A Case Study Approach on Manufacturing Alternatives in an Emerging Market

- Evaluation from a Cost, Flexibility and Risk Management Perspective

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Abstract

Title: A Case Study Approach on Manufacturing Alternatives in an Emerging Market – Evaluation from a Cost, Flexibility and Risk Management Perspective

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Research Issue: The need for flexibility as ways to risk manage plays a big part in both Supply Chain theories and Manufacturing Strategy. The literature reviewed states that increased flexibility equals higher costs and outsourcing to a low-cost country often means lower production costs. But the literature does not state how these factors change when the company already is operating in a low cost country. The following hypothesis was proposed:

"Flexibility is positively correlated with manufacturing costs in an emerging market"

Purpose: The purpose with the thesis was twofold. First, recommend a cost effective and risk minimising solution to Orkla Brand Russia's pre-processing issue. Second, test the hypothesis in the settings of the case study at hand.

Method: The method used was a deductive approach. After a literature study a hypothesis could be proposed and tested through a case study.

Conclusion: The study showed that in Orkla Brand Russia's case it is more beneficial to produce in house than to outsource. The reasons are that it is both more cost efficient and more flexible to produce in house than to outsource production, thus the hypothesis cannot be validated.

Keywords: Outsourcing, Supply Chain, Supply Chain Management, Flexibility, Manufacturing Strategy and Emerging Market

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Furthermore, we would like to say many thanks to our mentors at the university, Charlotta Johnsson and Måns Kjellsson for their time and efforts. Together you have been a superb source for ideas, critique and guidance, that we have appreciated a great deal during course of this process.

Lastly we would like to say thank you to Orkla Brands International/Russia for the opportunity to do our master thesis in such an interesting and inspiring project in Russia.

We leave you with an inspiring quote that has been a source for laughter during the many hours of work put into this master thesis:

"… näsa, inte nos. Nos har hundar och Katter…"

(Unknown little brother)

Lund 2012-05-22

Marianne Johansson

Robin Kärner Rendahl

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1 Introduction

In this chapter the foundation for the thesis is described. Theory, case background and issue at hand are explained to create a clear picture for the reader of what is to be studied.

1.1 Background

The trend of outsourcing manufacturing to other countries and market players has escalated in the past decade. The reasons for outsourcing are many but increased competition and worldwide access to low-cost labour markets are two important reasons. (Gray et al, 2009) Still, many manufacturing companies choose to keep production in house. One reason for companies to keep production in house is to avoid or to handle risks more effectively. In the pursuit of managing changes and thus risks, many companies focus on flexibility in the supply chain when outsourcing (Cucchiella et al, 2006) and flexibility in manufacturing processes when producing in house (Hill, 1993). Current literature discusses outsourcing to low-cost labour markets as common solutions when dealing with flexibility and cost minimising (Gray et al, 2009). But what the current literature lacks is the issue of outsource versus in house production from a cost, flexibility and risk management perspective if the company studied already operates in a low-labour cost country. Since the emerging markets are a big issue today, it was found to be interesting to test current literature in an emerging market setting and see if the results corresponded to the already established results.

Orkla Brands Russia (OBR) is in the process of consolidating its chocolate manufacturing process to reap efficiency gains. One part in the consolidation phase is to decide how the company should provide chocolate mass to the chocolate making process. Today, they have the so-called pre-processing production in house but there is a clear trend amongst the major international players to outsource this part to a third party. Since OBR is operating in an emerging market, OBR wants to evaluate if there are any benefits of shifting pre-production from in house to a third party. Variables influencing the decision are primarily investment- and manufacturing costs, flexibility and risk management ability.

1.2 Problem Identification

Manufacturing strategy addresses many different aspects of manufacturing with the focal point in all strategies of high effectiveness and efficiency. The different manufacturing objectives are costs, quality, speed, dependability and flexibility. (Gunasekaran et.al, 2004) When Hill (1993) discusses flexibility within manufacturing strategy, the different variables measured are often linked to manufacturing capabilities and how internal resources can cope with changes. Additionally, Hill explains that flexibility in manufacturing strategy is correlated with high costs. (Hill, 1993)

In supply chain- and later supply chain management models, flexibility is discussed but risk management is added as a flexibility measure (Manuj, Mentzer, 2008,

Cucchiella et al, 2006). The possible risks from a supply chain perspective can either be internally or externally driven and one risk mitigating strategy is to have a flexible supply chain. Cucchiella et al (2006) discusses flexibility and risk management in a supply chain from a real options perspective. They argue that flexibility is strongly linked to risk mitigating strategies such as having the possibility but not the obligation to e.g. outsource.

Considering the existing theories, the issue of correlation between manufacturing flexibility and risk mitigating strategies and the cost of these arose. Current literature often describes scenarios tested in stable markets and has not yet been applied to an emerging market setting, where conditions are different. The latter powered the interest to test the existing common assumption that manufacturing flexibility is correlated with high manufacturing costs in an emerging market setting, where many of the factors influencing the manufacturing costs as labour and energy are assumed to be lower.

1.2.1 The Orkla Brands Russia Case

Orkla Brands Russia is in a process of merging two of their companies on the Russian confectionary market. Besides obtaining management, procurement and sales, general and administrative synergies, they also seek production improvement. Since OBR is operating in Russia, an emerging market, the market conditions are characterised, besides from strong growth, with uncertainties and risks. Today, OBR have four production sites in Russia; Ekaterinburg, Petergoff (PPP), Ulyanovsk (PPU) and St Petersburg. But due to new legislations all industry sites near the city centre in St Petersburg need to be moved because of noise, odour and traffic. This means that the St Petersburg site needs to be closed down and all capacity moved to the other three factories.

An essential part in OBR's manufacturing process is the *pre-processing*, where cocoa beans are refined to chocolate mass. Today, OBR has two pre-processing sites, one in St Petersburg and one in PPU. Since St Petersburg is closing down, OBR need to make a decision regarding pre-processing in the future. This thesis will help OBR in answering the core question: How should OBR manage pre-processing with regards to cost efficiency, flexibility and the risks associated with operating in an emerging market?

1.3 Research Issue

The foundation for the thesis is based on literature on costs, flexibility and risk management from a manufacturing strategy- and supply chain point of view. Most of the literature on supply chain and outsourcing focuses on the cost benefits of extending the firms boundaries to low labour-cost countries, but these theories are not applicable to OBR since it is are already in a low labour-cost country. The literature also state that manufacturing flexibility equals higher initial investment costs, but can flexibility in production be reached through other means that are

more cost efficient? Based on the current literature and the setting of the case company, the following hypothesis was proposed:

"Flexibility is positively correlated with manufacturing costs in an emerging market"

1.4 Purpose

The purpose of the master thesis was twofold,

1. Recommend a cost effective and risk minimising solution to OBR's pre-processing issue
2. Test the hypothesis in an emerging market setting through a case study

1.5 Delimitations

Before gathering empirical data some delimitations were set. These were then complemented with delimitations found *during* the empirical gathering. There were many factors that contributed to newfound delimitations, such as insufficient- or lack of data.

1.5.1 Orkla Specific Delimitations

- Consolidating production to three sites (PPP, PPU, PPE)
- Pre-processing is only available at either PPP or/and PPU
- Cost calculation are based on recipe for dark chocolate
- No capital gains or losses were included in the investment calculations because the current machinery is old and has no additional value to add
- Outsourcing costs were only subject to liquid form not blocks or drops because the information found was only for liquid products
- Outsourcing and in house production are based on costs from 2011
- Outsourcing alternatives used in calculations were only from EU, not Russia because the Russian suppliers only produce chocolate mass, not other intermediate cocoa products
- Outsourcing to cocoa nibs were excluded since no outsourced prices could be found for this intermediate cocoa product

1.5.2 Theory Specific Delimitations

- Flexibility was only looked at from a SCM and manufacturing point of view
- Only specific parts from the flexibility theories were chosen
- Only specific parts from the SCM risks were chosen

1.6 Outline

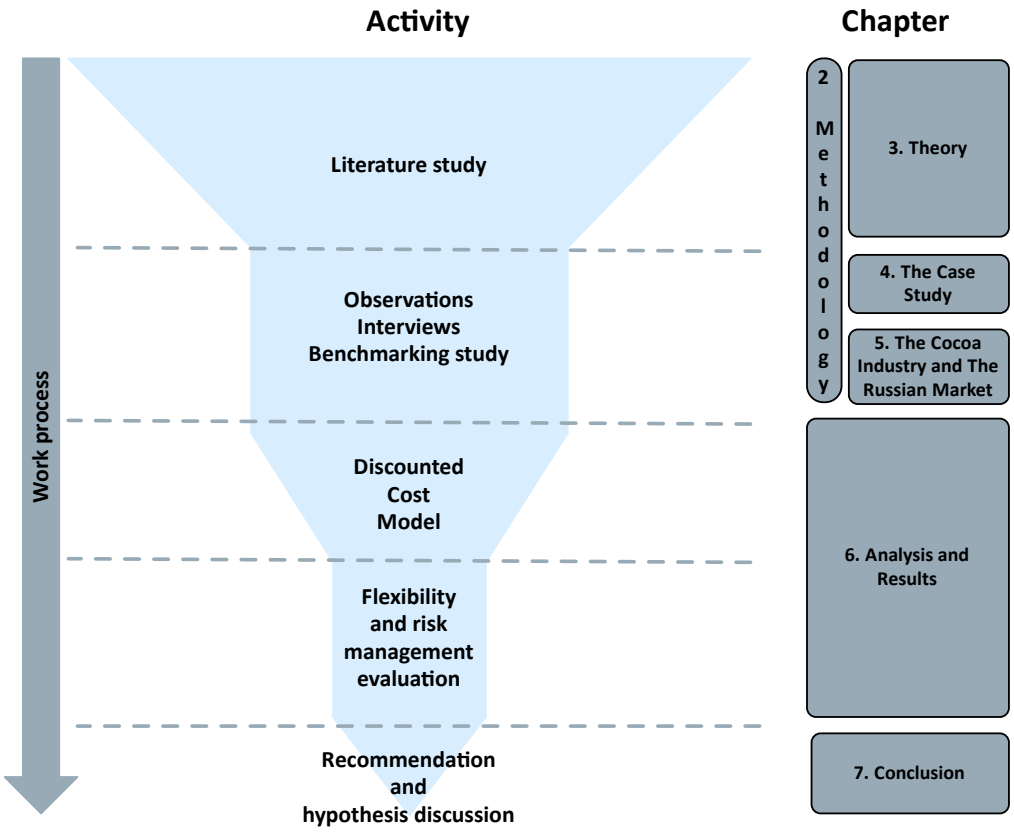

Figure 1. Outline of the master thesis including activities performed and the chapters were they are explained

2 Methodology

The chapter aims to clarify what methods were used for each part of the master thesis and how reliability and validity was achieved.

2.1 Research Approach

Many variables are discussed in literature that describes various methodology approaches for research projects. To describe the process in general terms in view of theory approach, *deductive*- and *inductive* method is used. Deductive method refers to the work process where a theory is the base for hypothesis build up. The hypothesis is then tested to decide whether or not the primary theory can be confirmed or not. Deductive processes goes from being general in theoretical view to specific observations. When using an inductive method, the work process is reversed. Specific observations are performed for the purpose of finding patterns to build hypothesises on. Hypothesises are then formulated to a general theory or fitted to an already existing theory. (Bryman& Bell, 2011) The method chosen for the master thesis was a deductive approach.

There can be several aims for the practical part of a research project; *descriptive*, *exploratory*, *explanatory* and *problem solving.* These can both be combined and changed in the interim of the work process, depending on the nature of the project. An example is when the key issues are found using a *descriptive* and *exploratory* approach and further along solved by using a *problem solving* approach. (Robson, 2002; Höst, Regnell, Runeson, 2006) Because of the description of the master thesis, the methodology was determined early on in the process. OBR had a clear need; to be able to make a decision based on the recommendation that followed from this master thesis. A problem solving aim was chosen as OBR was in need of a solution to the pre-processing decision problem.

The issue of how to conduct a research project is exemplified in four different approaches: *survey, case study, experiment* and *action research*. A survey refers to when a population is used in a *descriptive* matter. When performing a case study, the major focus is to deepen the knowledge in an area by *exploring* it. Experiments are used when the subject is in need of further *explanation*. Lastly the action research refers to improve and solve the identified problem. (Höst, Regnell, Runeson, 2006) As to how the master thesis was conducted, it was natural to follow a mix of case study and action research approach because of the necessity to gain a deeper knowledge of the process at the same time as finding the optimal scenario for the current decision situation. As for the action research, the PDSL–model can be used to describe the process with focus on cost efficiency. P=plan, where the key issue was identified through meetings and interviews. D= do, where the recommendation was created through a thorough analysis. S=study and L=learn are parts that come after the recommendation is delivered, i.e. not included in this master thesis. (Höst, Regnell, Runeson, 2006)

In connection to these approaches stated above, arises whether the method is seen as *fixed* or *flexible* (Robson, 2002). A method is fixed when the work process is rigid and unable to change during the progression of the research. Surveys and experiments are considered as fixed methods, as the output of the methods is dependent on a consequent work process. When the output is not dependent on the work process solely, as in case studies and action researches, it is considered as flexible. (Höst, Regnell, Runeson, 2006) As the master thesis was decided to be a combined case study and action research, the flexibility of the project was clear. Flexibility was shown to be important because of a continuous feed of new information that changed the direction of the project during the entire process.

2.2 Method for Theoretical Gathering

When conducting a research project, literature studies are often the starting point of the process. The literature can be found in many different forms such as books, articles, and reports. (Ejvegård, 2009) Examples of ways to identify appropriate literature is to first identify keywords that will simplify the search process and then use a search engine or electronic database to find published articles and books. References in found literature can be used to further deepen the search process and find the original source about the subject. (Bryman&Bell, 2011) By using several different keywords on numerous search engines and databases, the results will be clearer to the searcher as the found information will be broader, and thereby hold more substance about the subject. (Höst, Regnell, Runeson, 2006)

To add theoretical strength to the master thesis, a literature study was performed. The literature study was divided into two parts, one technical part, where useful theories regarding standardisations in manufacturing were the major focus, and one economic part, where theories regarding manufacturing strategies were the major focus. The reason for the chosen search subjects was the nature of the case study available.

Several sources were used in the process of finding proper literature references. *Libhub*, Lunds University database, was used as a primary source. Keywords used were *manufacturing strategy, manufacturing flexibility, outsourcing*, *process mapping, manufacturing standardisation, real option, supply chain, supply chain management* and *cocoa industry*. *Social Science Citation Index* and *Google Scholar* was also used as a search database with similar keywords.

2.3 Method for Empirical Gathering

Empirical facts and data were gathered in different forums that required different kinds of methods such as interviews, observations, benchmarking, and gathering of data collected by external sources. Interviews can be conducted through a variety of mediums, for example *email, telephone and face-to-face*. Throughout the master thesis the main interview format was face-to-face with follow-up questions by email. The interview techniques differed in what goal, disposition and purpose the

interviewer had with the interview; the different techniques are briefly described in table 1.

