Product development and international team management

Case: European Project Semester

The Visual Demo Kit

Sofia Nordlund

Bachelor's thesis

Industrial Engineering and Management

Vaasa 2011

EXAMENSARBETE

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Utbildningsprogram och ort: Ingenjör (YH) Produktionsekonomi, Vasa

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Titel: *Product development and international team management*

Case: European Project Semester - The Visual Demo Kit

Datum: 15.3.2011 Sidantal: 24 Bilagor: 1

Sammanfattning

Detta examensarbete har gjorts i samband med European Project Semester hösten 2010 vid Yrkeshögskolan Novias enhet för teknik och kommunikation i Vasa. Examensarbetet behandlar produktutveckling av ett energirelaterat undervisningsredskap på begäran av Yrkeshögskolan Novias FoU-avdelning. Vidare behandlas även marknadsundersökningsmetoder i korthet samt ledarskap och styrning av internationella arbetsteam i allmänhet, men med utgångspunkt från erhållna erfarenheter från deltagandet i European Project Semester. Målet med examensarbetet var att planera, designa och färdigställa ett undervisningsredskap samt erhålla och utveckla nödvändiga kunskaper inom ledning av arbetsteam bestående av personer av olika nationaliteter. Inledningsvis tas bakgrund och målsättningar upp, därefter teori och den specifika motsvarigheten av teorin i praktiken för fallet European Project Semester, The Visual Demo Kit.

Språk: Engelska

Nyckelord: produktutveckling, Visual Demo Kit, energikällor, Belbins teamroller, marknadsundersökningsmetoder

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NOVIA
UNIVERSITY OF APPLIED SCIENCES

BACHELOR'S THESIS

Author: Sofia Nordlund

Degree Programme: Industrial Engineering and Management

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Date: 15.3.2011 Number of pages: 24 Appendices: 1

Summary

This Bachelor's thesis was made through the European Project Semester in fall 2010 at Novia UAS's sector for technology and communication in Vaasa. The thesis deals with the product development of an energy-related tool for education made at the request of the R&D department at Novia UAS. Methods for marketing research are presented in short, followed by management and governing of international working teams in general, but setting out from experiences acquired while participating in the European Project Semester. The goal of this thesis was to plan, design and complete a tool for education, as well as to acquire and develop necessary knowledge of management of teams consisting of persons with different nationalities. Firstly background and goals are explained, followed by the theory and the practical application of this in the case of the European Project Semester, The Visual Demo Kit.

Language: English

Key words: product development, Visual Demo Kit, energy resources, Belbin's team roles, marketing research methods

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1 Introduction

1.1 Background

Having spent a semester abroad in spring 2010, studying marketing at ATEI Thessaloniki in Greece, it became clear to me that I wished to find an assignment including international connections and the English language for my Bachelor's thesis. After some brief research and contact with the teachers involved, it was decided that I could attend the European Project Semester (hereafter EPS) in fall 2010 at Novia University of Applied Sciences (hereafter Novia) and that my thesis would be based on the project my team would be assigned.

1.2 Background to the project

EPS is a project-based semester, giving students from different European countries a possibility to participate in a project team either at a partner university or at their home university. In Vasa EPS is arranged at Novia. The aim is to supply an opportunity for students to get real, first-hand experience of working in a team in an international environment. The team members are of different nationalities and the goal is that they should learn to work together interdependently in the teams but as independent teams, taking into account factors such as language barriers, cultural differences and differences in studies as well as personalities. These factors play an important part in understanding and learning how to make an international team work successfully, also in real life work situations. Participating in a project team while studying offers a practical grip on team work, corresponding to the situation at many workplaces nowadays.

1.2.1 Assignment

The project task this Bachelor's thesis is based upon was assigned to the team by Niklas Frände from the R&D department at Novia and the project work was supervised by the EPS personnel during the entire project semester. Employees from the R&D department sometimes visit primary schools around Ostrobothnia, giving information about energy and energy-related studies at Novia UAS. For this purpose they wished for a tool more adequate for the education of children, the only prerequisite was that it was related to energy. My supervisor for the Bachelor's thesis was Roger Nylund, head of the degree programme Industrial Engineering and Management at Novia UAS.

1.3 Phases

All in all the project work, together with the making of the Bachelor's thesis, went through eight different phases. These were both linked to and dependent on each other. Phase one focused on the planning. Phase two included research and the development of accurate protocols and paperwork for the weekly project meetings, e.g. agendas and minutes of meeting. Phase three focused on the field study: deciding which questions to ask, where to find participants, sending out the questionnaire and finally compiling and reviewing the answers.

Phase four dealt with the design of and the drawings for all the parts to be included in the Visual Demo Kit, but also the contact procedures for the parts of the production that the team members would not be able to accomplish on their own. Phase five was the manufacturing process, which blended into phase six, when the final documentation along with some brush-ups were made. Part seven included the preparations for and the giving of the final presentation at the end of the fall semester. Phase eight consisted of the writing of the individual part for the Bachelor's thesis and the presentation of this.

2 Aim of the thesis

The goal of my Bachelor's thesis was to acquire, increase and develop my knowledge of product development, research, management, production planning and manufacturing. For the EPS team the goal was to have a complete prototype, including the necessary documentations, by the end of the project semester. This Bachelor's thesis is my individual part of the work and the goal is to deepen the knowledge concerning some aspects of the project work. The original project documentation is included as an appendix to this Bachelor's thesis.

