Extending a new information system

with

financial information

for
DMT Design SA

Developing a calculation module for
DMT DESIGN SA

Company mentor:
Dhr. P.S. ter Schure

Tutor:
Dhr. H.Kroon

Pieter Vernooij

CONTENTS

Preface

Thanks for opening and reading my report! In the following I will give you a short introduction about its contents and thank some people who I really own a lot.

To graduate as a bachelor-student in Industrial Engineering & Management an external assignment needs to be solved. To fulfill this demand I searched for an international assignment and found one in Galati, Romania. DMT Design S.A, a medium-sized company, which designs and trades deck-equipment had an interesting problem. The company introduced a *new* information system and wanted to extent it directly. I want to lay emphasis on the word "*new*" in the previous sentence: an important factor in the research and therefore also a part of the title of this report. How this research was carried out and how solutions were developed is the main part of this report.

But that is of course only one side of the story. During my internship I really had a fantastic time in Romania. In DMT I was free to work independently and talk with employees as much as possible. The atmosphere at DMT was very nice, and my mentor and company-director Piet Ter Schure was an inspiring & motivating person to work with. He helped, guided, trusted and supported me. Therefore I want to thank him extensively.

I also want to thank the local AIESEC community in Galati, and especially Steluta Isabelle Udrea. She helped me were she could, and especially the first couple of weeks she was really my protection-angel. Special thanks also for Valerie, my coordinator from AIESEC-TWENTE, who helped me coming to Romania. Maarten Koster, my pre-successor at DMT also deserves attention. He interested me for DMT and helped me very good in my first (and his last) week. Thanks Maarten!

Valentin Anton a colleague from DMT made me "*Ciorba de Burta*"[1] and took me on a road trip trough the beautiful mountains. With Cristi Babas I spend a weekend on the sea-side and had 12 fun weeks in the office. He also did the hard work: programming all those ideas I had. These people really helped me feeling at home. *Multsumesc mult* [2]!

And last but not least I want to thank Annemieke, my girlfriend. She continuously supported me: from helping me taking the decision to go Galati and through my time here. The week she visited me was fantastic. *Pupici* [3]!

Finally, I am sure I forget many people who helped me with all those small things in a foreign country. Nevertheless, thanks for reading my report and I hope a little bit of the fantastic experience I had in Romania drips of these pages!

Pieter Vernooij
August, 2006

---

[1] "*Ciorba de Burta*" is a traditional Romanian dish.
[2] "*Multsumesc mult*" is Romanian for: Thank you very much!
[3] No translation….

Management-summary

This rapport deals with the development of an information system for DMT Design SA, a medium sized company located in Galati, Romania. This company is active in the international market for deck-equipment. It is growing very quickly, in terms of turnover and in amount of incoming requests for proposals. All departments are hiring new employees. These developments ask a lot of attention from management to manage and coordinate all extra occurring problems. Therefore management requested for more insight in running processes and underlying financial aspects of these processes.

It occurred that all calculations in the company were made on local computers without any sort of structure. This leaded to interdepartmental tensions and to inaccurate cost prices. Coordination of making calculations appeared to be impossible and it was also impossible to acquire financial management information.

To develop the desired output of management information and insight into business processes it was chosen to restructure all product-calculations as made in the company. This was done by the creation of a calculation-module, which fitted into the company (new) ERP system. This module offers a clear structure for different departments, internal and external to the company. It makes cost-calculations quite easy and still quite flexible, and open for different employees. A lot of data is directly shared across departmental boundaries, which could prevent some interdepartmental tension.

Nevertheless, the system has its practical disadvantages. It is quite static and needs a lot of clicking (not Window-based). It also demands an intensive training and adjusting period for employees. They need to change their way of working quite radically. These problems cause that the module is not completely in use. Currently no calculations are made with the system and most of the newly added functions are not being used.

At this moment the system doesn't have enough momentum to override all employees towards using it. Although management supports the system, full implementation failed. Nevertheless it could offer huge management-possibilities for the benefit of the growth of DMT Design S.A., the growth in orders list and the growth in employees

Introduction

A growing company faces major challenges, especially in highly competitive business-areas. Its time to market needs to drop and with shortening product life cycles the company needs to stay sensitive to external developments. But also internal developments offer threats.
Although new resources become available it is needed that the company works as efficient and effective as possible. This goal is difficult to achieve with a rapidly growing flow of information. Harmful side effects and problems occur.

This rapport deals with these problems in a company called *DMT Design SA*, located in Galati, Romania. It is active in the international market for deck-equipment. DMT Design SA is a company which is growing very quickly, in terms of turnover and in amount of incoming requests for proposals and received orders. All departments are hiring new employees. These developments ask a lot of attention from management to manage and coordinate all extra occurring problems. Therefore the company introduced a new information-system in May 2006. As a second try (another system failed) and only partly finished, the system required some important extensions and modifications.

This report deals with this step in the development of the system for which the following procedure is used. First the company and the currently running information systems are researched extensively. Also the total environment and the context in which the company operates is described. This information is used in the second part of the report where an extensive problem-analysis can be found. This problem-analysis resulted in the following central research-question:

"How to develop and implement financial modules as extensions of the current information system to coordinate a better flow of financial information between departments? "

This question was used to gain insight in the problem and develop solutions. These solutions, and the choices made for them, are described quite extensively, just like the process of implementation and evaluation afterwards.

The third part of the report describes my total international experience in Romania, the challenges I faced and how this affected my development and the internship.

Part I: Description of organizational context

To be able to analyze an existing situation, it is first needed to get a view of the organizational context by describing the internal & external environment and all stakeholders. This first part of the report will consist of this description of the external and internal environment of DMT design SA. After analysis this will lead to further problem identification in the second part of the research.

Chapter 1: The external environment

In this chapter the external environment is described using a STEP-analysis[4]. This will give a framework and structure for an internal analysis. The background of STEP-analysis is explained in detail in appendix A.

Social-cultural factors

The Romanian culture bears resemblance to a "Latino" culture. In general, people are outgoing and social. In the working place traces of collectivism can be found, because employees are really willing to operate in teams and perform for the company they work for. Remarkable is that the majority of the women population works outdoors. In factory's women and men work together, in sometimes very dirty and heavy circumstances. This is a remainder of the communistic period when just everybody was required to have a job.
Generally speaking, people born before 1970 only speak Romanian, and a little French. Younger people grow up in a more international addressed Romania and speak also English.

Technological factors

Romania is still trailing Western Europe on technological development. Factory's often look outdated, and work not very efficient, from a Western-European point of view.
For DMT Design this is not a problem, because it's main product is relatively easy to produce, as can be seen from the next chapter. This limited technological development is therefore not a barrier.

Economical factors

As can be seen from table 1, Romania's economy is rapidly growing last years. Despite this development, poverty is still a pervasive problem, and modernization's effects are only slowly being felt in the country's rural areas.

	2003	2004	2005	2006 (est.)
GDP (%real change pa)	+5.3%	+8.3%	+4.1%	+6%
GDP per capita (€)	2350 €	2600 €	3100€	4000€
Inflation	14%	9.2%	8.5%	5%
Medium gross wage	220€	250€	285€	335€
Unemployment	6.4%	6.3%	5.6%	5%
FDI	3.9bn€	5.1bn€	6bn€	8bn€
Mobile phone users	9,000,000	10,000,000	13,370,000	16,000,000
Cars production (units)	160,000	240,000	320,000	500,000(est.)
Internet users	5,180,000	7,800,000	10,400,000	13,600,000(est.)

Table 1: Markers of Romanian economic growth (source: www.wikipedia.org)

---

[4] STEP is an acronym standing for Socio-cultural, Technological, Economical & Political factors.

It can be seen from table 1 that the foreign direct investments doubled in 4 years. The international industries (for example: shipbuilding) therefore expands, and this increases the demand for deck-equipment as produced by DMT Design.
The average monthly wage is still very low, compared with Western Europe, but as people notice too, the accelerating developments also means a rising of wage. Corruption is a factor worth considering. For example, customs offices often need "a fee or tip" when importing or exporting.

Political factors
DMT-group's main office is in Romania, in the city of Galati. Since the capitalistic revolution of 1989 the country is a republic, governed by a president which is democratically chosen every 5 year. The legislative branch of the Romanian government consists of two chambers and the members of both chambers are elected every four years. More than 15 years after the communistic regime was overthrown, Romania is trying to cut its strings with the past and focus on a future within the European Union.

The Romanian judicial system is an inquisitorial system, of strong French influence and there is a lot of legislation around doing business. For this reason a legal advisor is necessary. Area's that touch DMT's practice are labor-legislation and (international) trade legislation.
Romania has been an active member of NATO since 2004, and is also an acceding country to the European Union. The EU Accession Treaty was signed in early 2005, and Romania is due to join the European Union on January 1, 2007. But conditions as set by the EU are strict.
Romania's economy has to grow, and especially corruption has to stop.
For a company like DMT this is a twofold development. Probably the attention for legislation and international procedures will make business easier to handle, but on the other side labor costs and prices will increase dramatically.

Chapter 2: The internal environment
In this chapter a general description of the DMT Group is given by describing internal aspects of the company like the organizational structure, the provided markets & products and the primary process. Because the original assignment was to make management-information available, a part of this chapter contains information about supporting information systems.

2.1 Introduction and history.
After having gained experience in the naval-shipyard industry, Dutch entrepreneur Piet ter Schure decided to start on his own in 2001. He founded Dutch Marine Trading design S.A. (DMT S.A.) with some Romanian designers. The company started with designing tailor-made winches.
At the same time DMT BV was established in the Netherlands to do most of the selling part. In the beginning the company was run with the Dutch company as the primary base, where most of the orders were running. Last year this system changed, when DMT design SA in Romania became the central company. From then the company in The Netherlands is only being used as a sales channel to ship goods from Romania to The Netherlands and vice versa. Next to these two companies there is DMT Production Ltd. in Ukraine, which takes care of the production in that country.