Table 1. Interview techniques (Lantz, 1993; Rosengren & Arvidson, 2002)

Interview techniques			
	Open	**Semi structured**	**Structured**
Goal	The interviewee´s experience	The interviewee´s experience of quantity and quality	The interviewer seeks causalities and interconnectivity
Disposition	Question subjects	Open and closed questions	Questions with standard answers
Purpose	Exploratory	Describing/explaining	Describing/explaining

The technique used for secondary information gathering was a mix of open and semi structured interviews. These techniques were most suitable due to the uncertainty concerning company strategies in different business units. When a clearer picture could be established, a shift towards semi-structured interviews was necessary.

2.3.1 Secondary Data

Secondary data is defined as data collected by someone else for another purpose than the project in focus (Lantz, 1993). Secondary data in this master thesis has been collected through various sources; but mainly through interviews, requests by emails and telephone calls. Raw statistics and indexes have been found within the boundaries of OBI and Orkla ASA. Public and processed data have been collected through Internet searches and international law books.

To understand the overall strategy of Orkla ASA, and more specifically for OBR, interviews with top management team were conducted. Through interviews with regulatory- and law experts within OBR, the required knowledge was gathered regarding specific Russian market conditions. The interviewee's statement and reference to current Russian and international law and regulations were double checked at the source for verification.

2.3.2 Primary Data

Data collected solely for the purpose of the master thesis is considered as primary data (Lantz, 1993). Gathering of data has mainly been done through observations and interviews with employees at OBR and other stakeholders within Orkla ASA.

When gathering primary data, a semi structured to structured technique was used. By defining the questions that needed answering prior to each interview, the purpose of the meetings was clear before the interviews took place. During the entire process, a master thesis journal was kept. The journal was used for defining the issues a head, possible solutions discussed and keep notes from the interviews.

Each interview was performed in the following disposition:

- Context summary: A brief summary of the purpose of the thesis and why the interviewee's knowledge could contribute
- Opening questions: Initial questions that clarified if the focal point of the interview was the best approach or if a different issue was better suited
- Main questions: The prepared queries were asked and information were either gathered straight away or ordered for later collection
- Summary: A summery including what information that had been given and what was to be delivered at a later date was clarified in an email to the interviewee

In order to understand the steps of pre-processing, several observations were made. According to Rosengren & Arvidson (2002) observations can be made with *several degrees of interaction* with the subjects as well as different degrees of *knowledge of being observed*. Throughout the master thesis, three visits to different manufacturing sites were made. All visits were conducted as *observing participants* with high degree of interaction and high knowledge of being observed.

To add to the overall understanding of chocolate manufacturing, a benchmarking study was performed at another OBI owned company in Norway and will be further explained in chapter 4.2.3. The benchmarking study lead to collaboration to find purchasing information for intermediate cocoa products as cocoa liquor and cocoa butter.

2.4 Method for Analysis

After gathering empirical data, the data was sorted and the quantitative analysis begun. Data collected was divided up into in house related data and outsourced production related data. The two groups were handled separately at first and then joint together in the Discounted Cost Model analysis (DCM).

2.4.1 In House Data Analysis

Data considered as in house related were divided up into production costs, such as losses, output and conversion costs; costs that origin from the production e.g. labour costs and energy. The data was divided up and costs were allocated to the intermediate cocoa products in the process in order to simplify the comparison with the outsourced alternatives later on in the process, see figure 2.

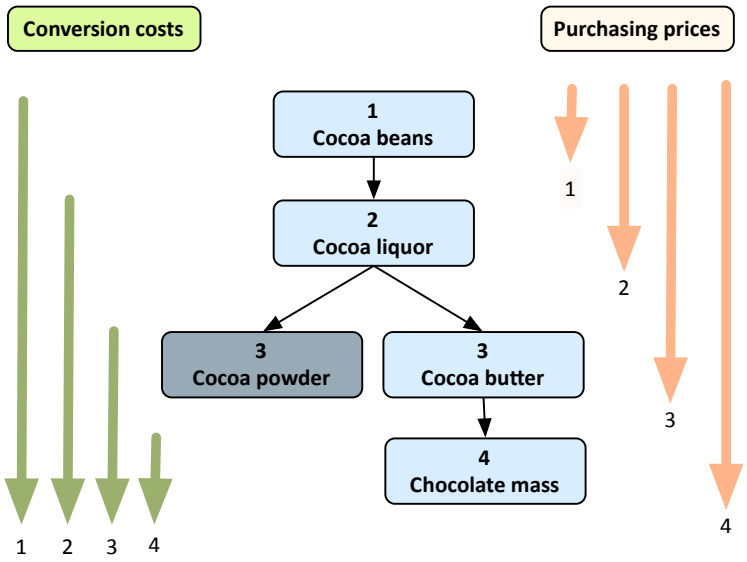

Figure 2. Analysis approach for in house conversion costs and outsourced purchasing prices (cocoa powder is marked in dark because the analysis does not handle cocoa powder)

2.4.2 Outsourced Manufacturing Data Analysis

Outsourced production data were mainly purchasing prices from different suppliers and transport costs. The purchasing prices based on ratios multiplied by the London International Financial Future and Options Exchange (LIFFE) price for cocoa beans were added for the same intermediate products used in the in house analysis. Transport costs were added as well as customs fees for products with other origin countries than Russia.

2.4.3 Scenario Analysis with Discounted Cost Model

After the primary analysis of the in house alternative and the outsourcing alternative, seven production alternatives were developed. Investment- and moving costs were taken into consideration for each of the production alternatives. A scenario matrix was constructed which resulted in 19 possible outcomes with fixed costs and variable production costs. The different scenarios were then compared using a Discounted Cost Model analysis with a ten-year horizon. To validate the data, a sensitivity analysis was performed to establish that the results were reliable.

2.4.4 Flexibility and Risk Management Evaluation

To analyse the second part of the purpose, a scoring matrix was used to evaluate the flexibility and supply chain risk management for each scenario created in the DCM-analysis. Criterions from existing literature were used to separate the four best and four worst scenarios from the DCM-analysis. The results from the flexibility and SCM risk management evaluation were then compared to the results from the DCM-analysis and a final recommendation and conclusion could be formulated.

2.5 Methodology Approach

Figure 3 shows the methods for each part of the thesis.

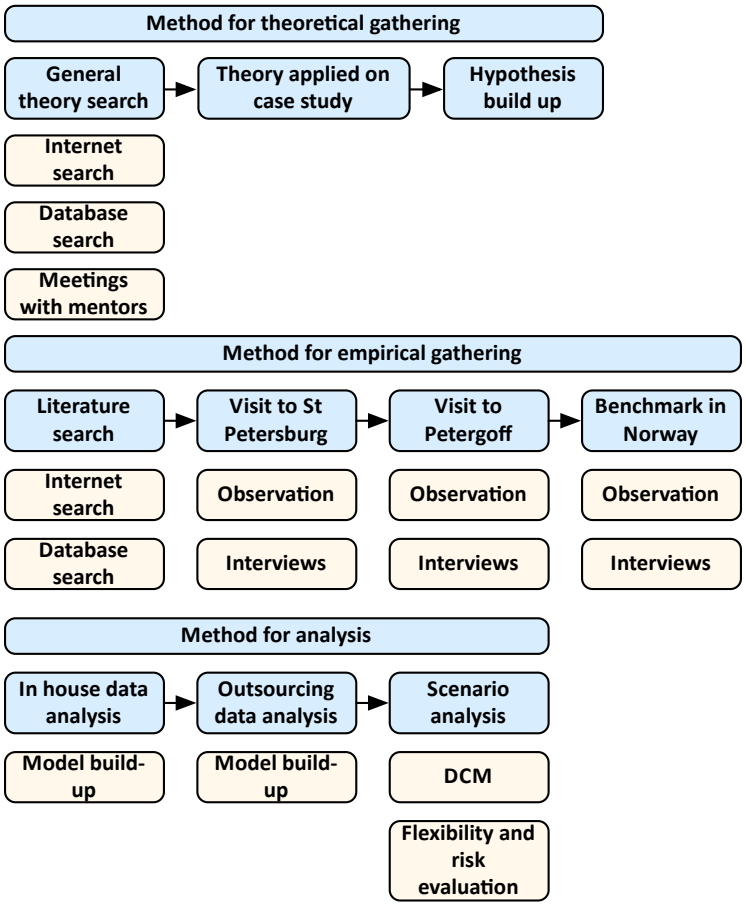

Figure 3. Methodological approach

2.6 Reliability and Validity

Validation of the research is important and is divided up into *Reliability* and *Validity*. Reliability refers to the reproducibility of the research and the authenticity of the data and analysis. Validity refers to that the research measures what is supposed to be measured. (Höst, Regnell, Runeson, 2006)

To strengthen the reliability of this research, interviews were conducted with people with different positions and responsibilities. This was to ensure that the information gathered could be compared and that the right conclusions were drawn. During the data collection, several sources were used for ratios for cocoa liquor and cocoa butter. The sources were used to confirm that the ratios were applicable.

The benchmark analysis gave extra input of possible solutions for OBR's issue. The benchmark analysis also strengthened the understanding of manufacturing

chocolate and the possible risks when handling dirty raw material. During the work process, continuous check-ups with supervisors from both the university and OBR were of big importance to support the research.

One possible drawback for the reliability might be the structured sampling during data handling of the ratios for cocoa liquor and cocoa butter from the EU. Since not all the available data was used, there can be minor differences in the actual prices for cocoa butter and cocoa liquor and the ones used in the analysis.

To make sure that the results from the analysis were reliable a sensitivity analysis was performed. This to test the calculation model if changes in WACC or initial investment costs would have an impact on the final recommendation.

The validity of the research is highlighted in the many scenarios built for the decision to find the most cost efficient alternative. Continuous meetings with mentors from both the university and the company have contributed to the quality of the quantitation in the analysis by discussing the reliability of the scoring. The methodology and the theoretical approach chapters added to the quality of the thesis by bringing standardised work methods and established frameworks.

3 Theory

First the theoretical approach is explained followed by a summary of each of the most relevant theories connected to the purposes. Secondly, a work hypothesis is proposed.

3.1 Theoretical Approach – Five Theories Make One Hypothesis

In order to find an answer to OBR's issue a single theory was not adequate enough. The theories addressed in this chapter are ISA-95, Supply Chain Management, Real Options, Manufacturing Flexibility and Resource-Based Theory. The theories above were chosen as they address the issues associated with Orkla's current pre-processing problem from several angles. The question regarding flexibility and risk management was first discussed with mentors at Orkla and was found to be of great importance for the project. Figure 4 shows the theoretical contribution that lead up to the proposed hypothesis.

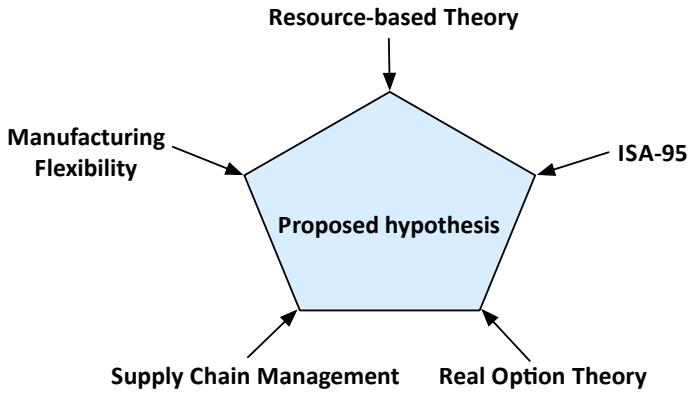

Figure 4. Theoretical approach that contributed to the proposed hypothesis

3.2 Process Mapping with ISA-95

The International Society of Automation, ISA, is an American organisation that develops standards for global industries and helps bring clarity to problems addressed by their 30 000 members. ISA has developed several well-known standards such as ISA-88 that describes Batch System Standardisation and ISA-95 that describes Manufacturing Enterprise Standardisation. (ISA.org) The latter will be further discussed in this chapter.

3.2.1 ISA-95 – A Standardisation Tool

As mentioned above, ISA-95 is a Manufacturing Enterprise Standard. This refers to the function as an integrating standard between enterprises and control systems in global manufacturing industries. ISA-95 is divided into five parts, see table 2. (ISA95.com)

Table 2. Parts and content of ISA-95 (ISA-95.com)

ISA-95	
Part	**Content**
1. Models and terminology	Models and terminology to describe the interfaces between the enterprise and its manufacturing operations
2. Object model attributes	Formal object models for information exchange
3. Activity models	Production activities and information flow
4. Object models and attributes	Defines exchange of MES activity
5. Business to manufacturing transactions	Transaction models for information exchange

3.2.2 Process Mapping Standardisation – an Equipment Hierarchy Approach

Hierarchy models are explained in ISA-95 chapter five, part one. To understand how to proceed with the categorisation of OBR and its manufacturing business, both functional and equipment hierarchy need to be further studied.

Functional hierarchy refers to the levels where decisions are made. The functional hierarchy model is divided into three major levels: *Business planning and logistics*, *Manufacturing operations and control* and finally *batch control, continuous control* and *discrete control*. Business planning and logistics are considered level four and is where decisions regarding for example plant production scheduling and operations management are discussed. Level three, manufacturing operations and control, handles manufacturing issues such as dispatching and production planning. Level two includes both level one and zero and it consists of three control systems, batch, continuous and discrete. These final levels represent line or cell supervision. (ISA-95, 2000)

The equipment hierarchy model defines the responsibilities for levels explained above in the functional hierarchy. The model stretches from the enterprise to the production units and is an extension of the model in ISA-88, see figure 5.

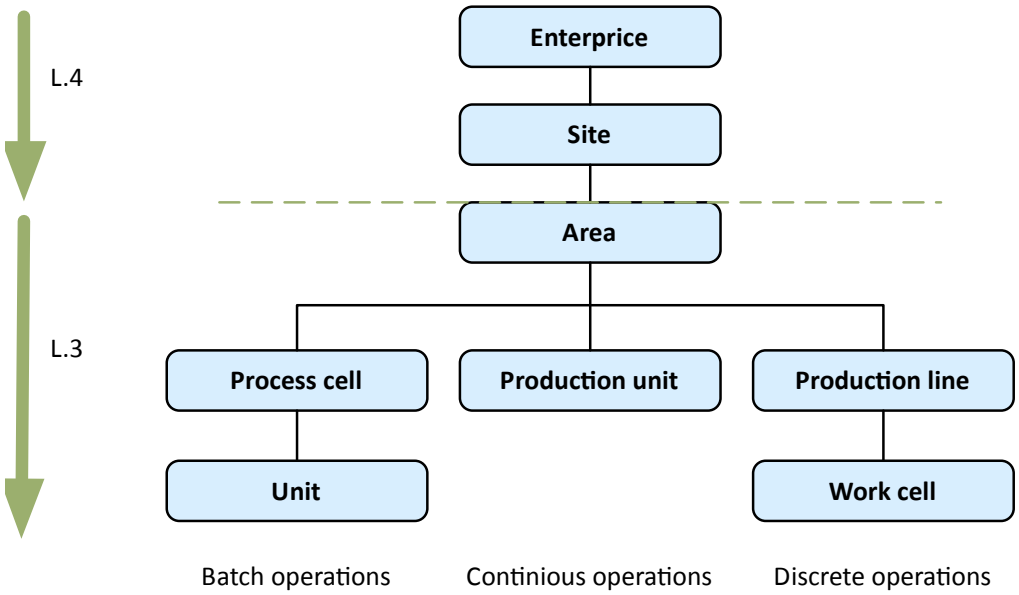

Figure 5. Equipment hierarchy model (ISA-95, 2000)

As can be seen in figure 5 above, the level four functionalities stretches from enterprise level to site level, where level three functions take over. Level two, one and zero are not shown in the model but operates under unit and work cell.

