

DeMaMech Exchange Program Report

Sep. 2005 – Jan. 2006

Technical University of Denmark (DTU)



IPL - Institut for Produktion og Ledelse



Tatsuya KEIDA

1. Personal Data

Name: Tatsuya KEIDA

E-mail: keida@combu.mech.eng.osaka-u.ac.jp

Home Institute:

Institute: Osaka University

Faculty: Graduate School of Engineering

Department: Department of Mechanical Engineering

Division: Micro-mechanical Science Division

Address: 2-1 Yamadaoka, Suita, Osaka 565-0871, JAPAN

Telephone: +81-6-6879-4489, Fax: +81-6-6879-7247

Supervisor: Prof. Masahiko SHIBAHARA

Host Institute:

Institute: Technical University of Denmark

Department: Department of Manufacturing Engineering and Management (IPL)

Address: DK-2800, Lyngby, Denmark

Supervisor: Prof. Peter JACOBSEN

2. Executive Summary

My exchange study at Technical University of Denmark (DTU) was 5month, which from September 2005 to January 2006. During my study at DTU, I worked on one project, two regular lectures and one English course.

During my whole stay in Denmark, which means from September to January, my project was about Reverse Logistics. The aim of my projects was to organize and propose the Reverse Logistics for next-generation refrigerator focusing on recycling. Although we could choose other products for my project, next-generation fridge was suitable because it is hybrid product of normal fridge with electronic components and it might involve new actors in its Reveres Logistics. In order to achieve this aim, I conducted some literature reviews, visited some companies in Denmark to collect information and finally organized and proposed the overview of Reverse Logistics.

Besides my project, I was attending two regular lectures from the very end of August to beginning of December; one was “Introduction to industrial environmental management” and the other was “CAD/CAM course”. Both courses were based on ordinary lectures and the actual exercises after its ordinary lectures, which was mainly group work. Instead of having final examinations at the end of semester, we had to deliver many assignments at each lectures as well as big final report. Moreover, I was taking extra English course twice a week, which is focused on daily conversation and vocabularies.

Talking of my residence, I was living at a kind of little house with six international students near DTU. We had our own rooms but we needed to share the kitchen and bathrooms but it was nice place to live because we easily get friendly each other. Sometime we held some party at our house and sometime we go out together.

3. Travel Schedule

From 22/August/2005 until 29/January/2006

4. Research and Lectures

- Research -

I was working on project about Reverse Logistics during the whole stay at DTU. On weekdays, mostly, I went to my office in DTU to do my project from 10am to 6pm except for my 2 regular lectures.

Talking of my supervisor, when I started my project, a PhD student at DTU was my supervisor and she supposed take care my project for whole stay. But in the end of October, she suddenly quit my supervisor because of her personal reason. I was very surprised and I couldn't imagine it. Anyway I had to look for new supervisor so I contacted to DTU's contact professor. He was very kind and he proposed me that he would be my supervisor for my project. After that he supported and take care of my project until the end of January.

Until the end of October, I was mostly reading some articles and books related to Reverse Logistics in order to understand what is Reverse Logistics as much as possible and summed up which I read. After that I started to work on specific task, which was to design the Reverse Logistics Network for end of life next-generation products. I had a meeting with my new supervisor in two weeks and made the progress little by little but with a certainty. Besides that, my supervisor arranged me several company visits in Denmark because actual information from industry was needed for my project. The following paragraphs are about my project.

Now a day, there are many unusable products and wastes. When we think about treating these wastes, we should try to recycle these wastes as much as possible in to prevent our environment from destruction. In case of recycle, many end-of-use or end-of-life products are send back from consumer to original manufacturer or other recyclers which we can consider as one of the "Reverse Logistics". In my project, I focused on organizing the Reverse Logistics for next-generation home electric appliances (especially refrigerator) with integrating the concept of mechanical design. Next-generation home electric appliances will be common in near future and have different characteristics compare to present one so that it might affect organizing the Reverse Logistics. Actually, it is still difficult and complicated to organize the Reverse Logistic of a certain product because there are many factors and parameters and it depends on each product and which place they conduct. This point of view is close to the concept of mechanical designing because the designers have to figure out the optimizing design respecting with their specification and constrained conditions.

Since my aim was to organize the Reverse Logistics, for the first step, I wanted to

bring out what is Reverse Logistics and to understand its characteristics by literature review.

And then, we survey the actual recovery and waste management in Denmark and Europe to have some tips for organizing the reverse Logistics. We had an opportunity to do my enterprise visit in Denmark; one is H.J.Hansen A/S whose main businesses are processing recyclable waste and scraps (mainly steel and other metals) into saleable and marketable materials. The other is RenoSam, which is non-profit association 31 Danish and 2 Faroese waste management companies (most of them are intermunicipal companies). Moreover I gather some information about WEEE (Waste Electronic and Electrical Equipment) treatment organization in Europe via Internet.

