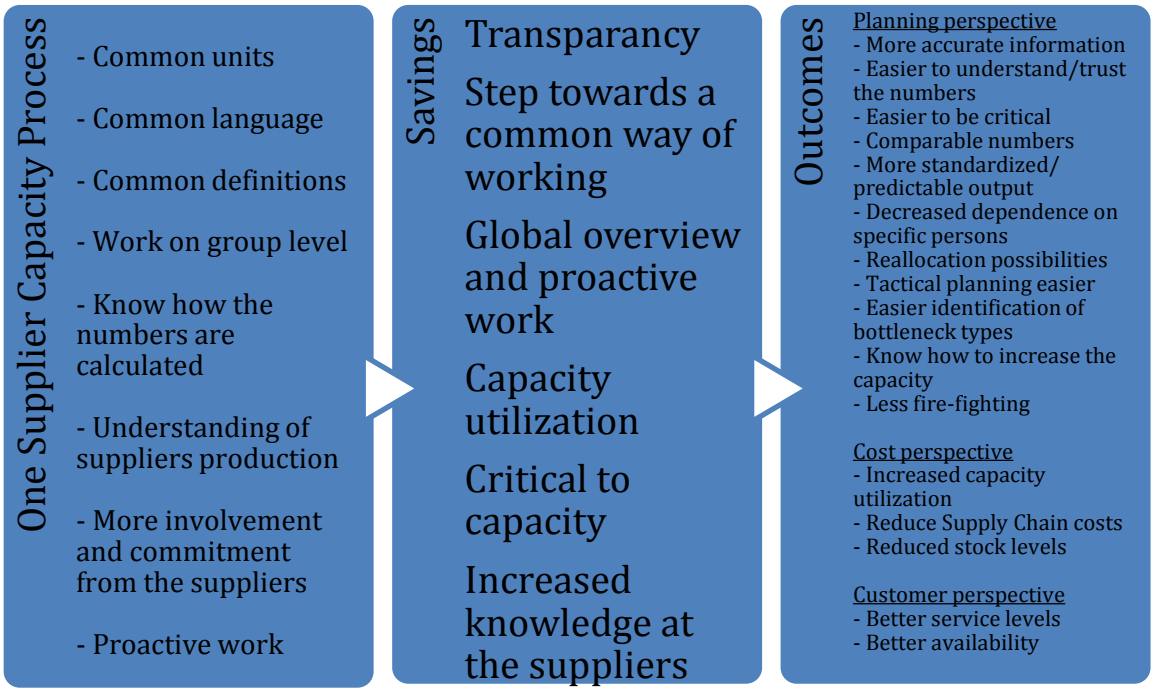

Figure 6.4: The savings and outcomes related to the One Supplier Capacity Process

6.4.1 Transparency

Before implementing this project, the capacity figures in the system have not been transparent. It has been difficult to know what they are based on and how they have been calculated. They have been highly dependent on the knowledge of the Supply planner as well as on the suppliers and the figures have only reflected the suppliers' perspective. The trading team has expressed that they experience that they have a better understanding of the capacities and capacity figures with the new way of working. By implementing One Supplier Capacity Process the figures will be more transparent because it will be clear what the actual capacity is and how it is calculated, compared to before when it was simply defined by the supplier. It will therefore also be easier to understand the capacities both for the Supply planner and the Need planner. Furthermore, it will also become easier to be more critical to the capacity figures given by the suppliers since there is an understanding of how they have calculated it. When having the same basis for the capacity calculation, the capacities will also become more comparable between the different suppliers.

6.4.2 Steps towards a common way of working

There has been different ways of working with capacity planning at the different Trading Areas at IKEA and the result is partly dependent on their competence. With One Supplier Capacity Process, a common language and way of working with capacity planning will be implemented. With a standardized way of working the output will become more standardized and more predictable. The process will also decrease the dependence of specific persons' knowledge within each Trading Area since the team will be forced to work in the same way with regards to capacity planning. The overall knowledge regarding capacity planning will be better and the team will be possible to teach and contribute to education of the suppliers. At the Trading Area Greater China, the Lighting Category has previously had a relatively good structure for working with capacity planning and the figures have been reviewed continuously. However the figures do not seem to always be true to the reality and for periods with reduced capacities, for example the Chinese New Year, they have not been updated properly. As mentioned before, the accuracy of figures has also been very dependent on the supplier and defined from the suppliers' perspective with different groups at different suppliers. Therefore One Supplier Capacity Process will improve the way of working by making sure that everyone defines capacity in the same way and use a common language. This will also mean that the figures in the system will be more accurate and true to the reality. The common language will be important in a global company like IKEA. Furthermore capacities have previously been registered in different units of measure, making them difficult to compare to each other. By implementing the new way of working a standardized way for registering capacities in pieces has been developed. This will make it possible to compare the updated capacities to each other.

6.4.3 Global overview and proactive work

Before the implementation of this project, it has been difficult to get a good overview of the capacities, especially for products sharing matrix. By implementing global Product groups, and by using the new naming in GPS, it will be easier to see the "big picture" because all suppliers will register their capacities based on the same groups. When the Product and Resource groups are defined it is possible to get a better overview of the capacities. It will also enable a better view of how the capacities are allocated between the Product groups and the suppliers. This is illustrated in the example in Figure 6.5 where four Product groups are produced at three different suppliers. The Resource groups are local and can be different for the different suppliers.

Resource group

	Supplier A	Supplier B	Supplier C	Sum Capacity	Sum Need	
Product group 1	150	100	50	300	200	OK!
Product group 2	200	100	250	550	600	!
Product group 3	100	250	0	450	400	OK!
Product group 4	200	300	200	700	600	OK!

Figure 6.5: An example of an allocation problem between Product groups sharing the same Resource groups. The capacities and the need are defined in pieces

The need must not exceed the capacity since it otherwise cannot be fulfilled. In the example, the capacity is enough for all Product groups except for Product group 2 where the total need exceeds the capacity. This means that there might be a capacity problem. However, if the table is studied more carefully one can see that there is unproven capacity for some of the other products. By having global Product groups, it is possible to have an overview of the capacities between the suppliers. Then it can be possible to reallocate the capacity between the Product groups to suit the demand better or when the capacities are not utilized in a good way. In other words, it can increase the agility and responsiveness. This will make it possible to improve the customer satisfaction through better availability in the stores. Hopefully it will lead to better capacity utilization and also reduction of stock levels which can be a big cost for the company.

The new way of working and the global overview will also increase the possibility to work more proactively. Previously, problems have been solved when they have occurred instead of working proactively to make sure that problems do not occur. The new process will facilitate the understanding of when action must be taken, for example when to reallocate capacity, produce to stock and review the dedication levels. Furthermore, the Need planner will have better overview and a better ground for the tactical planning. The Supply planners will have better understanding of the actual numbers in the system and can therefore place orders accordingly. Concerning the more operational planning, it will hopefully also improve the transport, DC and retail planning and make it possible to work more proactively with these parts. This will also contribute to cost savings, reduce supply chain costs and improve both the effectiveness and efficiency.

6.4.4 Capacity utilization

With more accurate figures in the system, there will be increased possibilities to compare different suppliers and to get a global overview of the capacities. It will therefore be easier to analyse the capacity utilization at the suppliers. The goal today, set by the Category, is that the registered value should be in the span of -25% to +25% from the real value to be acceptable. There is a sign of the Lighting Category having too much capacity, which can be seen through for example half empty production facilities. This can also be shown in numbers, where the capacity utilization in the Resource groups most commonly used is between 40% and 75%.

If the Lighting Business gets a better understanding of their capacities, there will be possibilities to utilize them better. This can be done through reallocation between the suppliers or by simply reduce the Dedicated Capacity at some locations. Later on, it might also be possible to handle

fluctuations in the need, which today disturbs the planning at the suppliers and also affect the capacity planning. In the end, better capacity utilization will hopefully lead to better availability in the stores and higher customer satisfaction. If the company gets better understanding of their actual capacities there will, as mentioned before, also be possibilities to reduce the amount of Dedicated Capacities and in that way also reduce the costs of having unutilized capacity.

6.4.5 Critical to capacity

With One Supplier Capacity Process, IKEA will have a better understanding of the suppliers' production. The consumption table, with for example the identified Resource groups and consumption data, gives an understanding of the flows and how the Product groups are connected to the different Resource groups. The bottleneck and the type of bottleneck, for example labour, are also identified for the different Product groups. All this knowledge will be combined in the new naming for registering capacities. This will make it possible to see what is critical to capacity for each Product group and what is driving the capacity in the system. It is important to understand what drives capacity, for example labour, raw material or machinery, to be able to make tactical and strategic decisions. If it is for example machinery that drives capacity, then an increment of capacity must most likely include some kind of investment and the time horizon will be longer compared to if it is labour that drives the capacity. Then it is possible to add an extra shift or hire more personnel to increase the capacity and that can be done in a shorter time perspective and to a lower cost. The Lighting Business has been proven to be very labour intensive, but there have been some cases when components are the bottleneck and the driver of capacity. In a long-term and tactical perspective, it is good to know what drives the capacity at the suppliers to be able to plan for the future.

6.4.6 Increased knowledge at the suppliers

The suppliers are highly involved when implementing One Supplier Capacity Process. The process might improve the supplier relationship by getting more involvement and commitment from the suppliers. Since the suppliers have all the information about the consumptions and Dedicated Capacities for their products, it is important that they have a good understanding of the process. If the suppliers become better at planning their capacities it will be beneficial for IKEA because they can for example get more accurate information from the suppliers. In the long run it also makes it possible to increase the service level to the customers. Some of the suppliers have expressed interest in implementing something similar for their sub-suppliers. This is a sign of increased interest and knowledge at the supplier which can be beneficial to IKEA.

6.5 Suggested improvements

The new way of working with capacity planning that has been introduced with One Supplier Capacity Process seems to be a well functioning working method for IKEA. Overall, the impression is that the theory base has been sufficient. However, in order to improve the process, to fully implement the process and to secure a common way of working some improvements are suggested.

6.5.1 Explicit global templates and guidelines

There is an extensive material created to explain One Supplier Capacity Process. However, there have been some templates missing that were needed to fulfill the implementation process. Therefore, templates have been developed and continuously improved during the implementation of One Supplier Capacity Process in the Lighting Category in Trading Area Greater China. This includes for example templates for presentation of the concept at the

suppliers as well as templates for the consumption table. The template of the consumption table is compatible with the tool for allocation of the capacities developed by a Process developer at Plan and Secure Capacity process. This is the tool that has been used within the category to do the allocation of the capacities at each supplier. To have a template for the consumption table has been very useful because it reduces the risk of errors, it is easy for the supplier to fill out and because it makes the use of the allocation tool easier. Global templates should also include training material to make sure that all involved have the same understanding as well as guidelines for how to define the dedicated capacity.

During the roll-out there were no guidelines for when to update the capacities in the system. Since the need in the Supply Plan Information is updated often, almost every day and there are continuous changes in the product range and the supplier matrix, the allocation of the capacities will also change. When the need changes, there is also a risk of moving the bottleneck. Furthermore, when the matrix changes, new products are introduced or old products are phased out the consumption table must be updated. It is therefore important to update the system with the new information. However, today there are no guidelines for when to do these updates. In order to establish a continuous work with capacity planning it is recommended to establish some general guidelines for when and how to update the system. Table 6.1 summarizes some suggestions of templates and guidelines that can be useful.

Table 6.1: Examples of templates and guidelines

Templates and guidelines
Preparation material for suppliers
Training material for Trading team
How to define dedicated capacity with regards to downtime etc.
How to work with the allocation, when to do manual adjustments
When to update the system and the information in the consumption table
When to react on certain figures

The templates that have been created during this Master's thesis have only been used within Lighting in Trading Area Greater China. Since the goal is to have a common way of working, it is important to have global templates within the category and within the company. This would force the teams to work in the same way, gather the same data, having it in the same format and will make sure that the registered data in the system is comparable for the different suppliers. It is important to adapt the guidelines to the categories since they have different characteristics in their products and production facilities. However, for some key decisions it is important to have standardized guidelines, both within the Category and within the company. Possible guidelines that could be created on a global level are for example when to update the figures in the system and when and how to do manual adjustments of the allocated capacities. Except from creating a standardized way of working, it will also contribute to making the process easier to work with for the Trading teams and it will hopefully limit the level of confusion and errors.

6.5.2 Development of allocation tool

It has been decided by the category that the maximum capacity shall be registered in the system in order to eliminate the hidden capacity. However, it is difficult to allocate the capacities in an optimal way since different Product groups, especially in more complex systems, might have

different bottleneck resources. In particular, it is difficult when many Product groups and Resource groups are shared, which have been the case for most of the suppliers included in this study. To do this optimization, some kind of prioritization of the Product groups must be done and that can be difficult. The capacity allocation tool used in this implementation calculates the system bottleneck and not the bottleneck for each Product group. Therefore there might be available capacity at the Product groups not using the system bottleneck. Currently, there are two ways of handling the problem; by manual adjustments or further iterations.

The manual adjustments of the capacities can be done by using the capacity calculation tool. However, it requires some additional understanding for the user in order to understand how to do the adjustments. It will also be complex and time consuming to find the maximal capacities for the Product groups. When doing the manual adjustments, there is also a risk of increasing the capacities too much and move the bottleneck to another resource. Too many manual adjustments will make the capacity calculation less standardized. The values will be less accurate and the aim of the new working process will therefore not be fulfilled. Another solution is to do further iterations to identify the bottleneck for different flows. This way of working will probably calculate a more accurate maximal capacity but it is time-consuming and complex. Therefore there is a risk that the calculations get wrong, they take too much time to pursue or that they do not get done at all. The impression after working with this implementation is that a common and complete tool will be crucial to have in order to ensure correct figures and comparability of the capacities in the system. It will also emphasize the common way of working which is the goal of the project. Before continuing the roll-out, it will be important to finalize the allocation tool and make sure that it is user-friendly to be able to provide the teams with a final solution of how to work with the allocation of the capacities. To continuously learn new methods and tools is both time consuming and confusing for an inexperienced co-worker.

The average need is used when calculating the capacities and the information is gathered from the Supply Plan Information. To summarize the information on group level is time consuming for the Supply planner, especially because of the Product groups being changed continuously and the tempo is highly dependent on the Supply planner's excel skills. Therefore it would simplify the Supply planners' work to create a tool that could handle the summation of the need on group level. It would also be appropriate to create a tool for synchronizing all the files related to capacity planning so that it only is needed to update one file when the information from the supplier or the Supply Plan Information changes. This improvement as well as the suggested improvement of the allocation tool will contribute to facilitating the daily work with capacity planning and to more accurate figures in the system. It will also save time which can be spent more valuable .

6.5.3 Extra-capacity

The capacity registered in the system is the maximal capacity during normal circumstances, see Figure 6.6. The figure shows how the total capacity at a supplier can be divided and that there might be some capacity that is not put into the system that is available for the company in a longer time perspective. The team, together with the supplier, is responsible for deciding how to define normal circumstances, for example how to include maintenance, breakdowns and the amount of labour in the value of the consumption. However, during some circumstances it can be possible to get some extra capacity at many suppliers. This can for example be done by adding an extra shift, outsource to sub-suppliers or doing additional investments. To have this information included in the figures in GPS would not be appropriate since it can be misleading.

The extra capacity might not always be possible to get since the suppliers need to have some time to prepare the extra capacity. The information can be valuable in a long-term and tactical planning perspective and therefore it is important to consider how this extra capacity could be visible within IKEA. One suggestion is that there could be a common way for handling and documenting the extra capacity, for example in a simple excel-sheet that is saved in a common folder. The problematic can also be important to consider when making changes and improvements of the current systems for capacity planning. It can be a good idea to make it possible to add this extra information in the systems.