The *Enterprise* in the equipment hierarchy model represents a number of sites and areas, and is seen as the actual company. This is where decisions are made concerning what, when and where to produce. Below enterprise is the *Site* level. A site is a facility, factory or geographical area that holds areas, process cells, production units and production lines. At this level in the equipment hierarchy model, manufacturing management and optimisation is conducted. Level four functions decide at this stage in the model. (ISA-95, 2000)

From level *Area*, the responsibility shifts from level four to three. Area represents a physical or geographical location that has major production capabilities within a site. An area can have several operations at the same time and they can differ from batch to discrete. Thereby, an area can have a mix of *Process Cells, Production Units* and *Production Lines*. A process cell overlooks the batch manufacturing processes and often represents units of the process, for example mixing. Batch processes are characterised as a discontinuous process with input going through a set number of manufacturing steps and then taken out as product (ISA-88, 1995). Production units are responsible for continuous manufacturing and are often represented by reacting, separating and conversion of feed to semi-finished-or finished products. A continuous process is when the feed is continuously fed into the manufacturing

process and products are continuously taken out of the manufacturing process. A production line handles discrete manufacturing processes and can have work cells when the manufacturing is considered as flexible (ISA-88, 1995). Discrete part manufacturing processes are characterised by a group of products that moves from workstation to work station while it still keeps its individual identity (ISA-88, 1995). (ISA-95, 2000)

3.3 Supply Chain Theory

Supply chain and supply chain management (SCM) has been broadly researched and even though there are no consensus definition of supply chain management (Gibson, Mentzer, Cook, 2005), D. Lambert defines it not as a chain of businesses but rather a network of businesses and relationships. He continues to point out:

"One of the most significant paradigm shifts of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather within supply chains." (Lambert, 2008)

3.3.1 Complexities, Uncertainties and Supply Chain Risks

Every supply chain can adopt different strategies depending on the environment and the customer it serves. With each supply chain strategy different levels of complexities exist (Harland et al, 2003). The more complex a supply chain is, the more uncertainties are associated with it (Manuj, Mentzer, 2008). Further, each uncertainty is associated with a number of risks. Cucchiella et al (2006) identified the following factors as catalysts to supply chain complexity:

"Scale, technological development, quantity of sub-systems components, degree of customisation of components in the final product/service, quantity of alternative design and delivery paths, number of feed back loops in the production and delivery systems, variety of distinct knowledge bases, skills and competencies incorporated in the product/service package, intensity and extent of the end-user involvement, uncertainty and change of end-user involvement and requirements, extend of supplier involvement in the innovation and transformation process, regulatory involvement, number of actors in the network, web of financial arrangements supporting the product/service, and extent of political and stakeholder intervention." (Cucchiella et al, 2006)

With regards to the complexities above some of the uncertainties will be categorised and explained followed by risks and a brief description of them, see table 3.

Table 3. Uncertainties and risks (Cucchiella et al, 2006)

Uncertainties within a supply chain	
Internal sources of uncertainties	**External sources of uncertainties**
Available capacity	Competitor action
Customs regulations	Manufacturing yield
Information delays	Political environment
Internal organisation	Price fluctuations
	Stochastic costs
	Supplier quality

Internal sources of uncertainties are connected to the lack of know-how of the correct design of the supply chain and/or the relationships in between the companies in the network. External sources of uncertainties are with regards to competition, market and macro effects.

Risks connected to these uncertainties have been identified by Harland et al (2003) and can be seen in the table 4.

Table 4. Supply chain risks (Harland et al, 2003)

Supply Chain risks	
Type of risk	**Description**
Strategic risk	Affects business strategy implementation
Operations risk	Affects a firm's internal ability to produce and supply goods/services
Supply risk	Adversely affects inward flow of any type of resource to enable operations to take place; also termed "input risk"
Customer risk	Affects likelihood of customers placing orders; grouped with factors such as product obsolescence in "product/market risk"
Asset impairment risk	Reduces utilisation of an asset and can arise when the ability of the asset to generate income is reduced
Competitive risk	Affects a firm's ability to differentiate its products/services from its competitors
Reputation risk	Erodes value of whole business due to loss of confidance
Financial risk	Exposes a firm to potential loss through changes in the financial market; can also occur when specific debtors default
Fiscal risk	Arises through changes in taxation
Regulatory risk	Exposes the firm to changes in regulations affecting the firm's business, such as environmental regulation
Legal risk	Exposes the firm to litigation with action arising from customers, suppliers, shareholders or employees

Manuj & Mentzer (2008) adds *a security risk*, which means Information systems security; infrastructure security; freight breaches from terrorism, vandalism, crime and sabotage. Figure 6 illustrates where in the supply chain the risks are situated.

Figure 6. Risks in the extended supply chain (Manuj & Mentzer, 2008)

3.3.2 Real Options Theory as Risk Management in Supply Chain Theory

There are many proposed ways of mitigating risks within a supply chain. Literature describes *avoidance, postponement, speculation, hedging, control sharing/transferring* and *security* as ways to manage risk (Manuj & Mentzer, 2008). Other discusses risk sharing through *contracts* (Norrman, 2008), *aligning incentives* (Narayanan & Raman, 2004) and *staying flexible* (Boston Consulting Group). While Boston Consulting Group proposed traditional risk management through flexibility, Cucchiella et al (2006) analysed risk management and flexibility through the lens of real option theory.

Real options theory has a lot in common with financial options theory. The option gives the company the *right,* but not the *obligation*, to either sell or purchase. Real option theory's introduction to supply chain has led to higher levels of flexibility and better risk management. Cucchiella et al (2006) argues that the use of real options…

"…allows to improve the firm's shareholder value and to reduce the level of risk that the firm faces in the implementation of the production activities; and real options need to be deployed, managed and exercised." (Cucchiella et al, 2006)

Table 5 lists and describes the main characteristics of the real options identified by Cucchiella et al (2006).

Table 5. Supply chain risks (Cucchiella et al, 2006)

Supply Chain risks	
Real option	**Description**
Defer	Option to delay investment
Time or Stage	When investment can be seen as a series of outlays
Explore	Possibility to realise a project on prototype scale
Lease	Lease with an option to buy in the future
Outsource	The resource required for the investments realisation can be leased to external actors as well as risks
Alter operating state	Possibility to scale up or down the production is market changes
Abandon switch	If market conditions decline severely, management can abandon current operations permanently and realise the resale value of captital equipment
Strategic grow	R&D, acuisitions and other growth strategies

3.4 Resource-Based Theory – A Possible Way of Explaining The Choices a Company Makes?

The resource-based view (RBV) of the firm aims to explain a company's sustained competitive advantage through its available resources. In order to understand the RBV theory assumptions, firm resources, competitive advantage and sustainable competitive advantage need to be explained.

The theory builds upon two assumptions. Firstly, the theory assumes that industries can have strategic heterogeneous resources and secondly, these resources are not perfectly mobile thus the heterogeneously can be long lasting. Firm resources is according to Barney (1991):

"…all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness."

Competitive advantage is a company's implementing of a value creating strategy not simultaneously being implemented by any current or potential competitor. It is said to have a *sustained* competitive advantage when the above holds plus the competitive firms are unable to duplicate the benefits with the firm's strategy (Barney, 1991). Whether or not sustainable advantage can be obtained is widely discussed and some authors argue that it is impossible (D'Aveni, 1994).

According to Barney's RBV theory, a firms resources need to have the following characteristics in order to have potential to gain competitive advantage; valuable, rare, inimitable and non-substitutable (VRIS). In the following paragraphs the above characteristics are explained briefly. (Barney, 1991)

- *Valuable*
  A valuable resource is a resource that enables a firm to implement strategies that improve its efficiency and effectiveness
- *Rare*
  When other competing firms are not simultaneously implementing the same strategy or having possession to the same resource it is considered rare
- *Inimitable*
  Valuable and rare resources can only be a source of competitive advantage if other competing firms cannot obtain or imitate them
- *Substitutability*
  If the resources can be substituted with other resources and still obtain the same strategically benefits the resources are not a source of competitive advantage

3.5 From Strategy to Manufacturing Flexibility – From Huge to Small Definitions

To understand the term manufacturing flexibility, a wider description of the overhead concepts as strategy, the strategy hierarchy and manufacturing strategy needs to be explained.

3.5.1 What is Strategy?

Strategy is a wide concept and the most common definition used in literature today is Chandler's definition of strategy (1962):

"… the determination of the basic long-term goals and objective of an enterprise, and the adoption of courses of action and the allocation of resources necessary for carrying out these goals." (Chandler, 1962)

In short it can be concluded as the overall decisions regarding goals and the resources needed to fulfil these. (Kirkland, 1962)

Since the strategy definition is wide, a breakdown of the concept into three strategy categories was done and resulted in *The Strategy Hierarchy* developed by Hofer & Schendel (1978). Strategy was divided into *corporate strategy, business strategy and functional strategy.* Corporate strategy refers to the highest level of strategy where assessments concerning the overall business are done. Next level, business strategy, explains how to compete in the business decided in the corporate strategy. Finally, the functional strategy includes how a specific function within the company can add to the competitive advantage of the business. Manufacturing and Research and Development are examples on functional strategies. (Hofer & Schendel, 1978; Wheelwright, 1984)

Corporate strategy and the function manufacturing was discussed in Skinner´s article "Manufacturing – missing link in corporate strategy" (Skinner, 1969). It is stated that corporate strategy affects the manufacturing function but also the opposite. It is also identified that manufacturing needed to be looked at in a new way in order to separate the corporate strategy from the manufacturing functions. Five decision areas are suggested as manufacturing specific and it is argued that these are disconnected from the corporate strategy, as they do not affect the entire company, see table 6. (Skinner, 1969)

Table 6. Manufacturing decisions (Skinner, 1969)

Manufacturing decisions	
Decision area	**Example of issue**
Plant and equipment	Span of process
Production planning and control	Inventory size
Labour and staffing	Job specialisation
Product design and engineering	Size of product line
Organisation and management	Use of staff

This lead to the conclusion that there was a need for a manufacturing policy that turns the management from a bottom up to a top down approach, where goals for manufacturing are set based on the corporate strategy. (Skinner, 1969) This was the beginning of what today is called manufacturing strategy defined as "*Manufacturing strategy consists of a sequence of decisions that will enable a business unit to achieve its desired competitive advantage"* (Wheelwright, 1984). Manufacturing strategy consists of several manufacturing objectives that show the purpose of the manufacturing. Commonly used manufacturing objectives are cost, quality, speed, dependability and flexibility. (Gunasekaran et.al, 2004) The latter will be further explored in this thesis.

3.5.2 Flexibility – With Focus on Manufacturing

Flexibility is also a widespread concept, used in endless contexts and situations. A definition of the content of the word is:

"*Flexibility is the ability to change and react with little penalty to time, effort, cost or performance*" (Upton, 1994)

The focus in this thesis will be manufacturing flexibility and supply chain flexibility.

Manufacturing flexibility is defined as the ability to respond effectively to change and is considered as a functional flexibility (Souza, Williams, 2000; Xie et al, 2009). Manufacturing flexibility plays an important role in the competitive advantages a company can hold and also impacts the strategy of the company. It is also stated that it is important for the company to choose the right type of flexibility to create value. (Xie et al, 2009)

The literature states many variables that are included in flexibility. Gerwin (1993) suggests and reasons a seven angle approach that includes the following areas: 1) Mix flexibility, the ability to produce different products during a set period of time. 2) Changeover flexibility, the ability to adjust and change the process. 3) Modification flexibility, the ability to make modification to a product in the making. 4) Volume flexibility, the ability to change the output of a process. 5) Rerouting flexibility, the ability to change the process steps. 6) Material flexibility, the ability to handle various types of material. 7) Flexibility responsiveness, the ability to change the six flexibilities stated previously due to changes in the internal or external environment. (Gerwin, 1993; Souza, Williams, 2000)

Another way of applying flexibility is in an outsourcing situation. Four dimensions are mentioned: 1) Robustness, an outsourcing collaboration with the ability to change capabilities for example if an urgent product need to be manufactured. 2) Modifiability, an outsourcing collaboration with the ability to adapt to new business requirements such as new reporting routines. 3) New Capabilities, an outsourced collaboration with the ability to adapt to radical changes in the business paradigm such as new legislations. 4) Ease of exit, an outsourcing collaboration with the ability

to terminate the collaboration if for example a conflict were to occur. (Tan, Sia, 2006)

Besides from the above stated areas, the issue of cost for manufacturing flexibility is commonly discussed. Two cost issues are discussed in the literature, the cost of performing a change and the cost of having the ability to change, the latter being of great importance for the company when deciding whether or not to invest in manufacturing flexibility. Slack argues that manufacturing flexibility has three dimensions: range, cost and time. (Slack, 1993)

Hill discusses manufacturing flexibility and defines it as a "strategic cop-out". When a company with dedicated processes have proved to be inappropriate due to changing market conditions the response by the company has often been to invest in more costly new equipment with a high level of flexibility. (Hill, 1993)

"One company, after witnessing an overall decline in volumes throughout the parent group, committed itself to the purchase of flexible processes to cope with an environment of change. An analysis of processes, product life-cycles, and order-winners clearly showed that the purchase, in part, of dedicated plant would best meet these requirements, and eliminated $0,25 million investment on unnecessary flexibility."(Hill, 1993)

3.6 Proposed Hypothesis to be Tested

From the above stated theories and the nature of the case study the hypothesis proposed was *"Flexibility is positively correlated with manufacturing costs in an emerging market"*. Flexibility has previously been associated with high costs when discussing manufacturing flexibility (Hill, 1993). The purpose of adding the context of an emerging market to the hypothesis was to test the already studied fact that a high level of flexibility is costly in a new environment with other conditions. The case study at OBR provided both manufacturing in an emerging market as well as the decision between in house and outsourced production.

4 The Case Study

Chapter four explains the structure of Orkla Brands with emphasis on Orkla Brands Russia. Further along, the information gathering process and the theoretical application on the case study is explained.