For the last step, I clarify how to organize the Reverse Logistics in general using IDEF0 (Integration DEFinition language 0), which is diagram with boxes to express the activities and arrows between the boxes to show the relationship and its order. As you can see in Fig.1, there are four main sequences to organize the overview of Reverse Logistics; the first one is “Find out the characteristics and information of products (P01-1)”, the second is “Figure out the concerning information from legislation (P01-2)”, the third is “Brainstorm the process and decide the order (P01-3)”, and the last is “Assign actors to each process (P01-4)”.

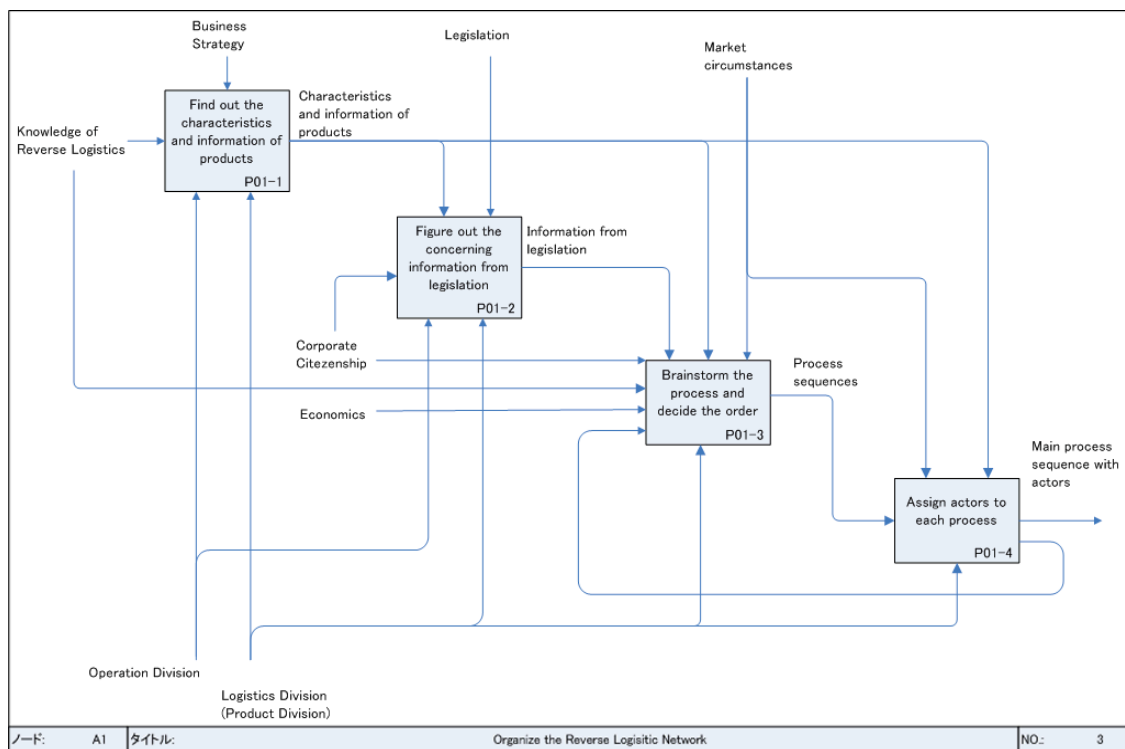


Fig.1 IDEF0 for Organizing Reverse Logistics Network

Following this IDEF0 chart, afterward, we organize the overview of Reverse Logistics for next-generation refrigerator (Fig.2) and made some arguments. I was focusing on proposing the overview of Reverse Logistics; it means that, the actual and detailed Reverse Logistic network is not obtained because of because the lack of information about Next-generation fridge and the actors who is involved in this network. Moreover, since the WEEE Directive is now putting into force, the recycling situation in Europe can be changed in few years so it is necessary to pay attention to this directive.