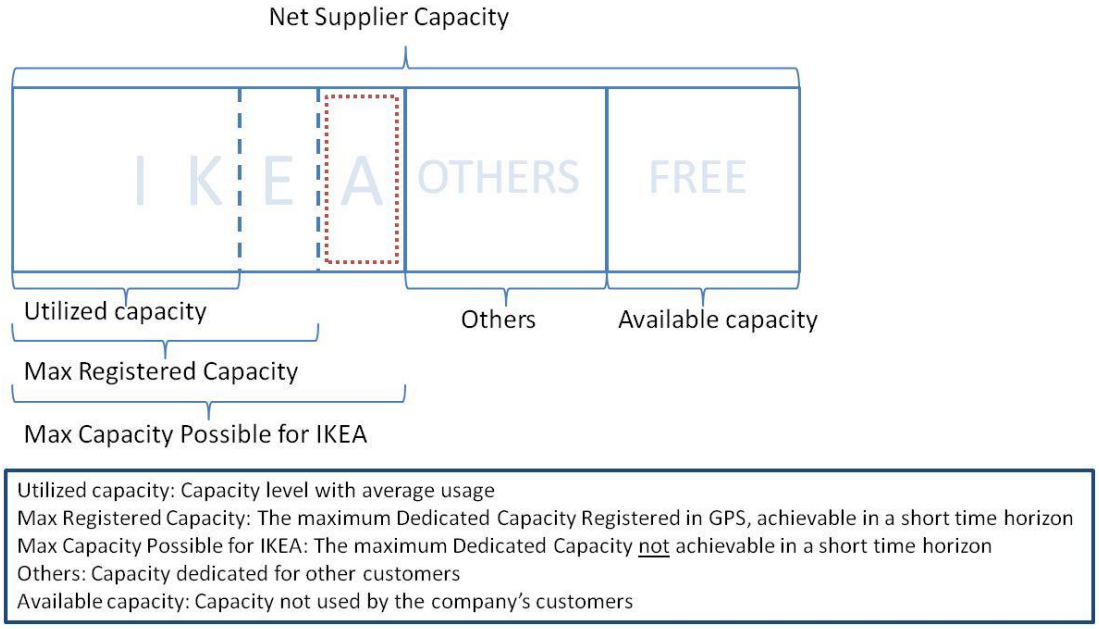

Figure 6.6: Division of capacity at suppliers

6.5.4 Available Expensive Capacity

Available Expensive Capacity is defined as the difference between the Dedicated Capacity and the sum of the Allocated Capacities. According to this definition there is almost no Available Expensive Capacity at the Lighting Category in the Trading Area Greater China today since it has been decided by the Category to register the maximal capacity in the system, see Figure 6.7. This means that all the Dedicated Capacity should be allocated to the Product groups. On the other hand, it has become clear that there is some overcapacity in the Category today and that the need in some cases is much less than the Dedicated Capacity. There is a risk of you believing that there is no problem since you have no or little Available Expensive Capacity while you in fact have a very low utilization of your capacity. To have unutilized capacity increases the flexibility but it is connected to extra costs.

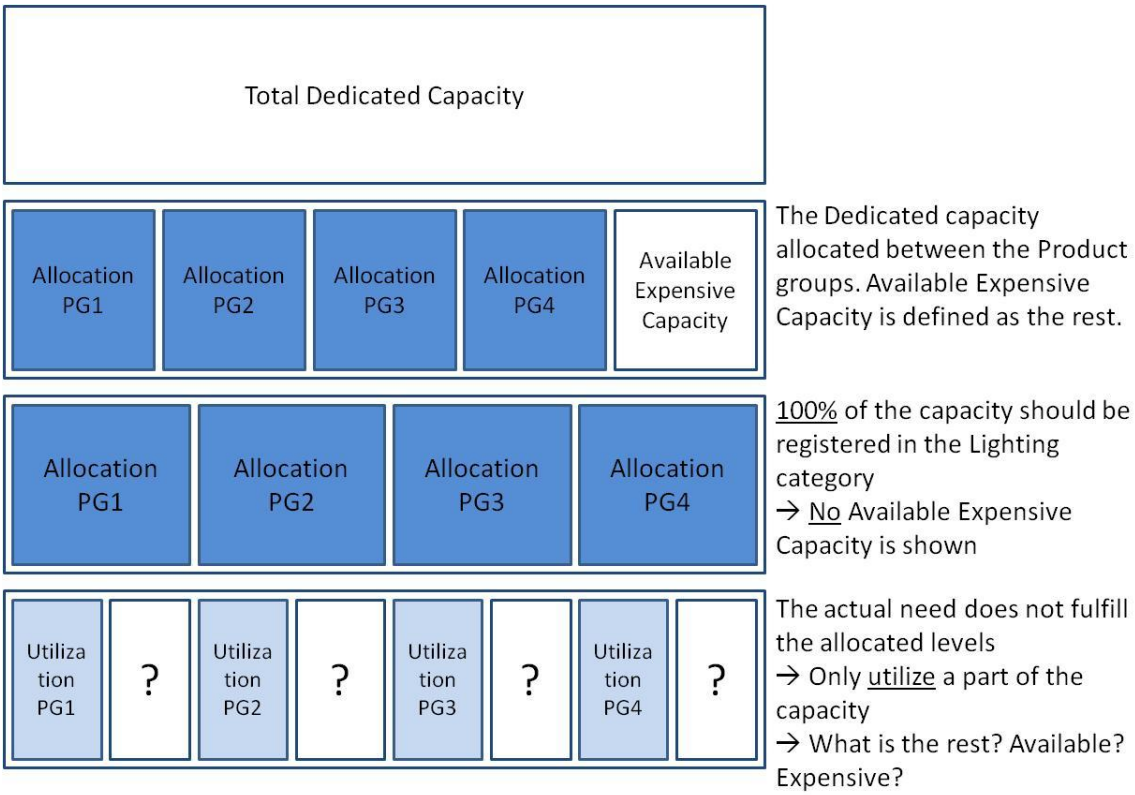

Figure 6.7: The relationship between Dedicated, Allocated and Available Expensive Capacity

A suggestion to highlight this problematic is therefore to either redefine the Available Expensive Capacity so that its focuses more on what you actually use or to add one supplementary definition that focus on this. It is important to always have the cost in mind and not only focusing on if the capacity is enough to cover the need.

7 Conclusion

After the analysis and evaluation of the project some final conclusions could be done. They will be described further in this chapter. Suggestions for further research will also be given.

The first of the four purposes of this Master's thesis was concerned with understanding the current way of working with capacity planning in Trading Area Greater China. It can be concluded that the common way of working with capacity planning is limited within the company. The Supply planners are working closely with the suppliers and they define and maintain the information differently. Furthermore, the capacity values are mainly defined by the suppliers and the figures are often based on the need from the Supply Plan Information. The suppliers did not see the reason for calculating the capacities more accurate or in another way since they are not experiencing any capacity problems. In fact, there is available capacity within the Lighting category.

The second purpose of the Mather's thesis was concerned with implementing One Supplier Capacity Process. The implementation has been performed with good results. The initial time line was followed throughout the project and the goal set by IKEA regarding the number of supplier visits was fulfilled. For the Lighting Business in China all suppliers, in total 23, were introduced to the concept by the end of this Master's thesis project. The Resource groups have been identified at the seven suppliers included in this Master's thesis. The production has been proven to be labour intensive with a focus and several bottlenecks in assembly. There have been discussions whether to include components as a Resource groups. In the cases where it has been included it has also been identified as the bottleneck. The Dedicated Capacity in the Resource groups related to components is dependent on the information from the Supply Plan Information. Therefore it is recommended to consider the components as an eventual Resource group in the future. In the analysis of the previous and updated capacities, the total capacity registered in the system has increased. The utilization with respect to the need has also been analysed and for half of the suppliers it was around 75%. The utilization in the bottleneck for the remaining suppliers was below 70%. Therefore it can be concluded that there seems to be overcapacity in the Lighting Category at Trading Area Greater China. When working with the implementation, there has been close collaboration with the local Trading team in the Lighting Business and together we have managed to gather and validate the information needed to update the capacities in accordance to One Supplier Capacity Process. There has been good commitment from the local Trading team to ensure success of the implementation and that has been valuable for this project.

The last two tasks in this Master's thesis have been concerned with evaluation and improvement of One Supplier Capacity Process. Most of the literature concerned with capacity planning is from an inside-out perspective, meaning that the focus is to plan the own production and production resources. From IKEA's point of view this is not very useful since they do not have any production of their own and the goal is rather to plan the capacity that they have at their suppliers. In other words they are working with capacity planning from an outside-in perspective. However, ideas and concepts from the standard capacity planning can be used and applied when working with capacity planning from an outside-in perspective. One Supplier Capacity Process captures many of the important parts of capacity planning and is a good theoretical base to build the capacity planning upon. It captures for example the concept of

Group Technology and it combines the short-term perspective with a longer time horizon. To be able to take full advantage of the benefits from One Supplier Capacity Process, implement the process fully and to establish a common way of working the recommendation to IKEA is to make sure that there are complete guidelines and materials as well as a complete tool for calculating capacities. Otherwise there will be a risk that there will be different ways of defining, maintaining and calculating the capacities. In the continuation, it is important to decide whether it should be a common way of working within the Trading Area, in the whole Category or at IKEA in total. It is also important to consider how to handle the overcapacities that there seem to be in the Lighting category. It can be discussed if it is necessary to have this extra capacity. It creates flexibility but it is at the same time related to additional costs. Of course, for the planned expansion in Trading Area Greater China this can be a good opportunity but in that case it is important that IKEA is aware of it and that they take advantage of the extra capacity. To invest in a new system or investigate the possibility of improving the current system can be valuable to be able to register all relevant information and work with capacity planning efficiently.

This Master's thesis, together with the theory base from One Supplier Capacity Process, has contributed to the research in the field of supplier capacity planning and capacity planning from an outside-in perspective. However, there is still much to learn and investigate. Firstly, it would be interesting to investigate and study the final results of the implementation of One Supplier Capacity Process. The real result of the implementation can be evaluated after approximately one year and then it will be interesting to evaluate eventual changes, improvements and problems. To be able to get deeper understanding and see pattern related to capacity planning from an outside-in perspective, it will be appropriate to involve more suppliers and understand the process from their perspective. Further studies of how planning from an outside-in perspective affect suppliers and the collaboration between companies and suppliers are suggested as an interesting area for further research.

8 References

8.1 Literature

BAKER, G. & MADDUX, H. 2005. Enhancing Organizational Performance: Facilitating the Critical Transition to a Process View of Management. *SAM Advanced Management Journal (07497075),* Vol 70 No 4, 43-60.

BAKKE, N. A. & HELLBERG, R. 1993. The challenges of capacity planning. *International journal of production economics,* Vol 30-31, 243-264.

BJÖRNSSON, P. 2012a.

BJÖRNSSON, P. 2012b. One Supplier Capacity Process - a common way of working (ver. 0.997). Älmhult.

BORJESSON, A. & MATHIASSEN, L. 2004. Successful process implementation. *Software, IEEE,* Vol 21 No4, 36-44.

BOURNE, M., NEELY, A., MILLS, J. & PLATTS, K. 2003. Implementing performance measurement systems: a literature review. *International Journal of Business Performance Management,* Vol 5 No 1, p. 1-24.

BRAGLIA, M., FROSOLINI, M. & ZAMMORI, F. 2009. Uncertainty in value stream mapping analysis. *International Journal of Logistics Research and Applications,* Vol 12 No 6, 435-453.

BURBIDGE, J. L. 1977. A manual method of production flow analysis. *Production Engineer,* Vol 56 No10, 34-38.

CHAN, F. T. S. 2003. Performance Measurement in a Supply Chain. *The International Journal of Advanced Manufacturing Technology,* Vol 21 No 7, 534-548.

DE WIT, A. 1988. Measurement of project success. *International Journal of Project Management,* Vol 6 No 3, 164-170.

DENSCOMBE, M. 2000. Forskningshandboken - för småskaliga forskningsprojekt inom samhällsvetenskaperna. Lund: Studentlitteratur.

DING, F. Y., RAGHAVAN, B. & POLLARD, S. 2007. Supplier capacity analysis for a manufacturing firm with a case study. *Production Planning & Control,* Vol 18 No 6, 514-525.

GIANNAKIS, M. 2007. Performance measurement of supplier relationships. *Supply Chain Management: An International Journal,* Vol 12 No 6, 400-411.

GOLDRATT, E. M. & COX, J. 2004. *The Goal - A process of Ongoing Improvement,* Great Barrington, MA, United States of America, North River Press.

HAMMER, M. 2007. The Process Audit. *Harvard Business Review,* Vol 85 No 4, 111-123.

HINES, P., RICH, N. & ESAIN, A. 1994. Value stream mapping: A distribution industry application. *Benchmarking: An International Journal,* Vol 6 No 1, 60-77.

HOLLIER, R. H. 1980. The Grouping Concept in Manufacturing. *International Journal of Operations & Production Management,* Vol 1 No 1, 71-78.

HOPP, W. J. & SPEARMAN, M. L. 2008. *Factory physics,* Boston, McGraw-Hill Publishing.

HÖST, M., REGNELL, B. & RUNESON, P. 2006. *Att genomföra examensarbete,* Lund, Studentlitteratur.

IKEA-WEBPAGE1. *Fakta och siffror* [Online]. Available: http://www.ikea.com/ms/sv_SE/about_ikea/facts_and_figures/index.html [Accessed 02-01 2012].

IKEA-WEBPAGE2. *Hur vi är annorlunda* [Online]. Available: http://www.ikea.com/ms/sv_SE/about_ikea/the_ikea_way/index.html [Accessed 02-01 2012].

IKEA-WEBPAGE3. *Listan som aldrig tar slut* [Online]. Available: http://www.ikea.com/ms/sv_SE/the_ikea_story/people_and_the_environment/the_never_ending_list.html [Accessed 02-01 2012].

IKEAINSIDE. 2010-2011. *Competence profile Business Developer, Technician, Supply Planner* [Online]. Available: http://inside.ikea.com [Accessed 05-01 2012].

IKEALEARNINGPLATFORM. *GPS, Fulfillment, Cognos* [Online]. Available: http://iwww.learning.ikea.com [Accessed 05-01 2012].

IKEASYSTEM. 2011. Welcome inside 2011. Available: http://www.ikea.com/ms/sv_SE/pdf/yearly_summary/Welcome_inside_2011.pdf [Accessed 2012-02-01].

JONSSON, P. & MATTSON, S.-A. 2011. *Logistik - Läran om effektiva materialflöden,* Lund, Studentlitteratur.

KING, J. R. 1980. Machine-component grouping in production flow analysis: an approach using a rank order clustering algorithm. *International Journal of Production Research,* Vol 18 No 2**,** 213-232.

KING, P. L. 2011. THE BOTTLE NECK CONUNDRUM: Breaking up logjams can be key for process plant production. *Industrial Engineer: IE,* Vol 43 No 1**,** 41-46.

KOHLBACHER, M. & GRUENWALD, S. 2011. Process ownership, process performance measurement and firm performance. *International Journal of Productivity and Performance Management,* Vol 60 No 7**,** pp. 70.

KOTZAB, H., SEURING, S., MÜLLER, M. & REINER, G. 2005. *Research Methodologies in Supply Chain Management,* New York, Physica-Verlag- A Springer Company.

KOVÁCS, G. & SPENS, K. M. 2005. Abductive reasoning in logistics research. *International Journal of Physical Distribution & Logistics Management,* Vol 35 No 2**,** 132-144.

LAGUNA, M. & MARKLUND, J. 2005. *Business process modeling, simulation and design,* New Jersey, Pearson Prentice Hall.