4.1 The Case Study Company – Orkla Brands Russia

Orkla ASA is one of Norway's oldest business conglomerates. With a history of more than 350 years it is now the leading branded consumer goods company in the Nordic region. Orkla ASA is also present in the aluminium solution industry and the financial investment sector. Today, the company employs over 30 000 people in over 40 countries and had a turnover of NOK 57 billion in 2011. (Orkla ASA)

4.1.1 Orkla Brands – A Food and Beverage Company

Orkla Foods Nordic consists of food and beverage companies in the Nordic region and the Baltics. Orkla holds number one and number two positions in its home markets. In Norway the main companies are Stabburet and Bakers, in Sweden they are Procordia and Abba Seafood, in Denmark it is Beauvais, in Finland they are Felix, Abba and Panda and in the Baltics they are Kalev, Põltsamaa Felix, Spilva and Suslavicius.

Orkla Brands Nordic comprises of Lilleborg (detergents and personal care products), Lilleborg Profesjonell, Axellus (dietary supplements and health products), Chips Group, Göteborgs/Saetre, Nidar and Pierre Robert Group.

Orkla Food Ingredients is the market leader in the Nordic bakery ingredients industry. The business unit main product categories are margarine products, marzipan, bread improvers and mixes, and yeast.

Orkla Brands International (OBI) is the business unit comprised of business outside of the Nordics and the Baltics. It consists of Orkla Brands Russia (the companies SladCo & Krupskaya), Felix Austria, and MTR Foods in India. (Orkla ASA)

4.1.2 The Case Issue – Pre-Processing in Russia

Under OBI is the company Orkla Brands Russia (OBR), which consists of the two chocolate confectionary companies SladCo and Krupskaya. Today, SladCo and Krupskaya have four factories that produce chocolate, pastries, wafers and biscuits. Even though both companies are active on the Russian market, Krupskaya's main market is in the western Russia and SladCo's in the eastern part of Russia, west of the Ural Mountains.

A consolidation of the companies Krupskaya and SladCo, both on a management level and a production level, is the starting point of creating one company, OBR. The consolidation project is divided into two phases, the first included unifying the organisation and management and the second includes consolidating production. OBR has been successful in gaining management-level synergies and just finished the first phase of the project. The second phase demands finding manufacturing

synergies and also dealing with the fact that one site, the St Petersburg site, need to be closed due to new legislations regarding the presence of industries in the city centre of St Petersburg. Today, the chocolate making process *pre-processing* is located in both the St Petersburg and the Ulyanovsk site and provides the entire company with chocolate products. As the St Petersburg site needs to be closed, the issue of how to manage the demand for chocolate products within the company emerges. Many large international consumer companies similar to OBR outsource their chocolate needs to a third party instead of keeping manufacturing in house. OBR need to decide if the pre-processing should be kept in house, and if so, if OBR should have two sites with pre-processing or just one. Since OBR prioritises cost efficiency above flexibility and risk management the master thesis will follow the same prioritisation.

4.1.3 Manufacturing Options within Orkla Brands Russia

As described before, OBR holds four manufacturing sites today, Ekaterinburg, St Petersburg, Ulyanovsk (PPU) and Petergoff (PPP). Many of the factories produce similar products but that will change when the St Petersburg site closes. Ekaterinburg will produce mostly pastries and bake goods, whereas PPU and PPP will produce the majority of the chocolate products. The distances between the manufacturing sites are great as the PPP site is located just outside of St Petersburg and Ekaterinburg on the west side of the Ural Mountains with a total distance from St Petersburg of 4 000 km. The PPU site is located in the middle of these two sites. As the St Petersburg site is closing, some of the equipment will be moved to PPP because of the short distance and space available at the site and some will be moved to the other sites. The pre-processing equipment could either be moved to PPP and be used in the manufacturing process or moved to PPU and be used as spare parts for the current machinery in PPU. Ekaterinburg is considered as free standing in this report and will not be further discussed, as the site has no impact on the decision regarding pre-processing.

4.2 The Information Gathering Process

The information needed for this research was gathered through several freestanding activities. Visits to factories combined with interviews and a benchmarking study of a similar chocolate confectionary company laid the foundation for the upcoming analysis.

4.2.1 Visits to Manufacturing Sites – From Russia with Love

During February 2012 visits were made to two of OBR´s factories in Russia. The first was to the St Petersburg site, situated in the middle of the St Petersburg city centre; only a few minutes drive from the main street. The factory produces chocolate products under the brand Krupskaya. A tour of the production process was done, accompanied by senior process managers. The purpose of the visit was to deepen the knowledge of how the production process works, how much space is needed for the individual machines and to get an overall understanding of the process.

The second visit was to the Petergoff site outside of St Petersburg. The purpose of this visit was to see the potential for installing many of the production lines from St Petersburg, see a more modern factory and identify possibilities regarding extensions of the current factory area. Currently, the Petergoff site produces pastries and bake goods, but is planned to remove approximately 50% of its current production lines and install the chocolate confectionary production lines that is to be moved from St Petersburg.

4.2.2 Data Gathering Through Interviews

The first meetings were conducted with top management at OBR and later interviews with middle management and specialists were held. Meetings with top management were crucial for understanding the key issue at hand and future production plans and milestones that needed to be reached. During the meetings, management shared valuable insights from earlier projects and helped define what information was needed for a reliable recommendation. Interviews with middle management and specialists were conducted to gain understanding of their special area of expertise, and thus adding one piece at a time to the overall understanding.. The focal point of the interviews in Russia was to identify the costs associated with the different pre-processing steps. Aside form the cost allocation perspective, the interviews worked as a source of knowledge for Russian production specific regulations and limitations, laws and machinery capacity.

- Limitations and regulations for transport of processed cocoa products
    - Intermediate cocoa products in liquid form needs heated transport
    - Chocolate mass in blocks have one to two years shelf life while liquid form only have two months
- Laws and regulations regarding dirty and clean areas in new production buildings
    - The dirty areas in the pre-processing need to be separated from the rest of the production. A new building with at least 15 meters space between the dirty area and the clean production site is the current demand.
- Machinery capacity
    - Information regarding maximum capacity and utilisation grade on a monthly basis was gathered with the purpose to identify bottlenecks and possible future needs for upgrades/expansions.

4.2.3 Benchmarking Study in Norway – A New Perspective

After the visits in Russia, further information was gathered through a benchmarking study of the OBI owned company Nidar in Norway. The visit included a tour of the production facility and also an interview with an experienced production manager, who also had great knowledge about the production sites in Russia. The purpose of the visit was to identify possible changes in the production process in Russia by comparing the two processes and to consult with the production manager about

possible risks connected to the production process and suggestions for improvements in Russia.

The benchmark analysis continued by interviewing the Category Manager in the procurement department at Nidar to get additional understanding about the pricing of outsourced intermediate cocoa products produced in Europe. The interview led to collaboration with the Category Manager in the search for suitable statistics for prices for outsourced intermediate cocoa products from Nidar's suppliers, which were needed in the DCM analysis for this research.

4.3 Theory Applied on the Case Study

The theoretical purpose was to determine if the proposed hypothesis, *Flexibility is positively correlated with manufacturing costs in an emerging market*, could be validated or not. This section highlights the parts from each previously mentioned theory that was selected and how it was applied on the case study.

4.3.1 ISA-95 Contribution – What to Analyse?

The standard ISA-95 was used for highlighting the levels in the functional hierarchy in focus in the theoretical analysis as well as the focus for OBR´s issue. As described in the theory chapter, the functional hierarchy include the steps enterprise, site, area and then three production/process functions with connected units (ISA-95, 2000). Because of the nature of the case study, the major focus of the theoretical approach was on the site- and area functions, see figure 7.

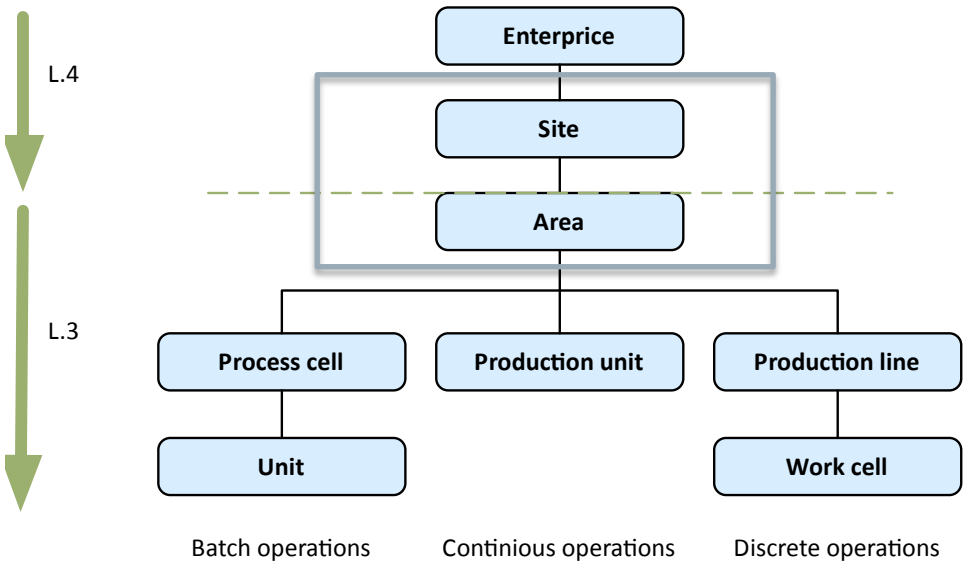

Figure 7. Theoretical focus from the functional hierarchy in ISA-95

4.3.2 Flexibilities in Focus

Since the case study was focused on manufacturing and the issue of how to manage pre-processing manufacturing, parts of Gerwin´s manufacturing flexibilities (1993) was found to be suitable for further determining the best manufacturing scenario with regards to flexibility; volume flexibility, mix flexibility, changeover flexibility and flexibility responsiveness. The factor of ease of exit was contributed from Tan & Sia (2006) as it was assumed to have influence on the outsourcing alternatives.

4.3.3 Risk Mitigation and Real Options in the Supply Chain

The supply chain risks argued in Harland et al (2003) were not all significant for the purpose and not applicable to the OBR case study. After studying OBR's resources and the characteristics of the Russian market, the most important factors were chosen as criterions for the evaluation of the manufacturing scenarios at hand. The Russian social and political conditions made operation-, supplier- and regulatory risks the most appropriate to take into consideration for the analysis. Supply security risk was also added (Manuj&Mentzer, 2008), due to the high political risk in Russia. From a real option perspective, outsourcing in the supply chain was chosen, as it is the most suitable option to handle the risks above. Also, OBR´s pre-processing issue is whether or not to keep in house manufacturing or to outsource to a third party.

5 The Cocoa Industry and the Russian Market

Chapter five describes how chocolate is made, all the way from cocoa bean to ready chocolate with emphasis on the pre-processing steps. Further ORB's macro- and microeconomic situation, from cocoa procurement to the characteristics of the Russian market is explained.

5.1 The History of Chocolate

The usage of cocoa beans origins from South America and the Mayan civilisation, where cocoa beans were used to make a religious drink in the seventh century. The usage spread throughout Central America and the cocoa tree was considered as the tree from paradise. In the 14th century, cocoa beans were used as merchandise and chocolate was introduced to Christopher Columbus and Spanish Hernan Cortes, the latter brought the chocolate to Europe. During the first two hundred years in Europe, the chocolate spread but was still served as a drink. In the end of the 17th century, cocoa started to be used as an ingredient for baking goods. Confectioners also started to make chocolate drops in solid form. Milk chocolate was first introduced in 1875 by Néstle and Peter, and further developed by Lindt in 1879. (Godiva)

5.2 From Cocoa Tree to Tasty Chocolate

The chocolate manufacturing process in PPU and St Petersburg stretches from the cocoa bean to finished chocolate products. Cocoa beans are imported from three countries, Togo, Ghana and the Ivory Coast. The cocoa beans differ in quality where the highest quality beans origins from Togo and Ghana, which are used in St Petersburg while cocoa beans from the Ivory Coast are used in PPU.

5.2.1 Handling in Origin Country

When the cocoa fruit is harvested, the cocoa beans are taken out and transferred to a large fermentation container. The fermentation process brings out the cocoa flavour and sweetens the beans. Every cocoa fruit holds about 20-50 beans each. After a couple of days in the fermentation tank, the beans are sun dried for approximately one week and then packaged for transport to cocoa product producer. (Cocoaweb, ICCO)

5.2.2 The Chocolate Manufacturing Process in St Petersburg- with Emphasis on Pre-Processing

The chocolate manufacturing process is divided into ten stages from cocoa bean to finished chocolate ready for the customers, see figure 8.

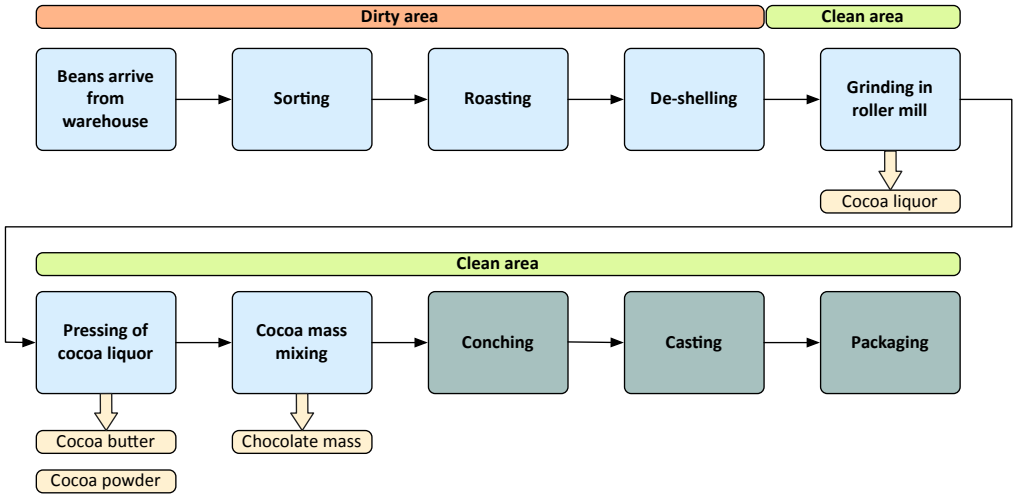

Figure 8. Process mapping of the chocolate manufacturing process

Cocoa beans arrive from a warehouse in trucks. The cocoa beans are then unloaded and stored short before usage. The first stage in the actual production process is the sorting step, where twigs, stones and soil are removed. The cocoa beans are sorted both by machines and manual labour.

After sorting, the cocoa beans are roasted in an oven, this to enhance the flavour and aroma of the ready-made product later on in the process. During this stage, the cocoa beans are exposed to heat, approximately 150 °C, and are thereby also dried. After roasting, the cocoa beans are cut in smaller pieces, cocoa nibs, and at the same time de-shelled. The process has until this stage considered to be dirty, as the cocoa beans are exposed to the surrounding environment and thereby can be contaminated or contaminate other parts of the production process. Up until this, the process has been separated from the down stream processing.

