



DeMaMech Exchange Project

REPORT

**The University of Tokyo
September 2004 – February 2005**

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Further Remarks

I conducted my master thesis in cooperation with Birgitte Sten Jørgensen who is also a student at the Technical University of Denmark and has joined the DeMaMech Exchange Program.

2 Executive Summary

The below is the abstract of the master thesis.

Toyota has shown superior results in terms of cost, quality, and lead-time compared to its competitors. This success has led to an extensive interest in the Toyota Production System and Toyota's way of doing business. Consequently, various studies of "The Toyota Way" have been carried out. This has led to the definition of lean production, which can be seen as a generic description of the Toyota Production System. While there are many different perceptions of what exactly has caused Toyota's success, Toyota itself suggests that the basis of its system is to consider the time from receiving the customer's orders to cash collection and shorten this lead-time by continuously eliminating waste.

Also in Denmark there has been an increased focus on lean production the recent years. According to a survey carried out by the Confederation of Danish Industries in 2004, more than 80% of the Danish manufacturing companies have already or are considering implementing lean production.

In a pre-project for the master thesis we concluded that the Danish breakthrough of lean production did not happen until in the early 2000s, why Danish companies are mainly focusing on internal optimisation. However, in order to gain the full benefits of lean production, it should be extended beyond the internal barriers of the focal company. Consequently, the next step for Danish companies is to pursue a lean supply chain.

The aim of this master thesis, therefore, has been to examine how to create a lean supply chain. In order to clarify this, Toyota's approach toward supply chain management is examined. Based on the case study of Toyota, we have examined how Danish companies can benefit from Toyota's approach and how to adapt to Danish environment.

Basically to achieve a lean supply chain requires that every member of the chain is lean, i.e. the lean principles should be spread throughout the supply chain. However, learning from Toyota, four issues are perceived as especially important for creating a lean supply chain: Production Planning Method, Outsourcing, Partnerships, and Supplier Association. Consequently, Danish companies are recommended to learn from Toyota's experience in these areas.

No larger constrain is found in terms of adaptability of Toyota's approach to Danish environment, except from one: Danish companies' fear of close relationship. This is perceived as the one major challenge for Danish companies to overcome, why it is argued that a change of mind-set is needed toward perceiving the parties in the supply chain as partners not competitors. This change of mind-set is critical; as particular Toyota's effective inter-firm relationships are the underlying reason for a successful implementation of TPS, i.e. lean production, in the supply chain.

3 Travel Schedule

Before I went to Japan, I attended a workshop at Delft University of Technology from Monday the 30th of August to September the 10th.

Students from Katholieke Universiteit Leuven, TU Berlin, Delft University of Technology and Technical University of Denmark, who were going to do their master thesis in Japan, attended the workshop.

The purpose of the workshop was to prepare us to live and study in Japan and therefore we had Japanese language lessons and learned about Japanese economy and culture. We were grouped according to which university we were going to conduct our master thesis at. Therefore, I was in the group of University of Tokyo students.

Monday the 13th of September I left Denmark at 10:40 am for travelling to Japan. I travelled with Birgitte Sten Jørgensen with whom I conducted my master thesis in cooperation. We arrived at Narita Airport, Tokyo at 7:40 am after travelling about 15 hours.

The next five and a half month I lived in Tokyo. I lived in Komaba International Lodge, which is a Tokyo University student accommodation. However, Komaba International Lodge did not open until the 5th of October and therefore I first stayed at student accommodation Azalea House in Heiwadai, Tokyo, from the 14th of September to the 5th of October. From the 5th of October to 28th of February I stayed at Komaba International Lodge.

After I got settled in Tokyo, I started working on my master thesis. Birgitte Sten Jørgensen and I worked hard from Monday to Friday and therefore we had time of in the weekend to go on sightseeing. Furthermore, we had a few holidays where we travelled in Japan.

I managed to see a lot of Japan during my stay. For instance, I went to Hiroshima, Kyoto, Osaka, Nara, Nagoya and Yokohama. This was only possible due to my saving and my work during the summer before I went to Japan.

Monday the 28th of February, I left Komaba International Lodge at 5:15 am and went for Narita Airport to travel back to Denmark.

Below my travel schedule is summarised.