LARSSON, E. & LJUNGBERG, A. 2001. *Processbaserad verksamhetsutveckling,* Lund, Studentlitteratur.

LINTON, J. 2007. Process Mapping and Design. *Circuits Assembly,* Vol 18 No 2**,** 26-30.

LUMSDEN, K. 2006. *Logistikens grunder,* Lund, Studentlitteratur.

MANGAN, J., LALWANI, C. & GARDNER, B. 2004. Combining quantitative and qualitative methodologies in logistics research. *International Journal of Physical Distribution & Logistics Management,* Vol 34 No 7**,** 565-578.

MATHUR, P. P. & SHAH, J. 2008. Supply chain contracts with capacity investment decision: Two-way penalties for coordination. *International journal of production economics,* Vol 114 No 1**,** 56-70.

MATTSON, S.-A. & JONSSON, P. 2003. *Produktionslogistik,* Lund, Studentlitteratur.

OKRENT, M. D. & VOKURKA, R. J. 2004. Process mapping in successful ERP implementations. *Industrial Management & Data Systems,* Vol 104 No 8**,** 637-643.

OLHAGER, J. 2000. *Produktionsekonomi,* Lund, Studentlitteratur.

OLHAGER, J., RUDBERG, M. & WIKNER, J. 2001. Long-term capacity management; Linking the perspectives from manufacturing strategy and sales operations planning. *International journal of production economics,* Vol 69 No 2**,** 215-225.

PAULSSON, U. B., MARIA 2003. *Seminarieboken - att skriva, presentera och opponera,* Lund, Studentlitteratur.

RAHMAN, S.-U. 1998. Theory of constraints - A review of the philosophy and its implications. *International Journal of Operations & Production Management,* Vol 18 No 4**,** 336-355.

ROWBOTHAM, F. 2007. *Operations management in context* Oxford, Elsevier Ltd.

SCHOLZ, R. W. 2002. *Embedded Case Study Methods - Integrating Quantitative and Qualitative Knowledge,* Zurich, SAGE Publications, Inc.
SCOR, S. C. C. *What is SCOR?* [Online]. Available: http://supply-chain.org/scor [Accessed 02-23 2012].
SULLIVAN, L. E. 2009. The SAGE glossary of the social and behavioral sciences. New York: Sage Publications, Inc.
WALLÉN, G. 1996. *Vetenskapsteori och forskningsmetodik,* Malmö, Studentlitteratur.
WANG, Y., ZHAO, Q. & ZHENG, D. 2005. Bottlenecks in production networks: An overview. *Journal of Systems Science and Systems Engineering,* Vol 14 No 3**,** 347-363.
WETTERAUER, U. & MEYR, H. 2008. *The Implementation Process - Supply Chain Management and Advanced Planning*, Springer Berlin Heidelberg.
XIA, Y., RAMACHANDRAN, K. & GURNANI, H. 2011. Sharing demand and supply risk in a supply chain. *IIE Transactions,* Vol 43 No 6**,** 451-469.

8.2 Personal interviews

Amanda Song	Supply planner, Shenzhen, China, 2012-03-27
Heidi Xie	Supply planner, Shenzhen, China, 2012-03-29
Jenny Zeng	Supply planner, Shanghai, China, 2012-04-02
Jojo Liu	Supply planner, Shanghai, China, 2012-04-02
Julie Ma	Deputy Logistics Manager, Shanghai, China, Continuous during the project
Lydia Ben	Supply planner, Shanghai, China, 2012-03-26
Paul Björnsson	Process Owner Plan and Secure Logistics, Älmhult, Sweden, Continuous during the project

8.3 E-mail and phone interview

Paul Björnsson	Process Owner Plan and Secure Logistics, Älmhult, Sweden, Continuous during the project
Tomas Francl	Need planner, IKEA of Sweden, Älmhult, Sweden, 2012-04-04
Björn Sunesson	Process Developer Plan and Secure Logistics, Älmhult, Sweden, Continuously during the project
Piotrt Andrukiewicz	Process Developer Plan and Secure Logistics, Älmhult, Sweden, Continuously during the project

Appendix A – Interview guide

The following interview guide has been used as a basis in the interviews with the Supply planners at Trading Area Greater China.

General

What are your responsibilities in your daily work?
What are you doing in your daily work?
What systems do you use in your daily work?
How do you use Supply Plan Information?

Capacity planning today

How are you working with capacity planning today?
What do you think about the capacity planning today?
Do you have a common way of working at the trading office?
Are the capacity figures in IKEAs system accurate?
    Do you trust/use them?
    If not accurate, why?

How do you know when you have a capacity problem?
    What are the symptoms?
If there is a problem with the capacity planning, why do you think?

How often is the capacity figures updated?
How is information about capacities collected today?
What do you use the capacity information for?
    Would you like to use it more/less? How in that case?
How have you worked with periods like Chinese New Year before? Have you considered that?
Do you feel like you have a good overview of your capacities?
    Where do you have too much/little capacity? If yes, why?

Do you feel like you have good knowledge about your suppliers' capacities?
Do you think IKEA has capacity issues?

What do you think about the need plan?
    Is it accurate?

Suppliers

Do you think that the suppliers have a good knowledge about their own capacities?
Do you know how your suppliers calculate their capacities? If yes, how are they doing it?
Do you think that the suppliers have a structured and good way of planning the capacities and their production?

One Supplier Capacity Planning

Is this One Supplier Capacity Planning something that you have thought about before?
Do you feel like it will improve the capacity planning?
Do you miss anything?

Is there something that could be improved?
What/How?
How do you feel about Product grouping?
Will it facilitate the work?
Do you want more or less number of groups?

Systems
How do you use GPS?
What do you use it for?
Do you use it in your daily work?
Do you use it for capacity planning?
What do you think about GPS?
Do you miss anything?

Do you use Cognos?
How?
What do you think about Cognos planning?
Do you miss anything?

Appendix B – Preparation guide to the consumption table

The following pictures were sent to the suppliers before the visit together with respective definition. The purpose of the pictures is to explain how to fill in the table and what information that is relevant.

Consumption table

- The consumption table is built up as the following example
- The coloured columns should be filled out with information
  - Excel document "Consumption table template"

	Product group 1	Product group 2	Dedicated capacity (week)	Unit	From (week)	To (week)
Resource group 1	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	
Resource group 2	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	
Resource group 3	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	

Preparation step 1

- Define the **Resource groups** and fill in the information in the first column in the consumption table.

	Product group 1	Product group 2	Dedicated capacity (week)	Unit	From (week)	To (week)
Component	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	
Assembly	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	
Packaging	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	

Preparation step 2

- Review **Product groups** (Excel document: "Product groups")
  - Try to connect the Product groups to the Resource groups

	Pg 1	**Pg 2**	Dedicated capacity (week)	Unit	From (week)	To (week)
Component	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	
Assembly	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	
Packaging	*Consumption*	*Consumption*	*Dedicated capacity*	*Unit of measurement*	*The period that the information is valid*	

Preparations step 3

- Define the **consumption** for every Product group in every Resource group
- Consumption is how much of the Resource group that is required to produce <u>one</u> unit of an article in the Product group
- The consumption can be measured in different units, e.g. hours, minutes, kg

	Pg 1	Pg 2	Dedicated capacity (week)	Unit	From (week)	To (week)
Component	**2**	**3**	*Dedicated capacity*	**Pcs**	*The period that the information is valid*	
Assembly	**5**	**0**	*Dedicated capacity*	**Minutes**	*The period that the information is valid*	
Packaging	**10**	**3**	*Dedicated capacity*	**Minutes**	*The period that the information is valid*	

Preparations step 4

- Define the **Dedicated Capacity** for each Product group in every Resource group
- The dedicated capacity is the <u>total</u> local capacity need for connected Product group/groups
- Must be in <u>the same</u> unit as the consumption

	Pg 1	Pg 2	Dedicated capacity (week)	Unit	From (week)	To (week)
Component	2	3	**2500**	Pcs	*The period that the information is valid*	
Assembly	5	0	**1500**	Minutes	*The period that the information is valid*	
Packaging	10	3	**2000**	Minutes	*The period that the information is valid*	

Preparations step 5

- Define which **periods** the information is valid
- It is important to have accurate information about e.g. seasonalities

	Pg 1	Pg 2	Dedicated capacity (week)	Unit	From (week)	To (week)
Component	2	3	2500	Pcs	**1221**	**1225**
Assembly	5	0	1500	Minutes	**1221**	**1225**
Packaging	10	3	2000	Minutes	**1221**	**1225**

PTC10009 Operational Supplier Capacity Process - ver 1.4 18 21/03/2011

Preparations step 6

- If possible send the information to the supply planner before the visit
- An example of a finished consumption table can be seen in the example below

	Pg 1	Pg 2	Dedicated capacity (week)	Unit	From (week)	To (week)
Component	**2**	**3**	**2500**	**Pcs**	**1221**	**1225**
Assembly	**5**	**0**	**1500**	**Minutes**	**1221**	**1225**
Packaging	**10**	**3**	**2000**	**Minutes**	**1221**	**1225**

Component (Pg1): 2500/2=1250
Assembly (Pg1): 1500/5=300
Packaging (Pg1): 2000/10=200

Component (Pg2): 2500/3=833
Packaging (Pg2): 2000/3=666

Limiting resource → Bottleneck

PTC10009 Operational Supplier Capacity Process - ver 1.4 19 21/03/2011

Appendix C – Capacity Calculation tool

Step 1 – Fill in the white cells, see Figure C 1.

1. Use the consumption table and put in the Product and Resource groups as well as the consumption rate into the table.
2. Register the Dedicated Capacity and the unit from the Consumption Table
3. Use the Supply Plan Information to calculate the average need for each Product group for 17 weeks outside the lead time
4. Decide how much of the net capacity that should be dedicated to IKEA and put the information into the cell.

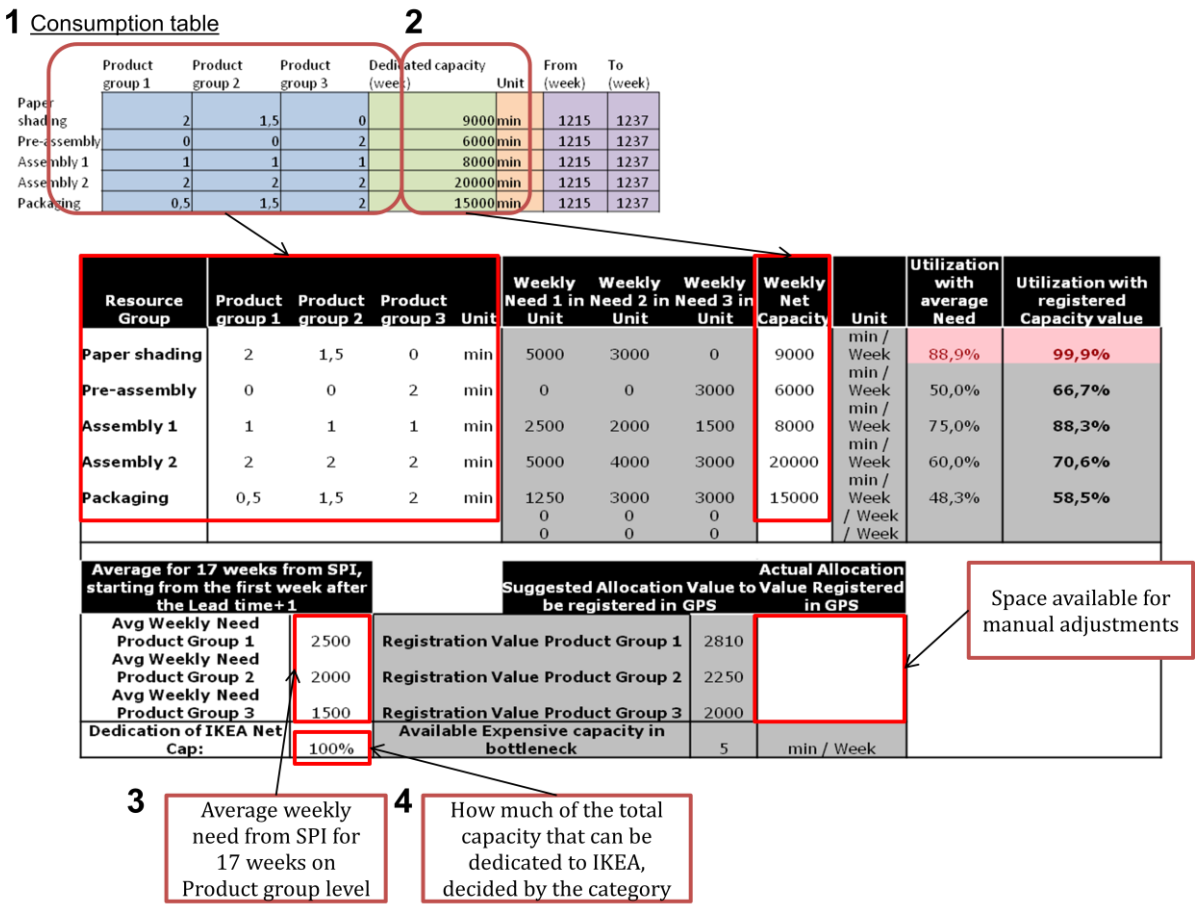

Figure C 1: A picture of the allocation tool and the boxes are columns where information must be inputted

Step 2 – Let the tool calculate the allocations, see Figure C 2.

5. The tool calculates the average need for every Resource group
6. Based on the Net Capacity, the consumption rate and the Average Need for the Product group, the utilization level in each Resource group can be calculated. The group with the highest utilization, the bottleneck, will be marked in red
7. The utilization is calculated again in order to have full utilization of the bottleneck
8. If the bottleneck not can be used 100%, there will be some Available Expensive Capacity expressed in the unit of the bottleneck
9. Based on the dedication, there will be a suggestion of the value to register

5 The average need for every Resource group

6 The utilization of every Resource group based on the average need

7 The utilization of every Resource group when the bottleneck is fully utilized

Resource Group	Product group 1	Product group 2	Product group 3	Unit	Weekly Need 1 in Unit	Weekly Need 2 in Unit	Weekly Need 3 in Unit	Weekly Net Capacity	Unit	Utilization with average Need	Utilization with registered Capacity value
Paper shading	2	1,5	0	min	5000	3000	0	9000	min / Week	88,9%	99,9%
Pre-assembly	0	0	2	min	0	0	3000	6000	min / Week	50,0%	66,7%
Assembly 1	1	1	1	min	2500	2000	1500	8000	min / Week	75,0%	88,3%
Assembly 2	2	2	2	min	5000	4000	3000	20000	min / Week	60,0%	70,6%
Packaging	0,5	1,5	2	min	1250	3000	3000	15000	min / Week	48,3%	58,5%
					0	0	0		/ Week		
					0	0	0		/ Week		

Average for 17 weeks from SPI, starting from the first week after the Lead time+1		Suggested Allocation Value to be registered in GPS		Actual Allocation Value Registered in GPS
Avg Weekly Need Product Group 1	2500	Registration Value Product Group 1	2810	
Avg Weekly Need Product Group 2	2000	Registration Value Product Group 2	2250	
Avg Weekly Need Product Group 3	1500	Registration Value Product Group 3	2000	
Dedication of IKEA Net Cap:	100%	Available Expensive capacity in bottleneck	5	min / Week

8 The amount of available expensive capacity

9 The suggested registation value based on full utilization of the bottleneck

Figure C 2: A picture of the allocation tool and the boxes show the information that the tool calculates

Appendix D – Supplier visit descriptions

Seven suppliers have been visited during this Master's thesis project. When implementing the One Supplier Capacity Process, the work followed the process shown in Figure D 1

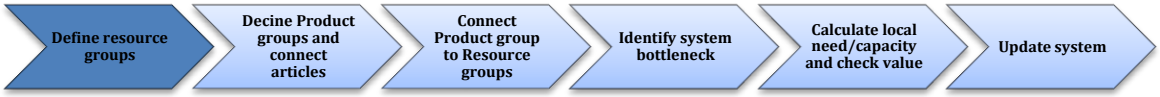

Figure D 1: The process of working with One Supplier Capacity Process

Supplier 1

Background

Supplier 1 is a company producing lighting products and has worked with IKEA since 1997. In 2008 they built a new factory which is completely dedicated to IKEA. In total, 90% of their resources are dedicated to IKEA. Today, Supplier 1 has approximately 300 people working in the company and 80% of them are direct labour, working with production. The company has got an ERP system that is specially created for them. The main focuses for the company is product development and to continuously work on improving the lead time.