3 The Bachelor's Thesis

3.1 Background

When the EPS semester began in September 2010, the participants were divided into two project teams. The three members selected for the Visual Demo Kit project chose the team name "Green Mills". The knowledge needed for, but also developed through, the Visual Demo Kit project included methods for research and product development, organization and management of an international team, and planning of the production.

Naturally, the planning, organization and management of the project itself created the baseline from which guidelines for all the activities were drawn. The participation demanded structured planning, including methods for time scheduling, definition of responsibilities, risk evaluations, and the required paperwork for the project meetings and follow-ups that were scheduled with weekly intervals. The project team had time until 17th December, 2010 to reach their goals.

3.2 Breakdown

The members of the project team were to assign each other a role in the team as well as clarify the main responsibilities through mutual agreement. Eva Adell and Guillermo Moreno held the position of Project Manager for half a semester each, while Sofia Nordlund functioned as secretary and Jiayuan Li joined later as a team member. Based upon the team members' field of study, each was chosen for certain responsibilities and tasks. Nevertheless, the members worked together a lot, practically sharing the responsibilities for most of the main tasks.

The project began with planning, including time scheduling, risk evaluations, a Gantt diagram and a Pert diagram. The next step included making models for the official documentations such as agendas, minutes of meeting and reports, while also researching general information about renewable energies as well as previous educational tools for similar purposes. To obtain information about the youngsters' current knowledge base, the team decided to conduct a field study among the pupils of two local primary schools: Vasa Övningsskola and Molpe skola.

When the results from the research and the field study had been reviewed, the process of designing and planning for the production began. This phase also included the search for and acquisition of tools and materials needed for the manufacture of the prototype. Thereafter, the drawings were sent to the workshops in charge of the manufacture of the wooden parts and the plastics to be constructed in a 3D plastic printer. The carpenters at the vocational school Yrkesakademin in Vasa, supervised by teacher Kenneth Julin, manufactured all wooden parts. For the making of the intricate plastic details, such as a miniature wind mill, the team turned to Mika Billing, who made these parts in the 3D plastic printer at Technobothnia in Vasa.

The rest of the production was the responsibility of the project team. This included some basic electric circuits, cutting and construction of the other plastic parts and the final brush-up of the prototype. After finishing the manufacturing phase, the team presented the prototype together with the final documentation at the end of the semester. The prototype can now be found at Novia University of Applied Sciences, where the R&D department can make use of it whenever necessary.

3.2.1 The tasks of the other team members

Eva Adell was in charge of the design and the drawings for all the parts of the visual demo kit, while Guillermo Moreno was responsible for the practicalities when implementing the designs and for the electric components. Jiayuan Li programmed and constructed the homepage for the project on the internet. General information and explanations regarding the project and the visual demo kit can now be found on the internet address http://eps2010greenmills.novia.fi in English, Swedish and Finnish.

3.2.2 Personal main tasks

The main tasks assigned to me included the secretary's responsibilities, being the contact person regarding manufacturing and purchase, head of the field study, and being the one in charge of all translations as well as correcting and compiling the final documentation. Other tasks, which the team worked together on, included product development, production planning, project team organization and management, including project team presentations.

3.3 Result

At the end of the semester, in December 2010, the project team had a prototype ready for presentation. This also included a final documentation, which can be found at the EPS office at Novia University of Applied Sciences and as an appendix to this thesis (Visual Demo Kit, 2010).

4 Marketing research methods in brief

The EPS project work included the conduction of a small-scale marketing research. The method chosen for the research was a field study consisting of a questionnaire. In this chapter I will give a basic background to marketing research methods focusing on the type that was used for the project. The common reason for companies or organizations using marketing research is in order to identify and solve marketing problems. Hence marketing research can be divided into two types of research: problem identification research and problem solving research. There is a wide range of different marketing research types; from advertising research, brand name testing and customer satisfaction research to sales forecasting, online panels and store audits. All marketing research processes have two things in common: they are systematic and they are supposed to be objective. The goal is to identify and assess how aspects of the marketing mix affect customer behavior, further along helping management in making decisions regarding marketing matters through providing relevant, accurate, valid and current information about the marketing situation.

The methods for marketing research are generally divided into two sets of categories: by target market or by methodological approach. The methods used for researching the target market are consumer marketing research and B2B marketing research. The methodological research methods are either based on questionnaires or on observations. There is also a difference regarding the data the research is based upon. This can be either primary or secondary, the former meaning that you start from scratch and collect your own data, the latter meaning that the research is based on data that has already been collected for other or similar purposes. (Wikipedia, 2011)

4.1 Methodological marketing research methods

The methodological marketing research methods include qualitative marketing research, quantitative marketing research, ethnographic studies and experimental techniques. Qualitative marketing research is used with a smaller group of respondents and mainly for exploring the marketing area. Among these methods one finds in-depth interviews and focus groups. Quantitative methods on the other hand are used for actually drawing conclusions about the marketing situation, in the sense that they are made to test a hypothesis. These methods include questionnaires and surveys, generally requiring a great number of respondents and random sampling techniques. Ethnographic studies are a type of qualitative marketing research, where a social phenomenon is observed in its natural setting by one or several researchers. The observations are either cross-sectional, if the observations are made all at one point of time, or longitudinal if the observations take place at several different times. Experimental techniques are considered to be quantitative and include test markets and purchase laboratories where the researcher creates a certain environment and then manipulates different factors, observing the effects of these. (Malhotra, 2002; Wikipedia, 2011)