Date	Activity
30 August to 10 September 2005	Workshop at Delft University of Technology
13 September & 14 September 2005	<i>Departure</i> 1 st flight Copenhagen Airport 10:40 Frankfurt Airport 12:10 2 nd flight Frankfurt Airport 13:45 Narita Airport 7:40 (local time)
28 February 2005	<i>Going home</i> 1 st flight Narita Airport 10:40 (local time) Frankfurt Airport 14:25 2 nd flight Frankfurt Airport 17:00 Copenhagen Airport 18:25

4 Research

The guideline for the DeMaMech report says that this section describes “Research or Lectures: Technical report!” My master thesis is within the area of manufacturing engineering and management and this is the reason why this part might be structured somewhat different than a “normal” technical report. However, I hope that the below will provide an appropriate overview of the outcome of the master thesis.

At the Technical University of Denmark it is recommended that two students do the master thesis together. Therefore, I conducted my master thesis in cooperation with Ms. Birgitte Sten Jørgensen.

4.1 Lean Supply Chain Management – A Toyota Case

Below the Background and Motivation, Objectives, Approach and Conclusions of the master thesis is described

4.1.1 Background and Motivation

In our studies at The Technical University of Denmark we have participated in courses at the Department of Manufacturing Engineering and Management, where we have learned about various manufacturing and management theories including lean production.

The publishing of the book “*The Machine That Changed the World*” in 1990 marks the worldwide breakthrough of lean production. Since then, there has been a major focus on lean production as a way to enhance competitiveness.

Danish companies too have turned their attention to lean production, which seems to be the definitive answer to make Danish companies more efficient. According to a survey made of the Confederation of Danish Industries (DI)¹ in 2004, lean production is the preferred management concept among manufacturing companies: more than 80% of the Danish companies asked have already or are considering implementing lean production. Consequently, lean production has become a topic of particular interest to us.

Studying lean production, the opportunity to go to Japan for half a year to finish our master degree in this field was seen an outstanding opportunity. Being close to the primary source of lean production – Toyota Motor Corporation – was a dream coming true. Therefore, we did not hesitate long before deciding to join the DeMaMech exchange project, which resulted in half a year study at The University of Tokyo.

Before our studies in Japan, we conducted a pre-project on lean production during the summer of 2004 in order to get a more in-depth understanding of the approach. The history and evolution of lean production was examined, as were the benefits, challenges, and limitations of lean production. The primary focus of the pre-project, however, was on analysing the lean principles in perspective to Danish culture, with the overall objective to clarify whether lean production can be adapted to Danish culture.

In addition to the pre-project, we interviewed 10 Danish companies on the subject lean production in Denmark. The purpose of this survey was to gain more in-depth knowledge about lean implementation in Denmark and to verify or disprove our findings of the pre-project. Moreover, this survey served to detect the expansion of lean production in Denmark, and to

¹ The Confederation of Danish Industries (Dansk Industri - DI) is a private organisation funded, owned and managed entirely by currently 6,100 companies within the manufacturing and service industries. Hence, the power of the organisation is considerable in Denmark.

clarify the future challenges that Danish companies face in perspective to becoming a lean enterprise.

The two above-mentioned studies found the basis for the master thesis. The outcome of the studies were the following:

In the pre-project, we state that while the worldwide breakthrough of lean production happened back in the 1990s, the acknowledgement of lean production in Denmark happened relatively late, i.e. in the early 2000s. Although, since then several companies are working with lean production, many Danish companies still have a long time ahead of them in order to gain the full benefits of lean production.

This assessment has been made based on the finding that in order to attain the full benefit of lean production; the whole supply chain needs to be included. Having successfully implemented lean production within the focal company, the lean practices should be developed beyond the internal mechanism of the company. Consequently, to successfully adopting lean production, the whole value stream has to be considered, i.e. the focus should be expanded to also considering up- and downstream relationships.

Still, as the overall focus of lean production is cost reduction, we concluded that any company could benefit from lean production no matter industry. Moreover, we did not identify any larger constrain in terms of Danish culture, why the conclusion was that lean production is adaptable to Danish environment. Though, we saw one major challenge for Danish companies pursuing leanness: a change of mind-set is needed, as lean production contradicts traditional mass production.

The interviews with the ten Danish companies verified the late introduction of lean production in Denmark. The main motivation for introducing lean production was found to be the promising outlook to obtain cost reduction. In general it seemed that the perception of lean production was more analogue to a rationalisation concept than a philosophy. Accordingly, it became clear that Danish companies have not yet expanded their focus of lean production beyond the organisation's internal barriers. Consequently, we find that the future challenge of Danish companies, in regard to becoming a true lean enterprise, is to extend lean production to their supply chain.