Capacity planning today

Supplier 1 is currently producing 254 different articles for IKEA and they have divided them into eight capacity groups. The company is planning their production four weeks in advance but is also updating the plans continuously if the orders change. The company is trying to adapt their planning to seasonal patterns through for example frontloading.

Supplier 1 uses the Supply Plan Information to a limited extent, approximately four weeks in advance. The company is focused on having a continuous flow in the production and therefore they are working more with sales forecast and history than the need. To ensure a continuous flow in production they use a push strategy and produce to stock rather than producing based on physical orders.

Values for planned and actual need respectively capacity for week 49-8 (2011-12) is illustrated in Table D 1. There are differences between the planned and demonstrated data, both for the need and the capacity. When comparing the demonstrated capacity to the planned, the later is in most cases much higher. This could either indicate that they have unutilized and Available Expensive Capacity or that the figures in the system are wrong. However, the supplier has managed to deliver according to the most of the need, about 90 % or more. On the other hand they should have been able to deliver everything with their high planned capacity values.

Table D 1: Need and capacity data for Supplier 1 in pieces, wk 49-8 (2011-12

Capacity Group Name	Sum of PN	Sum of PC	Sum of DN	Sum of DC	Cancelled %	DC/DN %
Group 1	66 666	206 784	11 760	10 344	12%	88%
Group 2	46 798	171 360	6 230	6 360	0%	102%
Group 3	19 144	57 600	36 754	33 460	0%	91%
Group 4	137 392	561 600	50 171	44 522	3%	89%
Group 5	45 792	129 600	130 200	125 088	2%	96%
Group 6	13 116	17 280	87 144	86 146	0%	99%
Group 7	-	-	52 092	46 128	1%	89%
Group 8	-	-	297 659	308 220	0%	104%

The delivery reliability, cancellation rate and lead-time can be seen in Table D 2. The supplier's delivery reliability is around 95 %. However, there seem to have happened something in the last period when the delivery reliability is much lower than the other periods, approximately 73.77%. There seem to have been many cancellations in the first period of 2012 (201201) and this is probably connected to the Chinese New Year which takes place during this period.

Table D 2: The delivery reliability, cancellation rate and lead-time for Supplier 1, week 4-8

Data	201137	201141	201145	201149	201201	201205	Total
Delivery reliability, %	99,83	94,82	98,75	94,37	93,00	73,77	94,00
Cancellation, %	3,46	3,85	4,10	1,12	12,76	1,51	4,34
Agreed LT, days	24,64	24,25	24,09	25,27	24,22	23,66	24,44
Actual LT, days	18,34	22,44	19,65	20,92	21,66	27,33	21,37
Difference in LT (Agr-Act)	6,30	1,80	4,45	4,35	2,56	-3,67	3,07

When looking at the planned need and capacity for the coming 31 weeks, see Table D 3, the planned need is lower than the planned capacity, in average 64% of the planned capacity. This might indicate that IKEA will have some unutilized and Available Expensive Capacity.

Table D 3: The planned need and capacity for Supplier 1 in pieces, the coming 31 weeks

Capacity Group Name	Sum of PN 13-44	Sum of PC 13-44	PN/PC %
group 1	28 608	38 336	75%
group 2	26 390	38 336	69%
group 3	78 948	105 440	75%
group 4	133 170	172 576	77%
group 5	383 192	490 848	78%
group 6	245 503	412 224	60%
group 7	207 150	536 864	39%
group 8	737 100	1 783 136	41%

Observations

Supplier 1 is a company that has quite good control and understanding of their processes. They have an ERP system which is an indicator of them having some control and planning of the production. The company is able to draw a picture of their planning process as well as production process, which shows that they are well aware and interested in their way of working. The production manager does also have knowledge about where the bottlenecks are in their production process and know where to add resources if there is a need for more capacity.

One Supplier Capacity Process

Step 1 - Resource groups

Six different Resource groups have been identified at Supplier 1, see Resource groups identified at Figure D 2. The company has got two different types of assembly lines, short and long, where different products are produced. Therefore they are separated into two different Resource groups. There are also different packaging machines used in the company and they have different capacities. Therefore, the packaging machines are separated into three different Resource groups.

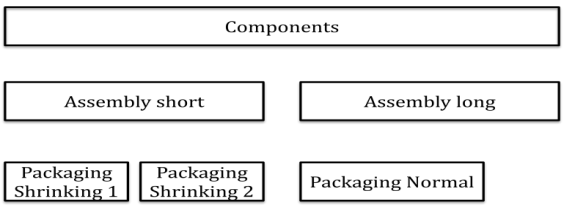

Figure D 2: Resource groups identified at Supplier 1

Step 2 - Product groups

The current grouping of the products at Supplier 1 is done in 8 different groups. The suggested number of Product groups by the category was 32. However, it was found that some of the products have the same characteristics and share the same resources. Therefore some of the groups could be merged and the number of Product groups was finally determined to 23, see Table D 4 below. Based on this grouping, there are in average 11 articles in every Product group at this supplier.

Table D 4: Product groups determined at Supplier 1

Group Nr	NEW GROUP Name	Number of articles in the group
1	BASISK pendant	12
2	GAVIK	34
3	IKEA 365+ LUNTA pend	10
4	KOPPAR	32
5	KVINTETT	8
6	MÅNLJUS table 44	8
7	SÖDER chandelier	5
8	KNUBBIG	42
9	MINUT pendant/wall	17
10	KRISTALLER chandelier	4
11	MÅNLJUS pendant 41	5
12	MINUT pendant 3	10
13	MÅNLJUS pendant 20	5
14	SÄVERN wall	4
15	MINUT floor	8
16	SMÄRT table lamp	15
17	BASISK track	5
18	SÖDER pendant	4
19	SÖDER pendant glass/flowers	5
20	SÖDER wall	7
21	SÖDER pendant pearls/flowers	4
22	SÄVERN ceiling	4
23	TOSTARP	2

Step 3 - Connect Product groups to Resource groups

The Product groups were connected to the Resource groups and four different flows were identified for the Product groups, see Figure D 3. All products are sharing the component resource but have different assembly and packaging resources.

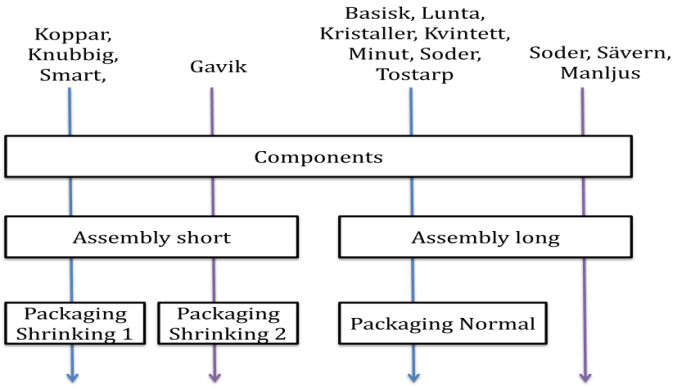

Figure D 3: The Resource groups connected to the Product groups at Supplier 1

Step 4 - Identify system bottleneck

When analysing the system, the system bottleneck was found in the component resource, which in this case was glass, see Figure D 4.

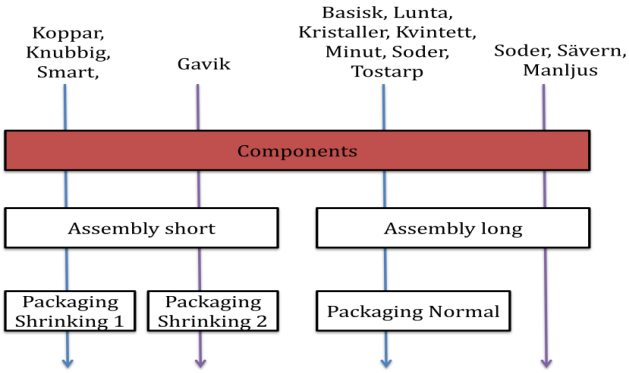

Figure D 4: The identified bottleneck at Supplier 1

Step 5 - Calculate local need/capacity and check value

The Dedicated Capacity was allocated between the Product groups based on their consumption in each resource. The updated capacities can be seen in Table D 5. The average need constitutes approximately 73% of the maximum capacity for each Product group. This means that in average, the capacity in the bottleneck will be used 73%. At the moment, there is no need for the Product group Tostarp and that is the reason for the allocated capacity being zero for this group.

Table D 5: Weekly need and the updated capacity at Supplier 1

Product group	Avg need	Allocated cap	Difference
BASISK pendant 12 & 22	4609	6278	73%
GAVIK	4955	6749	73%
IKEA 365+ LUNTA pend lmp 11 & 20	737	1003	73%
KOPPAR 20 & 22 & 23	6651	9060	73%
KVINTETT pendant & wall	1728	2353	73%
MÅNLJUS table 44	385	524	73%
SÖDER chandelier	761	1036	73%
KNUBBIG 11 & 18	27065	36868	73%
MINUT pendant 25 & downlighter & wall	2982	4062	73%
KRISTALLER chandelier	187	254	74%
MÅNLJUS pendant 41	235	320	73%
MINUT pendant 3 lamps & pendant 32	1864	2539	73%
MÅNLJUS pendant 20	70	95	74%
SÄVERN wall dbl	1158	1577	73%
MINUT floor	822	1119	73%
SMÄRT table lamp	2109	2872	73%
SÄVERN wall	701	954	73%
BASISK track	3830	5217	73%
SÖDER pendant	1885	2567	73%
SÖDER pendant glass/flowers	479	652	73%
SÖDER wall	476	648	73%
SÖDER pendant pearls/flowers	1213	1652	73%
SÄVERN ceiling	344	468	74%
Tostarp	0	0	0%

When analysing every Resource group more closely, see Table D 6, the average utilization in the assembly and packaging resources with respect to the average need is around 50%. In one of the packaging resources the utilization is even lower, about 40%, which means that there is a lot of unutilized capacity. To improve the capacity utilization, the supplier can investigate if it is possible to increase the capacity in the purchasing of components or if it is possible to adjust the capacity levels in assembly and packaging.

Table D 6: Utilization of the different Resource groups based on the average weekly need respectively allocated value for Supplier 1

Resource	Utilization (need)	Utilization (max)
Glass	73%	100%
Assembly -short line	49%	67%
Assembly -long line	51%	69%
Packaging-normal	51%	70%
Packaging-shrinking 1	63%	85%
Packaging-shrinking 2	40%	54%

When comparing the capacity figures that previously were in the system to the updated capacities, the total capacity levels for the supplier will be slightly reduced, see Figure D 5.

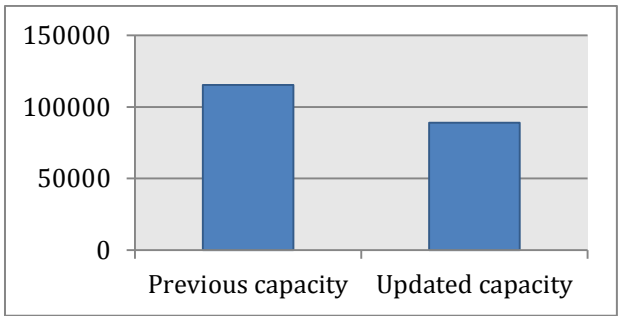

Figure D 5: Illustration of the sum of previous capacity and the sum of updated capacity at Supplier 1

Summary Supplier 1

According to the data regarding planned and demonstrated capacity earlier registered in the system, it was shown that the supplier had high capacity levels registered in the system. The supplier could not manage to deliver all the demonstrated need even though they had available capacity in the system. The updated capacities that are registered in GPS are lower than the previously registered numbers, which is in line with the analysis of the data. There is still 25% available capacity in the bottleneck resource which should be enough to cover deviations in the need and it is in line with the category's decision regarding utilization of capacity.

Supplier 2

Company information

Supplier 2 has 400 employees today and has been working with IKEA for sixteen years. The company has got three main strategy areas; LED, Plastic and Metal surface treatment. Their goals are to deliver low cost, high customer experience and high quality. IKEA's current share of the capacity in the company is approximately 85%.

Capacity planning today

When determining the capacities today, Supplier 2 is using the Supply Plan Information from IKEA and adds approximately 20%. The company experience stable orders for the popular items but more varying demand on the other items and today they have seven capacity groups. The current groups and values for planned and actual need respectively capacity for week 49-08 (2011-12) can be seen in Table D 7. By studying the data, it is clear that Supplier 2 has little problem delivering according to need. The rate DC/DN is above 100 % all cases except for one. However, when comparing their planned and demonstrated capacity they have much higher planned capacity registered in the system. The reason for the high numbers might be that they have a lot of unutilized and Available Expensive Capacity but it might also be that their capacities are not correctly defined and registered in the system.

Table D 7: Need and capacity data for Supplier 2 in pieces, wk 49-8 (2011-12)

Capacity Group Name	Sum of PN	Sum of PC	Sum of DN	Sum of DC	Cancelled %	DC/DN %
Basisk wall, Basisk spot, Grundtal	25 286	268 152	24 503	25 708	0%	105%
Format, Flygel, Fanaholm, GOTO, NON3	49 600	238 356	65 104	68 230	3%	105%
HEMMA	463 414	1 099 404	565 809	571 712	2%	101%
Lagra, NON1, NON2	228 696	643 548	183 008	190 784	0%	104%
Smila, Torsten	49 418	119 172	52 073	53 482	2%	103%
TERTIAL	72 435	238 356	98 860	103 185	1%	104%
TIDIG, STOCKHOLM, SMYG	37 656	238 356	23 290	20 016	0%	86%

Table D 8 shows the values for delivery reliability, cancellations and lead times for a four weeks period. The supplier has high delivery reliability, almost one 100%, and the cancellation rate is quite low. All figures, including the lead time, are stable.

Table D 8: The delivery reliability, cancellation rate and lead time for Supplier 2, week 4-8

Data	201137	201141	201145	201149	201201	201205	Total
Delivery Reliability, %	99,94	99,84	99,97	99,29	99,77	99,73	99,77
Cancellation, %	0,86	1,42	1,44	5,05	2,53	3,58	2,36
Agreed LT, days	24,64	24,40	24,58	25,20	26,65	26,76	25,25
Actual LT, days	20,71	20,65	19,48	21,43	21,02	22,72	20,93
Difference in LT (Agr-Act)	3,93	3,75	5,11	3,77	5,62	4,04	4,32

When studying the figures for the planned need and capacity for the coming weeks, see Table D 9, there are some things that might become a problem. In many of the cases the planned need is much higher than the planned capacity, in one case it is up to three times higher. In the long run, it will be important to consider why IKEA plans for more than they have registered in the system.