The chopped cocoa nibs are transported further in the process to a three-step grinding phase. Roller mills with small metal spheres are used to crush the cocoa nibs. The friction created by the metal spheres creates heat that temperate the mass. After the three steps of grinding, the cocoa is liquidised and is now called *cocoa liquor* (see picture 1). The cocoa liquor can be stored in tanks or as blocks, depending on the temperature. Some of the cocoa liquor is further processed to other downstream products, while the rest is stored and later on added to the process again in cocoa liquor form.

Picture 1. Cocoa liquor coming out of the roller mill

The cocoa liquor that is processed further is transported to a press, where the cocoa liquor is separated into *cocoa powder* and *cocoa butter*. The cocoa powder is produced as round cakes and stored dry or grinded and packaged as cocoa powder (see picture 2). The cocoa butter is in liquid form and is stored in tanks before further processing (see picture 3).

Picture 2. Cocoa powder cakes after pressing

With all the produced ingredients the recipes can be mixed and *chocolate mass* is produced. Cocoa butter, cocoa liquor and sugar are mixed to the ratio in the recipes. This is where pre-processing ends and actual chocolate making begins. The chocolate mass is then pressed and worked before entering the conching stage. Conching means that the chocolate mass is worked, tempered and agitated for a long period of time. At this stage, aromas as vanilla can be added to the mass. After conching the chocolate mass is smooth and ready for further processing as finished *chocolate.*

Picture 3. Cocoa butter after pressing

Before casting the chocolate, it is tempered in tanks. Casting is done in various ways depending on what kind of form the finished chocolate is to have. Some is used for glace and some for tablets for example. After casting the finished chocolate is packaged and ready for transportation to the customers.

5.2.3 The Pre-Processing in Numbers

To calculate the total outcome of cocoa butter from one tonne of raw cocoa beans, it is necessary to know the losses through the process. To simplify the calculations, new process boundaries were drawn up based on the output products, clean cocoa beans, cocoa liquor and cocoa butter. The parts that did not regard pre-processing were taken out of the scheme. For each block in the scheme in figure 9, the losses are stated in percentage of raw beans added in the process.

Figure 9 shows that from one tonne of raw cocoa beans, the actual output today after the pre-processing equals 183 kg cocoa butter for PPU and 143 kg of cocoa butter for St Petersburg (to be PPP). Along the way several waste sources were identified, where waste from roasting and de-shelling was found to be the greatest. After the grinding step where cocoa liquor is produced, approximately 64% of the produced cocoa liquor is taken out of the process in St Petersburg in comparison to 52% in PPU. The cocoa liquor taken out is used in the chocolate mass-mixing step. The total loss along the process from cocoa bean to cocoa butter was found to be approximately 16% for St Petersburg and 17% for PPU. The results from the process mapping and losses were used in the calculations when preparing for the DCM analysis.

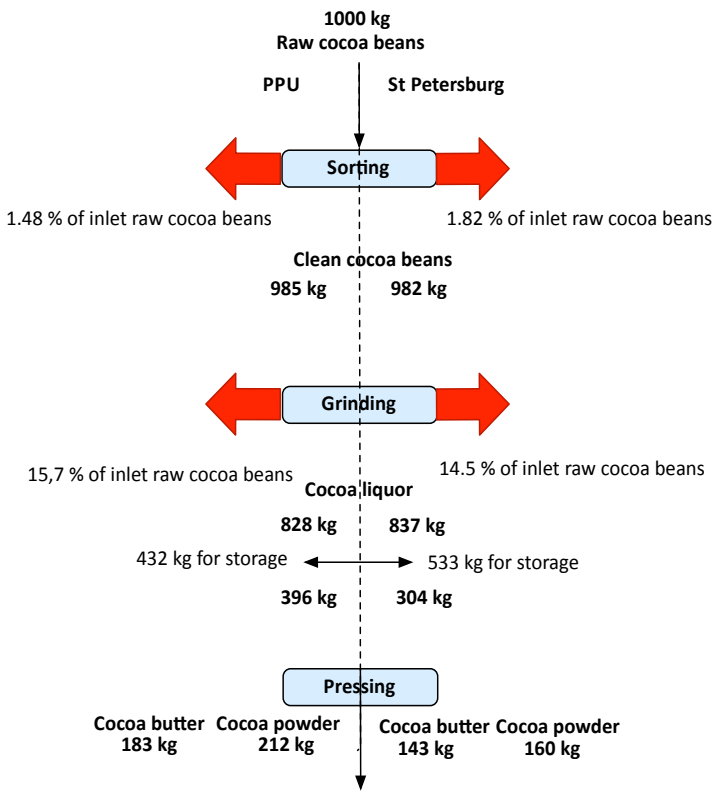

Figure 9. Losses along the pre processing for both St Petersburg and PPU

5.3 The Cocoa Industry

The cocoa industry has undergone notable structural changes. The trend is towards high degree of vertical integration and horizontal concentration, although in different parts of the chain. Firstly, the vertical integration can be seen between trading and processing companies as the main trading companies on the international market now also engage in cocoa processing. Secondly, the largest cocoa processing companies have now stretched downstream to produce industrial chocolate mass. The structural changes in the second part are due to the increasing trend of outsourcing among large chocolate companies, such as Nestlé and Cadbury. For the largest cocoa traders and processors (Barry Callebaut, Cargill) this has meant vertical integration from trading to production and trading of semi-finished and industrial chocolate mass. (UNs Conference on Trade and Development)

The horizontal concentration between processors has involved mergers between large multinational companies. Two industry specific factors are firstly, the need for chocolate processors to gain scale in order to increase cost efficiency and secondly, the desire for large chocolate consumer companies to outsource their requirements for chocolate to a few chocolate processors. (UNs Conference on Trade and Development)

5.3.1 Bargaining Power in the Chocolate Confectionary Market

With these trends of vertical integration (V.I) and horizontal consolidation, the bargaining power is unevenly distributed. There are many small farmers (sellers) but almost an oligopolistic character of trading and processing companies (buyers). Collusive behaviour is a large risk factor in this market where foreign companies internalise backwards into producing countries. On the other hand, the large chocolate companies (Nestlé, Cadbury) are balancing the trading and processing companies bargaining strength with professional procurement departments and by being well informed about the costs associated with cocoa processing. (UNs Conference on Trade and Development) Figure 10 shows both the material flow in the chain as well as the bargaining power shift.

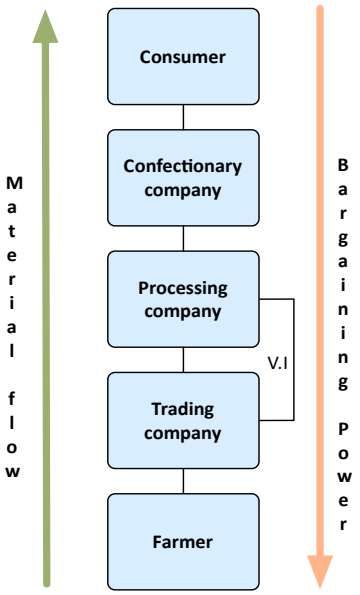

Figure 10. Bargaining power in chocolate confectionary

When looking at the consuming countries and the importance of brand marketing there are indications that consumer product companies are reaping the extra value. On the other hand, the high costs of marketing and distribution may undermine the high chocolate margins. (UNs Conference on Trade and Development)

5.4 Procurement in the Cocoa Industry

Cocoa beans are traded as a commodity on the New York- and London International Financial Futures and Options Exchange (LIFFE). Processed cocoa; cocoa liquor, cocoa butter, cocoa powder and industrial chocolate mass are bought from cocoa processing companies, where the major players are Cargill, ADM and Barry Callebaut.

5.4.1 Consumer Companies Purchasing Cocoa Beans

Historical prices of cocoa beans has shown to be volatile with prices reaching a peak of $3 525 in January 2011 and a bottom of $1 529 October 2006. (ICCO) To create stability, discover price and eliminate risk in a volatile market, consumer companies with in house pre-processing trades futures. (The Ice) There are both benefits and disadvantages by purchasing futures, companies can either get the beans at a premium or below market value price, but it makes production and cost estimations easier to plan.

5.4.2 Consumer Companies Purchasing Intermediate Cocoa Products

When sourcing processed cocoa, one can do this at different stages in the pre-processing; cocoa liquor, cocoa butter or chocolate mass. Prices for the different intermediate products at producers are set as a ratio times the current market price of raw cocoa beans. Table 7 below illustrates an example of how the prices can be set. The example shows ratios for cocoa liquor from the Ivory Coast for February 6th 2012, estimated for the coming year. This ratio, in this case 1,38, is then multiplied with the LIFFE price. (Baklykov)

Table 7. Liquor ratios (Gaydamashko)

Liquor ratios					
Feb 06, 2012		Ratio FCA-A'dam	LIFFE	GBP/USD	Price USD
CC-Liquor-IC	Mar '12	1,38	1516	1,579	3303
CC-Liquor-IC	May '12	1,38	1530	1,579	3332
CC-Liquor-IC	July '12	1,38	1545	1,579	3360
CC-Liquor-IC	Sept '12	1,38	1555	1,579	3380
CC-Liquor-IC	Dec' 12	1,38	1560	1,579	3389

Although the same principles are applied for cocoa liquor and cocoa butter, the pricing method for industrial chocolate mass differs. Chocolate processors producing industrial chocolate mass do this on demand and custom made after each consumer company's recipe. Because the percentage of cocoa liquor, cocoa butter and additives varies with each specific recipe, the pricing model often consists of commodities prices and a fixed mark-up per tonne to cover conversion costs.

5.5 The Russian Confectionary Market

The Russian confectionary market is the fourth largest in terms of turnover after Great Britain, Germany and USA. Contributions per confectionary segment are shown in table 8 (Ofiserova).

Table 8. The Russian confectionary market segments and their market value and volume in per cent (Ofiserova)

Russian confectionary market		
Segment	**Market volume in %**	**Market value in %**
Chocolate confectionary	44%	61%
Pastry	40%	30%
Sugar confectionary	14%	9%

The development of the Russian confectionary market can be seen in figure 11 and 12. The lines clearly illustrate the fast recovery of chocolate confectionary after a major decline in 1999. After the recovery, a strong growth in the segment can be seen indicating the superior popularity of chocolate over pastries and sugar confectionaries. It is clear that the value of the chocolate segment has not been growing as fast as the volume, indicating falling average prices of chocolate due to increased popularity of more budget alternatives.

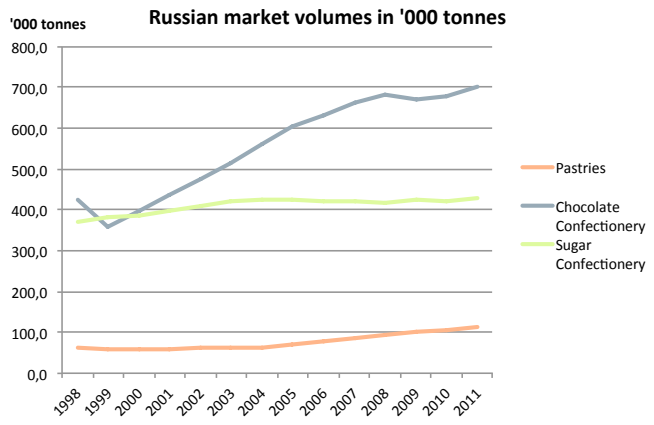

Figure 11. Russian market volumes (Euromonitor, 2012)

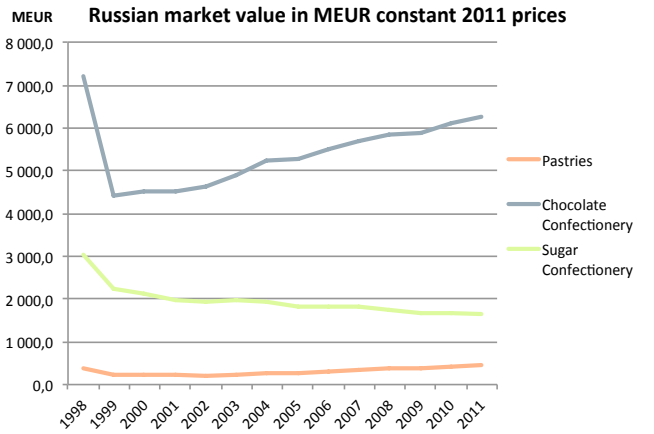

Figure 12. Russian market value (Euromonitor, 2012)

5.5.1 The Russian Chocolate Confectionary Market

Each regions volume, value and population is shown in the table 9. The largest areas in terms of both volume and value are Central, Volga and Siberia region.

Table 9. Sales per region in Russia (Ofiserova)

Sales per region			
Region	**Population mil people**	**Volume share in %**	**Value share in %**
North-West region	13,4	11,2%	12,2%
Central region	37,1	32,8%	35,9%
Volga region	30,1	21,2%	18,3%
South region	23	11,0%	10,4%
Ural region	12,3	8,5%	8,1%
Siberia region	19,6	12,8%	12,3%
Far East region	6,4	2,6%	2,8%
National Russia	141,9	100,0%	100,0%

In figure 13, the red pins illustrate where OBR has its production sites. These are all situated near or in their core markets – Central, Volga, Siberia and Northwest region.

Figure 13. Russian regions with marked OBR production sites (Ofiserova)

5.6 Risks and Vulnerabilities in Russia

The Russian market is influenced by several factors that affect companies operations in different ways.