So far, the vast majority of the studies of lean production have focused on how to apply lean production internally in the company. This seems reasonable, as this is the first step on the path to achieve leanness. However, while many authors advocate that lean production should be extended beyond the company's internal barriers in order to gain the full benefit of lean production, we have found no suggestions on how this should be done in practise. Consequently, this becomes an interesting field to explore. Especially, considering that the next step for Danish companies will be to expand their focus of lean production in order to create a lean supply chain. The aim of this thesis is, therefore, to contribute to Danish companies within this field. As a result, our master thesis – this report - focuses on how to achieve a lean supply chain and how to adapt to Danish environment.

4.1.2 Objectives

Considered the situation in Denmark we find it interesting to investigate lean production in a supply chain context. Thus, the objective of the master thesis is:

To examine how to create a lean supply chain

Toyota has shown superior performance compared to its western competitors. Part of this success is believed to be Toyota's ability to see beyond the company's internal barriers. Consequently, Toyota is used as a case for studying lean production in a supply chain context. The objective of the case study is:

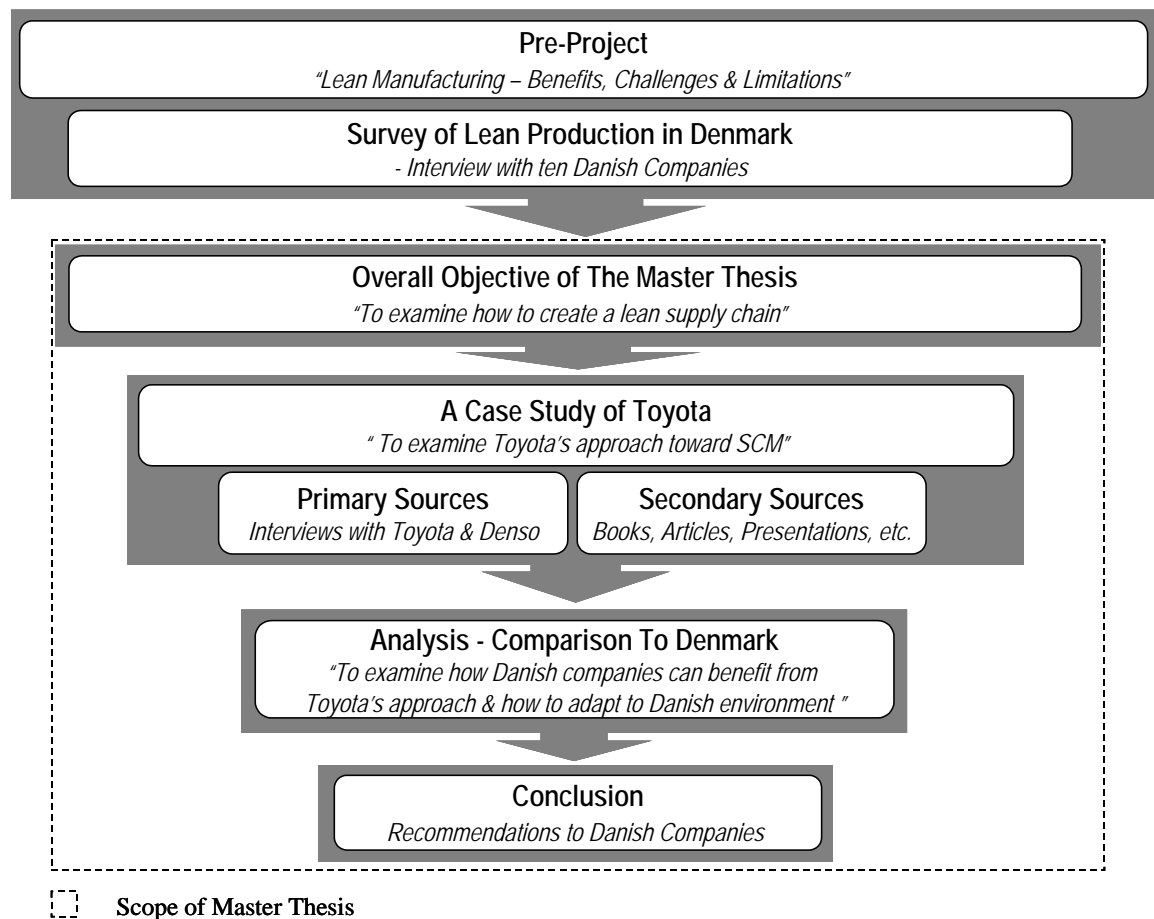
To examine Toyota's approach toward supply chain management

Having identified Toyota's approach toward supply chain management, it should be compared to Danish environment in order:

To examine how Danish companies can benefit from Toyota's approach, and how to adapt to Danish environment

4.1.3 Approach

The figure below shows the approach of the master thesis, which was described in Background and Motivation and Objectives.