Table D 9: The planned need and capacity for Supplier 2 in pieces, the coming 31 weeks

Capacity Group Name	Sum of PN 13-44	Sum of PC 13-44	PN/PC %
Basisk wall, Basisk spot, Grundtal	81 820	178 768	46%
Format, Flygel, Fanaholm, GOTO, NON3	151 508	158 904	95%
HEMMA	2 379 157	732 936	325%
Lagra, NON1, NON2	806 380	429 032	188%
Smila, Torsten	155 240	79 448	195%
TERTIAL	336 390	158 904	212%
TIDIG, STOCKHOLM, SMYG	95 976	158 904	60%

Observations

During the visit the impression was that there was a lack of understanding regarding capacity planning. This was observed through limited knowledge regarding the new planning process. Much time was therefore spent on explaining the concept and to come to a conclusion regarding the Product and Resource groups. The supplier had a hard time understanding the purpose with the process and the language differences made the discussions difficult. Finally, the Product and Resource groups were decided. It will be important to verify the data when the consumption table is filled in by the supplier.

One Supplier Capacity Process

Step 1 - Resource groups

There were two major Resource groups identified during the supplier visit: Components and Assembly. The Components were divided into plastic, steel and glass and the Assembly were divided into normal and LED, see Figure D 6.

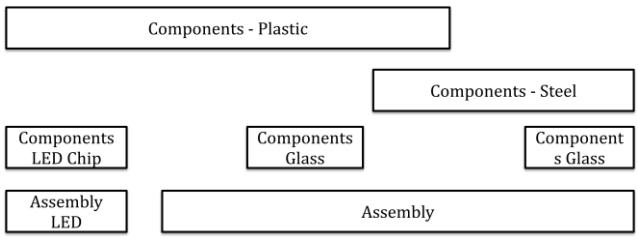

Figure D 6: Resource groups identified at Supplier 2

Step 2 - Product groups

The current grouping of the products at Supplier 2 is done in 7 groups. The suggested Product grouping from the category was 16 groups which is an increment of 8 groups. The final number of Product groups became 14 groups, which mean that there were in average 9 articles per group. See Table D 10 for the Product grouping.

Table D 10: Product groups determined at Supplier 2

Group number	Group name	Number of articles in group
1	SMILA CHD Wall & Ceil lmp	9
2	SMYG CHD wall lmp	8
3	FORMAT	12
4	GRUNDTAL	6
5	IKEA STHLM	4
6	LAGRA	16
7	TIDIG	5
8	GOTO	1
9	HEMMA	17
10	NON spot/cabinett/counttp	14
11	TERTIAL	22
12	BASISK wall spot	15
13	LEDBERG	1
14	NON LED	1

Step 3 - Connect product groups to resource groups

The Product groups were connected to the Resource groups through using the information in the consumption table, see Figure D 7. There were six different flows identified with one related to LED production.

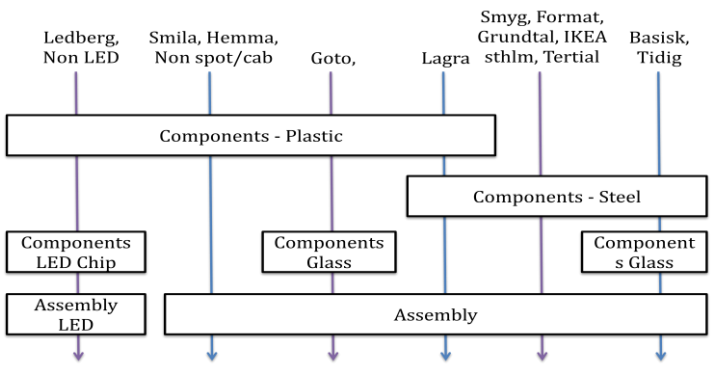

Figure D 7: The Resource groups connected to the Product groups at Supplier 2

Step 4 - Identify system bottleneck

When analysing the system, the bottleneck were found in the different component Resource groups. Depending on the Product groups, the bottlenecks were found in plastic, LED chip, glass and steel components, see Figure D 8.

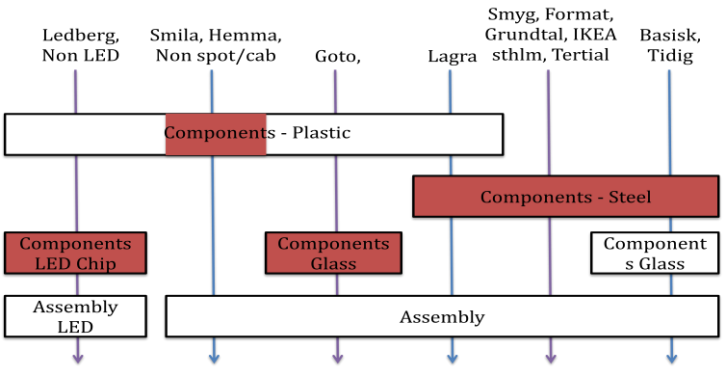

Figure D 8: The identified bottlenecks at Supplier 2

Step 5 - Calculate local need/capacity and check value

The Dedicated Capacity was allocated between the Product groups based on their consumption in each resource. The updated capacities can be seen in Table D 11. The utilization of the resources based on the need is varying for the different Product groups. The reason for this is connected to the different flows and bottlenecks in the system. The need for some of the Product groups covers almost 70% of the allocated capacity. At the same time, there are Product groups that only utilize their bottleneck resource by approximately 30%. For the groups with lower utilization it is important to consider if it really is necessary to have such big amount of dedicated capacity.

Table D 11: Weekly need and the updated capacity at Supplier 2

Product group	Avg need	Allocated cap	Difference
SMILA CHD Wall & Ceil lmp	5059	19280	26%
SMYG CHD wall lmp	1578	2289	69%
FORMAT	2271	3295	69%
GRUNDTAL	793	1150	69%
IKEA STHLM	1343	1948	69%
LAGRA	23370	33910	69%
TIDIG	3806	5522	69%
GOTO	3148	11996	26%
HEMMA	67856	258618	26%
NON spot/cabinet/counttp	3328	12682	26%
TERTIAL	13342	19359	69%
BASISK wall spot	4732	6866	69%
LEDBERG	6783	13761	49%
NON LED	4258	8638	49%

When analysing the Resource groups more closely, it can be seen that the utilization of the groups vary, see Table D 12. Based on the need, the component resources are utilized between 37% and 69%. The utilization in the two assembly lines based on the need is low, between 20% and 60%. According to the Supply planner, the reason for the low utilization in the LED line is that the supplier has invested in new technology, which has increased their capacity. At the same time, the need is not as high as they have expected and it has therefore resulted in low utilization. When utilizing the bottlenecks at their maximum, the utilization in the Assembly LED is still below 50%.

Table D 12: Utilization of the different Resource groups based on the average weekly need respectively allocated value for Supplier 2

Resource	Utilization (need)	Utilization (max)
Component /plastic	37%	72%
Component / steel	69%	100%
Component / glass	54%	82%
Component / led chip	49%	100%
Assembly (Normal)	58%	100%
Assembly LED)	21%	43%

When studying the aggregated capacity levels for Supplier 1 before and after the update of the capacity information, it can be seen that the total capacity has increased. The new total capacity is almost double as much as the previous registered capacity, see Figure D 9.

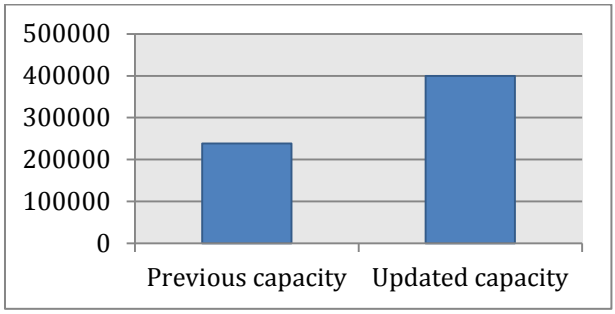

Figure D 9: Illustration of the sum of previous capacity and the sum of updated capacity at Supplier 2

Summary Supplier 2

Supplier 2 had more capacity available than previously registered in the system. This finding is in line with the data analysis done regarding performance and capacity value where there were signs of the supplier having some available capacity since they had very good performance. The bottleneck for the supplier was proven to be in the Components and for all Product groups and this information can be valuable in the tactical planning perspective.

Supplier 3

Company information

Supplier 3 has approximately 500 employees and produces different lamps and lamp shades. The company is for example working with metal, textile, paper and assembly. The company is dedicated to IKEA by 95%.

Capacity planning today

The company is basing their capacity planning on Supply Plan Information from IKEA today, but the planning is depending on the type of orders and products. Today the company thinks that they have some overcapacity in their production facility. One example is the painting machine, which is automated, and only is used two days a week. They base their capacity calculations on the need given from IKEA and add additionally 30%. They consider it quite easy to adjust their capacity through the workers having flexible working hours, from six to ten hours per day. They can also increase the number of shifts if needed. The company has a quite clear picture of where their bottleneck is located and it is probably in the shading production since that process requires manual work. Another bottleneck that was mentioned was the base of the lamp. This part is outsourced which makes it harder for the supplier to control, especially for products with

low forecasts. A possible future bottleneck for the company may be the new environmental friendly components that will be used in lighting products, since it takes time to adapt the production to these and to secure the quality of the components.

Table D 13: Need and capacity data for Supplier 3 in pieces, wk 49-8 (2011-12)shows the figures that IKEA has registered in the system regarding the need and capacities at Supplier 3. Both planned and demonstrated data for week 49-8 (2011-12) is included in the table. By just comparing the planned capacity to the planned need it seems like that the supplier should have no problem delivering according to the need. However, when studying the last column, DC/DN, it seem like they in most cases deliver below 90% of the need. On the other hand, there is a great difference between the demonstrated and planned need where it has increased a lot, doubled or tripled in some cases. Finally, when comparing the planned and demonstrated capacities the demonstrated capacities are not reflecting the planned. In some cases the numbers are much lower and in some cases they are a bit higher.

Table D 13: Need and capacity data for Supplier 3 in pieces, wk 49-8 (2011-12)

Capacity Group Name	Sum of PN	Sum of PC	Sum of DN	Sum of DC	Cancelled %	DC/DN %
Januari	50 536	75 112	57 197	48 640	0%	85%
Basisk	29 276	35 302	51 025	46 464	1%	91%
Dudero	34 240	90 134	56 986	48 360	3%	85%
Holmo	105 032	75 112	168 886	148 656	3%	88%
Lyrik	13 446	14 304	70 662	66 522	0%	94%
Rutbo	23 952	33 050	42 782	36 230	5%	85%
Sore	80 388	122 748	84 490	95 112	3%	113%
Spoka	158 307	172 754	173 947	162 048	0%	93%
Vate	123 844	213 312	217 915	185 574	12%	85%
Vate table/floor	3 953	7 508	4 988	5 048	0%	101%

When studying the figures for the delivery reliability and the cancellation rate, see Table D 14: The delivery reliability, cancellation rate and lead time for Supplier 3, week 4-8. The supplier has a delivery reliability which is about 90% and a quite high cancellation rate. The lead time is also varying between the different periods.

Table D 14: The delivery reliability, cancellation rate and lead time for Supplier 3, week 4-8

Data	201137	201141	201145	201149	201201	201205	Total
Delivery reliability, %	96,13	95,66	89,76	87,11	82,26	90,94	90,14
Cancellation, %	4,14	6,41	14,44	1,44	3,39	3,90	5,74
Agreed LT, days	22,75	22,89	23,33	24,46	25,71	23,57	23,78
Actual LT, days	18,42	19,58	21,86	23,54	29,11	22,83	22,37
Difference in LT (Agr-Act)	4,33	3,31	1,46	0,92	-3,40	0,74	1,41

The figures for the planned need and capacity the coming 31 weeks can be seen in Table D 15: The planned need and capacity for Supplier 3 in pieces, the coming 31 weeks. The planned need is lower than the planned capacity and the rate between them has an average of 65% which is relatively low. Therefore, there might be some utilized and Available Expensive Capacity at this supplier.

Table D 15: The planned need and capacity for Supplier 3 in pieces, the coming 31 weeks

Capacity Group Name	Sum of PN 13-44	Sum of PC 13-44	PN/PC %
Januari	152 088	318 240	48%
Basisk	106 060	159 136	67%
Dudero	75 780	159 136	48%
Holmo	445 968	477 376	93%
Lyrik	142 914	190 944	75%
Rutbo	108 944	159 136	68%
Sore	327 406	381 888	86%
Spoka	611 216	916 576	67%
Vate	498 736	700 160	71%
Vate table/floor	13 542	47 744	28%

Observations

The supplier is well aware of their production process. They can identify which are the most common bottlenecks in their production and what the reason is for that. During the supplier visit it was possible to identify the Resource groups, but it was very hard to explain the difference between consumption, Dedicated Capacity and Allocated Capacity to the supplier. The supplier wanted to talk about the allocation rather than the dedication.

One Supplier Capacity Process

Step 1 - Resource groups

The major Resource groups first identified were components, paper shading, assembly and packaging. The shading production is highly dependent on tools for the different sizes of the shades. Some of the product sizes have few tools which may limit the production. To reflect the true capacity, it was therefore decided to have an extra Resource group called tooling for every Product group using the shading resource, see Figure D 10: Resource groups identified at Supplier 3.

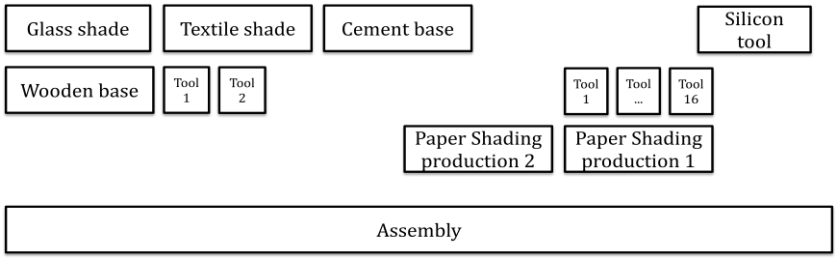

Figure D 10: Resource groups identified at Supplier 3

Step 2 - Product groups

There are currently 10 groups of products at Supplier 3 and the suggested new number of Product groups was 16. During the visit, more Resource groups than expected needed to be created because of the limitation of the tools in the shading production and some of the Product groups had therefore to be split. The final suggestion was that there should be 27 Product groups which mean that there are in average 7 articles in each Product group at this supplier, see Table D 16.

Table D 16: Product groups determined at Supplier 3

Group number	Group name	Number of articles in group
1	Basisk UP	14
2	Basisk 40	6
3	Januari	12
4	Rutbo 114	8
5	Rutbo 160	8
6	Rutbo 50	4
7	Rutbo 33	6
8	Holmo	8
9	Dudero	8
10	Morup	0
11	Vate 32	2
12	Vate 46	2
13	Vate 55	2
14	Vate 38	5
15	Vate 72	5
16	Vate 26	8
17	Vate 30	8
18	Vate 93	8
19	Vate 54	8
20	Vate Floor	8
21	Sore 164	8
22	Sore 100	8
23	Sore Pendant	2
24	Lyrik Floor	7
25	Lyrik Table	7
26	Lyrik Pendant	4
27	Spoke	14

Step 3 - Connect product groups to resource groups

The Product groups were connected to the Resource groups through using the consumption table given by the supplier, see Figure D 11. There are 23 different flows identified at this supplier and that is mostly connected to the need for different tooling in the paper shading production. There are several Product groups sharing the same flow, for example the Product groups Basisk.

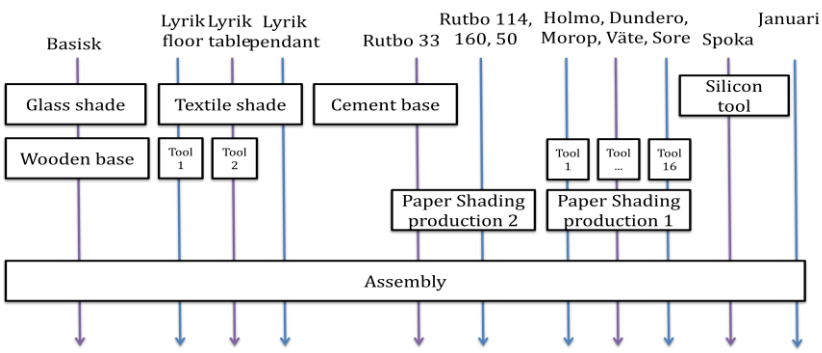

Figure D 11: The Resource groups connected to the Product groups at Supplier 3

Step 4 - Identify system bottleneck

There was no common bottleneck at Supplier 3. Bottlenecks were found in assembly, textile shading and in the tools, see Figure D 12.