4.1.1 The DECIDE model

The DECIDE model consists of six steps, which could be good to follow when dealing with a marketing research situation. The letters each stand for a separate part of the recommended process: define, enumerate, collect, identify, develop and evaluate, where the first letter of each of these words in turn creates the word “decide”. According to the DECIDE model the first step of the process is to define the marketing problem itself, after which you should be able to enumerate the controllable as well as the uncontrollable decision factors related to the issue. This is followed by a stage of collecting relevant information and an identification of the best alternative solution. Once the solution is clear, a plan is to be developed and implemented. After carrying out the planned solution

it is of good use to evaluate the decision that was made, together with the entire process model. (Wikipedia, 2011)

4.2 Field study

Due to the size of the project and the limited time at hand, it was decided to focus on a small number of respondents just in order to get a perception of the youngsters' knowledge base regarding energy in general. The team decided to go for a mix between a qualitative and a quantitative marketing research method, where a field study consisting of a questionnaire would be sent out to at least a couple of primary schools. The questionnaire was made for the teachers, who in turn would bring the questions up in class and discuss them more thoroughly with the pupils, making the field study a mix between a simple questionnaire and an in-depth interview. The result of this marketing research is not translated into a generalization of all the youngsters in Finland, rather it focuses on the area around Vasa with the primary schools Vasa Övningsskola and Molpe Skola participating with about 200 respondents, aged six to twelve.

The planning of the field study began when the team decided to make a questionnaire to be sent out to the schools in question. The questionnaire consisted of eight questions relating to energy, renewable energy and ways of saving energy. The teachers agreed to bring these questions up in class, discuss them with the pupils and compile the respondents' answers and thoughts and then send them back to the Green Mills team. In this way the team could be sure that professional pedagogues working with children would bring up the questions in a way suitable to the respondents' various ages. The team already had a hypothesis regarding the children's knowledge base; it was probable that the older the pupils were the more they would know and understand, while the younger pupils would be less aware of energy-related things. This was very much confirmed by the answers returned, making it obvious that the design of the Visual Demo Kit needed to be made with regard to the younger users; as long as they understand the purpose of the kit, so will the older users. The questionnaire and the compiled answers are found in the appendices. (Visual Demo Kit, 2010; Wikipedia, 2011)

5 Acquired and developed knowledge

During the EPS I held the role as secretary for the Green Mills team. The responsibilities included creating models for the agendas as well as the minutes of meeting, taking part in organizing the weekly project meetings and writing the minutes for every meeting held. Apart from the secretary's tasks, I also acted as contact person for the team with regards to manufacturing and purchase. This meant I was responsible for all local contacts that we made during the process of the project, such as getting Kennet Julin at Yrkesakademin to be in charge of the manufacture of the wooden parts for the demo kit. As marketing and related research methods were parts of my study program, one of my greater tasks was to conduct the field study. This included making the questionnaire, contacting possible participants, conducting the field study and compiling the answers. Since it was thought I had the best English within the group, and I was the only one fluent in Swedish and Finnish, another of my tasks was to be in charge of all translations. This also meant that I corrected and compiled the final documentation. Other tasks included working with product development, in terms of thinking of ideas for designs and research information. The aspects of production planning mainly dealt with what we could make ourselves in the team and what to buy from external sources, the latter aspect included searching for and contacting possible manufacturers and places for purchase. Other general tasks included project team organization and management.

5.1 Belbin's team roles

The British researcher Raymond Meredith Belbin published the book "Management Teams: Why They Succeed or Fail" in 1981, in which he established eight, later nine, different roles that can be found in a team. The research is based on participants who took part in a business game, where they had to work together in teams. Belbin could prove that the most successful teams included nine team roles. A person rarely takes on only one single role. Most people act and react according to a mix of several of the roles. The Belbin test for team roles that is used in order to find out which role or roles a person

will most likely take in a team can be of great value. Even a basic knowledge of these roles can make a big difference e.g. at a work place, since after the employees' roles have been established, they can be put into groups or teams according to the roles that will work together best. Belbin argues that the optimum is a team with four members, any more individuals involved and you have a group instead of a team, since then the individuals will not be able to work as closely together as is needed in a team. The roles are: the Plant, the Implementer, the Coordinator, the Shaper, the Resource Investigator, the Monitor Evaluator, the Team Worker, the Completer and the Specialist. (Belbin, 1996)

Table 1. Belbin's team roles and descriptions of these.

Roles	Concise description
Plant	Creative, unorthodox, a generator of ideas. Sees things as "a whole", losing sight of details. Multiple Plants in a team can lead to conflicts.
Implementer	Conservative, efficient, self-disciplined, reliable. Practical thinkers motivated by a sense of loyalty, often leading them to take on jobs everyone else dislikes.
Coordinator	Confident, stable, mature and great delegators. Clarifies decisions and creates focus. May be manipulative.
Shaper	Dynamic, provocative, impatient, task-focused. Will 'shape' others to achieve the goals. Several Shapers in a team will lead to conflict.
Resource Investigator	A networker focused on the outside world. Enthusiastic, curious, slightly unfocused.
Monitor Evaluator	Strategic, discreet, sensible and impartial. Gathers information and valuates.
Team Worker	Social, sensitive, indecisive. Creates a good working climate.
Completer	Methodical, conscientious, a perfectionist. Achieves quality.
Specialist	An expert in their field but uninterested in all other things.