Together these three companies act as the (unofficial) DMT Group, or in short: DMT. (Koster, 2006). Table 2 contains some accounting key-facts.

	2002	2003	2004	2005
Turnover	€103.761	€322.792	€654.792	€1.603.516
Gross result	€20.982	€64.785	€70.187	€12.380
Current assets	€21.466	€83.193	€121.103	€601.399
Total capitals	€13.862	€67.965	€63774	€76.738

Table 2: Key figures DMT design SA

In the past four years the company continuously grew in number of orders and turnover. Due to many investments profit did not grow continuously in these years. Nowadays the company employs twenty-three people on sales, engineering, purchasing, quality, finance, legal and human resources. The order portfolio is expanding vastly and there is pressure on the engineers to process inquiries. The company does not assemble or manufacture products itself. The manufacturing of DMT equipment is carried out in cooperation with factories in Romania and Ukraine. This process is kept in control by daily check on stages, carried out by quality inspectors, allowing DMT to guarantee quality and fixed delivery time, because DMT is fully responsible for the delivered products. (Koster, 2006).

2.2 Products.
The main products DMT produces are winches for use on ships. These winches can be used for many different operations, like controlling the anchor, mooring, towing and many other applications. All these winches are designed to the exact specifications the client wishes, in terms of forces, size, weight and etcetera. Because the company does not produce itself, the added value of these products is mainly in the design and in the purchasing of components, to deliver a complete end product. Next to winches, the company can deliver other kinds of deck equipment for naval use, like dredging equipments or rudders. Sometimes DMT designers engineer these, but it also happens that a complete drawing is delivered and that DMT takes care of the production at a subcontractor and the purchasing of the necessary parts. In this case DMT in fact only operates as a reseller, so the added value is in the gathering of components.
For all products goes more or less the same: due to proper procurement of components and control on manufacturing at a subcontractor, the company can deliver good quality for a reasonable price. (Koster, 2006) Next to the winches DMT is extending its product portfolio. Customers find their way for more types of highly customized products, like for example diving equipment.

2.3 Markets
The market DMT is serving is the shipbuilding industry. Most of the clients are large shipyards which order custom products for their ships under construction. The market can be found worldwide, but most of the clients are of Dutch origin, as there is the best existing network. At the moment DMT is expanding to Eastern European countries, the Middle East and even the United States of America. A more elaborate market analysis has been done using the five forces model of Porter (1980). This complete analysis can be found in appendix B.

2.4 Organizational structure
The location of DMT Design SA is the unofficial headquarters of the DMT Group. Other company's included in this group are DMT Sales Ltd. From the Netherlands and DMT Production Ltd from Ukraine. These companies exist because of import and export legislation. The DMT Group does not exist as a legal entity, but because of the close links between the companies it chosen to call it like this.

Shares of the group are divided in the following way: (Koster, 2006)
- DMT Design SA:
    - 88% by Piet ter Schure.
    - 3% by Marianne ter Schure.
    - 3% by Cornel Hincu, Liviu Trimbitaru and Marian Darie. (Head designers)
- DMT Sales Ltd.: 100% owned by Dutch salesman Gerben Donselaar.
- DMT Production Ltd.: 100% owned by Ukrainian production manager Oleg Kozyrko.

Currently the company has 23 employees. The following functional structure gives a view of responsibilities: (Figure 1)
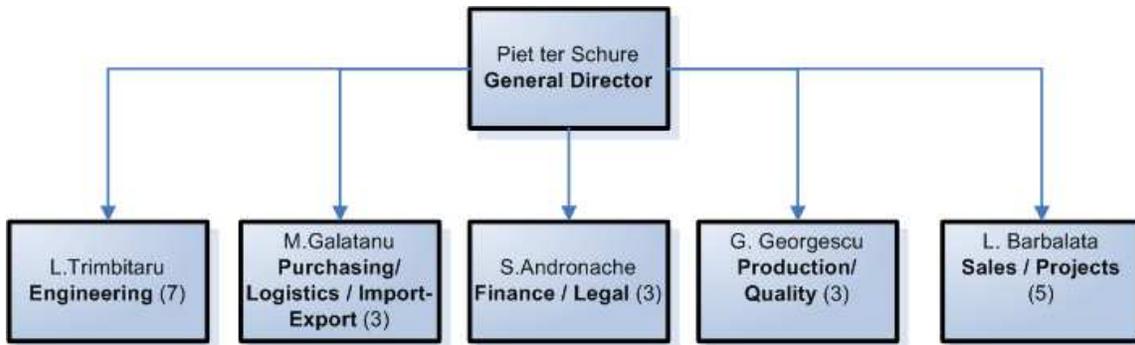
Figure 1: Structure of DMT Design SA

The grouping of common functions from the bottom to the top of the organization defines a functional structure according to Daft (2001). As can be seen from figure 1 this is also the case within DMT. But in practice, DMT doesn't have a strict hierarchy. From the figure can be seen that DMT design has a rather flat structure. Director Ter Schure has overall management control. In every department he delegated authority to an assistant, but in the office it is noticeable that Piet really is the leading figure. When people have questions they just ask Piet.

Slack (2001) uses another methodology to describe a company. He identifies three core functions, and different support functions in a company. This analysis can be found in appendix C. The next paragraph describes how DMT uses these functions to create value in its primary process.

2.5 The primary process
The primary process is the core process which creates value by means of certain products, which can be sold to customers. The primary process starts for DMT with active selling. Customers have to be attracted by the products and services offered by DMT. When they are interested a custom made offer will be sent by DMT, for which DMT establishes a preliminary design (if asked), and a price overview after a short research on cost prices. This research is executed by an employee of the department of sales on a local computer. Because the importance of this sub-process, this is also explained more in detail in appendix C.

After this, both parties will negotiate about the specifications of a potential order, technical as well commercial. When they finish this and DMT gains the order, it will be confirmed and the engineering department can start with the detailed design of the product (if the customer does not deliver its own drawings). Purchasing can start to find a suitable subcontractor for the manufacturer and during the designing process Engineering will give them a list with necessary components to be delivered by DMT. When the design is finished, the components are ordered (and delivered) and a subcontractor will be ready to produce the product, the real production phase starts. In this period DMT will carry out some quality controls and keep an eye on delivery time. When the product is finished, tested and – if the customer wants – certified by a certification organization, it can be transported (and if abroad: exported) to the customer. If there may be any problem with the product, DMT will deliver after sales service.

An overview of the primary process is given in figure 2. In appendix C an extended overview of the primary process is given. All supporting processes are described there too.
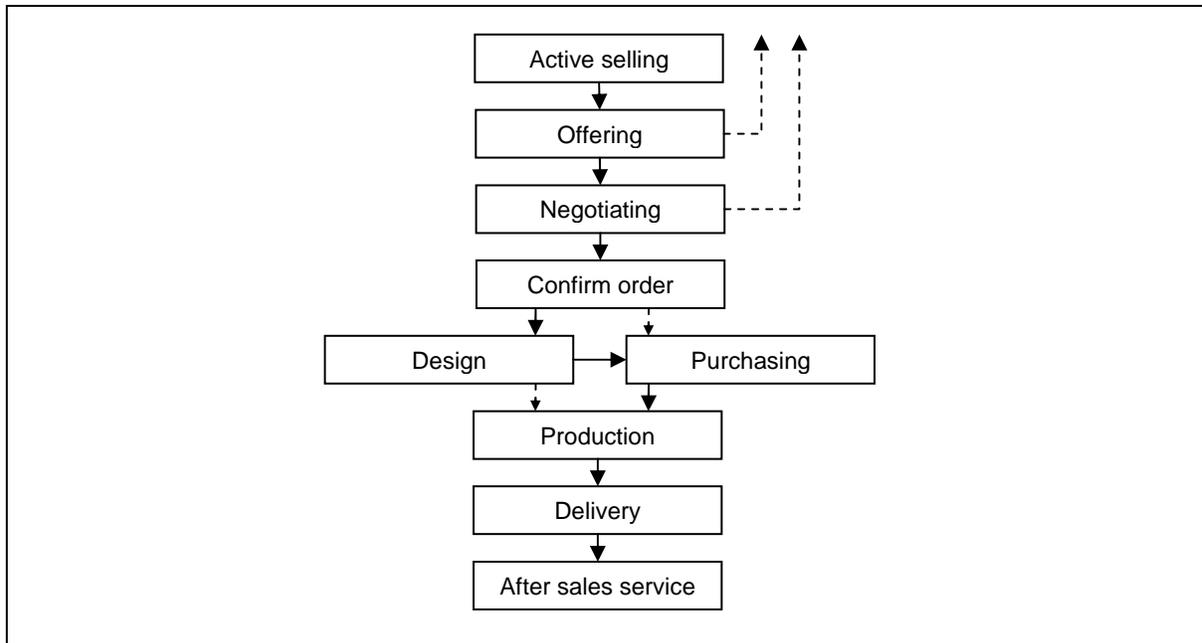
9

```
                    ┌─────────────────┐      ↑ ↑
                    │  Active selling │      ┊ ┊
                    └────────┬────────┘      ┊ ┊
                    ┌────────┴────────┐      ┊ ┊
                    │    Offering     │┄┄┄┄┄┄┘ ┊
                    └────────┬────────┘        ┊
                    ┌────────┴────────┐        ┊
                    │   Negotiating   │┄┄┄┄┄┄┄┄┘
                    └────────┬────────┘
                    ┌────────┴────────┐
                    │  Confirm order  │
                    └────────┬────────┘
          ┌──────────────┐   │   ┌──────────────┐
          │    Design    │──────→│  Purchasing  │
          └──────┬───────┘       └──────────────┘
                    ┌────────┴────────┐
                    │    Production   │
                    └────────┬────────┘
                    ┌────────┴────────┐
                    │     Delivery    │
                    └────────┬────────┘
                    ┌────────┴────────┐
                    │After sales service│
                    └─────────────────┘
```

Figure 2: Overview of primary process

Koster (2006) analyzed the primary process from DMT with Porter's value chain (Porter and Millar, 1985). He proposed that "the value adding activities in DMT are: Sales, Engineering and Operations, which consists of design, components purchasing, inbound logistics, production, outbound logistics and after sales service". And "because DMT delivers custom made equipments, the engineering part of the process is very value adding. Also the components purchasing part is value adding, because it makes difference when comparable goods are bought for a better price. The production is not carried out by DMT, but the quality control is and this can be seen as value adding."