5.6.1 Socio-Political Risks

The GINI index is an index that measures income inequalities in countries. It is denominated as a number between 1 and 100, where 1 being perfect equality and 100 being perfect inequality. In 2009 Russia's Gini index was 41,1 compared to 39,5 in 2000. (The World Bank) Despite increasing average income, the wealth tends to

be concentrated to the Moscow and St Petersburg area, with poverty spread in many other regions. (Euromonitor, 2011)

Corruption Perception Index (CPI) is an index from Transparency International measuring perceived public corruption in 183 countries. It is denominated, as a number between 10.0 and 0.0, where 10.0 is perfect non-corruption and 0.0 is perfect corruption. Russia comes in 143rd place with a score of 2,4, compared to Sweden and Norway's 4th and 6th place with scores of 9,3 and 9 respectively. (Transparency International, 2012)

5.6.2 Country Specific Logistics Risks

Logistics Performance Index (LPI) is a tool that assesses logistic performance of 155 countries worldwide. A brief explanation of the variables is described below. The Russian Federation scores low in all variables indicating high risks and also possibly higher real costs, see table 10. (Logistics Performance Index, 2012)

- **Customs**: Efficiency of the clearing process (i.e speed, simplicity and predictability of formalities) by border control agencies, including customs
- **Infrastructure**: Quality of trade and transport related infrastructure (e.g. ports, railroads, roads, information technology)
- **International shipments**: Ease of arranging competitively priced shipments
- **Logistics competence**: Competence and quality of logistics services (e.g. transport operations, customs brokers)
- **Tracking & tracing**: Ability to track and trace consignments
- **Timeliness**: Timeliness of shipments in reaching destination within the scheduled or expected delivery time

Table 10. Russian Logistics Performance Index (Logistics Performance Index)

Russian Logistics Performance Index							
Country	LPI	Customs	Infrastructure	International shipments	Logistics competence	Tracking & tracing	Timeliness
Russian Federation	2.61	2.15	2.38	2.72	2.51	2.60	3.23
Sweden	4.08	3.88	4.03	3.83	4.22	4.22	4.32
Norway	3.93	3.86	4.22	3.35	3.85	4.10	4.35

5.7 Emerging Markets – Countries Moving Forward

The term emerging market is broadly used and the variations of the term can be very specific, like BRIC or Asian Tigers. But all terms have one thing in common; they emphasise the motion forward from being a developing nation to a developed nation. (EoBITW, 2012)

5.7.1 BRIC Countries – History and the Future

The BRIC countries refer to the fast growing economies of Brazil, Russia, India and China (Goldman Sachs, 2003). Jim O'Neill, economist at Goldman Sachs, first developed the phrase "BRIC countries" in the article *The World Need Better Economic BRIC's in 2001 (Goldman Sachs, 2005).* The BRIC's are often compared to the G-countries, initially including the US, UK, France, Germany, Italy and Japan. Later on Canada has been added and in some contexts also Russia. (The Globalist, 2006) O'Neill argued in his article from 2001 that the BRIC countries together would overcome the economies of the G7 countries by 2050.

6 Analysis and Results

The data gathered in the previous chapters are here analysed. Firstly, a data analysis is conducted followed by a manufacturing scenario analysis. Secondly, the scenarios are analysed through the chosen theoretical lens.

6.1 ISA-95 applied on Orkla Brands Russia

As described in the theory chapter, ISA95 can be used as a tool to map and categorise the levels in a company, from the enterprise down to work cells. The purpose with this analysis was to give the reader a clear picture of the company structure, how it can be broken down in smaller pieces and highlight the levels in focus in the following analysis.

6.1.2 Results from ISA-95 Standardisation

As can be seen in figure 14, the enterprise Orkla Brands Russia, OBR, holds four production sites located in St Petersburg, Ekatrinburg, Ulyanovsk and Petergoff. Since pre-processing only is available in PPU and possibly in PPP after the move from St Petersburg, these sites were further explored in the analysis. Areas identified were pre-processing, chocolate making and packaging. Process cells were only mapped for the area pre-processing and resulted in five process cells. The machines were placed on each process cell, to which it belonged. For entire ISA-95 standardisation and chosen paths marked in light blue, see figure 14. The focus of the master thesis and the analysis were on site and area level marked in orange.

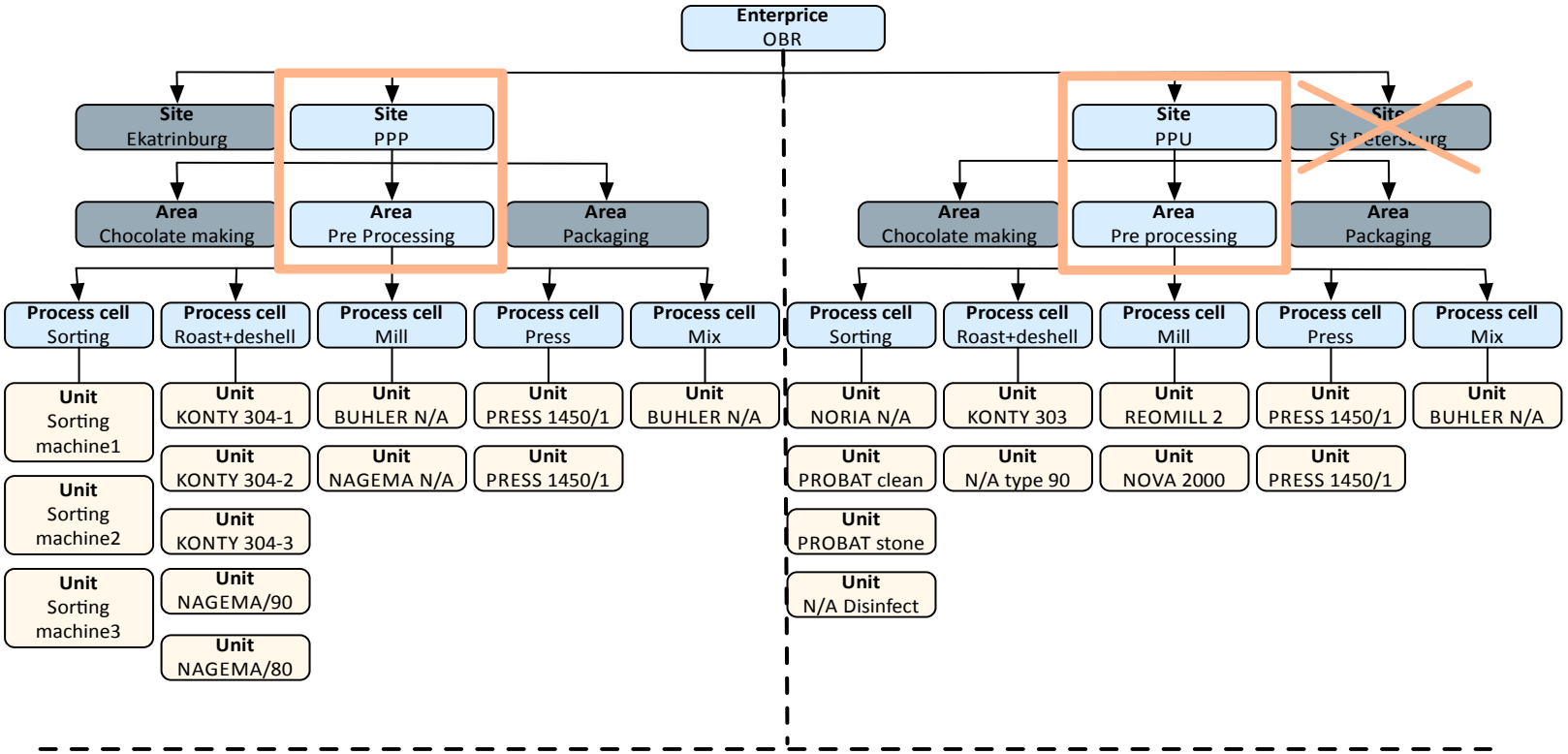

Figure 24. Equipment hierarchy from ISA-95 applied on OBR with highlighted focuses

6.2 Data Analysis – Two Tracks Combined into One

Data was collected trough several activities; interviews, visits to factories and a benchmarking study. The data was then sorted in order to find the appropriate factors to analyse. It was decided to divide the data load into in house related data and outsourced manufacturing related data. Some of the data, for example purchasing of raw cocoa beans, were used in both tracks. These separate tracks were to be analysed individually and then be put together in a cost model, one for each site with pre-processing in focus. The year chosen for comparison between in house production and outsourced production was 2011, because of the large amount of data available. The current production costs from the St Petersburg site were directly transferred to PPP, as it is only PPP and PPU that was further analysed.

6.2.1 In House Manufacturing Related Costs

All information regarding in house production was gathered and sorted according to source and what the information regarded. The following paragraphs show the breakdown that was used to organise the data load.

Firstly, the prices of raw cocoa beans were analysed. Prices from LIFFE were gathered from January 2001 to January 2012. The purpose of this was to see fluctuations in the cocoa bean price, see figure 15. (ICCO, 2012) As LIFFE only represents the price of the actual raw bean on the market, two other parameters were to be taken into consideration to reach a fact price, differentials and logistics. Differentials refer to the cost for transport from origin country, cost for emissions and cost for transport from first carrier to warehouse. Logistics refer to the cost of transport from warehouse to manufacturing site. When adding up LIFFE, differentials and logistics, a fact price for raw cocoa beans could be calculated. No customs fee was added for import of cocoa beans, as it is a commodity.

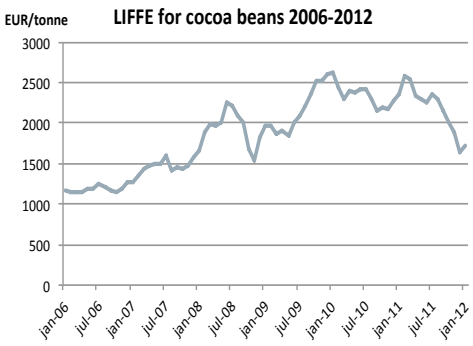

Figure 15. Prices on the London Stock Exchange for cocoa beans 2006-2012 (ICCO)

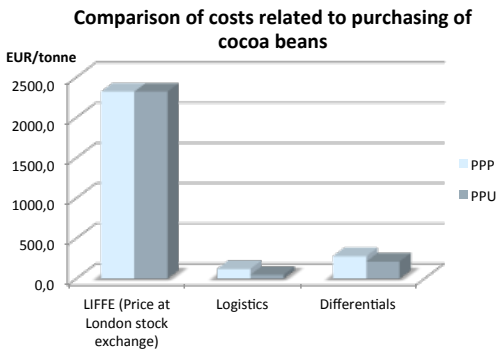

Figure 16. Comparison of average costs for purchasing of cocoa beans for 2011

The total cocoa bean price for the two factories differed because of differences in bean quality and transport costs. Since the purpose of the analysis included determining the best manufacturing process, the same cocoa bean price was used

for both factories. The cocoa bean price calculated for PPP was chosen as the best choice because of the higher quality cocoa beans, even though the total price per tonne was higher.

Secondly, actual production costs as labour, energy, transport, maintenance and depreciation were categorised as conversion costs. The production process was used as a basis for the cost model. Four stages in the production process were chosen as suitable stages because of the outsourced purchasing possibility for the same intermediate products; cocoa bean, cocoa liquor, cocoa butter and chocolate mass. For each stage, conversion costs were allocated per tonne intermediate product produced. Material costs for the stages were directly transferred from the stage above with exception to chocolate mass, where a recipe for dark chocolate with 44,5 % cocoa liquor and 9,6% cocoa butter was used. All calculations were done per tonne intermediate product. In addition to conversion costs, costs for losses in the production process were added for each stage.

6.2.2 Outsourced Manufacturing Prices and Related Costs

The same approach for data analysis was performed for outsourced production. The same costs that had been sorted and analysed regarding raw cocoa beans were used. Same LIFFE prices were used as in the in house analysis, this to simplify the comparison later on in the process. Prices were collected for both Russian suppliers and suppliers from EU. The prices for intermediate products such as cocoa liquor and cocoa butter were based on ratios that were multiplied by LIFFE for cocoa beans to get the actual purchasing price. Since the data load were sheets of daily ratios for cocoa liquor and cocoa butter from two different suppliers, the data needed to be monthly sorted. Because of the size of the data load it was decided to use structured sampling in order to manage the information.

Three samples were taken for each month and each intermediate product; dates chosen were 10th, 20th and 30th of each month. If exact dates happened to be a Saturday or Sunday, the nearest date available was used. Monthly averages were calculated for the two intermediate products and the two individual suppliers. The supplier that had provided the largest amount of data was chosen as the best source of information as the average was based on more entries, see figure 17.

The ratios were then multiplied by LIFFE for each month and after an adjustment of transportation costs of 140 EUR/tonne the data were added to the cost model.

Besides costs for products, costs for transport from supplier to site, customs needed to be taken into consideration. For international suppliers, a customs fee of 10 % was added to the cost model.

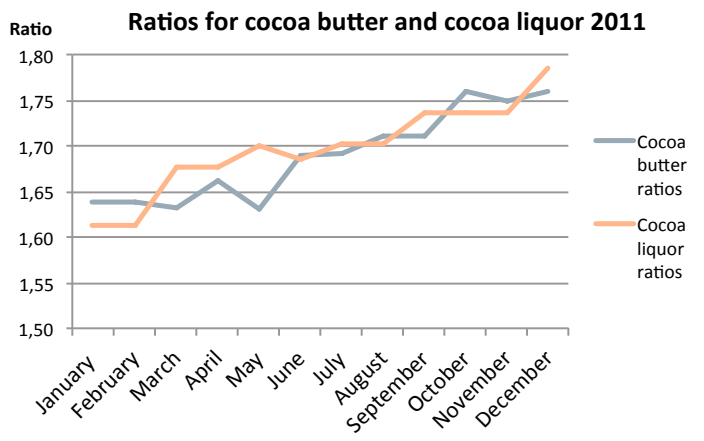

Figure 17. Ratios for cocoa butter and cocoa liquor for 2011 (Myrbäck)

Transport costs varied depending on what state the products were transported. Cocoa liquor, cocoa butter and chocolate mass can be transported both in solid form as blocks and in liquid form. The transport costs are two times higher if the intermediate products are transported in liquid form because of the need for tempered transportation. Especially the tempering aspect matters when transporting in Russia because of the cold climate during winter. All intermediate products were delivered in liquid form.

6.2.3 In House Manufacturing Versus Outsourcing

The data analysis resulted in a monthly detailed cost model for each site. The cost model included both the in house alternative as well as the outsourced alternative. For easy comparison, a yearly average cost per intermediate product was calculated.

The conversion costs for in house production differed between the two factories and it could be seen that production in PPU was more cost efficient than in PPP, see figure 18.

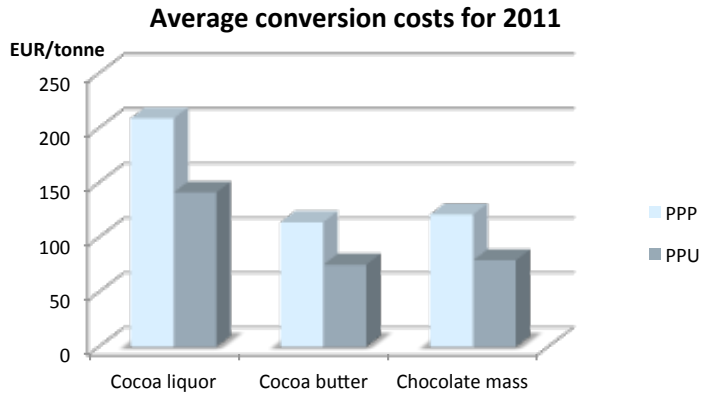

Figure 18. Comparison of average conversion costs for 2011

Production costs that differed the most were labour and energy, see table 11. The post "Transport" in table 11 refers to internal transportation within the site.

Table 11. Conversion costs for both PPP and PPU

Conversion cost drivers			
[EUR/tonne]	Average conversion costs		Relative conversion cost
	PPP	PPU	PPP/PPU
Labour costs	84	52	162%
Energy	12	9	133%
Transport	1	1	100%
Maintenance	6	6	111%
Depreciation	8	7	116%

Other interesting findings were the difference in transport cost of raw beans from origin country to the two sites. Transport to PPP turned out to be 54% more expensive than transport to PPU.