5.1.2 Roles recognized in the Green Mills team

After having read about Belbin's team roles I could recognize and identify some of the roles that appeared during the process of the team work for the Visual Demo Kit project, both in me but also in the other members of the group. Looking at how I myself tend to

act and react in working situations, I believe I am a mix of the Monitor Evaluator, the Team Worker with a hint of the Completer. As this is what I recognize in myself, there is a good chance someone else could identify other roles in me since they see me from another perspective than I see myself. For the other team members I would say Adell is a mix of the Plant and the Implementer, in Moreno I sensed a mix of the Resource Investigator and the Team Worker while Li was the one I had the least to do with, making her the hardest one to fit into any role, but from my perspective I would go for the Specialist mixed with the Monitor Evaluator.

During the semester there was not much information about Belbin's team roles. However, having read Belbin's theories afterwards and seeing them in the light of my experience from the EPS, I am of the opinion that it would have helped us achieve our goals even better if we had been more aware of the roles we had in the team and how these interact. Having even a basic knowledge of these might help understand your personal roles and build ways for working together with other team members. All in all the Green Mills team worked together without any bigger issues surfacing. The interaction between the members ran smoothly with only some minor problems occurring, mainly due to the language barrier. The fact that the team had to interact in English, the language being no one's mother tongue, caused problems in understanding, since the members' knowledge was on different levels.

Taking into account that the members also had different cultural backgrounds, it was not always exactly clear to everybody what was being said. Everybody was not comfortable with asking about everything they did not understand, either out of respect or fear of embarrassment. This behavior in turn caused some misunderstandings, mostly the team solved them together but sometimes the misunderstandings were not revealed until weeks later. From this I learned that one should never expect anyone else to understand completely after the first time something has been said or decided, patience is needed. It is better to repeat, follow up and try to create an atmosphere where you discuss openly and do not feel ashamed to have to ask about something you do not understand. (Belbin, 1996)

5.2 Cultural dimensions

People from different cultures have been and will continue to be exposed to common problems, commanding cooperation *"between people, groups and nations who think, feel and act differently"*. Hofstede explains the uniqueness in human mental programming as a pyramid with three levels. The levels consist of human nature, culture and personality. Human nature is universal and considered to be inherited. Culture is learned in specific groups or categories, such as a nation's people, while personality is specific to the individual and developed through inheritance and learning. Another useful metaphor provided in Hofstede's "Cultures and Organizations" is the onion diagram, showing the different levels where cultural manifestations lie. These levels are from the outside inwards: symbols, heroes, rituals, practices and values. Values are implicitly learned and believed to be firmly in place by the age of ten. After this, it is very difficult to make any changes to a person's value system. Both culture and human mental programming lies in several layers within every individual, making the background for what people base their actions and decisions on very intricate.

Cultural differences appear regarding region, religion, gender, generation and social class. Hofstede based his study of the cultural dimensions on four aspects: the power distance index (PDI), the degree of individualism (IDV), the degree of masculinity (MAS) and the uncertainty avoidance index (UAI). The PDI shows to which extent inequality regarding power distribution is accepted among the less powerful of the society. The IDV shows the degree of individualism as opposed to collectivism. The MAS quite similarly exposes to which degree the society is considered masculine or feminine. In this sense masculine stands for the assertive pole and feminine for the modest and caring pole. Finally, the UAI indicates how comfortable the members of the culture are in uncertain, unstructured situations. In cultures where the UAI is low, the members follow strict rules and laws, believing there is only one "Truth". Cultures with a high UAI are more tolerant towards others' different opinions. Members in these cultures are considered to be more phlegmatic and contemplative. (Itim International, 2011)