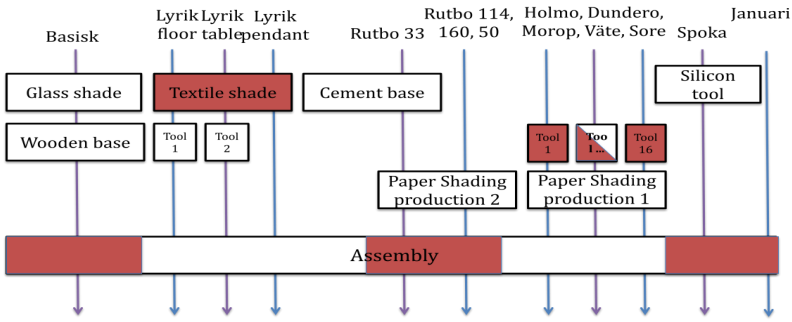

Figure D 12: The identified bottlenecks at Supplier 3

Step 5 - Calculate local need/capacity and check value

The allocated capacities based on the average weekly need and on the bottleneck resource were calculated and the capacities to be registered in GPS can be seen in Table D 17. The rate between the weekly need and the registered capacity is varying between the different Product groups since they have different bottlenecks but it is approximately between 60% and 80%. For three of the product groups, which have their bottleneck in the tooling, the need is higher than the allocated capacity. According to the responsible Supply Planner, the reason is related to the products being relatively new. The production rate of this product will be increased continuously and the capacity will therefore increase in the soon future. The Product group Morup is a new product that still does not have a need and therefore it has not got any allocated capacity.

Table D 17: Weekly need and the updated capacity at Supplier 3

When studying the utilization in the different Resource groups, the utilization varies a lot between them, see Table D 18. The utilization with respect to the need in the assembly, which is shared by all Product groups, is 77%. However, the utilization for some of the tools is extremely low, 5% respectively 8% in two cases.

Table D 18: Utilization of the different Resource groups based on the average weekly need respectively allocated value at Supplier 3

Resource	Utilization (need)	Utilization (max)
Glass Shade	20%	32%
Wooden Base	46%	74%
Paper shade Tooling 1	113%	100%
Paper shade Tooling 2	61%	97%
Paper shade Tooling 3	0%	0%
Paper shade Tooling 4	18%	29%
Paper shade Tooling 5	77%	99%
Paper shade Tooling 6	64%	102%
Paper shade Tooling 7	28%	44%
Paper shade Tooling 8	51%	81%
Paper shade Tooling 9	29%	46%
Paper shade Tooling 10	8%	12%
Paper shade Tooling 11	26%	41%
Paper shade Tooling 12	5%	8%
Paper shade Tooling 13	24%	38%
Paper shade Tooling 14	56%	88%
Paper shade Tooling 15	167%	100%
Paper shade Tooling 16	117%	100%
Paper shade Producing 1	75%	86%
Paper shade Producing 2	53%	84%
Textile Shade	88%	100%
Casting Base Tooling 1	26%	30%
Casting Base Tooling 2	59%	67%
Cement Base	44%	70%
Silicon Tooling	74%	96%
Assembly	77%	100%

The updated capacity information will be a little bit lower than the previous one, see Figure D 13.

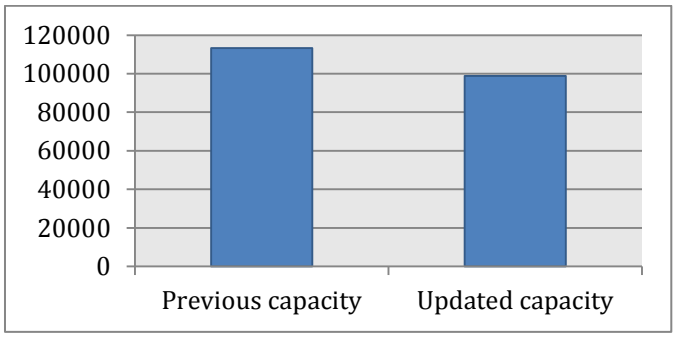

Figure D 13: Illustration of the sum of previous capacity and the sum of updated capacity at Supplier 3

Summary Supplier 3

When studying the data of the performance for Supplier 3, it could be concluded that the supplier have had some delivery problems. They have not been able to fulfil the need in all cases and the delivery reliability has not been as good as expected. It could also be seen that the lead times were a little bit unstable and this indicated that there might was too much capacity registered in the system. When calculating the new allocated capacities, it could be concluded that the aggregated capacity level for the supplier was slightly reduced. This was in line with the previous observations and the updated capacity levels will hopefully reflect the reality more.

The supplier's impression was that the system bottleneck was in the paper shading production. Some of the Product groups had its bottleneck in the tooling related to the paper shading production but not in the paper shading production.

Supplier 4

Company information

Supplier 4 was founded in 1991 and is an electronic company producing different types of sockets and cables. They have 2 300 employees and in 2010 their sales was approximately 130 000 000 USD. The sockets constitute 45% of the total sales, which makes it the biggest part of the company. IKEA is one of the largest customers to the company and represent 9% of their sales. In 2004, a workshop dedicated only for IKEA was built and today they have 6 workshops for assembly and production for IKEA alone.

The supplier has a factory of 7 000 m^2 with 78 assembly lines and claims that they have capacity to produce 54 000 000 pieces. The annual capacity dedicated to IKEA is supposed to be approximately 6 000 000 pieces.

Capacity planning today

Today, the supplier is basing their capacity calculations on the Supply Plan Information given by IKEA. The supplier is well aware of their capacity in terms of the possible output from the production facility. However, some insecurity regarding the numbers was visible when asking them additional questions during the visit.

The relationship between the demonstrated capacity and need is relatively low, see Table D 19. It might indicate that they have had some problems delivering according to the need. However, when discussing the figures with the Supply planner it seems like they have not had any major delivery problems and that they are performing well. When studying the data more closely, the supplier seems to have high planned capacities registered in the system today compared to the demonstrated capacities. In this case there might be much Available Expensive Capacity or too high figures registered in the system.

Table D 19: Need and capacity data for Supplier 4 in pieces, wk 49-8 (2011-12)

Capacity Group Name	Sum of PN	Sum of PC	Sum of DN	Sum of DC	Cancelled %	DC/DN %
Ext. cord	34 880	76 164	24 343	19 160	0%	79%
Sockets and Adapters	356 948	1 071 084	598 123	469 028	1%	78%

Table D 20 illustrates the delivery reliability, cancellation rate and the lead-time for the supplier. The supplier's delivery reliability is quite good, around and above 90%. However, there was a dip in the first period of 2012 (201201) where the delivery reliability was only 84, 65%. The cancellation rate and the lead time are also varying.

Table D 20: The delivery reliability, cancellation rate and lead time for Supplier 4, week 4-8

Data	201137	201141	201145	201149	201201	201205	Total
Delivery reliability, %	93,12	97,68	98,19	96,62	84,65	99,54	96,07
Cancellation, %	7,99	13,83	4,69	1,04	0,00	2,83	6,70
Agreed LT, days	24,69	24,14	23,86	22,96	22,72	25,36	24,01
Actual LT, days	19,61	18,22	15,32	14,08	24,58	15,93	17,33
Difference in LT (Agr-Act)	5,08	5,92	8,55	8,88	-1,86	9,43	6,69

The rate between the planned need and capacity for the coming 31 weeks can be seen in Table D 21. The planned need covers approximately 75% of the planned capacity. Depending on the variation in the demand it can be judged if there is some Available Expensive Capacity at the supplier.

Table D 21: The planned need and capacity for Supplier 4 in pieces, the coming 31 weeks

Capacity Group Name	Sum of PN 13-44	Sum of PC 13-44	PN/PC %
Ext. cord	150 200	203 104	74%
Sockets and Adapters	2 146 148	2 856 224	75%

Observations

When visiting the supplier, the impression was that they might have available capacity. They had assembly lines not running which they could start up and then add more capacity. Their assembly is labour intensive but they have thoughts about investing in more machinery and making the production more automatic.

One Supplier Capacity Process

Step 1 - Resource groups

Two Resource groups were identified at Supplier 4; Pre-assembly and Assembly, see Figure D 14. The packaging of the Product groups was included in the assembly lines since the packaging was a physical part of the assembly line. There was some discussion whether to include components or not. Since the supplier did not think that components ever would be a bottleneck it was decided to exclude them.

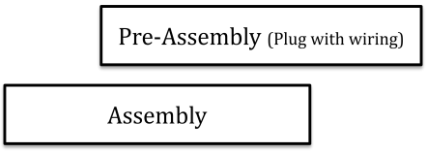

Figure D 14: Resource groups identified at Supplier 4

Step 2 - Product groups

At Supplier 4 there are currently 2 groups of products and the same groups were suggested by the category for the Product groups. It was decided that it was important to take the switch on the sockets into consideration as well as the size when doing the grouping because these characteristics created differences in the production process. This resulted in 4 different Product groups, see Table D 22. In average there will be 6, 5 articles in each Product group at this supplier.

Table D 22: Product groups determined at Supplier 4

Group number	Group name	Number of articles in group
1	Sockets (with switch)	7
2	Sockets (without switch)	5
3	Ext. cord	8
4	Adaptor	6

Step 3 - Connect Product groups to Resource groups

The Product groups were connected to the Resource groups according to the consumption table, see Figure D 15. There were four different flows in the production facility sharing the two Resource groups identified.

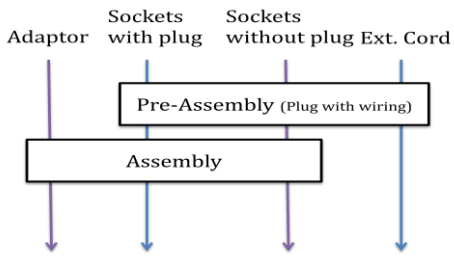

Figure D 15: The Resource groups connected to the Product groups at Supplier 4

Step 4 - Identify system bottleneck

The system bottleneck for Supplier 4 was the Pre-Assembly resource, see Figure D 16. However, one of the Product groups, the Adaptor, does not use the system bottleneck, which means that this Product group has its bottleneck in another resource. Since it only uses the Assembly this will be the bottleneck for this Product group.

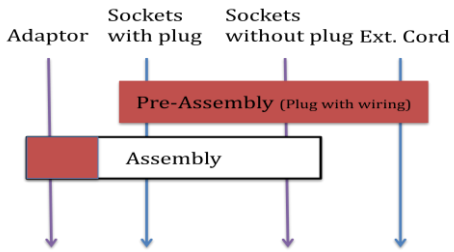

Figure D 16: The identified bottlenecks at Supplier 4

Step 5 - Calculate local need/capacity and check value

Based on the need for the coming period and the information from the consumption table the capacity was allocated between the different Product groups. Based on the average need, the capacity utilization was 75% for three of the four Product groups, see Table D 23. The utilization of the capacity allocated to the adaptor was only 12%.

Table D 23: Weekly need and the updated capacity at Supplier 4

Product group	Avg need	Allocated cap	Difference
Sockets (without switch)	36572	49018	75%
Sockets (with switch)	18526	24831	75%
Ext. cord	12433	16664	75%
Adaptor	6042	48800	12%

The utilization of the bottleneck is 75% and the utilization for the other assembly line is 62%, see Table D 24. The utilization in the most common bottleneck is almost within the scope that is agreed on by the category.

Table D 24: Utilization of the different Resource groups based on the average weekly need respectively allocated value at Supplier 4

Resource	Utilization (need)	Utilization (max)
Pre Assembly	75%	100%
Assembly	62%	100%

When comparing the previous total capacity at Supplier 4 to the new total capacity it is increased by approximately 30%, see Figure D 17. The new calculated capacity is slightly higher on a yearly basis compared to the capacity that the supplier claimed that they had available for IKEA.

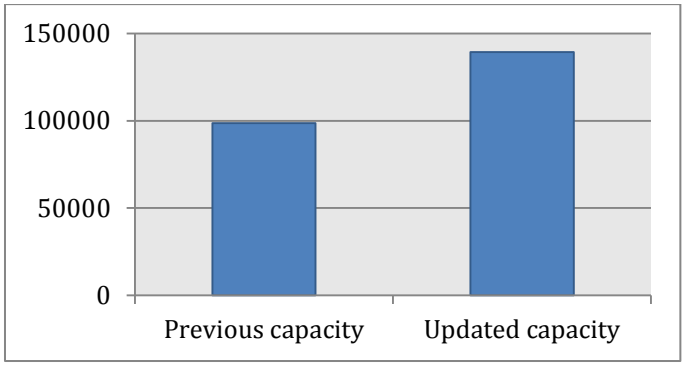

Figure D 17: Illustration of the sum of previous registered capacity and the sum of updated capacity at Supplier 4

Summary Supplier 4

The conclusion from studying the data of the previous performance of Supplier 4 it was seen that the supplier had high capacities registered in the system but could not always reach them. There were also some signs of the supplier having some Available Expensive Capacity in their production related to IKEA. The new total capacity registered in the system is higher than the previous total registered capacity and there is some unutilized capacity in the Resource groups.

Supplier 5

Company information

Supplier 5 was established in 2011 and is originating from another IKEA supplier. The separation was done in order to separate normal- and free range products. The supplier delivers exclusively for IKEA and its main business is LED lighting. Their workforce consists of 750 people. The company is currently renting a factory building but will, during this year, move to a new plant of 80 000 m^2. The supplier claims that they have a max capacity of 10 million pieces per year and their annual turnover is 30 million EUR. The supplier is mostly focusing on assembly but do also have some plastic production. The supplier is trying to optimize their production through introducing lean production and automation in their new production facility.

Capacity planning today

The supplier is currently basing their production plans on the Supply Plan Information from IKEA when planning the production. Today, the supplier has eight week planning horizon. The planned capacity is in many cases much higher than the demonstrated capacity, but the

demonstrated capacity is in most cases higher than the demonstrated need, see Table D 25. The supplier expresses that they do not have any need for planning since they have overcapacity.

Table D 25: Need and capacity data for Supplier 5 in pieces, wk 49-8 (2011-12)

Capacity Group Name	Sum of PN	Sum of PC	Sum of DN	Sum of DC	Cancelled %	DC/DN %
Haggas	6 696	19 848	6 590	6 048	5%	92%
IKEA PS 2012 floor	10	9 924	720	720	0%	100%
IKEA PS Maskros	-	-	9 810	11 160	0%	114%
Jansjo clmp	662 820	99 244	629 988	652 200	1%	104%
Jansjo floor	12 096	89 320	31 098	31 584	0%	102%
Jansjo work	-	-	216 426	234 144	0%	108%
Maskros	51 436	79 396	67 435	71 610	0%	106%
Onsjo	8 064	26 796	9 745	6 608	23%	68%
Solkullen	10 968	29 772	10 416	8 160	18%	78%
Stranne floor	21 058	22 828	6 158	7 532	0%	122%
Stranne table	-	-	14 543	14 672	0%	101%
Tived ceiling spot	32 460	148 868	2 736	3 816	0%	139%
Tived floor	-	-	3 080	3 472	0%	113%
Tived floor/read	-	-	8 512	8 512	0%	100%
Tived table	-	-	3 720	3 660	0%	98%
Tived wall/clmp	-	-	7 297	8 064	0%	111%
Tived work lamp	-	-	12 095	12 096	0%	100%

When studying the delivery reliability, cancellation rate and the lead time further, it also indicates that the supplier is performing well since they have a delivery reliability rate of almost 99%, see Table D 26. The actual lead time is also shorter than the agreed lead time and seems to be stable which also indicates that the supplier can deliver as promised.