Both primary and secondary sources have been used for examining how lean production can be applied in a supply chain context and how to adapt this approach to Danish industries. The primary sources consist of interviews with employees from Toyota Motor Corporation and Denso Corporation, whereas the secondary sources are books, articles, brochures and company materials, web pages and they.

The interviews were arranged in order to verify the findings of the case study based on secondary sources.

4.1.4 Conclusion

The recognition of the fact that no supply chain is stronger than the weakest part of the chain implies that in order to attain a lean supply chain, every member of the supply chain need to be lean, i.e. the lean principles should be spread and applied internally in every company of the supply chain.

However, looking at Toyota's approach toward supply chain management implies that there is more to a lean supply chain than just spreading the principles of lean production. The way Toyota cooperates with its suppliers is unique and it is perceived as a vital part of its world-wide-recognised performance. Based on a case study of Toyota, four issues have been identified as central for achieving a lean supply chain: Production Planning Method, Outsourcing, Partnerships, and Supplier Association. Consequently, we recommend Danish companies to learn from Toyota's experiences in these areas.

Based on the above findings, a three-step model has been developed, as the conclusion to how Toyota's approach can be adapted to Danish environment and, thus, how Danish companies can create a lean supply chain. The model is illustrated in Figure 4-1, below.

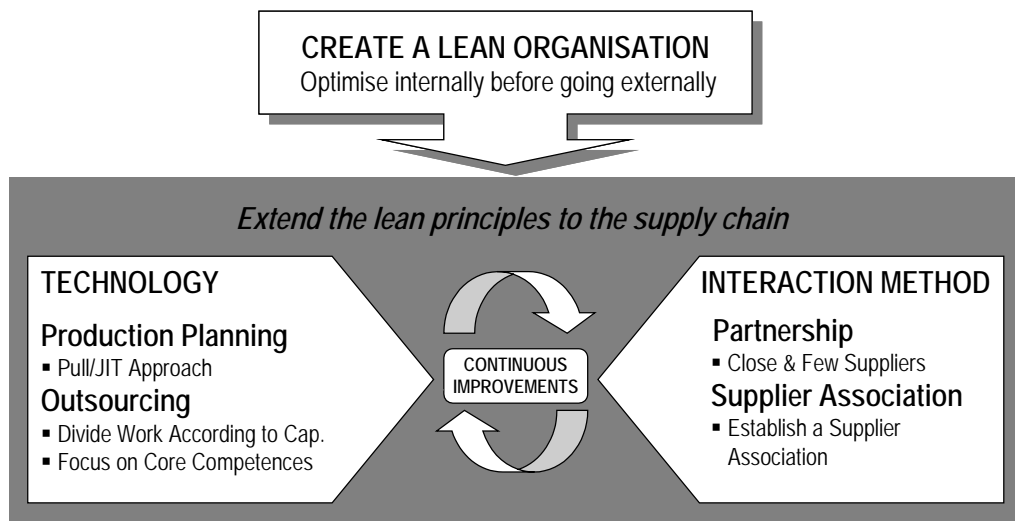


Figure 4-1 - Roadmap for Creating a Lean Supply Chain

We have not identified any larger constraints in terms of adaptability of Toyota's approach to Danish environment, except from one: Danish companies' fear of close relationship. This we find is the one major challenge for Danish companies to overcome, why we argue that a change of mind-set is needed toward perceiving the parties in the supply chain as partners not competitors. This change of mind-set is critical; as we find that, in particular, Toyota's effective inter-firm relationships are the underlying reason for a successful implementation of TPS, i.e. lean production, in the supply chain.

5 Exchange Student Life

Studying abroad is very different from being a student at the Technical University of Denmark. First, I was a student at Kimura lab at the University of Tokyo and secondly I lived in Japan and had to adjust to the culture and norms. Furthermore, I only spoke a little Japanese and hence the language was the major challenge when living in Japan.

5.1 *Being a Student at the University of Tokyo*

At the University of Tokyo I was assigned to Kimura Laboratory within the Department of Precision Machinery Engineering. Furthermore, I enjoyed a life as an international student.

5.1.1 Kimura Laboratory

The research topic of the laboratory was Product System Design considered service/function, which the product provides, in its whole life cycle. Within this area Life Cycle Engineering was the main topic and the focus was on modelling and evaluating the whole product life cycle in computers.