The value created by the department of sales is of special interest of this research. This department creates the first preliminary design, which shape the boundaries and restrictions of the future product based upon experience and knowledge, and often fix the future cost and profits of a project in an early stage of the product life cycle.

2.6 Information processes
The information being used during the primary process has been structured using a completely new information system. This system has been in use since 01-06-06. It consists of two elementary data elements: a products / components database and an order / inquiry (project) database. Also data is stored about relations like employees, customers, manufacturers and suppliers. This structure makes it possible to keep track of orders and inquiries throughout the primary process. This makes the sharing of information across departmental boundaries possible.

According to Levy and Powell (2000):"information is crucial for any business strategy and an information system should place much greater emphasis on informal as well as formal information flows, both within and outside organizational boundaries." A decent overview of all information flows is needed. Therefore all current information exchanges are identified in appendix D. A basic overview (summary) is given in figure 3:
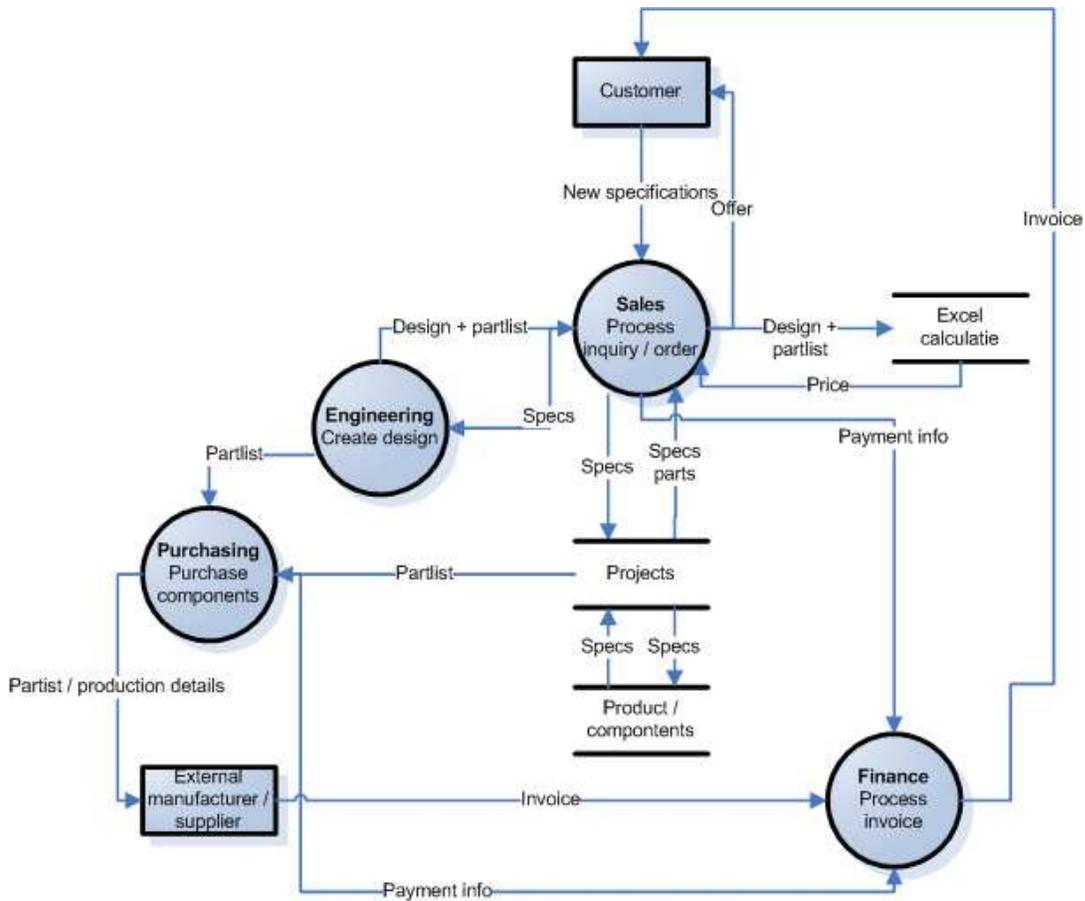
Figure 3: Basic overview of information exchanges

Specific information about the current information system can also be found in appendix D
The system provides basic functionality. It creates a platform in which it is able to maintain all necessary information about a project (order or inquiry) and all relations it holds with stakeholders and underlying components. As can be seen from figure 3, not all information is shared. For example price-calculations are executed and saved on local computers. This has some important consequences, as can be read in the next part of the report.

Part 2: The assignment

This is the main part of the report. Using the descriptions from the previous chapters it is possible to analyse the company using a SWOT analysis to identify problems. The ABP (Heerkens, 2002) describes a problem in business terms as "the difference between the current situation and a desired situation." This desired situation will be formulated and reached by implementing a certain solution. This part will keep track of this process of analyzing the situation and the implementation of the solution. After this solution is implemented it evaluated.

Chapter 1: SWOT-analysis

The following SWOT-analysis makes it possible to find a starting point for problem identification and problem formulation. The SWOT-analysis is explained in detail in appendix A.

Strengths

The major strength of DMT Design lies in the cheap labour costs it has in comparison with other competitors. The average monthly wage (avm) in Romania is about 15% of the avm in Western Europe. This makes the cost price of the labour-intensive products significant lower. But in addition, DMT Design also places a huge effort in emphasizing the importance of quality. All deliveries are quality-inspected what offers (some) guarantees for customers. The location of the company, near the important Damen shipyard, is also an important factor to success. A high proportion of the orders come from this customer. DMT has also a growing portfolio of products. These are engineered-to-order and the highly educated employees are flexible in the products they can design and produce; DMT is therefore producing in a lucrative niche of the market.

The small size of the company contributes to the excellent working-atmosphere. Employees are really motivated to work hard and seem to have pleasure in their work. The good working conditions created by management really support this atmosphere.

Weaknesses

DMT works using a functional organizational structure. Daft (2001) describes the following problems with this structure (page 97):
1. It may cause decisions to pile on top and hierarchy overload.
2. It could leads to poor horizontal coordination among functions and departments.
3. It involves often a restricted view of organization goals.

These problems are also valid for DMT. Although general director Ter Schure is trying to delegate authority, employees still involve him in almost all processes and problems. This means a lot of decisions are piled on top. Information is crucial for decision-making and currently there are no methods to gather current situation information quickly. Especially in rapidly changing situations and environments like in Eastern Europe (see chapter I) it means that DMT is handicapped, and limited to the knowledge and strategic vision of one person.

Nevertheless, turnover is rapidly growing. But this comes with a huge grow of information flows, with some additional occurring problems. Employees seem to be overwhelmed by the enormous growth of the company. Sometimes orders are not processed correctly, for example with wrong prices or wrong dates of delivery, or both. The same goes for invoices which are not always send or paid in time.

This is because not all needed information about products and deliveries is captured into the new information system. Some very important information is still managed on local computers, as can be seen in appendix D. Sharing complete information is therefore not possible. An example is the way sales prices are calculated. During the inquiry-phase of an order the future price of an order is calculated by the department of sales. This department gathers all possible financial information about an order in a local (excel) sheet. The calculation is then rather easily computed

but sometimes important cost-drivers are not included. Also because the after calculation is made along a certain standard format it is therefore quite a lot of work to compare the pre & after calculation. Consequence of this is that the after calculation is not always made (hardly ever). Therefore it is not possible to calculate real profits and acquire an accurate financial insight. This process of creating calculations is described more extensively in appendix C.

Opportunities
The demand for naval equipment is expanding. Therefore DMT's turnover is also increasing rapidly. New markets are discovered and new customers acquired. This means that the company can grow and invest in assets. DMT is acquiring customers in Turkey and China and is also busy with the acquisition of its own manufacturing facility. This provides new possibilities for quality-assurance and a certain control of prices.

Threats
Competitors are also coming to the markets on which DMT is active. The company has major cost-advantages with an unique quality focus. But this cost-advantage is gradually disappearing because Romanian labor price increases rapidly too.

Also the company has difficulties adapting to its new size. Management needs to hire new employees while maintaining the quality of products at the current level. Growing needs of information also need to be managed effectively and efficient and it will also be difficult to conserve the current atmosphere because a growing company will face a change in employee behavior. The acquisition of the new factory will also ask huge attention from management and less control of the company in Romania.

Chapter 2: Analysis: problem formulation & method

Using the SWOT-analysis and the insight acquired about the organization it is possible to draw a problem knot, a tool also explained in appendix A. The current problems are extensively described in appendix E with the use of this tool. After analyzing this knot it can be concluded that it is needed to exchange financial information more efficiently and effective between departmental boundaries. This will lead to a lower pressure of work and a better insight in some planning and general financial processes.

To be more specific, the research tries to design and implement solutions for the following problems:
- Because after calculation is not always carried out, (changes) of important cost drivers are unknown.
- (Short-term) planning of future cash flows is not available.
- There is no available management information, so decision-making in controlling the process is more difficult.