When comparison with outsourced prices were done, only suppliers from EU was found to provide all intermediate products. Russian suppliers only produced chocolate mass. When comparing in house costs with outsourced products produced in EU, it was clear that in house production is more cost efficient than outsourced production. The largest difference is seen for PPU, this because of the more cost efficient production and the increased transportation costs for the outsourced production, see figure 19 and 20. Total conversion cost model for both in house production and outsourced alternatives for PPU and PPP can be found in appendix 1.

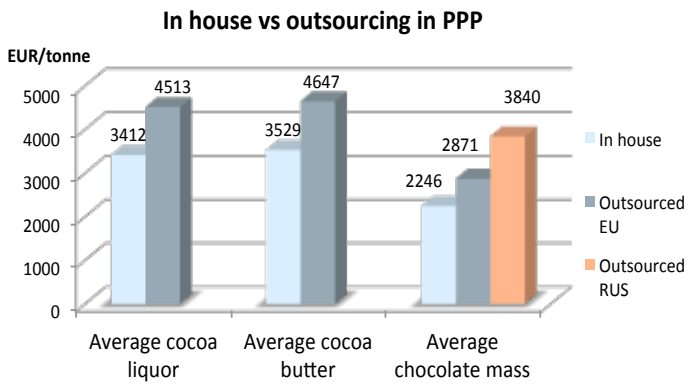

Figure 19. Comparison for intermediate products in PPP

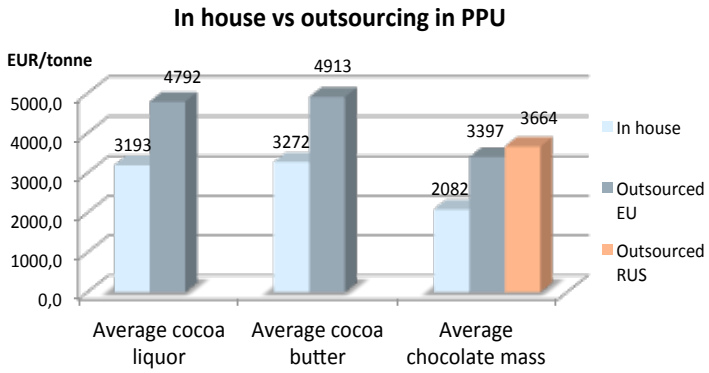

Figure 20. Comparison for intermediate products in PPU

6.3 Manufacturing Scenario Analysis

After the data analysis was conducted the total conversion costs could be determined for each site, thus revealing the most efficient site, PPU. The different production alternatives that were to be combined and analysed could therefore be limited to the following:

As described in the data analysis chapter, the four stages of production are denoted in the table 12 as 1,2,3 and 4. Production alternative 2 to 4 mean various levels of outsourcing, while production alternative 1 is solely in house manufacturing. Production alternatives 5 to 7 represent each stage that PPP could source production to PPU. Production alternatives where PPU buys intermediate products from PPP was excluded from the analysis because the production in PPP is proven to be more expensive, thus the alternatives would not result in a more cost efficient manufacturing scenario.

Table 12. Production alternatives

Production alternatives			
Denotation	Level of pre processing	PPP factory	PPU Factory
1	In house production	✓	✓
2	Production from cocoa liquor	✓	✓
3	Production from cocoa liquor & butter	✓	✓
4	Production from chocolate mass	✓	✓
5	Buy chocolate mass from PPU	✓	N/A
6	Buy cocoa butter & liquor from PPU	✓	N/A
7	Buy cocoa liquor from PPU	✓	N/A

6.3.1 Investment Analysis

Each production alternative was associated with different capital expenditures. The necessary investments varied due to each scenarios different prerequisite. The factors influencing the variable investment costs were the following:

- Moving costs of equipment from St Petersburg to PPP or PPU
- Upgrading costs either for larger capacity or renewal of old machines
- Construction of new building at PPP because of handling of dirty goods

Capital gains and losses were disregarded due to the old age of the machines (S. Gaydamashko). Table 13 and 14 show the investment and moving costs for each production alternative for each manufacturing site.

Table 13. Investment analysis PPU

PPU			
[MEUR]	Investment cost	Moving cost	Capital gains
1 (IH)	1	0,05	N/A
2 (CCL)	1	N/A	N/A
3 (CCB)	1	N/A	N/A
4 (ICM)	1	N/A	N/A

Table 14. Investment analysis PPP

PPP			
[MEUR]	Investment cost	Moving cost	Capital gains
1 (IH)	3,12	0,15	N/A
2 (CCL)	1	0,1	N/A
3 (CCB)	1	0,1	N/A
4 (ICM)	1	N/A	N/A
5 (ICMPPU)	1	N/A	N/A
6 (CCL+CCBPPU)	1	N/A	N/A
7 (CCLPPU)	1	N/A	N/A

6.3.2 Manufacturing Scenarios for Managing Pre-Processing

Based on the production alternatives available, 19 manufacturing scenarios were combined in a scenario matrix, see table 15. The 16 scenarios marked in red are all different levels of in house production with outsourcing to third party, while the blue are all different levels of sourcing from PPU to PPP where PPU do full in house.

Table 15. Investment scenario matrix

Investment scenario matrix								
[MEUR]		PPP						
		1 (IH)	2 (CCL)	3 (CCB)	4 (ICM)	5 (ICMPPU)	6 (CCL+CCBPPU)	7 (CCLPPU)
PPU	1 (IH)	4,27	2,15	2,15	2,05	2,05	2,05	2,05
	2 (CCL)	4,27	2,1	2,1	2	N/A	N/A	N/A
	3 (CCB)	4,27	2,1	2,1	2	N/A	N/A	N/A
	4 (ICM)	4,27	2,1	2,1	2	N/A	N/A	N/A

6.3.3 Discounted Cost Model Analysis – A Net Present Value Analysis with a Twist

When evaluating which production strategy to adopt, from a pure costs perspective, a Discounted Cost Model (DCM) analysis was done. The DCM analysis is a revised Net Present Value analysis that only considers expenses, not cash inflows. There are many ways of evaluating investments but the DCM was chosen in this master thesis as Orkla's most commonly uses the net present value method.

Weighted Average Cost of Capital (WACC) was set to 16 % after adding inflation premium and country risk of 2% and 4%. (Stoltz) The investment horizon was set to the economic value of new machines i.e. ten years. Yearly produced volume started at 2011 years level and a growth of 5 % were then added the rest of the ten-year period due to expected increased demand for chocolate in Russia. The total cost for each scenario was calculated with the following formula:

$$DCM = Initial\ investment + \sum_{n=1}^{10} \frac{Variable\ costs}{(1 + WACC)^n}$$

The results of the DCM can be seen in figure 21. The first number represents PPU and the second number PPP at different levels of in house production/outsourcing, for further explanation of the meaning of the numbers see table 15. The green columns represent the four top alternatives with the lowest cost, and the orange represent the four least cost efficient scenarios. Complete analysis for all scenarios can be found in appendix 2.

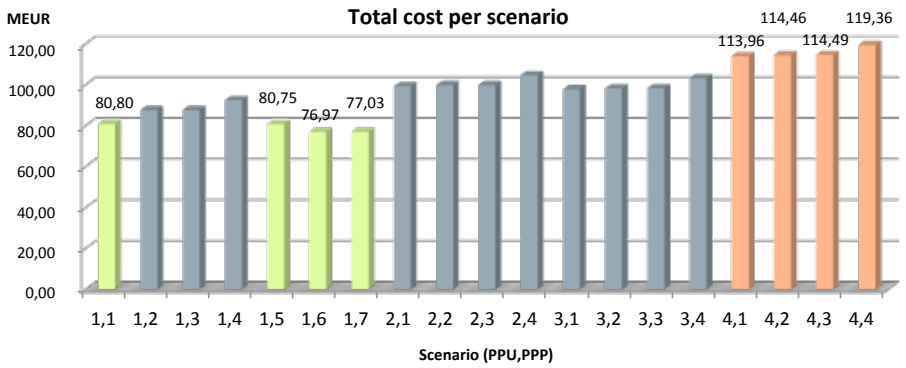

Figure 21. Total discounted cost per scenario

6.3.4 Sensitivity Analysis -

A sensitivity analysis was conducted to see if different WACC's or investment costs affected the results. The WACC was changed 1,3,5 and 10 points up and down and investment costs were increased to 2,4,6 and 10 MEUR. The actual costs of each alternative changed with each test but the relative results were unchanged and initial internal ranking was kept.

6.4 Flexibility and Supply Chain Risks

The previous DCM-analysis showed a significant difference in cost between the scenarios in the case study. To provide the necessary information to argue for or against the proposed hypothesis, a quantitation of flexibility parameters and supply chain risk management parameters was performed. As declared in chapter 4.3, parts from both flexibility theory and SCM-theory were chosen as suitable scoring variables, see table 16.

Table 16. Scoring variables for the evaluation

Scoring variables	
Flexibility	**SCM risk factors**
Volume flexibility	Operational risk
Mix flexibility	Supplier risk
Changeover flexibility	Regulatory risk
Flexibility responsivness	Security risk
Ease of exit	

6.4.1 Flexibility and Risk Management Evaluation

From the 19 manufacturing scenarios previously worked out and analysed with the DCM, the four best and worst scenarios were selected for this part of the analysis, i.e. the four scenarios with the highest and the lowest costs. All manufacturing scenarios were scored according to the grading of both evaluation approaches but only the eight scenarios from the top and bottom of the DCM analysis were compared, see figure 20. Note that all the scoring variables in table 16 were scored for each manufacturing scenario ending up in a maximum score of 36 points per manufacturing scenario.

Table 17. Scoring grading with descriptions

Scoring description				
	1	**2**	**3**	**4**
Flexibility	Very poor flexibility	Poor flexibility	Good flexibility	Very good flexibility
Risk management	Very poor risk management	Poor risk management	Good risk management	Very good risk management

The matrix in table 18 shows the results of the scoring for the chosen scenarios. Scoring for all other manufacturing scenarios can be found in appendix 3. The scoring was based on knowledge gained from the interviews and previous studies regarding the Russian market environment.

Table 18. Scenario scoring matrix for flexibility and risk management ability

Scenario scoring matrix										
	Flexibility criterions					Risk managment criterions				Total Score
Scenario	Volume	Mix	Changeover	Flexibility responsivness	Ease of exit	Operational	Supplier	Regulatory	Security	
1,1	2	4	4	3	2	4	2	1	4	26
1,5	3	4	4	4	4	4	3	4	4	34
1,6	3	4	4	4	4	4	3	4	4	34
1,7	3	4	4	4	4	4	3	4	4	34
4,1	3	3	3	3	3	3	3	2	1	24
4,2	4	3	2	2	3	2	2	3	1	22
4,3	4	3	2	2	3	2	2	3	1	22
4,4	4	3	2	2	3	1	2	3	1	21

7 Conclusion and Discussion

In this chapter the conclusions are presented. Firstly the conclusions from the analysis are presented, followed by a recommendation for Orkla Brands Russia. Secondly the results are discussed and an attempt to explain the results is given through the lens of RBV followed by suggestions for further research. Finally suggestions for further research are presented.

7.1 Theoretical Conclusion – Hypothesis Could Not be Validated

In the introduction, the following hypothesis was assumed: "*Flexibility is positively correlated with manufacturing costs in an emerging market*". Based on the results from the DCM analysis and the flexibility and SCM risk management evaluation, it can be shown that the hypothesis cannot be validated. As the results show, the four most cost efficient manufacturing scenarios in the case study, proved to have the highest level of manufacturing flexibility and SCM risk management scores. The results were unanimous for the four scenarios on each side of the cost range, see figure 22.

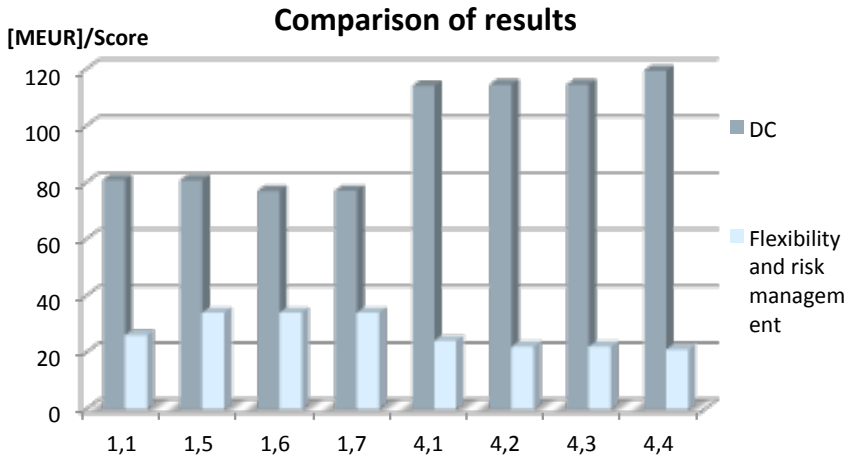

Figure 22. Comparison of results from DCM and flexibility and risk management evaluation

As can be seen in figure 22, the four alternatives with in house production at both sites and in house at PPU with sourcing to PPP are the most cost efficient as well as the most flexible according to the results. Total outsourcing at PPU in combination with the four production alternatives at PPP proved to be the most expensive and the least flexible. These results go against the common assumption that a high level of manufacturing flexibility is correlated with high costs, as to why the hypothesis cannot be validated.

7.2 Recommendation for Orkla Brands Russia – Keep Pre-Processing in PPU

Regarding a recommendation for OBR's manufacturing issue, the results show that from a cost, flexibility and risk management perspective, the pre-processing should be kept in house and only at PPU since it is the most efficient site. When only considering costs, the manufacturing scenario where pre-processing is kept at PPU and PPP sources cocoa butter and cocoa liquor from PPU was proven to be the most efficient alternative (alternative 1,6). The difference between the most cost efficient and second most cost efficient was insignificant (0,06 MEUR) but the second most efficient meant that a part of the pre-processing needed to be kept at PPP i.e. the pressing part of the cocoa liquor into cocoa butter and powder. Whether or not this is favourable or not is left for OBR to decide.

Since transportation is costly it is more efficient to transport high-valued products i.e. cocoa liquor and butter instead of chocolate mass that has over 40 % added sugar. And since sugar is an inexpensive commodity compared to cocoa and can be acquired through many regional distributors within Russia, it is more efficient to add the sugar in PPP to avoid unnecessary transportation, i.e. supporting manufacturing scenario 1,6 and 1,7.

Orkla is suggested to further explore outsourcing possibilities within Russia. If possible, comparison for the other intermediate products, cocoa butter and cocoa liquor should be done in order to provide a complete analysis with all possible scenarios of manufacturing. Also the issue of transporting sugar should be taken into consideration.