The laboratory was very international with students from Germany, Sweden, Japan, China, Korea and then Birgitte and I from Denmark. Therefore, English was the language spoken in the lab. The students in the laboratory were at different stages in their education, as there were master students, Ph.D. students and Post Ph.D. students. Furthermore, I found the students assigned to the laboratory were within very different areas of programming, mathematics, and management. This, I found, was very beneficial in that I learned about other approaches toward manufacturing.

Every Monday a laboratory meeting was held. At the meeting two or three students held a presentation about the progress of the research and Professor Kimura commented on the presentation. Furthermore, the other students in the laboratory could ask questions. The meetings provided me with an overview over the research topics of the other students in the laboratory.

I liked conducting my master thesis at Kimura Laboratory, as the other students and the staff was very friendly and very helpful when I had questions or needed help in any occasions. Professor Kimura has been an excellent supervisor for the master thesis and he provided insight of Japanese businesses and history. Furthermore, he arranged factory visits and interviews for the master thesis. He always had time for meetings and guided us when we needed help.

5.1.2 Student Life

When I arrived in Japan I knew little about being a student at the University of Tokyo. The Office of International Students at the School of Engineering was very helpful in any matter. Furthermore, they arranged a bus tour in Tokyo, which I joined and other arrangements were organised.

I like doing sports and the sports facilities at Tokyo University were good and I could work out three times a week at a very low cost.

It was also nice that the university has a shopping centre where all necessary goods were provided. Furthermore, there was a travel office from which I could buy tickets and have my pictures developed.

5.2 Living in Japan

Japan is very different from Europe and therefore I had to adjust my everyday life to the Japanese way of living.

The Japanese language was the greatest challenge that I faced. Before I came to Tokyo I only spoke a little Japanese and I knew that Japanese only speak a little English. Even though I sometimes had problems because of the language I learned to get by and learned enough Japanese to understand basic questions.

Not being able to speak the language was one problem. Another problem was that I could only read a few Hiragana characters and very few Kanji and Katakana characters. Therefore, I had problems reading information when it was only in Japanese. However, I must admit that I was surprised that the Japanese translate most of their information boards and the road signs are always in both Japanese and Roman letters.

In general the Japanese are very friendly and helpful so whenever I had problems I could always ask for help and people would do their best to help me – even though they did not speak English.

I met many nice Japanese people and made many friends during my stay and the 5½ months I stayed in Japan I will always remember as a very exciting period of my life.

6 Summary

I have conducted my master thesis in cooperation with Ms. Birgitte Sten Jørgensen at the University of Tokyo in the period of 14th of September 2004 to 28th of February 2005.

Before I went to Japan I did some preparation on both my master thesis as well as for living in Japan.

The production philosophy *lean production* was the overall topic for the master thesis. This area was chosen, as there in Denmark has been an increased focus on lean production the recent years. According to a survey carried out by the Confederation of Danish Industries in 2004, more than 80% of the Danish manufacturing companies have already or are considering implementing lean production.

A pre-project was conducted in the summer of 2004. In this we concluded that the Danish breakthrough of lean production did not happen until in the early 2000s, and Danish companies are mainly focusing on internal optimisation. However, in order to gain the full benefits of lean production, it should be extended beyond the internal barriers of the focal company. Consequently, the next step for Danish companies is to pursue a lean supply chain. This has led to the overall topic of the master thesis: *Lean supply chain management*.

In addition to the pre-project, we interviewed ten Danish companies on the subject lean production in Denmark. The purpose of this survey was to gain more in-depth knowledge about lean implementation in Denmark and to verify or disprove our findings of the pre-project. The pre-project and the interviews form the basis of the master thesis.

Japan is very different from Europe and for preparing me for living in Japan I attended a workshop arranged by the DeMaMech Exchange Project in Delft in Holland. During the two weeks workshop I had Japanese lessons and I learned about the Japanese society and culture. This was very beneficial for me, as I found it easier to adjust to the Japanese culture and live in Japan.

Conducting my master thesis at the University of Tokyo and being a student at the DeMaMech Exchange Project have been very beneficial for me.

Japanese car manufacturers and Toyota Motor Corporation in particular are the leading companies within in my research area. Therefore, it was a great opportunity to be able to go on a company visit and interview Toyota employees. This has made the work with the master thesis very exciting.

Furthermore, living in Japan has widened my horizon and I have learned about Japanese culture and I have got many Japanese friends.

Joining the DeMaMech Exchange Project and conducting my master thesis at the University of Tokyo have been very exciting and something that I will look back on with joy for the rest of my life.