But of course the research has its limitations and must take the following conditions into account:
- Time is limited. In a maximum of 12 weeks the assignment needs to be designed, implemented and evaluated.
- The chosen solution has to work together with the existing information system.
- Not all needed information is open for public. Discretion is necessary.
- The budget is fixed. Other investments than the 2 currently paid wages are not possible.
- Important (strategic) choices have to be made by company management.
- An ICT-specialist is already on site. Therefore a rapid introduction is desirable.

Considering the conditions and requirements, the main question of the research will therefore be:

How to develop and implement financial modules as extensions of the current information system to coordinate a better flow of financial information between departments? "

To find solutions to this problem, the method as described in the next paragraph will be used.

2.1 Method
With the conditions and main question taken into account it is clear that the used approach or method needs to have an information system building approach. According to Hoffer (2002) some different types of system development methods can be distinguished, dependent on the new IS characteristics (page 17). To develop a transaction processing system (TPS) the used research method needs a process-orientation. This concerns a focus for capturing, validating and storing data. Because management also wants the system to include management information, the data must also be available and accessible in a variety of ways, and relationships between data must be clear. Hoffer calls this a data-orientation (page 17). The method used in this research will therefore have a process and data orientation.

Because of the availability of IT-specialist Christi the prototyping-approach for development was chosen. This method distinguishes some different phases for system development, which structures this research. Advantages are the quick introduction of new functions and the ability to really involve the user in the development. Because the high work pressure and the recent introduction of a complete new system these are important advantages. The complete system and the applied modifications can be found in appendix G.

Chapter 3: Analysis: requirements determination & restructuring.

In this chapter an analysis of the existing problems can be found. To acquire reference to the primary process and the concerning information flows, appendices C & D are recommended to read and study.

First the collected desirable system requirements are presented and restructured here to present a view of the desired process and its specifications. Hoffer distinguishes different methods (page 206) for collection system requirements. From these different methods, interviewing, observing and studying business documents like spreadsheets were used extensively to discover issues and collect the needed requirements. In appendix F the firstly used interview outline form can be found. Although making outlines was useful, most information was collected in non-structured interviews and meetings. For the sake of intelligibility, the chapter is divided according to the 3 main problems as stated in the previous chapter.

3.1 Problems occurring because of the existence of local calculations.
All calculations during the primary process are executed locally in departments on spreadsheets and these are not shared across departmental boundaries. This has important negative consequences, as can be read extensively in appendix E. Management decided therefore to research the possibility for a new system of cost-accounting. To research this wish, first the necessary requirements from the user point-of-view were determined.

The primary stakeholders are working at the department of sales. These employees value the ease of working with complex sheets. Calculations contain a lot of remarks and suggestions, sometimes totally incomprehensible. It is not clear how sheets are related to each other; even within a single sheet there is clearly a lack of structure. Indeed, flexibility is mentioned as the most important requirement. Employees define every new order as an unique product and emphasize the uncertain relations with suppliers and producers.

Nevertheless, sales history is being used to obtain some kind of reference for the new order. Users from the department of sales emphasized the importance of the process of going trough similar orders to acquire a product-overview. The use of history and analogies should therefore not be forgotten and sometimes complete products are also purchased by the department of sales, a process which should not be restricted by the solution.

Also the solution needs to integrate the process of making pre- and after calculation, by making it easier and less time consuming. Management asked for higher accuracy, and a shorter response time to important changes. Some new cost-drivers needed to be included and researched. Because of the high diversity of products and underlying components this is an important demand, and in fact the key reason for this assignment.

It is possible to deduct some guidelines from literature for an alternative system of cost-modeling. This helped structuring the user wishes. Layer et al. explicitly state some requirements for an accurate cost-model. (For theoretical background, see appendix A)

- The model should offer a high level of accuracy. It must reflect the latest prices. An accurate cost price determines an accurate margin and accurate decision-support information.
- The offered cost-structure should have a high level of transparency. By offering a high level of transparency, interdepartmental traffic becomes more effective and efficient. This also clears responsibilities and guidelines.
- The model should be dynamically adaptive. It must be very easy to include the latest cost-drivers in the calculation.
- Calculation of complex parts should be applicable. DMT Design's product portfolio can be defined as very diverse and complex. It is therefore indeed needed to make the cost-calculation very flexible.

The company often uses an analogue cost-estimation with similar products from design-history to make cost estimations. Therefore it must also be possible to search in the history for past-used designs. In summary: history should support new calculations, but should not limit it by reducing the accuracy.

After some internal discussion it was clear that management wanted to eradicate all local calculations and storage of data. It was quickly decided that all local storage and calculation should disappear in favor of a more extensive standardization of the current processes and practices, probably by means of extending the ERP-system. Different authors claim huge advantages of enterprise wide-standardization, as can be read in appendix A. Akkermans & Van der Horst (2002) notice the following:

- Collaboration trough communication becomes cheaper and faster.
- Changes in the organizational network becomes more easier.
- Standards allow economies of scale, with costs of IT shared on more applications.

For a growing company these are important benefits and different authors also claim that an (extended) ERP-system can offer such benefits. In DMT's situation this would mean that the current information system also needed a price-calculation module, with requirements for cost-models as stated in the previous chapter. But in addition, for each ERP system applies that potential benefits depends on the specific characteristics of the underlying process. Hoffer (2002) therefore suggests that 3 questions are needed to be asked for the identification of good opportunities for such radical change (page 227):

1. How important is the activity to delivering an outcome?
2. How feasible is changing the activity?
3. How dysfunctional is the activity?

It was quickly decided that making the pre-calculation was a key-activity (Layer et al. (2002), Akkermans et al. (2002)) although it was quite dysfunctional with its negative consequences and problems. Therefore it was needed to check the feasibility of the project, like Hoffer suggests.

3.2 Feasibility
The decision to implement a company-wide ERP system was made by management and is supported by analysis of scientific literature. For reference, see Koster (2006). But taking the decision to implement a calculation module was postponed en is therefore necessary.

Porter and Millar propose that IT will play a strategic role in an industry that is characterized by high information intensity in both the value chain and the product. Mooney et al. state (1996, page 74) that firms especially derive business value from IT through its impacts on intermediate business processes, which comprise of all operations that form a company's value chain. It is therefore needed to look at this value chain, and in special the part of making calculations.

In chapter 2.5 it can be read why making a pre-calculation is an important activity in the value-chain. It handles huge loads of information from different sources. The product of pre-calculation is an attempt to bring structure in this large available amount of information (see for some examples appendix C). Current and future prices and alternative designs are distilled and combined until one offer remains which needs to match (at least) and reflect the future conditions for production, with a certain margin for safety and profit. In Porters and Millar's intensity matrix (1985) the product of this activity is a product with high information content and a high a information intensity of the activities constructing this profit. These sort activities are critical for IT-re-engineering according to Porter and Millar: "obviously, activities that represent a large proposition of cost bear closest scrutiny, particularly if they have a significant information-processing component". (1985, page 159)

But the standardization accomplished with introducing calculations in to the current information system should match the characteristics of the current process of making this calculation. (Akkermans & Van der Horst, 2002). This process is like working within a set of work constellations as can be seen from appendix C. Akkermans & Van der Horst argue that such a process can do without standardization. However, this argument only counts for the current process, with its costs and benefits. A process, which consists of a flow of regulated activities, can be very well supported by ERP-software, and for example a calculation-module. (Akkermans & Van der Horst, 2002, page 219) The criteria of Weil and Broadbent (appendix A) also show that in theory it was possible to standardize a pre-calculation module:

- *Local versus integral nature*. The calculation is created locally, but the data is used as a basic structure for different departments. Also different departments should be able to give input for the process. It has an integral nature, although not the complete calculation is shared.
- *Speed of change*. The process and its products did not change throughout a couple of years. It is not expected it will change in the near future; only a radical change from the company's primary process will be able to do this. This is not expected.
- *Number of people using it.* In the company the calculation is used by at least 3 people, but in fact more people need input for it; something what is impossible right now. Therefore probably a relatively large part of the company should be able to use it.

After this conclusion, the question remained if the calculation in practice at DMT design could be re-engineered to "a regulated flow of activity" and if both software and process could adept to each other. Different employees supported this possibility and confirmed also it was needed. They also believed that it was possible, although the process of making the pre-calculation is quite complicated. Akkermans & Van der Horst again supported this; they conclude that this applies especially where communication between customers and different employees is based on product-specifications rather than the product itself (page 226)

Together with management, users and the ICT-specialist it was then decided it should be possible to re-engineer the current process towards higher grade of standardization. The project was feasible.

3.3 The long-term planning of cashflows.
From the problem knot (appendix E) it can also be concluded that the process of handling invoices could also be improved. Employees from different departments mentioned the amount of work included with checking, transferring and paying invoices. Information about receiving and

sending invoices was not shared freely across departmental boundaries. As can be seen from the problem knot this had some negative effects.

In interviews some strict requirements and logical information became clear. The employees from the different involved departments stated the following requirements:
- The tool had to be easy to use and present a clear overview.
- There had to be no significant extra amount of work entering data.
- Warnings had to be created automatically, for example by sending a mail.
- Everybody had to take the system serious. The corruption of data was absolutely forbidden.
- The department of Finance desired a time-accuracy of approximately 1 week. So a prediction for a needed payment in a certain week was specific enough.

After this the requirements were transformed into the following scenarios in which the stated problems would be solved, by using the theoretical recommendations and with respect to the mentioned constraints.