Table D 26: The delivery reliability, cancellation rate and lead time for Supplier 5, week 4-8

Data	201137	201141	201145	201149	201201	201205	Total
Delivery reliability, %	98,03	97,48	98,66	99,43	99,95	97,40	98,44
Cancellation, %	3,69	1,70	0,51	0,00	3,72	3,84	1,94
Agreed LT, days	21,33	21,06	21,22	21,00	21,38	20,90	21,15
Actual LT, days	18,62	18,28	17,50	17,63	17,88	18,98	18,09
Difference in LT (Agr-Act)	2,70	2,79	3,72	3,36	3,50	1,92	3,06

The relationship between the planned need and the planned capacity for the coming 31 weeks is very different depending on the product, see Table D 27. For some of the products the planned need is much higher than the planned capacity and for other products there is almost no need and much planned capacity.

Table D 27: The planned need and capacity for Supplier 5 in pieces, the coming 31 weeks

Capacity Group Name	Sum of PN 13-44	Sum of PC 13-44	PN/PC %
Haggas	38 772	62 784	62%
IKEA PS 2012 floor	190	31 392	1%
IKEA PS Maskros	30 204	94 176	32%
Jansjo clmp	1 096 080	313 952	349%
Jansjo floor	43 296	282 560	15%
Jansjo work	467 640	1 255 840	37%
Maskros	73 521	251 168	29%
Onsjo	47 376	84 768	56%
Solkullen	36 788	94 176	39%
Stranne floor	36 908	72 224	51%
Stranne table	51 368	94 176	55%
Tived ceiling spot	15 552	470 944	3%
Tived floor	13 104	15 712	83%
Tived floor/read	29 008	25 120	115%
Tived table	4 380	15 712	28%
Tived wall/clmp	22 656	37 664	60%
Tived work lamp	31 392	47 104	67%

Observations

The supplier seems to work in a structured way and has good knowledge and understanding of production planning and of the concept. They are interested in improving their production and they mentioned that they were going to try to implement a lean way of thinking when moving to the new plant by for example reducing transportation and waiting times. The supplier expresses that they have a lot of overcapacity and that is also shown during the factory tour through for example much unused space.

One Supplier Capacity Process

Step 1 - Resource groups

The main Resource groups at Supplier 5 were plastic injection, assembly and packaging. It was discussed whether to include components and raw material as well but these were not seen as a problem in the production and therefore it was decided to exclude them. The plastic injection was finally divided into two different Resource groups. The final Resource groups can be seen in Figure D 18.

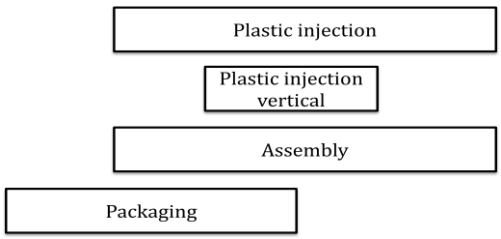

Figure D 18: Resource groups identified at Supplier 5

Step 2 - Product groups

The current number of capacity groups at Supplier 5 is 18 groups. The suggested grouping was agreed upon and no changes were needed, see Table D 28. The average number of articles per group became 7,8.

Table D 28: Product groups determined at Supplier 5

Group number	Group name	Number of articles in group
1	IKEA PS 2012 floor	7
2	Haggas	5
3	IKEA PS Maskros	5
4	Jansjo clmp	35
5	Jansjo floor/read	14
6	Jansjo work	14
7	Maskros	5
8	Niptid	3
9	Onsjo	5
10	Solkullen	5
11	Stranne floor	7
12	Stranne table	7
13	Tived ceiling spot	4
14	Tived floor	5
15	Tived floor/read	5
16	Tived table	5
17	Tived wall/clmp	5
18	Tived work lamp	5

Step 3 - Connect product groups to resource groups

By using the consumption table, the Product groups were connected to the Resource groups, see Figure D 19. The Production connected to IKEA consists of five different flows and all the flows except from one use the plastic injection and the assembly resource. One of the Product groups is semi-finished and therefore only goes through the Packaging resource.

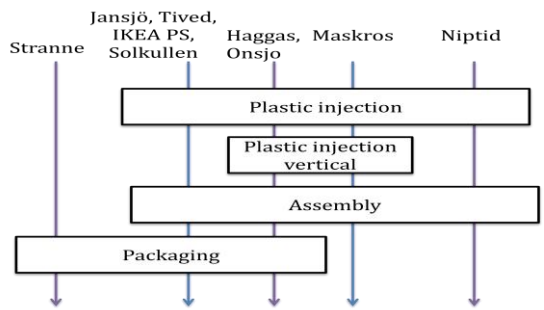

Figure D 19: The Resource groups connected to the Product groups at Supplier 5

Step 4 - Identify system bottleneck

When conducting the bottleneck analysis, the Plastic injection was identified as the system bottleneck and also the bottleneck for most of the Product groups, see Figure D 20. This means that the bottleneck type is most likely connected to machinery. To have the bottleneck in machinery is not very surprising since machinery is expensive and therefore it is important to optimize its utilization. For the semi-finished Product group Stranne the bottleneck was identified in the packaging since this is the only Resource group used by the group.

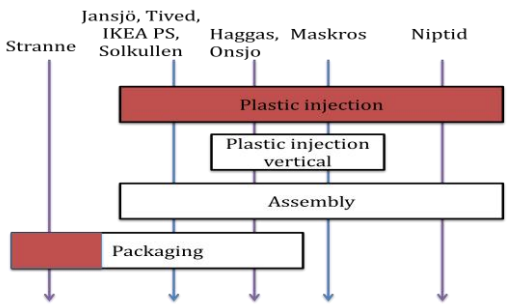

Figure D 20: The identified bottlenecks at Supplier 5

Step 5 - Calculate local need/capacity and check value

Based on the need and the bottleneck for each Product group, the capacity was allocated and the result can be seen in Table D 29. The utilization of the updated capacity with respect to the need is approximately 73%. For the Product groups only using the Packaging, the utilization is only 8%, which is very low.

Table D 29: Weekly need and the updated capacity at Supplier 5

Product group	Avg need	Allocated cap	Difference
Jansjo clmp	28481	38941	73%
Jansjo work	16469	22517	73%
Jansjo floor/read	1509	2063	73%
Tived table	152	207	73%
Tivede wall/clmp	510	697	73%
Tived work lamp	810	1107	73%
Tived floor	504	689	73%
Tived floor/read	840	1148	73%
Tived ceiling spot	509	695	73%
Haggas	1978	2704	73%
IKEA PS Maskros	893	1221	73%
IKEA PS 2012 floor	41	55	74%
Maskros	3917	5355	73%
Onsjo	1596	2182	73%
Solkullen	281	384	73%
Stranne table	1633	21421	8%
Stranne floor	1396	18310	8%
Niptid	0	0	0%
Sunnan	6302	8616	73%

The utilization in the different Resource group can be seen in Table D 30. As mentioned before the utilization in the injection, which is the system bottleneck, with respect to the need is 73%. The other Plastic injection machine has not as high utilization since it is not used by as many Product groups. The utilization in Assembly, which is used by all Product groups except from Stranne has a utilization of only 55% with respect to the need.

Table D 30: Utilization of the different Resource groups based on the average weekly need respectively allocated value at Supplier 5

Resource	Utilization (need)	Utilization (max)
Injection	73%	100%
Injection [Vertical]	39%	53%
Assembly	55%	76%
Packaging	33%	100%

When comparing the updated capacity that will be registered in the system to the previous registered capacity will increase by approximately 20%, see Figure D 21.

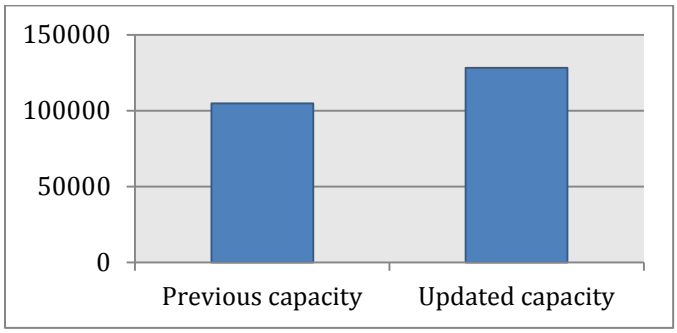

Figure D 21: Illustration of the sum of the previous registered capacity and the sum of updated capacity at Supplier 5

Summary Supplier 5

It was not surprising to find the bottleneck in the Injection resource since it is most likely the most expensive resource and it is therefore desirable to have a good utilization of it. However, there seemed to be a low utilization of the assembly resource.

Supplier 6

Company information

Supplier 6 has been a supplier to IKEA since 1997 but the company has other customers as well. They have approximately 450 workers and 300 of them work with assembly. They have one factory of 12 000 m² completely dedicated to IKEA. There are 9 regular assembly lines and 3 LED assembly lines in the factory dedicated to IKEA. In addition to assembly and packaging the supplier also has metal production and in-house metal processing equipment. The supplier has approximately 80 % metal processing and 20% electronic production. The supplier claims that they have a capacity of 50 000 pieces per week in the IKEA factory.

Capacity planning today

Today, the supplier is calculating their capacity based on their bottleneck value. They experience problems with much free capacity. When comparing the figures for planned and demonstrated capacity it is clear that the value for planned capacity is much higher than the demonstrated and the rate between the demonstrated capacity and need is varying, see Table D 31.

Table D 31: Need and capacity data for Supplier 6 in pieces, wk 49-8 (2011-12)

Capacity Group Name	Sum of PN	Sum of PC	Sum of DN	Sum of DC	Cancelled %	DC/DN %
Tisdag	3 888	32 304	3 360	4 512	0%	134%
Antifoni	41 081	103 296	45 068	40 700	3%	90%
Fuga NN	4 074	78 072	61 477	57 750	0%	94%
IKEA 365+	7 104	9 072	7 097	5 846	0%	82%
IKEA PS 2012 Pend	0	11 388	368	368	0%	100%
Klor pend	0	19 404	8 120	7 680	0%	95%
Kryssbo	16 244	37 920	18 212	14 788	0%	81%
Leding N nickel	7 989	204 960	185 929	173 720	0%	93%
Skepp chrome	15 876	25 920	15 956	10 584	0%	66%
STOCKHOLM	2 628	10 800	2 327	2 124	0%	91%
Tidig	11 320	20 040	20 137	9 000	34%	45%

The delivery reliability for the supplier is around 99% and the cancellation rate is low, see Table D 32. The lead time is relatively stable in terms of it being shorter than the agreed lead time. According to these numbers it seems that the supplier performs well.

Table D 32: The delivery reliability, cancellation rate and lead time for Supplier 6, week 4-8

Data	201137	201141	201145	201149	201201	201205	Total
Delivery reliability, %	98,51	100,00	99,80	99,33	98,41	99,73	99,28
Cancellation, %	0,74	0,00	0,23	12,69	0,00	1,00	1,90
Agreed LT, days	23,38	24,43	22,78	22,38	22,64	23,00	23,26
Actual LT, days	19,92	16,93	16,88	13,88	16,06	19,15	17,27
Difference in LT (Agr-Act)	3,46	7,50	5,90	8,50	6,58	3,85	5,99

The planned need and capacity for the coming 31 weeks can be seen in Table D 33. The planned capacity is relatively high in comparison with the planned need with an average of 64% but the number is very dependent on the type of product.

Table D 33: The planned need and capacity for Supplier 6 in pieces, the coming 31 weeks

Capacity Group Name	Sum of PN 13-44	Sum of PC 13-44	PN/PC %
Tisdag	96 752	245 024	39%
Antifoni	182 369	308 429	59%
Fuga NN	168 714	233 103	72%
IKEA 365+	20 342	27 092	75%
IKEA PS 2012 Pend	15 872	25 600	62%
Klor pend	19 584	38 400	51%
Kryssbo	60 210	113 155	53%
Leding N nickel	479 326	611 810	78%
Skepp chrome	45 472	77 240	59%
STOCKHOLM	9 576	32 570	29%
Tidig	37 944	59 820	63%

Observations

When talking to the supplier and walking around in the factory it was clear that the supplier had a lot of unutilized capacity. The manager was eager to get more orders so that they could increase the production. The management team was very interested in this way of working and will use some of the information in the daily work with their suppliers. The overcapacity was especially clear in the metal production where many machines were standing still. The supplier estimated the capacity utilization of the production facility to around 40%.

One Supplier Capacity Process

Step 1 – Resource groups

When discussing the Resource groups the first suggestion was to have a Resource group for metal processing, one assembly and one packaging for LED and one assembly and packaging for other products. However, there were some other Resource groups that needed to be added, for example powder coating and painting, and the complete picture can be seen in Figure D 22.

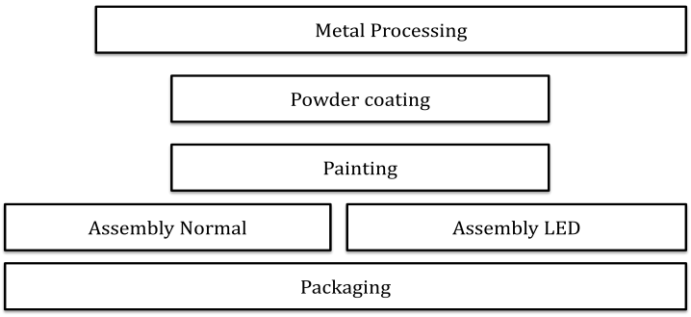

Figure D 22: Resource groups identified at Supplier 6

Step 2 – Product groups

Currently there are 17 groups of products at Supplier 6 and the same groups were suggested by the category. However, after some discussion with the supplier it was decided to split some of the groups since they have different production flows. The discussion resulted in 22 Product groups and an average of 9,8 articles per group at this supplier, see Table D 34.

Table D 34: Product groups determined at Supplier 6

Group number	Group name	Number of articles in group
1	ANTIFONI N floor	17
2	ANTIFONI N work	17
3	Fuga NN ceiling/wall	10
4	Fuga NN ceiling spot	10
5	IKEA PS 2012 Pend	12
6	IKEA 365+ Hotta/Lunta	15
7	IKEA STHLM floor/read	21
8	KLOR pend	4
9	KRYSSBO floor	5
10	Kryssbo pendant	4
11	KRYSSBO wall	5
12	KRYSSBO double wall	5
13	Leding N nickel 3	12
14	Leding N nickel 5	12
15	Skepp chrome	2
16	TIDIG 4	5
17	TIDIG 6	5
18	TISDAG clamp	10
19	TISDAG floor	5
20	TISDAG pend	4
21	TISDAG wall	5
22	TISDAG work	12

Step 3 – Connect product groups to Resource groups

The Product groups were connected to the Resource groups through using the consumption table given by the supplier. There are five flows and several of the Resource groups are shared between the Product groups, see Figure D 23.

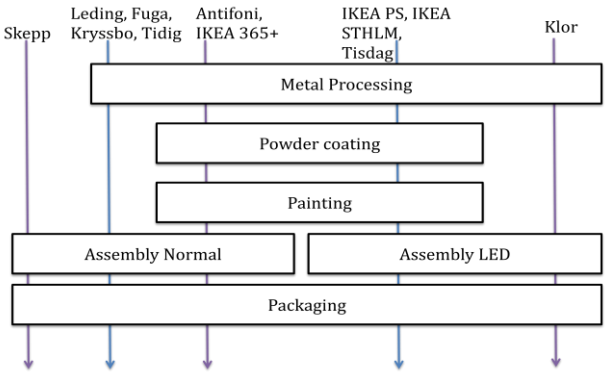

Figure D 23: The Resource groups connected to the Product groups at Supplier 6

Step 4 – Identify system bottleneck

The packaging resource became the bottleneck for the system. Since this Resource groups is shared by all Product groups it is also the system bottleneck, see Figure D 24.