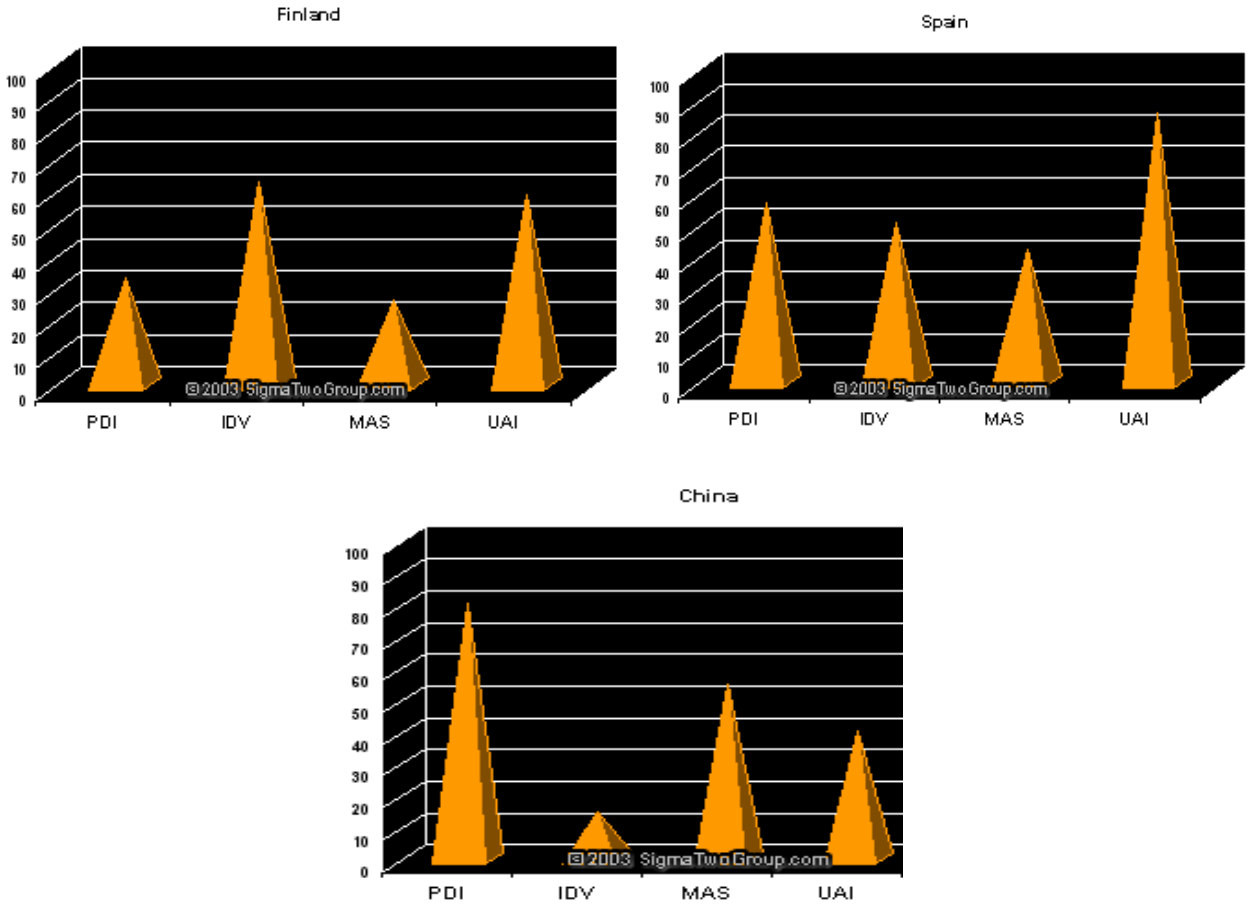

Figure 1. Tables over Hofstede's cultural dimensions for the nationalities included in the Green Mills team: Finland, Spain and China (Itim International, 2011).

Judging from the tables above the biggest cultural differences in the Green Mills team would be found in the degree of individualism. All the other dimensions also differ, but not as much. The PDI is high in China reaching almost 90 %, in Spain it is 52 % and Finland has the lowest score with 29 %. The degree of masculinity is about 20 % in Finland while it is almost reaching 40 % in Spain and 51 % in China. Finally, the UAI index is the highest in Spain, followed by Finland and leaving China at the lowest score. The differences in cultural dimensions are the smallest between Finland and Spain with an overall difference of 81 %. The biggest difference is found between Finland and China, with the overall 143 % in difference, while the difference between Spain and China lies at 118 %. According to this the cultural dimensions in Finland and Spain would be easier to overcome, while those between Finland and China as well as China and Spain will require more work. (Itim International, 2011)

During the project semester there was also a lecture given on the subject, giving the participants some general knowledge of the cultural differences to be expected. From the time spent working together in the Green Mills team I acknowledged some of these differences. The most pronounced was the difference in communication; Spaniards are more talkative and also have a smaller personal space, coming quite close to each other and giving kisses on the cheeks or hugging when they greet. Another thing regarding communication that I noticed was also their tendency to interrupt others when they had something on their mind. This behavior is considered rude in Finland, but after realizing they did not do it out of rudeness but out of enthusiasm I accepted their way and tried to be more like them when I wanted to make my voice heard. I was also of the opinion that they did not handle critique as objectively as I do. The Spanish very quickly expressed their worries about everything being wrong when I saw the critique as a small suggestion for minor changes in our work. Apart from this I got the feeling that the Chinese woman would have liked to make some changes in our plans and designs but, not wanting anyone to lose their face according to Chinese cultural standards, she did not say anything straight out about it. (Itim International, 2011)

6 Energy resources

Since the goal of the Visual Demo Kit project was to create a demonstration tool regarding energy, I will in this following chapter discuss different types of energy resources as well as some of the current political goals and forecasts for the future. The resources used for supplying the world with energy are of two types: renewable or non-renewable. It is known that the non-renewable energy resources will come to an end sooner or later. This is one of the main reasons as to why there is already a need for alternative sources of energy, especially since the world's need for energy seems to increase or at least stay at its current, quite high level. In the last few years so-called "green" energy has become a well-known phrase, associated with a cleaner and more sustainable way of life. These types of energy resources are up-and-coming, not only due

to the fact that the non-renewable energy resources will eventually run out, but also because these are damaging both our health and our environment.

A great advantage with renewable energy sources is the fact that all of them are naturally replenished, they are ultimately better for the environment and they have not yet reached their full potential. There are several practically infinite renewable energy resources that are far from being fully utilized yet, and a lot of research and work being done on how to maximize the uses of these. Thus the project team decided to concentrate on the renewable sources of energy and ways of saving energy, when laying down the basic guidelines for the project at hand.