- *Situation with cash inflow: sending invoices to customers.*

The process starts when an order is confirmed in the system. The price is from then fixed and the delivery-date is confirmed. Often it is agreed that down payments should be paid. Instantly this confirmation of future cash flows goes to the department of finance. This way the department always has a real-time overview of the current outstanding projects and their future-value and date of inflow. A change of specification like delivery date (which means a delay in cash inflow) is detected and registered by the department of sales. This registration is extremely important because it is directly connected to the date when the invoice should be sent. In summary: it is extremely important to keep a close eye on the final delivery-date.

3 days before delivery the department of finance automatically receives an announcement that an order-value needs to be incurred. By using the invoice-creator a new invoice is created by the system and is printed automatically.

- *Situation with cash outflow: receiving invoices from suppliers*

After purchasing supplies, the department of purchasing adds these components to the part list of an order in the order database. The items all have a certain (sometimes negotiated) price, and a delivery-date. Instantly this confirmation of future cash outflows should go to the department of finance. This department always needs a real-time overview of the current outstanding orders and their future-value and date.

Any change of specification like for example the delivery date (which means a delay in cash outflow) will be detected and registered by the department of purchasing in the system

When the value and delivery time of (groups of) products becomes definite, this must be followed by a change in status in the financial planning database system. The received invoice can then be matched and validated by the department of finance to the data in the system. Purchasing must release a final confirmation for items to be paid. 3 Days before an invoice due-date the department of finance automatically receives an alert that an invoice needs to be paid. The department of finance is than able to change the status of the invoice to "paid".

3.4 Real-time management information.
Hoffer (2002) uses the following definition of a management information system (MIS): " A MIS takes the relatively raw data available through a transaction processing system and converts them into a meaningful aggregated form that managers need to conduct their responsibilities" (page 16). For creating such a system it is therefore needed to collect the following knowledge:
- What raw data is available and how can this be analyzed and exported? Which data is missing?

- How do managers want to see their meaningful representation?

Following these points of attention it was easily found that management desired the following information from the system:

Name	Stakeholder	Needed information	Source	Type
Long term overview of future cash flows	Finance, general management	Future total cash flow of orders.	Calculation-module, components-module	Barchart
Forecast of turnover.	General management	Future cash inflow of orders	Calculation-module	Linechart
Forecast of deadlines (engineering finished, production finished).	Sales, general management	Deadlines of activities following from orders.	Order-database	Barchart
Difference between pre-aftercalculation of orders.	General management, head of Sales	Estimated price order, real price order.	Aftercalculation module	Table
Proportion of specific costs in turnover.	General Management	Cash inflow, specific cost (transport, purchasing etc.)	Calculation module	Piechart

Table 3: Wishlist

It appeared that the content that management wanted to be presented was similar to the requirements as ventilated by the different departments for the other solutions. Management was also quite satisfied with the other (of course still theoretical) solutions as presented in this thesis, which meant support for the validity of the used data was confirmed. But of course there were some additional requirements:

- The data presented needed to be real-time and very accurate.
- The presentation needed to be graphical.
- It had to be easy accessible with the information system.

The requirements as stated above were taken to the next development phase: the design of solutions.

Chapter 4: Design of solutions

Following the requirements from users and the guidelines from theory it was possible to construct and design solutions for the three partly distinct problems as discussed in the previous chapter. These solutions where coded completely by Cristi, the IT-specialist on site.

The underlying basic structure of these chosen solutions can be found in this chapter. Detailed final design of the solutions can be found in appendix I.

4.1 Problems occurring because of the existence of local calculations.

The challenge was to introduce one standard of calculation, with the flexibility of creating individual projects, as can be seen from the requirement structuring. To design this solution at first very different types of calculations were studied, and stripped to their basics.
The following parts explain this creation of a standard calculation by first describing some needed fundamental basic choices and then by applying these choices to the major cost-drivers, important elements in a calculation.

Basic structure choices

In pre-calculation phase no explicit knowledge is available about the details which will fill the bill of materials. Therefore it was needed to introduce general "descriptions" of components in the

system. This means that every time when adding a component the employee has the choice to enter a specific component from the database, or enter a generic component with a description and a price. This created flexibility, and (theoretically) unlimited freedom in creating unique products.

According to the system, products are built from components. But DMT also sells items which just consist of one solid physical object. The component *is* a product. It seemed to be illogical to build these products from (seemingly irrelevant) components because it causes extra work of adding components. To solve this problem it was chosen to make the two following clear distinct definitions.
1) A product is *"an item created by the primary process of DMT with a certain value coming from the underlying components"* and
2) A component is a *"by a supplier provided item which build up products and have a certain value, determined by the supplier"*.

So for intelligibility it was chosen to build every product from at least one component. With these definitions it was possible to keep the database structure clear, and explain the reasoning behind it. Employees from Sales sometimes purchase solid products, and need to build this from one component (following the previous reasoning). Because of the intrinsic difference in goals these departments have[5] it was therefore chosen to introduce a group of components, the so called "Solid objects". An employee can add a certain solid product, and then adds a generic component from the group "solid objects".

Every inquiry needs a pre-calculation, but every inquiry is also built from products, and often products are re-used in new inquiries. Therefore it was chosen to connect the pre-calculation directly to the products. While adding products to an inquiry automatically the specific calculations are added too. Like this product-calculations only have to be created once. Because flexibility was a requirement, also on inquiry-level calculations & specific components can be added. With this possibility the total calculation is made editable.

This also counts on order-level because revisions of order occur regularly. After making an order from an inquiry it must still be possible to revise the order and its configuration. Therefore next to the pre-calculation (inquiry-phase) an order-calculation (order-phase) was created. To distinguish these different calculations some buttons were slightly modified and the colors totally changed.

Employees often use the history of an inquiry or an order. After numerous revisions it must still be possible to use the history of the offer and for example the prices as offered back then. Therefore it was chosen to introduce a new "calculations" database. This gives the possibility to save all changes and look in the inquiry-offering history. From this history specific products can be chosen for re-use.

In summary, a flexible calculation-module (in blue colors) was created for the pre-calculation and for the order-calculation a module was created in red colors. Using this system, calculations could be created, saved and re-used with a product-component hierarchy to provide structure and still some degree of flexibility. The following subchapter explains another tier in all calculations: the group of major cost-drivers, which add extra costs to the products.

Major cost-drivers
5 Different groups of general cost-drivers could be identified, which are explained below.
- *Transport:* A highly variable cost is the international transport of goods, which needs special attention when making the pre-calculation. Therefore it was chosen to exclude

---

[5] The department of sales tries to offer the lowest price possible which after a certain time the department of purchasing needs to realize by negotiating with a supplier. Sometimes this causes interdepartmental stress and tension. Giving sales control over components-prices would do harm to this situation. More about this delicate subject in the latter chapter about the implementation of the modules.

transport as a standard-component, and create a totally flexible module where employees could allocate these costs accurately. Miss-estimation of transport prices was a source of irritation between the sales & purchasing, and the specific separation of this cost-driver could help solve this problem. Properties of the product like data of delivery and place of delivery, maintained and introduced by the department of sales are automatically copied to this menu.

- *Customs*: Every product incurs costs for the passing of the borders of its supplies. These costs need to be estimated, although the system offers a default value.
- *Certification*. Specific parts of the product need a safety-classification. A price can be attached to it, just as the exact certification class and other specifications.
- *Margin*. Employees can give a desired margin in % for the product and add extra value to the product. The module automatically calculates the total amount of margin. Currently only 2 employee have rights to this menu-screen.
- *Design*. DMT Design calculates the price for product design by multiplying the weight with the kilo-price. Employees can give enter this kilo-price and also add extra costs manually. The system automatically calculates the price for design.

Also one group of *extra costs* was created. This group consists of the following cost-drivers:

- *Unexpected:* Every order has unexpected costs occurring during production. Therefore a certain value is added to the sales price to prevent unexpected loss. The module automatically adds a default value, which can be modified.
- *Opportunity cost of capital:* An order takes a certain time to be designed, purchased and finally produced. During these stages (as in figure 2.2) some (down) payments are made and incurred from and paid to suppliers and customers. Because of the opportunity cost of capital it is needed to specify these transactions, and include this cost of capital as a cost driver in the calculation mode. A formula was derived to calculate these costs, which can be found in appendix I.
- *Valuta exchange costs.*
  DMT tries to pay in Euros as much as possible to avoid valuta -exchange costs and exchange-rate risks. Therefore all international transactions are in Euros. Nevertheless, sometimes certain Romanian suppliers need to be paid in RON, the local currency. A new cost-driver was therefore introduced in the pre-calculation to take these costs into account. Automatically the total purchasing value of components from Romanian suppliers is multiplied with the cost of the exchange. This value was determined by studying the exchange-history and set on a (default) setting of 3%.

	January 2006	February 2006	March 2006	April 2006	May 2006
Amount of RON exchanged.	836.442,87	875.476,68	843.539,65	872.290,72	1.421.803,18
Costs of exchange (RON)	21.262,64	19.376,37	30.905,65	22.039,32	14.516,64
	2,54%	2,21%	3,66%	2,53%	1,02%
Average	**2,39%**				
Prop. to size	**2,23%**				

Table 4: Exchange history EURO - RON

Finally, an inquiry consists (sometimes) of different products and multiples of identical products. For identical products it was chosen *not* to work with multipliers of cost drivers. This is because sometimes products (with identical components) have a different separate cost-driver configuration (like with certification) or are only valid for the total amount of identical products (like with transport).

Next to the "product—component +extra cost driver" hierarchy some features were included in the system. These are summarized in the next section.