7.3 Result Discussion

The major findings from the DCM analysis were the impact of the transport costs and the difference in conversion costs between PPU and PPP. Starting with the firstly mentioned, the transport costs for raw cocoa beans from origin country to site was found to be 56% more expensive for PPP than PPU. The reason for this is assumed to be the way of transporting. The majority of goods to PPU go by railroad whilst PPP uses mostly road transportation. There is also a significant difference in transportation costs of liquid goods and solid goods. Russia only has a 2,61 score in the Logistics Performance Index compared to Norway's 3,91. The high transportation costs for road transport may be due to the poor infrastructure and lack of logistics competence in Russia. In the DCM analysis, liquid transport was used in the calculations and resulted in a 50% higher transport cost than if solid transport had been used. The reason for usage of liquid transport was mainly because the outsourcing costs in the analysis were for liquid intermediate cocoa products. Secondly, as seen in the DCM analysis there is a small cost difference between 1,5; 1,6 and 1,7. All alternatives mean in house production at PPU and sourcing from PPU to PPP, the only differences are what intermediate product is shipped from PPU to PPP and what additional equipment is needed at PPP to handle the intermediate products from PPU.

The outsourcing alternatives at hand for this thesis could have been further explored, especially within Russia. Surprisingly, the EU producers provided both more cost efficient alternatives as well as a broader product mix. The intermediate product found in Russia was only industrial chocolate mass; no supplier for cocoa butter and cocoa liquor was found. Instinctively, Russian industrial chocolate mass was thought to be more cost efficient than EU produced because of shorter transports and low-cost labour. The comparison proved the opposite. The reason to why the EU could provide more cost efficient alternatives and also several more alternatives is thought to be a larger market and demand for the products. The companies used in the comparison are global companies that provide the globe with products, and are therefor assumed to be able to provide lower prices due to assumed economies of scale. The Russian market is limited and the export of chocolate products are assumed to be low, i.e. a smaller market and demand and thereby a higher price.

The high difference in conversion costs derives predominantly from the difference in labour costs between the sites. Overall, the conversion costs are 62% higher in PPP than PPU, where labour costs represent approximately 65% of the total conversion cost in PPU and 70% of the total conversion cost in PPP. There is also a risk that the conversion costs will increase at PPP due to increased labour costs. Russia has a high GINI score and it is rising every year, this implies a high income-inequality where most of the wealth is concentrated to the urban area of St Petersburg and Moscow. Since PPP is closely located to St Petersburg this might be an indication that labour costs in PPP will increase relative to PPU in the future, which further supports the chosen manufacturing scenario where pre-processing is located at PPU.

The flexibility and SCM risk management evaluation was scored according to knowledge gained from the interviews, observations, literature study and the benchmarking study. As can be seen in appendix 3, some of the manufacturing scenarios that was not included in the four top and bottom scenarios from the DCM analysis (scenario 1,2; 1,3; 1,4) scored higher flexibility and risk management points than one of the four top scenarios (1,1). Because the cost perspective was set as the main priority, these three manufacturing scenarios was not considered as top alternatives despite the better score in the flexibility and risk management evaluation. As the scoring results are close to the chosen alternative (1,1), the risk of better alternative not included in the final recommendation is considered as low.

The recommendation for OBR can be discussed because the recommendation according to the costs in the results point towards selling or not using parts of the current machinery and resources. Although the costs are clear, in housing at both sites is not the *most* cost efficient alternative, but can it be cost efficient enough? Because OBR already has invested in resources to manage pre-processing at two sites, can the current machinery add enough value to the overall picture to overcome the lack in financial benefits? These questions will be passed on to decision makers at OBR.

7.3.1 Results from a Resource-Based Theory Perspective

The cocoa pre-processing industry is concentrated to three to four large producers supplying most of the European consumer companies. With somewhat transparent pricing one could have though they enjoyed large economies of scale that would be reflected in their prices. But on the contrary, the DCM analysis and the conversion costs model showed that production in house was significantly more cost efficient than the options to outsource mainly due to the in house production being situated in a low-labour cost country and the outsourcing options in a high-labour-cost market. In order to understand how this can be, one needs to look at the Russian market and its characteristics and examine it through the lens of the Resource-Based Theory. Can OBR's resource of having the pre-processing in house add to their possibility to have a sustainable competitive advantage? The pre-processing is *valuable* since it enables OBR to have a more efficient production than other market players. Whether or not it is *rare* is difficult to say since no market survey for the rest of the players on the market has been done. The costs associated with in house pre-processing is not only the capital expenditures on machinery and other fixed and variable costs but also the costs for acquiring the necessary know-how, following certain regulations and laws and setting up logistics from raw material producers to site. This could be argued as a rare resource that OBR already has and therefore be seen as adding to the advantages of in house production. It is most definitely possible to *imitate* but the costs of imitating might offset the benefits. The same argument could be applied to *substitutability,* where an outsourcing option is a clear substitute for in house pre-processing, but when adding the factor of cost, outsourcing is a poor substitute thus not leading to the same competitive advantage.

7.3.2 Hypothesis Discussion

The hypothesis "*Flexibility is positively correlated with manufacturing costs in an emerging market*" was proven to be false in the setting of the case study. The hypothesis was very generally proposed and did not specify that the setting involved an in house and-or outsource decision. As flexibility was compared to manufacturing costs, a few factors from the conversion cost analysis can be assumed to be particularly significant for an emerging market country. For example, labour costs were a big part of the conversion costs, and there was a difference in labour costs between urban - and rural areas. Flexibility on the other hand is not affected by the location of the site. Because the manufacturing costs are dependent on the location of the site, and flexibility is not, the suggested hypothesis is discarded. GINI index indicate that many of the emerging markets have the same urban and rural area structure as Russia with the same income trend, i.e. the same difference in manufacturing costs in sites near and far from large cities is assumed. This indicates that the hypothesis in general terms is false and that there is no clear positive correlation between flexibility and manufacturing costs in an emerging market.

7.4 Analysis Tools in the Future

The DCM can without any changes be used in general in any situations connected to investments with variable costs over time. If fixed costs are identified, these have to

be added to the formula and discounted in the same manner as the variable costs. If alternatives with both positive and negative cash flows are to be evaluated, the Net Present Value model is suggested instead.

The flexibility and risk management evaluation can be further developed and several more criterions can be added to make it more general. Today, it is directly connected to manufacturing situations, but could easily be transformed into a more general flexibility and risk management evaluation matrix. It was also realised that there is a correlation between risk management and flexibility that was not further explored in this thesis. A high level of flexibility is often seen as having a high level of risk management. This is further discussed in chapter 7.5.

The two major analysis tools together resulted in a multidimensional result and can advantageously be used together in the future, when additional changes has been made to the flexibility and risk management evaluation in order to make it suitable for the case to be studied.

7.5 Suggestions for Future Research

The flexibility and SCM risk management evaluation could possibly need improvements in the future. Flexibility and risk management have strong bonds and have significant effect on each other and may therefore not have been the best two criterion approaches for the evaluation of the softer parameters in the study. Although, the nature of the case study; located in an emerging market, food industry and the Russian market in particular, the risk perspective was too great not to be included in the analysis. Because of this, future studies on similar projects in an emerging market would strengthen the analysis and the conclusion that there is no necessary link between high level of flexibility and high costs in an emerging market.

Further on, future studies on the Russian market and the cost of flexibility in emerging markets such as the BRIC countries are suggested.

Orkla is advised to further explore outsourcing possibilities within Russia. If possible, comparison for the other intermediate products, cocoa butter and cocoa liquor should be done in order to provide a complete analysis with all possible scenarios of manufacturing. Also the issue of transporting sugar should be taken into consideration. If possible, local sugar suppliers should be used.

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Appendix 1 – Calculation Model for PPP and PPU

Summarised calculation model						
[EUR/tonne]	PPP			PPU		
	In house	Outsorced liquid EU	Outsourced RUS	In house	Outsorced Liquid EU	Outsourced RUS
LIFFE	2323,3	2323,0		2323,0	2334,4	
Logistics	121,5			48,0		
Differential	280,0			213,3		
Labour costs	66,3			42,5		
Energy	10,7			8,0		
Transport	2,4			2,4		
Maintenance	4,4			4,0		
Depreciation	4,1			3,5		
Total conversion cost for CB	**88,0**			**60,5**		
Cocoa bean	**2812,8**	**2323,3**	**N/A**	**2644,8**	**2323,0**	**N/A**
Labour costs	101,5			65,0		
Energy	10,7			8,0		
Transport	0,0			0,0		
Maintenance	4,4			4,0		
Depreciation	4,4			3,8		
Total conversion cost for CCL	**121,0**			**80,9**		
Price per tonne		3799,4			3811,1	
Transport		333,3			600,0	
Customs 10%		379,9			381,1	
Loss in production	478,5			467,5		
Cocoa liqour	**3412,3**	**4512,7**	**N/A**	**3193,1**	**4792,2**	**N/A**
Labour costs	81,0			47,9		
Energy	12,4			9,3		
Transport	0,0			0,0		
Maintenance	8,1			7,3		
Depreciation	12,7			10,9		
Total conversion cost for CCB	**114,2**			**75,5**		
Price per tonne		3921,1			3921,1	
Transport		333,3			600,0	
Customs 10%		392,1			392,1	
Losses in production	3,2			3,9		
Cocoa butter	**3529,7**	**4646,6**	**N/A**	**3272,5**	**4913,3**	**N/A**
Labour costs	88,8			52,5		
Energy	12,4			9,3		
Transport	0,0			0,0		
Maintenance	8,1			7,3		
Depreciation	11,9			10,3		
Material cost	1857,3			1735,1		
Sugar	267,5			267,5		
Milk						
Total conversion cost for IC	**121,2**			**79,4**		
Price per tonne		2537,7	3647,7		2542,9	3584,2
Transport		333,3	80,0		600,0	80,0
Customs 10 %		253,8			254,3	
Chocolate mass	**2246,1**	**2871,0**	3727,7	**2082,0**	**3397,2**	3664,2

Appendix 2 – DCM-Analysis

Discounted Cost Model																				
[MEUR]	Scenario (PPU,PPP)	1,1	1,2	1,3	1,4	1,5	1,6	1,7	2,1	2,2	2,3	2,4	3,1	3,2	3,3	3,4	4,1	4,2	4,3	4,4
	WACC	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%
	Investment cost	4,27	2,15	2,15	2,05	2,05	2,05	2,05	4,27	2,1	2,1	2	4,27	2,1	2,1	2	4,27	2,1	2,1	2
Year 1		16,23	17,34	17,35	18,35	15,98	15,21	15,22	18,71	19,82	19,82	20,82	18,39	19,50	19,51	20,51	21,68	22,79	22,80	23,80
2		17,04	18,21	18,22	19,27	16,78	15,97	15,99	19,64	20,81	20,81	21,86	19,31	20,48	20,49	21,54	22,76	23,93	23,93	24,99
3		17,90	19,12	19,13	20,23	17,62	16,77	16,78	20,62	21,85	21,85	22,96	20,28	21,50	21,51	22,62	23,90	25,12	25,13	26,24
4		18,79	20,08	20,08	21,24	18,50	17,61	17,62	21,65	22,94	22,95	24,11	21,29	22,58	22,59	23,75	25,10	26,38	26,39	27,55
5		19,73	21,08	21,09	22,30	19,42	18,49	18,51	22,74	24,09	24,09	25,31	22,36	23,71	23,72	24,93	26,35	27,70	27,71	28,92
6		20,72	22,13	22,14	23,42	20,39	19,42	19,43	23,87	25,29	25,30	26,58	23,48	24,89	24,90	26,18	27,67	29,08	29,09	30,37
7		21,75	23,24	23,25	24,59	21,41	20,39	20,40	25,07	26,55	26,56	27,91	24,65	26,14	26,15	27,49	29,05	30,54	30,55	31,89
8		22,84	24,40	24,41	25,82	22,48	21,41	21,42	26,32	27,88	27,89	29,30	25,88	27,44	27,45	28,86	30,50	32,07	32,07	33,48
9		23,98	25,62	25,63	27,11	23,61	22,48	22,49	27,64	29,28	29,29	30,77	27,18	28,82	28,83	30,31	32,03	33,67	33,68	35,16
10		25,18	26,90	26,91	28,47	24,79	23,60	23,62	29,02	30,74	30,75	32,30	28,54	30,26	30,27	31,82	33,63	35,35	35,36	36,92
DCM [MEUR]		83,92	87,58	87,61	92,48	80,75	76,97	77,03	96,14	99,76	99,79	104,66	94,61	98,23	98,26	103,12	110,84	114,46	114,49	119,36
Building		3,12	N/A	N/A	N/A	N/A	N/A	N/A	3,12	N/A	N/A	N/A	3,12	N/A	N/A	N/A	3,12	N/A	N/A	N/A
Total cost		80,80	87,58	87,61	92,48	80,75	76,97	77,03	99,26	99,76	99,79	104,66	97,73	98,23	98,26	103,12	113,96	114,46	114,49	119,36

Appendix 3 – Flexibility and SCM Risk Management Evaluation

Scoring matrix										
	Flexibility criterions					Risk management criterions				Total Score
	Volume	Mix	Changeover	Flexibility responsivness	Ease of exit	Operational	Supplier	Regulatory	Security	
1,1	2	4	4	3	2	4	2	1	4	**26**
1,2	3	3	3	4	3	3	3	2	3	27
1,3	3	3	3	4	3	3	3	2	3	27
1,4	3	3	3	4	3	3	3	2	3	27
1,5	3	4	4	4	4	4	3	4	4	**34**
1,6	3	4	4	4	4	4	3	4	4	**34**
1,7	3	4	4	4	4	4	3	4	4	**34**
2,1	3	3	3	3	3	3	3	2	1	24
2,2	4	3	2	2	3	2	2	3	1	22
2,3	4	3	2	2	3	2	2	3	1	22
2,4	4	3	2	2	3	1	2	3	1	21
3,1	3	3	3	3	3	3	3	2	1	24
3,2	4	3	2	2	3	2	2	3	1	22
3,3	4	3	2	2	3	2	2	3	1	22
3,4	4	3	2	2	3	1	2	3	1	21
4,1	3	3	3	3	3	3	3	2	1	**24**
4,2	4	3	2	2	3	2	2	3	1	**22**
4,3	4	3	2	2	3	2	2	3	1	**22**
4,4	4	3	2	2	3	1	2	3	1	**21**

Appendix 4 - Abbreviations and Definitions

Orkla Brands Russia	OBR
Orka Brands International	OBI
Production Plant Petergoff	PPP
Production Plant Ulyanovsk	PPU
Production Plant Ekaterinburg	PPE
Sankt Petersburg Site	KFK
London International Financial Futures and Options Exchange	LIFFE
Discounted cost model	DCM
Net Present Value	NPV
Cocoa bean	CB
Cocoa liquor	CCL
Cocoa butter	CCB
Chocolate mass (industrial chocolate)	IC
Weighted average cost of capital	WACC
Vertical Integration	V.I.