6.1 Renewable energy sources

A source of energy is considered renewable as long as it is naturally replenished and derives from natural resources such as sunlight, geothermal heat, water or wind. All plant materials can also be used as a renewable energy source, known as biomass. The usage of renewable energy sources is growing; in 2008 the global final energy consumption was covered to about 19 % by these sources. The greatest benefits include less pollution and practically infinite amounts of available energy, while the drawbacks mainly consist of economic costs. It is still relatively expensive to build large-scale power plants for renewable energy sources (Wikipedia, 2011).

6.1.1 Energy sources included in the Visual Demo Kit

Since it was decided the Visual Demo Kit should focus on renewable energies and ways of saving energy, the renewable energy sources finally included in the kit were: wind energy, solar energy, geothermal energy and hydraulic energy. Apart from these, there would also be a module dealing with the differences between some of the light bulbs one can currently find in stores. (Visual Demo Kit, 2010)

6.2 Non-renewable energy sources

The natural resources for energy either exist in a fixed amount, or their reproduction takes way longer than the current scale of consumption can allow. These resources are known as non-renewable energy sources. Fossil fuels and nuclear power are the resources most commonly known among these. The fossil fuels include petroleum, natural gas and coal, while nuclear power is derived from uranium. (Wikipedia, 2011)

There are various estimates for all of the resources mentioned above. However, there is no telling which one would be the most accurate. The estimates vary, depending on whether the calculations are based on a leveled line of consumption, or the idea that the world's need for energy will continue to increase and the use of e.g. fossil fuels will continue to grow. The estimates also differ from one another since some are calculated with the currently known remaining reserves, and some with the estimated amount of remaining resources not yet found and utilized. The estimates for the lifetime of the remaining reserves and the consumption rate for crude oil featured here are based on Bartlett's calculations (2000, 1-17).

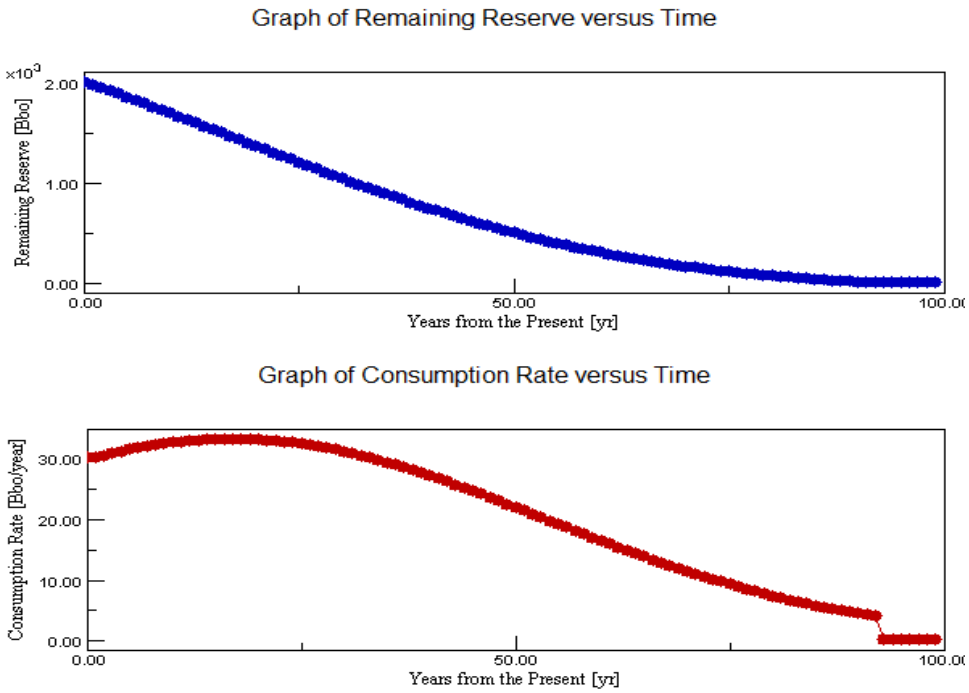

Figure 2. One estimate of the remaining reserve and the consumption rate for crude oil (Behringer E.R., 2004).

Natural gas is a major source of electricity generation, both for industrial and domestic use. Natural gas is a low density gas, consisting primarily of methane. It is usually transported as a gas or as a liquid, in pipelines or tankers (Wikipedia, 2011). According to Behringer (2003, Natural Gas Lifetime: A Simple Estimate), the remaining reserves will last for about another 40 years, based on default values from the United States Department of Energy.