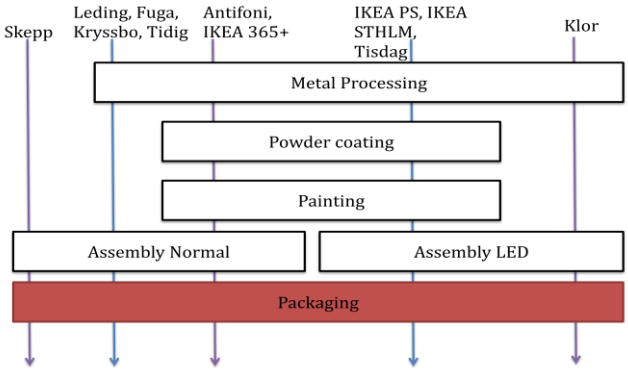

Figure D 24: The identified bottleneck at Supplier 6

Step 5 – Calculate local need/capacity and check value

The allocated capacities based on the average weekly need and on the bottleneck resource was calculated and the capacities to be registered in GPS can be seen Table D 35. The rate between the average weekly need and the capacity that will be registered in GPS is 65 % for all Product groups. This means that the average utilization of the capacity at the supplier will be approximately 65 % and that is lower than the level agreed by the category.

Table D 35: Weekly need and the updated capacity at Supplier 6

Product group	Avg need	Allocated cap	Difference
Leding N nickel 3	9789	15141	65%
Leding N nickel 5	2928	4529	65%
Fuga NN ceiling/wall	1887	2918	65%
Fuga NN ceiling spot	2839	4392	65%
KRYSSBO floor	487	753	65%
Kryssbo pendant	810	1253	65%
KRYSSBO wall	360	556	65%
IKEA PS 2012 Pend	514	795	65%
Skepp chrome	1484	2294	65%
KLOR pend	342	528	65%
Stockholm floor/read	333	514	65%
ANTIFONI N floor	1852	2864	65%
ANTIFONI N work	5178	8009	65%
IKEA 365+ pend	663	1025	65%
TIDIG 4	559	863	65%
TIDIG 6	612	947	65%
TISDAG clamp	2025	3131	65%
TISDAG floor	366	566	65%
TISDAG pend	330	510	65%
TISDAG wall	567	877	65%
TISDAG work	303	468	65%
KRYSSBO double wall	252	389	65%

When studying the utilization in the different Resource groups it can be seen that the utilization with the average need the utilization is approximately 60% in many of the resource, see Table D 36. This means that the supplier has a lot of free capacity, approximately 40%. This shows that the utilization of the resources in the production facility is higher than what the supplier expected. However, it is still below the level allowed within the category.

Table D 36: : Utilization of the different Resource groups based on the average weekly need respectively allocated value at Supplier 6

Resource	Utilization (need)	Utilization (max)
Metal Process	63%	98%
Powder coating	35%	54%
Painting	40%	62%
Assembly for LED lamp	51%	79%
Assembly for Normal lamp	62%	96%
Package	65%	100%

The new total capacity registered in the system is approximately the same as the old, see Figure D 25. The capacity on a weekly basis is slightly more than 50 000 pieces which is the same as the supplier expressed that they had available for IKEA.

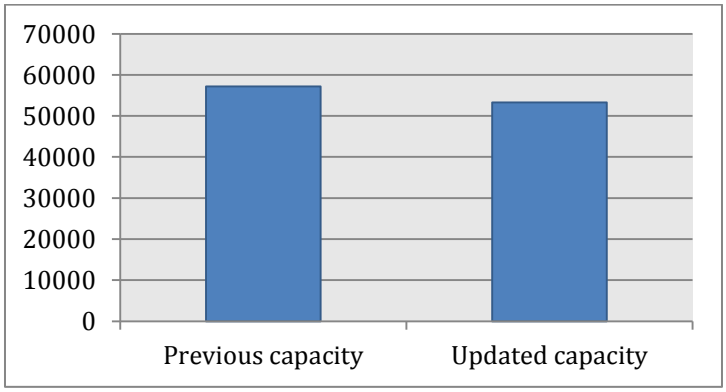

Figure D 25: Illustration of the sum of the previous registered capacity and the sum of updated capacity at Supplier 6

Summary Supplier 6

The supplier has had good delivery reliability but at the same time there were also signs of the supplier not being able to reach the planned capacity levels when needed. The updated capacity level is approximately the same as the previous level and it is also in line with the suppliers calculations. The utilization of the resources is relatively low, about 60%. Therefore there is some unutilized capacity at this supplier that needs to be considered.

Supplier 7

Company information

Supplier 7 has worked with IKEA since 2003. It is a relatively small supplier with a factory of 10 000 m^2. They have approximately 200-400 workers, the number is depending on the season and at the moment they have about 300 workers. The supplier has a fully integrated ERP system and 80 % of the business is dedicated to IKEA. The business share in Europe is devoted to 70 %. According to the supplier they have a capacity of 5 million pieces per year.

Capacity planning today

The rate between demonstrated need and capacity is high, almost or slightly above 100% for most of the products. There is a difference between the planned and demonstrated capacity but it is connected to the need, see Table D 37.

Table D 37: Need and capacity data for Supplier 7 in pieces, wk 49-8 (2011-12)

Capacity Group Name	Sum of PN	Sum of PC	Sum of DN	Sum of DC	Cancelled %	DC/DN %
365+ brasa	8 586	16 248	14 199	14 292	4%	101%
365+ Lunta	8 550	26 968	16 572	16 326	0%	99%
Arod	6 330	27 890	9 370	8 520	0%	91%
Barometer	25 310	62 445	32 342	30 648	0%	95%
Blixt	0	66 800	1 152	1 248	0%	108%
BLIXT N recess spot 3-p	28 224	43 468	40 349	36 768	8%	91%
HEKTAR floor lamp	-	-	774	1 092	2%	141%
HEKTAR pend lmp 22	-	-	3 173	3 276	2%	103%
HEKTAR pend lmp 47	-	-	3 642	3 894	0%	107%
HEKTAR wall	-	-	0	0	-	-
Januari floor	2 348	17 323	6 525	7 008	0%	107%
Januari table 35	8 496	47 062	18 772	14 784	0%	79%
Januari table 45	3 520	36 485	6 399	7 360	0%	115%
KLABB table lamp	35 784	52 464	67 883	67 608	0%	100%
Trogsta	5 320	201 678	30 538	30 120	0%	99%

When looking more closely at the figures for delivery reliability and cancellation rate it looks like it has been varying quite a lot, see Table D 38. The lead time has been relatively stable during the time period shown in the table. According to the Supply planner, the supplier has performed quite well and has a lot of potential.

Table D 38: The delivery reliability, cancellation rate and lead time for Supplier 7, week 4-8

Data	201137	201141	201145	201149	201201	201205	Total
Delivery reliability, %	98,32	96,89	82,01	74,35	76,22	86,47	87,02
Cancellation, %	0,00	1,14	0,64	0,00	1,36	6,05	1,37
Agreed LT, days	24,11	25,48	30,44	31,30	31,20	31,39	28,44
Actual LT, days	22,03	20,92	25,86	31,03	28,10	29,82	25,63
Difference in LT (Agr-Act)	2,08	4,56	4,59	0,27	3,10	1,57	2,81

There are differences between the planned need and capacity for the coming 31 weeks, see Table D 39. For some of the products there seems to be a lot of Available Expensive Capacity and for others the capacity is almost fully utilized.

Table D 39: The planned need and capacity for Supplier 7 in pieces, the coming 31 weeks

Capacity Group Name	Sum of PN 13-44	Sum of PC 13-44	PN/PC %
365+ brasa	36 772	59 968	61%
365+ Lunta	50 973	79 744	64%
Arod	39 950	102 336	39%
Barometer	136 848	141 669	97%
Blixt	288	103 456	0%
BLIXT N recess spot 3-p	71 904	134 400	54%
HEKTAR floor lamp	10 380	34 368	30%
HEKTAR pend lmp 22	43 668	96 120	45%
HEKTAR pend lmp 47	7 716	40 128	19%
HEKTAR wall	55 104	155 520	35%
Januari floor	9 804	63 936	15%
Januari table 35	31 008	163 882	19%
Januari table 45	12 160	134 656	9%
KLABB table lamp	101 016	141 792	71%
Trogsta	19 740	744 384	3%

Observations

When visiting the supplier it was clear that they have a lot of potential for improvement and the production felt quite unstructured. It could be seen that there was available capacity in the production and that was also confirmed by the supplier.

One Supplier Capacity Process

Step 1 – Resource groups

When identifying the Resource groups it was clear that some of the Product groups has an own assembly line while the other share. There was a discussion whether to include component or not. Since it is never considered a problem it was decided to exclude it and therefore the identified Resource groups were Assembly 1, Assembly 2 and Packaging, see Figure D 26.

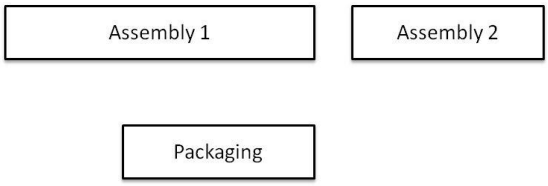

Figure D 26: Resource groups identified at Supplier 7

Step 2 – Product groups

Currently there are 13 groups of products at the supplier. During the discussion with the supplier, it was decided that some of the suggested Product groups were needed to be split. The reason for this is mostly related to that different versions of the lamps, for example floor and table lamp, require different amount of resources. Finally this resulted in 19 Product groups and an average of 10 articles per group, see Table D 40.

Table D 40: Product groups determined at Supplier 7

Group number	Group name	Number of articles in group
1	Arod floor/read	8
2	Arod work	8
3	BAROMETER floor/read	14
4	BAROMETER work	16
5	BLIXT N EU/AUCN/TW	3
6	BLIXT N NA	1
7	UTG articles	4
8	HEKTAR floor	7
9	HEKTAR pend 22	4
10	HEKTAR pend 47	4
11	HEKTAR wall/clmp	7
12	IKEA 365+ BRASA	21
13	IKEA 365+ LUNTA floor	15
14	IKEA 365+ LUNTA table	15
15	JANUARI floor	8
16	JANUARI table 35	9
17	JANUARI table 45	8
18	KLABB	21
19	TROGSTA	8

Step 3 – Connect Product groups to Resource groups

The Product groups were connected to the Resource groups and the flow is quite simple, see Figure D 27. There are three different flows and there was no resource that was shared between all Product groups.

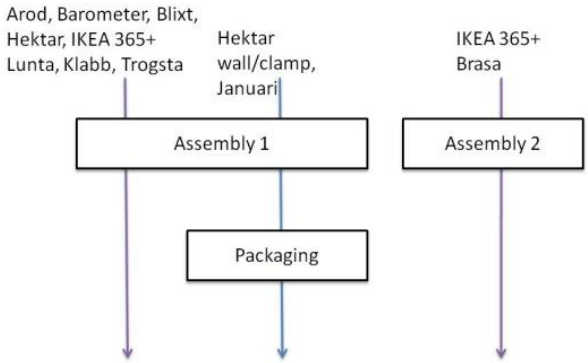

Figure D 27: The Product groups connected to the Resource groups at Supplier 7

Step 4 – Identify system bottleneck

When conducting the bottleneck analysis the bottleneck was identified in the Assembly resource for all Product groups, see Figure D 28. Assembly 2 was identified as the system bottleneck but Assembly 1 is the bottleneck shared by most Product groups.

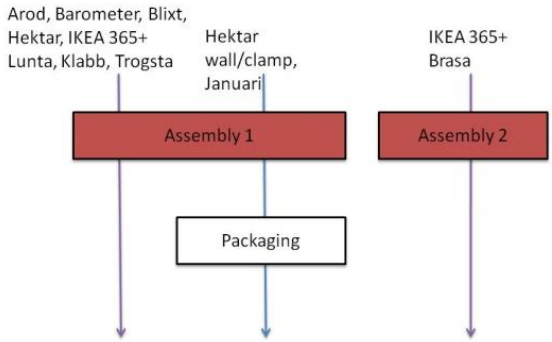

Figure D 28: The identified bottlenecks at Supplier 7

Step 5 – Calculate local need/capacity and check value

The allocated capacity values for each Product group can be seen in Table D 41. The utilization of the allocated capacity for each Product group with respect to the need is approximately 41%. For the Product group going through Assembly 2 the utilization is a little bit higher, 59%. This means that the capacity utilization for most of the Product groups is below 50%, which can be regarded a low utilization and it is much lower than the minimum value of approximately 75-80% that IKEA has decided on.

Table D 41: Weekly need and the updated capacity at supplier 7

Product group	Avg need	Allocated cap	Difference
Arod floor	718,75	1761	41%
Arod table	696,875	1708	41%
Barometer floor	1937,75	4750	41%
Barometer table	2456	6020	41%
Blixt EU	213	522	41%
Blixt NA	2124	5206	41%
Hektar floor	391,875	960	41%
Hektar pend 47	268,6875	658	41%
Hektar pend.22	1913,625	4691	41%
Hektar wall/clamp	1638	4015	41%
Ikea 365+ Brasa	1084,3125	1851	59%
Ikea 365+ Lunta floor	997,59375	2445	41%
Ikea 365+ Lunta table	608,25	1491	41%
Januari 35 table	1071	2625	41%
Januari 45 table	395	968	41%
Januari floor	327,875	803	41%
Klabb	6048	14826	41%
Trogsta	717,5	1758	41%

In Table D 42 the utilization of the Packaging can also be seen and it is only 8% with respect to the need. This is a very low utilization rate.

Table D 42: Utilization of the different Resource groups based on the average weekly need respectively allocated value at Supplier 7

Resource	Utilization (need)	Utilization (max)
Assembly 1	41%	100%
Assembly 2	59%	100%
Packaging	8%	19%

When comparing the updated capacity to the previous registered capacity it has decreased with approximately 20%, which means that IKEA will have lower capacity level registered in the system for this supplier, see Figure D 29.

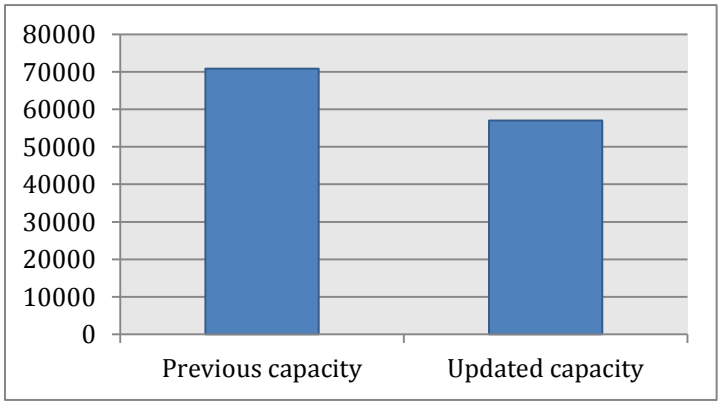

Figure D 29: Illustration of the sum of previous capacity and the sum of updated capacity at Supplier 7

Summary Supplier 7

Even though the updated capacity has decreased compared to the old, the utilization is quite low. This means that the supplier must have had even lower utilization before. It can be

discussed if it is necessary to have all this unutilized capacity but at the same time the supplier is seen as a supplier with big potential which means that it will get more business which will improve the utilization.