Extra features
The following extra features where included to fully use the advantages of a database driven ERP-system:

- To create the possibility for management to change the chosen settings a new *Management-settings* screen was created. Settings like valuta costs, opportunity cost of capital and margin-viewers were included.
- Prices which are *not*-updated by the department of purchasing turn red in the calculation.
- Prices which are updated by the department of purchasing (during inquiry running time) turn blue.
- The component-lists can be sorted on value and name, and can collapse to create a clear overview.
- When an order is made from an inquiry, the estimations of prices of components of the products are copied automatically to the order part list, also known as the bill of materials. This list is maintained by purchasing. This action creates transparency and adds an extra layer of control of these prices. Purchasing creates the definite part-list and saves this into the system (attached to the product). The next time the product is used in an inquiry this part-list is then used automatically; this way sales can use quite concrete and well-defined products in inquiries.[6]

Next to all these basic structure choices a lot of small intermitting design choices were made. In appendix H the visual development of this project can be found chronologically, with screenshots of all menus. In this appendix also the mode of operation of the new module can be found.

4.2 The long-term planning of cash flows.
To design a tool for creating the desired planning it was needed to provide Cristi with a graphical overview of the desired processes. Therefore 2 diagrams were drawn to explain the actions as performed by the different departments. These two diagrams can also be found in appendix H.

Using these two basic process overviews it was easy to identify processes and required data. The following table identifies these flows and an appropriate source of information:

Sending invoices	Source	Receiving invoices	Source
Customer specification	Relation database	Client specification	Relation database
Down payment (Quantity, date)	Department of Sales	Down payment (Quantity, date)	Department of Purchasing
Final confirmation delivery date / time	Department of Sales	Final payment (date)	Department of Purchasing
Order nr.	Order database	Order nr.	Order database
Price	Department of Sales	Negotiated price	Department of Purchasing
Product description	Order database	Component description	Department of Purchasing

Table 5: Required data for long term planning of cash flows

Some data already existed in the system where it could be extracted easily from existing databases. Unfortunately the data marked in grey was not available. For this data it was needed to acquire the conviction if it was really necessary to add these new fields to the system. With

---

[6] Use and re-use is in fact one of the most important functions of the system.

inexperienced users, parsimony is an important requirement. Nevertheless for the process of *sending invoices* it was decided that this data was specifically needed.

Because the development of the different solutions occurred parallel, the fields to add the data needed in this column could be easily included in the module for making calculations. In this position it could be filled in quite effective & efficient while make the pre-calculation. Of course delivery dates and the date of incurring payments is also flexible so even on order level these dates are editable.

It was more difficult to find a solution for the required data for the process of receiving invoices. The department of purchasing could add this data but this would mean they would have to fill in an extra field for each separate component. This would mean a lot of extra work because an order consists of tens of components.

Extensive discussions with the suppliers and users of information (respectively the departments of purchasing & finance) were started to try to find some general rule of thumb to be able to create the forecast. After all this appeared to be impossible. It was then decided to just introduce these fields in the module when components are added to the final part-list.

All needed data was therefore present to create the planning tool. A new module strictly for the department of finance was created. Appendix H contains the final tool created and the mode of operation. The following list contains some basic structure choices.

- It is totally unpredictable which components are on a supplier invoice. For example: ordering 10 different components at the same time from the same supplier can result in 1 till 10 different invoices, which can arrive on different times. It was therefore not possible to add (more or less identical) cash flows: each unique component (and multiples) from a supplier results in one invoice-forecast.
- As became clear from the requirement determination a time accuracy of one week was needed and therefore introduced.
- A direct connection with the ordered parts was established. Cancellations of purchases and changes of any variable like payment week, quantity of goods and total amount of money is therefore automatically transferred to the financial overview.

4.3 Real-time management information.

Originally one of the main goals of this assignment was to generate real-time management information. A fundament for this goal was created in the form of the previous stated solutions. After the creation of these solutions it appeared that table 3 was still correctly describing management requirements. Therefore table 3 was taken as the basic wish list for the production of management information. Using the other solutions as the appropriate source for the needed information, it was easy to draw the needed charts and figures. Some can be found in appendix I.

Management was satisfied with these solutions but the developments from the concurrently running implementation of the other solutions demanded a stop on further implementation of the solution for real-time management information, as can be read in the following chapter about the implementation. Therefore the solution for the output of real-time management information was not fully implemented.

Implementation & project evaluation:

The solutions as developed were introduced into the organization by a certain chosen path of organizational implementation in collaboration with management. This chapter deals with this process. The second part of the chapter consists of the evaluation of the development and implementation of the chosen solutions.

4.4 System implementation

To develop an underpinned implementation the framework as developed by Lucas (1997) was used. Key points to consider are described by following the 6 factors which influence a successful use of a system, identified by Lucas. These factors were used to create a path of implementation which tries to guarantee future use.

User's personal stake.
Employees from the department of sales have a very high stake in the new system. They have to change their way of working quite radically. This can lead to resistance with some employees because it needs time to change. Extensive attention must therefore by provided by management to prevent this resistance. This also counts for the department of purchasing on a moderate level. Employees from the department of finance will probably have a low to zero-level of resistance. They don't have to provide input (in other words: extra work), and only receive the benefits. Sometimes the system requires data of an employee which doesn't support this employee's direct task. Attention is needed to ensure the employee keeps providing this data, and comprehends the relevance of this data for processes outside his or her department. This will also reduces some of the interdepartmental tension. Already some users have intensive experience with the system and make clear they really support the new systems, while others are more reluctant and don't have experience.

System characteristics.
The system and its interface are quite static and don't have a very pleasant interface to work with. This is a problem because its increases the resistance against the system. On the other side the system can be considered very reliable as long as all users cooperate and keep paying attention to the relevance and quality of the data they provide.

User demographics.
All users have an academical background and are used to work with computerized systems. Nevertheless, some users show some problems in working with the database. They are hesitating in using it and are uneasy while browsing through it. Attention is needed for this point.

Organization support.
Users need extensive support to master the skills needed to work with the new system. This must be provided by the organization. The following two points of support need to be provided:

- *Process support.* It is crucial to train the users in using the new system as a replacement of their former business processes. This training will provide the initial needed skills to start with the system. The existing manual will be updated to provide back-up information about the system. This manual can be found in appendix J. During the former (failed) implementation an extensive manual was available for the employees, which was never used. Therefore small incentives like posters will be developed to support the employees on their workplace. This old manual was also not suitable for a fresh introduction in the system; therefore the set-up of the manual will be changed quite radically, just as the current procedure for new employees. (the rigorously adjusted manual can be found in appendix M)

- *Technical support.* In the first weeks after the introduction employees probably will still have a lot of comments and updates to make about the system. Lay-out and minor technical modifications will therefore be made by Cristi, who will stay on site for one week.

After this start-up period technical assistance will be provided remotely by the helpdesk of Tempo Labour.

Performance.
It is needed that users will have insight in the benefits the system offers and the increase in performance in running business processes. Hoffer (2002, page 601) also mentions that users will appreciate it being able to work creatively with the system. A point of attention is therefore needed to create future possibilities for user input in enhancing the system and its performance. Performance represents a two-way relationship with use, and it is largely determined in the development phase. Management needs to show users the performance increase during the running of the system, for example every 3 months.

Satisfaction.
Like performance, satisfaction also has a two-way relationship with use. The system is not finished unless users are not totally satisfied with the way it works. During the start-up phase it is therefore also important to focus on how satisfied users are with chosen solutions and layout for example.

4.5 Time schedule
The points as described above were followed to create the path of introduction in the following schedule. Also management had an important voice in this.
The results of the different phases were also added to this schedule to provide the input & output of the different phases to the reader.

1st week	Focus on improving (awareness of) management-support and involve users. Show *users stake* in system, and improvements to business process.	Result
	• Extensive talks with management and key-users to improve top-down support and obtain employee awareness of support. • Give presentations to the department of sales and to department of purchasing to increase awareness and share knowledge. Introduce the importance of using the system for the support of other departments.	Only comments about the static way of working in the system came to the surface during the presentation. After the presentation for the department of sales, management decided to launch the new system, and do a 2-week try-out.
	Focus on mastering the use of the new modules.	
	• The new system will be learned to employees by the providing of personal training. Attention is needed for every detail, and extensive comprehension. • Offer of support by introducing the new manuals to every employee and a demonstration how to use these. This will provide back-up information and support.	A member of the project team and the employees of sales made the first calculations together. By this way these employees were learned to use to the system. Some minor layout bugs also came to the surface, which could be fixed quite easily. The manual was adjusted, and not introduced because of the option of live support.
	Evaluation of system with users.	
	• After a week using the new system the system will be evaluated and the go/no-go decision is taken. This will	The department of sales supported the system. The person which had most problems was still uneasy and

	enlarge employees stake and increase management-confidence.	had no new experience but said she would support the system.
2nd week	Focus on *satisfying* users and collect *performance* feedback. Official start of system	Result
	• Personal meeting with employees to collect newly risen user wishes. Adapt system to satisfy users in term of lay-out and small minor modification. • Provide performance increase benchmarks to employees and management to strengthen confidence in system and support.	Small lay-out changes, and around 10 orders were entered in the system. Some new calculations were added hesitantly.
3rd week	Focus on final streamlining the system.	
	• Provide technical support by Cristi.	No technical problems.

Table 6: Time schedule of implementation.

4.6 Project evaluation

Nah, Lau and Kuang (2002) developed a framework with eleven critical factors for the "successful development of enterprise systems". This framework is used to evaluate the total project. This evaluation can be useful for coming temporarily projects. It is strongly recommended to read the underlying ideas behind these critical factors in appendix A and the extensive evaluation in appendix K. The main conclusion from this appendix follows here:

The project required a lot of input and quite a ready-to-change-mentality from employees. Not everybody could bring up this time and energy, although the project had quite strong support from management. This probably had two causes. The first was that the information system as a whole was not even in-use while starting. Employees were forced to adapt to changes quickly and were not waiting to a new person who came asking the same questions. The 2nd problem was that the management-support was not always directly visible. Business vision and strategy could be communicated better, for example to the heads of the departments.