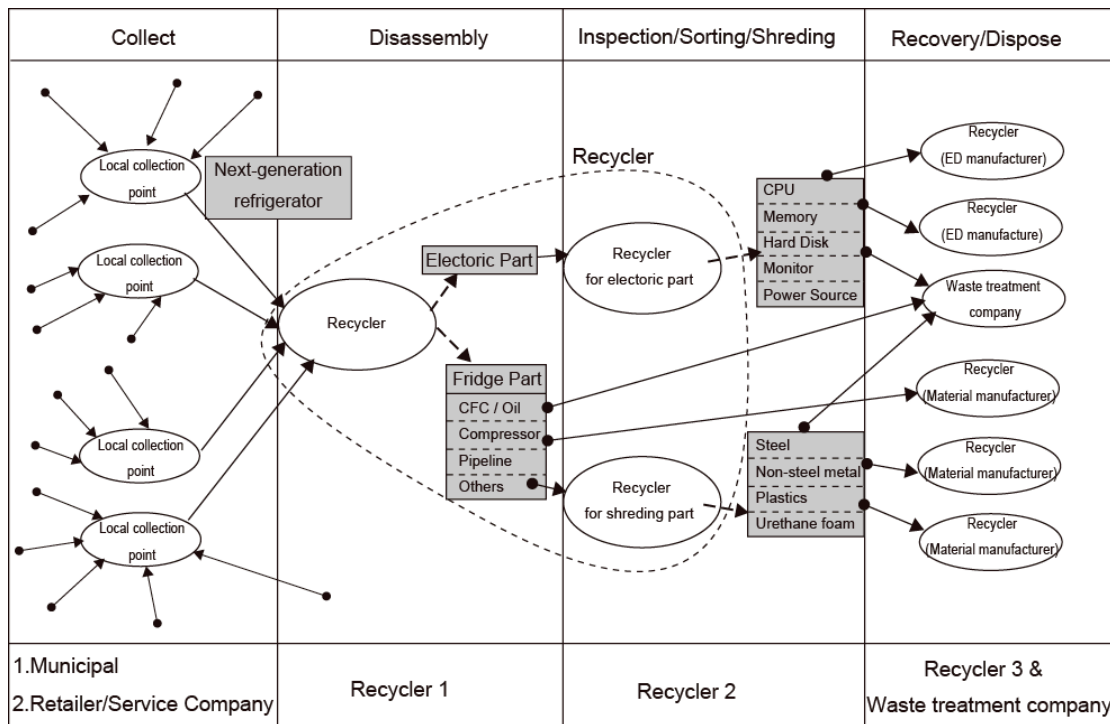


Fig.2 The overview of Reverse Logistics for Next-generation fridge

- Lectures -

Besides my projects, I was attending two regular courses and one extra English class. Talking of regular lecture in DTU, most of course are held once a week but for basically four hours each. Each course has 13 weeks for one semester and the courses have started from the week of 29/Aug/05 so it was until 2/Dec/05. After that there was three weeks for examination period.

One of my regular courses was “Introduction to Industrial Environmental Management” which was held on Tuesday afternoon. This course’s aim was to understand how to plan, implement and control the environmental and work environmental management activities in a company. In our first 8 lessons, there were

ordinary lectures about 2 hours or more and the remaining time (appx. 1.5 hours) was for the group work to implement the assignment every week. Ordinary lectures were about the environment management work environment in company, the organization or workplace assessment. In addition, four lectures out of eight were given by people from actual companies in Denmark to show us their environmental and work environmental management activities. Our group was 5 members and we had to deliver our assignment to our TA every week via Internet system (Campus Net) and sometimes we need to modify them. This course has no strict exam (there was short multiple choice test once) in exam period but the big final report, which we had to evaluate the actual 4 Danish companies' management, was necessary. Actually our last four lessons was the time to prepare our final report.

Another course was "CAD/CAM course" on Thursday morning. This course was to create models of machine parts and assemblies of these using a CAD-system and use computer aided systems (CAD/CAM systems) in process planning. This course had 11 lessons and each lesson had 1 hour lecture with 3 hour practical lesson (addressing with 2 students) for using CAD/CAM system (Pro Engineering). The content of the lecture was about CAD, FEM and CAM, and practical assignment should be delivered every week. Some of assignments were to model the LEGO human over several weeks and, for the CAM assignment, we had to make simple NC processing using ProE and actually machine a workpiece with CNC milling. Instead of final examination, the final report was mandatory. Our final report was to machine the scaled-up LEGO brick by NC machine (NC milling center), which is supported by 3D-CAD modeling and CAM system. (Both are ProE). In order to achieve this aim, first we model the scaled-up LEGO brick at ProE, and then, the NC processing (NC files) for this machining was made. Afterward, the scaled-up LEGO brick was machined by NC milling at workshop at DTU using those NC files. Of course, it was necessary to write our report what we have done in order to machine the LEGO brick. Following images is the CAD modeling and the actual LEGO brick, which we machined.



Fig.3 CAD model and scaled-up LEGO brick

I just took two courses in DTU but it was not so easy to manage them. When the course begin in September, I had hard time to catch up the lecture especially in Environmental one because it was new for me and my English was not enough good to catch up. In addition, our professor asked us to read some materials for every courses as well as group work assignment. But in the end, I got used to it so, not very well but I could manage it better than beginning. I found that there was many courses based on group works in DTU and I thought it was pretty practical.