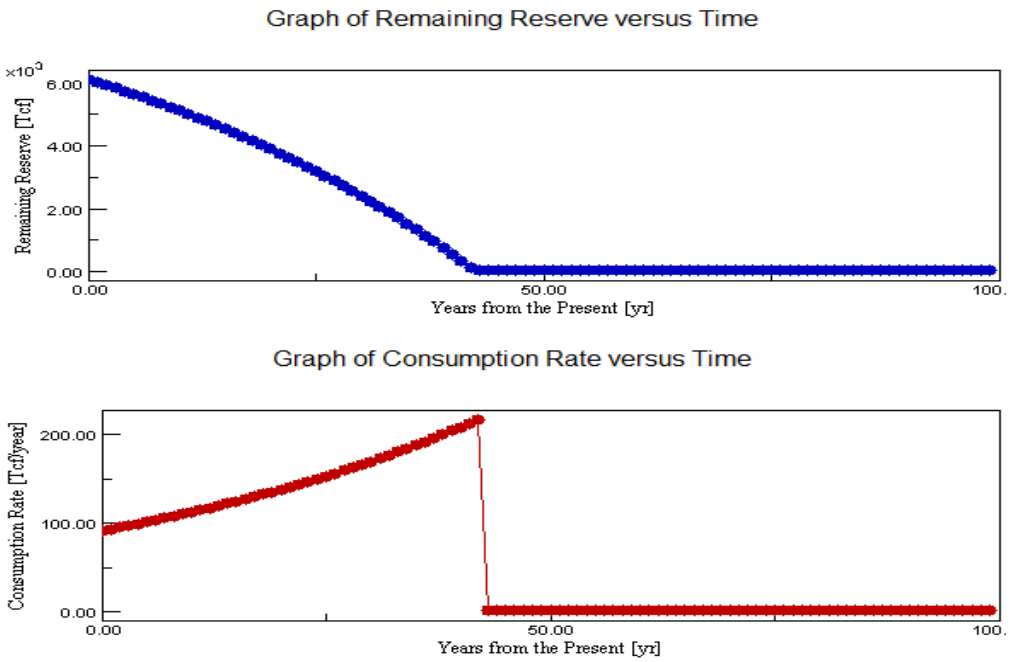

Figure 3. One estimate of the remaining reserve and the consumption rate for natural gas (Behringer, E.R., 2003).

Coal has for a long time held the position as the world's largest source of energy for electricity generation. Coal is found in over 100 countries in the world, making it the most common fossil fuel to be found. The CO_2 emissions created from the usage of coal are slightly above the emissions for petroleum and doubled when compared to natural gas (Wikipedia, 2011). The estimates for the remaining reserves of coal by Behringer (2004, Coal Lifetime: A Simple Estimate) are based on the default values from the United States Department of Energy, showing that the world has got coal for about 95 more years.

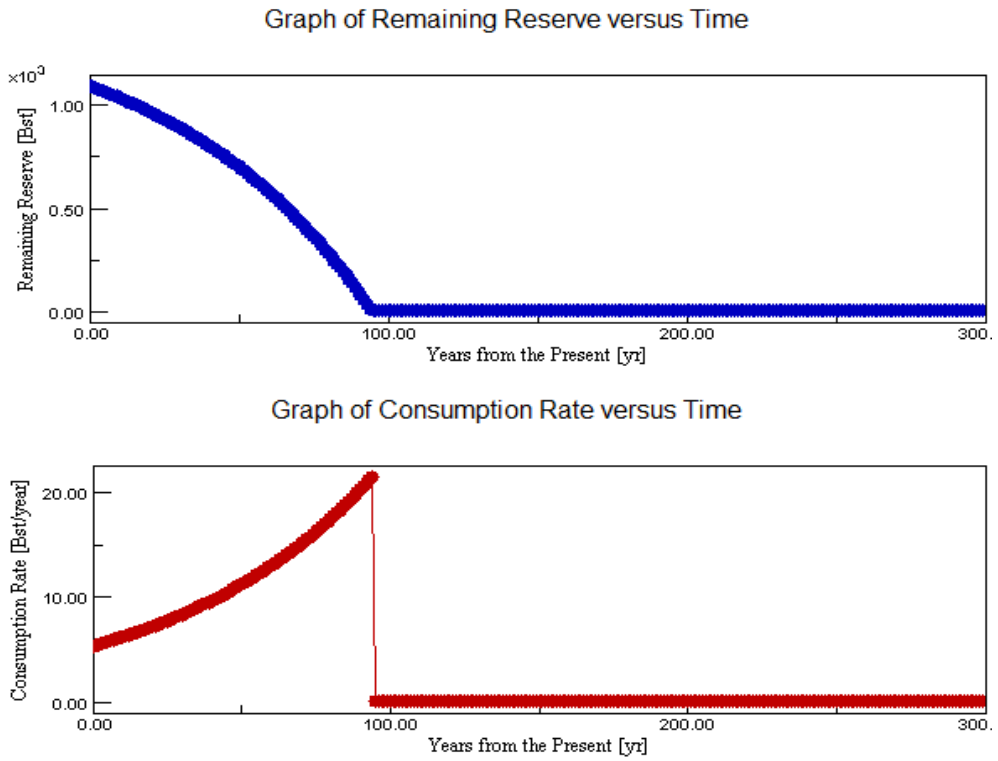

Figure 4. One estimate of the remaining reserve and the consumption rate for coal (Behringer, E.R., 2004).

The energy derived from uranium in nuclear power plants is also a non-renewable energy source, since there is a certain amount of uranium available on the planet. Among the biggest issues with nuclear power lies the problem with storing the radioactive waste. The waste remains radioactive for over 100.000 years and can cause great disasters like the one in Chernobyl in 1986 if the material is not extremely well taken care of. However, there are possibilities for using nuclear power as an energy supply well into the next century and beyond (Actis, 2001).

6.2.1 Peat

In parts of the world, including Finland, peat is harvested and used as fuel. In the world all together there is about 4 trillion m³ of peat, or turf, formed in varying wetland areas such as moors, mires and peat swamp forests. The volume of peat is smaller in the southern hemisphere than in the countries of the northern hemisphere. Some estimates show that the energy in peat to be found in Finland alone is more than twice the size of the North Sea oil reserves. About 30 % of Finland's area consists of wetlands, where peat can be

found. Although the country only uses about 1 % of these wetlands for energy production, Finland is the second largest user of peat after Ireland. About 6 % of the annual energy production is covered by burning peat.