The prototyping approach worked sensitively and adaptively with user wishes but also a bit inefficient. Future development and extensions can probably better be undertaken by taking more time for analysis and requirements determination and restructuring, but also demanding more quality time from employees. Nevertheless, in general planning and performance feedback of settings and targets or milestones worked quite well, although the project had some delay. Because of organizational resistance and lack of resources the project did not achieved all of its goals. A next project will therefore need to pay attention to these points.

Conclusion & recommendations

This chapter contains a critical evaluation of the chosen solutions and its achievements.

To develop the desired output of management information and insight into business processes it was chosen to restructure all product-calculations as made in the company. This was done by the creation of a calculation-module, which fitted into the company (new) ERP system. This module offers a clear structure for different departments, internal and external to the company. It makes cost-calculations quite easy and still quite flexible, and open for different employees. A lot of data is directly shared across departmental boundaries, which prevents some interdepartmental tension.

But the system has its practical disadvantages. It is quite static (based on a PHP-database) and a lot of clicking (not Window-based) and demanded an intensive training and adjusting period for employees. They need to change their way of working quite radically and some need to do a lot

of extra work. For example the department of Purchasing needs to add and maintain a lot (5000+) of components.

These problems cause that the module is not completely in use. Currently no calculations are made with the system and most of the newly added functions are not being used.

The extra module built for the planning of cash flow is fully dependent on the calculation module. By selecting components being bought and adding orders it offers a direct link from Purchashing / Sales which executes these actions to the department of Finance which needs to pay and write invoices. The module is easy to use and offers a clear overview. Unfortunately currently it cannot be used because of a lack of data. This can be blamed to the dependent relation with the calculation module. Because this module currently does not capture input no output with the planning module can be given.

The possibilities for management-information suffer from the same problem. A complete framework is built to collect this information but of course without the information it cannot be displayed.

Although the current situation is not like it is supposed to be, it is still possible that in the near future all possibilities of the system can be used. At this moment the system doesn't have enough momentum to override all employees towards using it. Management and external users must built up support towards a moment of full implementation and integration into business processes. This needs an extra effort from all stakeholders and will take some precious resources. Nevertheless it will offer huge management-possibilities for the benefit of the growth of DMT Design S.A., the growth in orders list and the growth in employees. Some other further steps are more extensively described in appendix L.

Bibliography

Aladwani Adel M. (2001), "Change management strategies for successful ERP implementation" *Business Process Management Journal*, 7 (3): 266-275

Akkermans H.A. and Horst H. van der (2002), "Managing IT infrastructure standardization in the networked manufacturing firm" *Int. J. Production Economics,* 75: 213-228

Daft, R.L. (2001). *Organization Theory and Design.* 7th edition. Cincinnati, Ohio (U.S.A.): South-Western College Publishing.

Drury (2004) *Management and cost accounting.* 6e ed. London, Thomson Learning inc..

Gattiker F.T and Goodhue D.L. (2003), " ERP through organizational information processing theory" *Information & Management*" 41 (2004) 431–443

Giannini, F., Monti M., Biondi D., Bonfatti F., Monari P.D. (2002),"A modeling tool for the management of product data in a co-design environment", *Computer-Aided Design* 34: 1063-1073

Gupta, M. and Kohli, A. (2006), " Enterprise resource planning systems and its implications for operations function", *Technovation* 26: 687:696

Han K.H.and Do N., (2006), "An object-oriented conceptual model of a collaborative product development management (CPDM) system", *Int. J. Adv. Manuf. Technol.* 28: 827-838

Heerkens, J.M.G. (2001). *Inleiding Technische Bedrijfskunde – onderdeel: Methodologie.* Enschede: Universiteit Twente, faculteit Technologie en Management, dictaatnr. 360.

Hoffer, J.A. et al. (2002). *Modern Systems Analysis and Design.* 3rd edition. Upper Saddle River, New Jersey (U.S.A.): Pearson Education Inc

Holland, P., Light, B. and Gibson, N. (1999), ``A critical success factors model for enterprise resource planning implementation'', *Proceedings of the 7th European Conference on Information Systems,* Vol 1, pp. 273-97.

Holsapple C.W and Sena M.P. (2005) "ERP plans and decision-support benefits" *Decision Support Systems* 38: 575– 590

Koster, M. (2006), *Development of the new DMT information system.* University of Twente.

Layer A., Brinke E.ten, Houten F.van, Kals H., Haasis S. (2002), "Recent and future trends in cost estimation", *Int.J.Computer Integrated Manufacturing,* 15 (6): 499-510

Levy, M. and Powell, P. (2000),"Information systems strategy for small and medium sized enterprises: an organizational perspective" *Journal of Strategic Information Systems,* 9: 63-84.

Lucas, H.C. 1997. *Information Technology for Management.* New York, NY:McGraw-Hill

Mooney, J.G, Gurbaxani V., Kraemer K.L. (1996), "A process orientated framework for assessing the business value of Information Technology", *The DATA BASE for Advances in Information Systems,* 27 (2): 68-81

Nah F.F.H, Lau J.L.S, Kuang J. (2001), "Critical factors for successful implementation of enterprise systems" *Business Process Management Journal*, 7 (3): 285-296

Porter, M.E. (1980). *Competitive Strategy: Techniques for Analysing Industries and Competitors.* New York (U.S.A.): Free Press.

Porter, M.E. and Millar, V.E. (1985). How information gives you competitive advantage. *Harvard Business Review*, pp. 140-160.

Slack, N. et al. (2001). *Operations Management.* 3rd edition. Harlow (U.K.): Pearson Education Ltd.

Veeramani D. and Joshi P. (1997). "Methodologies for rapid and effective response to request for quotation (RFQ's)" *IIE Transactions,* 29: 825:838

Websites:
http://www.anu.edu.au/people/Roger.Clarke/SOS/StratISTh.html ;retrieved on 11-08-2006

http://www.netmba.com/strategy/value-chain, retrieved on 11-08-2006

http://en.wikipedia.org/wiki/Romania , retrieved on 01-06-2006

Glossary

The external organizations which are mentioned in the rapport are described in this glossary.

AIESEC
I arranged my internship using the AIESEC exchange-program. AIESEC stands for *Association Internationale des Etudiants en Sciences Economiques et Commerciales.* It is the world's largest student organization and 100% non-profit. More information can be found on http://www.aiesec.org/. The local committee which helped me arranging my internship was AIESEC Twente (http://www.aiesec.nl/twente), which sent me and, and AIESEC Galati (http://www.aiesecgalati.ro), who received me and arranged the internship.

Damen Shipyards
Damen Shipyards Group is a Dutch conglomerate of more than 30 companies around the world building all kind of ships. A Damen shipyard is present in Galati, which I visited several times during my stay. More information on www.damen.nl
.
DMT Design SA
The company in which I had my internship. The address of the company website is http://www.dmt-design.ro

Mittal Steel
Mittal Steel is the world's largest and most global steel company, with shipments of 49.2 million tons and revenues of over $28.1 billion in 2005. The company owns steel-making facilities in 16 countries, spanning four continents, employing 224,000 people. (Source: www.mittalsteel.com) Mittal Steel Galati is the largest integrated iron and steel works in Romania, accounting for over 50 per cent of the country's steel production. Built in the 1960s, Mittal Steel Galati is an integrated blast furnace BOF operation with a capacity of 5.5 million tons." (Source: http://www.mittalsteel.com/Facilities/Europe/Mittal+Steel+Galati/)

Tripomet

Tripomet is a steel manufacturing company located in Galati and one of the main manufacturers for DMT products. I paid some visits to this company and received a guided tour to get more insight into DMT products and different processes. (http://www.tripomet.ro/INDEX_content.html)

TempoLabour ICT

Cristi Babas did most of the programming of the information system. He is an employee of TempoLabour ICT, a small company which delivers custom-made ICT-solutions. (www.tempolabour.ro)

List of appendices

Part 3: Self-reflection

In this last part of this report my personal reflection on what I learnt during my internship of 12 weeks within DMT can be found. I also added a part about the international experience which was indissoluble connected to this assignment.

1.1 The company

The atmosphere in the company was really fantastic to work in. DMT is still a rather small company, in which everybody knows they need to work hard to remain competitive. Almost all employees are close with each other and also undertake activities outside working hours. Weekly we played football on a pitch located outside the city and had a happy hour on Friday to celebrate the weekend: very good for the atmosphere, just like watching Holland football matches in the local *Café Rotterdam.*

The employees believe in the company and the way management undertakes activities and communicates. Management (Piet ter Schure) is an important factor in this atmosphere. He really has a direct but fair way of communicating, what people seem to like. I think I learned a lot from the way he tackled problems and how he attached importance to the atmosphere. A small incentive like the possibility to use company cars outside working hours is an example of this. Piet trusts his employees and tries to give them their own responsibility. For example; on the second day I was in the company Piet gave me the assignment to check the rules of conduct he wanted to reintroduce in the company. I changed it quite radically and he just looked at the changes and approved it. With such a little sign of trust he really improved my, at that moment, fragile self-confidence. I directly felt a member of the "DMT family".

1.2 The assignment

Because of the good working atmosphere, my assignment therefore was also far more pleasant as expected. Before starting I expected to have the feeling of "going to work again and again….. and again" combined with making long working days. But it totally did not feel like that. I really liked to be at the office, discussing and making small talks with everybody. This was also because employees took me to some different manufacturers and suppliers of DMT. I saw shipyards, lots of products and interesting factories with very different working circumstances as in the Netherlands.