5. Exchange student life

My exchange student life has started with “Introduction week”, which is for new international student at DTU. This “Introduction week” was held a week before the lectures started, in my case, it was from 22/Aug/05(Tues) till Friday. It was mainly organized by International Affairs with some DTU’s volunteer students. At the beginning, international students are separated into several groups with appx. 15 people. Actually, there were more than 200 exchange students and MC students each so there were more than 400 international students coming to DTU. And in each group, there were Danish volunteer student guide who showed us around DTU and etc. One day was for a day trip to Copenhagen and we looked around the town in that same group. And the other day, they showed us how to register at commune. And most of the night, they arranged us nice dinner and party. Most of the activities were based on group so it was very good opportunity to make international friends. I have still contact with my friends.

Actually, DTU is located in town called Lyngby, which is suburb of Copenhagen (25min by bus from central of CPN). Although there are some shops, supermarket, restraint and shopping mall around the Lyngby station, DTU is 20min walk from Lyngby station and surrounding was houses or trees or fields. So living in near DTU, I suggest to have bike to get far place much easily. In addition, there are well-organized bike rode along the road most of place in Denmark and using bike is very popular for Dans.

Talking of my accommodation, I was living at a little house called “International student house” with 6 bedrooms, one kitchen, two bathrooms, one living room and garden with tables. It was close from DTU (5min walk to main building) and was located next to DTU’s dormitory. Moreover, near our house (10min by bike), there was a big park with dears and beyond that there was sea cost where we could see Sweden on the opposite shore. Actually, I was living with 5 other international students, which was one American boy, one Swedish girl, each Spanish boy and girl, one Australian girl. We just move in the same semester and our place was like a “little house” so we were easily to

get well each other. Sometime, we cooked our dinner together or cooked their own countries dishes to others. I ate some tortilla (Spanish omelet), paella, pizza, Swedish meatball, Thanksgiving dinner and Danish Christmas dinner and so on...Actually, Spanish boy became crazy about Japanese food and now he can cook some Japanese food such as OyakoDon (We called it Parents and Kids), Miso-soup, Okonomiyaki (Japanese Pizza) etc. Now my roommates know how to use Chopsticks and, moreover, they say "Itadakimasu" before eating meal. Of course, we made some party in our place such as BBQ party, Wine & Cheese Party and Halloween party and, some time, Spanish party (Many Spanish student in DTU). Those parties were really nice and very fun time. To tell the truth, at the beginning, I thought my place was not so good compare to my place in Japan. But at the end, I felt I really was lucky and had good experiment to live with international student in such house because I learned lot about them and I really had a precious time.

Most of the weekdays, I went to my office or my course until December. Mostly, I arrived my office around AM10 and worked and left around PM6. At my lunchtime, I went to S-Hus (Student-House), which is like lounge, to meet my friends and eat sandwiches, which I prepared. In DTU, there were some cafeteria but it was not so cheep so many student were bringing sandwiches as me. This thing is not only in cafeteria but also all over in Denmark. I mean Denmark is relatively expensive to live compare to Japan except the beer in supermarket. Most other things, restaurant and transportation are not cheep. So I manage to cook dinner at my place or to make sandwich for lunch to save money.

In the beginning of the semester, there were very few Japanese students in DTU; actually I could count in one hand. So most of the time, I was staying with international student. But I think this was very good for me because it forced me to use English. And several times, I made a trip with my friend in weekends or in our autumn one-week holiday (Danes call Potato holiday because it was the period to gather the potato in old days). However, in the end of semester, some Japanese student came to DTU and this helped me to prepare Japanese food more easily to my international friends. Talking of my travel, I didn't made many trip in Europe but I tried to visit many place in Denmark.

Denmark was quite nice place for me because, as I told you, our place had very nice nature and scenery, and if you go downtown Copenhagen, you can find nice old buildings with cozy streets, especially in a very nice day in summer. Around the Christmas time, many beautiful illuminations were all over in Denmark, but one thing I didn't like in Denmark is the short day and low sun in December. Even in noon, it was like before evening in Japan so I was very shocked and it was impossible to get used to

it. By the way, Danes really drink beer a lot and the beer is the one of the only thing you can buy cheap in Denmark. And I was almost to forget to write that, in Denmark, you can just use English most of the place even in a little restaurant at rural country.

6. Summary

To sum up, I can say that I had a really great time in Denmark from both point of view of my study and life. Since my project and courses are little bit different from my major in Japan, at first, I was confused and had a hard time. But after all, since I learned many things, which I don't know, and I can't have this kind of experiment in Japan, I think it was really good to study other study fields with English. Moreover I met many international friends here and learned many cultures as well. But one thing that I am regretting is I didn't have many Danish friends. There were some but I didn't get well known each other. I am going to stay in Belgium 5 months more so, this time, I'll try to make more Belgian friends. Although this stay in Denmark was quite different from my life in Japan, I am sure that I will never forget this experiment.