Finland, along with the EU, has classified peat as a slowly renewing energy resource of the type biomass fuel. New peat is produced continuously, but it is a process of thousands of years. The peat used today can be up to 10.000 years old. Apart from the slow process, another issue is the fact that most wetlands on the planet are home to rare and specialized organisms, found nowhere else. Thus the process of harvesting peat can damage the unique wildlife in these areas. The challenge remains to be solved in a way that does not put endangered species at too great a risk. This is one of the reasons peat is not yet used on a larger scale. (Wikipedia, 2011)

6.2.2 Byproducts in short

The byproducts forming from the burning of fossil fuels are to be considered very harmful. The particles are able to exist in the air for indefinite periods of time, at least up to several weeks, and they can travel for miles with the wind. The particles, aerosols, can be smaller than 10 microns in diameter and therefore reach deep within the lungs of all animals or enter the blood stream. Apart from causing irritation in the lungs, the aerosols can also carry toxic substances such as heavy metals and pollutants with them into a body (Bartok & Sarofim, 1991).

6.3 Europe 2020 – current political goals

The European Union (hereafter the EU) has set five objectives to be reached by the year 2020. These objectives are summarized in the EU's growth strategy for the next decade, Europe 2020. The five different objectives concern employment, innovations, education, social inclusion and climate, including energy. When it comes to the objectives for the energy consumptions, the member states found it necessary to adapt to the energy

consumption without delay. Not only has a change been seen in the climate, with issues tracing back to global warming, but also in the energy dependence. The majority of the sources used for producing the energy required to meet the needs of modern society derives from non-renewable energy sources. These sources are still available for some time, but they will come to an end.

With this background, the EU found that renewable energy sources could make a great contribution: there are a lot of possibilities, while another benefit is that these energy sources produce little or no CO_2 emissions at all. Research showed that in the final energy consumption within the EU 8.5 % consisted of renewable energies in 2005. The goal set in the Europe 2020 strategy is to increase the share of renewable energies in the final overall energy consumption to 20 % by 2020. Since the EU is the world leader in the development of renewable energies, with over 350 000 employees working on this, the aim is both to maintain this position and reach the 2020 goal by both governmental as well as individual measures. However, there is a risk with these types of political goals. The worst case scenario is that while the western countries tighten up their strategy and regulations for the sake of the environment, it might only lead to an expedited move of production facilities to countries with less strict regulations. In these countries production is cheaper, but also a lot more harmful to the environment. The end result would be both a total of more emissions and a weakened economy within e.g. the EU due to the moving of production to outside of the union. Among politicians who stand behind this theory, criticizing the Europe 2020 goals, is Finnish Eija-Riitta Korhola. Korhola was a working member of the European Parliament's Environmental Committee in the years 1999-2004. (European Commission, Directorate-General for Energy and Transport, 2008)

6.4 Possibilities

Renewable energy sources can be utilized for various uses, which are continually investigated by the EU among others. Wind and hydraulic energies are usually seen as single application energies, while solar and geothermal energy sources have multiple applications. The former are usually converted into electricity, while the latter can be converted both into electricity and heating systems. Biogas has even more uses, since the

gas can be converted to liquid and used as biofuel. However, the “Sleeping Giant” among these sources is biomass, since this is thought to become the most important source of renewable energy in the future. Energy from biomass is won from all biological wastes, like urban and animal waste, e.g. spoiled vegetables and animal feces (European Commission, Directorate-General for Energy and Transport, 2008).

7 Conclusions

While working with the practical part of this thesis I came to valuable insights regarding how many different factors there are that all affect the outcome of team work, especially in cases where the team consists of individuals with different cultural backgrounds. There really is a lot more to it than what I first thought. From the team work I learned the invaluable importance of communication. I also realized how the interaction between team members and the roles that can be found in a team affect the way of working and the general planning and management skills needed in these cases. The practical work with the making of the prototype added insight to the procedure of product development. The project required more work than any of us first thought it would, which was another aspect we learned to deal with.

Within the team we had to begin at the planning stage, lay out possible solutions and implement the ones we saw best fit for the project. The last few weeks were stressful and in hindsight there are always things that could have been done differently. However, the team reached the goals and achieved what had been planned within the time limit. I also learned more about the energy resources we make use of in modern day society, both non-renewable and renewable resources. The possibilities for the future were the most interesting to read up on. The prototype for the Visual Demo Kit is now in the possession of the R&D department at Novia UAS and may possibly be altered further by a new team during one of the coming EPS projects. All in all I felt that I learned a lot from the project work and gained experiences that will come to good use during my working life, as well as in my personal life when dealing with people from different cultures. From the individual part, my Bachelor’s thesis, I learned more about the cultural dimensions and their effect

on team work, Belbin's team roles and I had to go back to my studies in the second year at Novia and research the marketing research methods. Also the information regarding the energy resources used and available today, together with the EU's 2020 goals, made for an interesting research. I especially learned to appreciate the team roles and the way one's cultural background affects oneself as well as one's team mates when one is put together with other individuals of different nationalities.

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Explanations

B2B = business-to-business

FoU = the Swedish abbreviation for R&D

R&D = Research and Development

UAS = University of Applied Sciences