In the beginning I didn't really knew how to start my assignment. The employees were not really seriously using the new information system, and I had the feeling my questions (probably all asked before by my pre-successor) were too much a burden for them. But Piet really tried to make the IS high priority and gave me the feeling my assignment was difficult but very important. He also gave me responsibility and quite a free hand in carrying out my work. This gave energy but was sometimes also a little bit of a burden: I was really restricted by the speed of programming and also by the time employees wanted to speak with me. People started arranged meetings sometimes with the words "you said this wouldn't take long": quite de-motivating. Therefore I couldn't develop and introduce as much as I wanted to do when I started, but that is probably how things go with projects like these.

In general I really liked my assignment. I truly felt like an industrial engineer; in between different people, departments and conflicts of interest and translating user wishes for usable concepts and drawings for Cristi. Sometimes I felt a bit of regret not being able to produce more coding-input. Therefore I myself started programming PHP and MySQL to get more insight into what Cristi was doing, and to be able to give more input.

1.3 Challenges and skills

In a very short time I needed to master the old information system and supply programmer Cristi with new tasks. Therefore I quickly had to develop solutions and provide an underlying structure for it. Planning my work and the coding to be done by Cristi was therefore quite important. With

my planning we both knew what pace to work and how to cope with problems, and newly arising problems, problems, problems and challenges. Sometimes this was difficult. I had a lot of questions and logically, employees often did not have time for me. Therefore I had to save al my questions and problems and had to ask them in short time, as efficient and effective as possible.

This was a real challenge with the inevitable language barrier. In the beginning the language was some kind of barrier, but this was gradually becoming less and less. I needed to inform, present, discuss, convince and live by using English. After some weeks I thought in English what writing the report made far easier. For my personal development I think an important development and achievement.

Also I had a very close contact with employees and was a very close observer of their problems, frustrations and stress. This was really informative, and gave a good background and basis for the information system and the assignment in general. It made me really conscious of the real work going on outside my office and the critical needs for the system without gadgets, but only with effective supporting systems. It made trading costs again benefits easier when making decisions.

A bit difficult was also my personal situation because my absence in the Netherlands. I had some major responsibilities for the faculty council and the board of my sports club. Also a friend of mine really needed personal help. So things back in the Netherlands did not go as smoothly as I hoped it would go, which required a lot of attention. Before leaving the Netherlands I had doubts of accepting the assignment because of these problems. Some people convinced me to go: something I'm still happy with. I think it didn't harmed my work in Romania and I really learned from managing and helping people from 2000 km distance.

1.4 The international experience
Coming from the Netherlands to a former communistic country was a fantastic experience. The economical contrast between people here is really striking and especially Romania's countryside is in Western eyes really poor. Nevertheless a lot of people confirm that Romania is really closing the gap with the rest of Europe, and that it will only take time for the country to catch up. I met a lot of Dutch businessmen who could talk for hours about these developments. To see such a country struggling with its past and trying to adapt to the future was an experience never to forget.

The main part of my experience has been made up by the people in Romania. The members of AIESEC did almost everything to make me feel comfortable. Cristi, Vali and Marian of DMT took me on different road trips trough Romania. And the local population is very kind and complaisant. I lived together in the local student dorms with French, Spaniards, Portuguese, Turkish and Indian people… to never forget! (I brought a lot of books, but they still wait to be read.)

So the months I spend in Romania were very instructive, very interesting but especially really really really sociable.

Appendix A: Theoretical background

This appendix contains the underlying theory on which this thesis builds. The first paragraph is a short summary for the following theoretical underpinnings and the last paragraph explains the used techniques and tools in the rapport.

Summary
An effective and efficient pre-calculation is crucial requirement for a good (and clear) company performance. To acquire this level of performance an intense inter-departmental collaboration is needed. This can be achieved by standardization of procedures and IT-infrastructure, dependent on the characteristics of the specific process. Standardization also offers huge benefits in the area of the product data management, with its direct link to the process of calculation cost prices. The implementation of these ERP-systems asks for good project management, and a firm analysis of the company characteristics.

Cost models
Layer et al. (2002) describes costs as "the sum of money expended in terms of labour, materials, use of equipment etc. to produce a good". There are two different purposes for which a company assigns these costs to products. The first reason is for internal profit measurement and external financial accounting requirements. The second reason is for providing useful information for managerial decision-making requirements. The first reason does not require cost allocating to individual products, the second does, as Drury states (2002). For accurate decision making it is therefore necessary to assign goods accurate to products. This happens in the process of calculation. Costs can be estimated with some different types of calculation (Layer et al.):
- Pre-calculation
- Post-calculation

DMT employees refer to post-calculation as "after-calculation". Therefore this term is being used in the following. Pre-calculation estimates the price of a product before actual production. During this development phase a very large proportion of the future costs and price will be fixed, although costs are not expended yet. Pre-calculation should therefore be very accurate because the future margin is completely determined here.

In contrast, after-calculation determines the actual costs incurred with these costs then serving as the base data for future pre-calculations. Pre- and after-calculation may utilize different kinds of information. For example, information from purchasing can be collected to determine product costs for after-calculation. In contrast, pre-calculation is only able to access product-describing data and, unfortunately, such data may be incomplete or uncertain. (Layer et al., 2002)
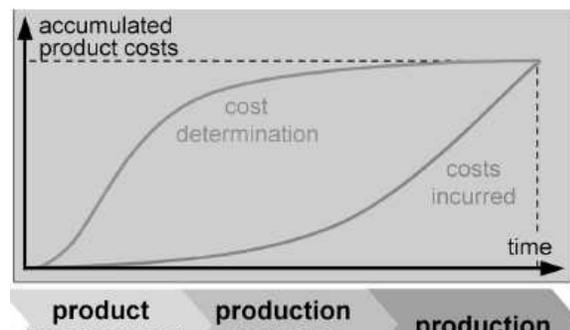

Figure 4: Product costs which accumulate trough the product life-cycle. (Source: Layer et al.)

Often designer make choices solely on the basis of their own experience; frequently make design decisions that impact upon product costs. If a more accurate and in-depth cost estimation is needed, greater effort is involved with lots of interdepartmental traffic. This prolongs a time-to-market. An effective and efficient model is therefore very important. Layer et al. describes the following requirements:

- The model should offer a high level of accuracy.
- The offered cost-structure should have a high level of transparency.
- Concurrent design of products should be applicable.

- The model should have a dynamically adaptive.
- Calculation of complex parts should be applicable.

The choice of the level of sophistication for the costing system should be made on costs versus benefits criteria. Simplistic systems are inexpensive to operate, but managers using information extracted from these systems are more likely to make important mistakes arising from using inaccurate cost information. The end result may be a high cost of errors. Conversely, sophisticated systems are more expensive to operate but minimize the level of errors. (Drury, 2002)

Consequences for product data management
Data about products (for example costs) should therefore be maintained efficiently and effective trough the product life cycle to survive in a global and competitive business environment. Veeramani and Joshi (1996) define the ability to respond quickly and effectively to satisfy customers a "defining characteristic for all manufacturing companies". A short time to market and maintaining a high quality level has become the main success factors. Generally, the development of a new product can not only be reduced to find the appropriate configuration of standard components already existing on the market, but very often it requires the development of new ones, possibly not only for the modification of the physical interfaces, but also in functional terms. (Giannini et al., 2002) A greater emphasis must therefore be laid on collaboration inside enterprises to develop more innovative products at lower costs with a reduced time to market. (Han & Do, 2006)

This desired collaboration becomes easier through standardization, for example of the used IT-infrastructure. Three advantages of standardization exist: (Akkermans & Van der Horst, 2002):
- Collaboration trough communication becomes cheaper and faster.
- Changes in the organizational network become easier.
- Standards allow economies of scale, with costs of IT shared on more applications.

But the possible advantages of standardization are depending on the specific characteristics the business process owns. In his Structure in Fives (1983), Henry Mintzberg distinguishes 5 different views of business processes (from Akkermans & Van der Horst, 2002, page 219:

- the flow of formal authority, supported by e.g. the accounting infrastructure. Here are entire work processes standardized.
- the flow of regulated activity, supported by e.g. ERP systems.
- the flow of informal communication, supported by e.g. electronic mail. This is the middle ground were people are free to decide how to carry out their work, as long as their outputs confirm to specific criteria.
- the flow of work within a set of work constellations, supported by e.g. design management systems; and
- the flow of ad hoc decision processes, supported by e.g. a decision support system (DSS) or executive information systems (EIS). Here only selection of inputs is required, like standardization by hiring people with certain skills.

So the need for IT-driven control and standardization becomes less for each subsequent flow (Akkermans & Van der Horst), and therefore a decent analysis of the ongoing process is required.

Also the value of information for the company needs to be analyzed, for example by the use of Porter and Millar's information intensity matrix and value chain (1985), as Levi and Powell (2000) conclude. The value chain and information intensity matrix are summarized below.

Weil and Broadbent stress in Akkermans & Van der Horst (2002) that local, fast changing applications used by small groups need not to be standardized. "For them, the standardization include (a) its local versus integral nature, (b) it speed of change and (c) the number of people

that use it. Integral applications that remain stable over longer periods of time and that have large user groups should be standardized (page 218)

Akkermans & Van der Horst concludes with the importance of standardization of product data management. "This applies especially where communication between customers and different employees is based on product-specifications rather than the product itself. Also design of products will benefit from standardization. Designers should be able to use the same underlying databases to work effectively. "No longer is product data management a local issue, but one that is becoming crucial for interactions between different business areas" (page 226)

"An extended enterprise resource planning can be used to introduce such standardization. Standardized systems, such as ERP, are influenced positively by the level of interdependence among organizational sub-units. Interdependence is the degree to which sub-units must exchange information or material in order to complete their tasks. Interdependence increases the need for ''mutual adjustment'' and decreases the degree to which activities can be pre-planned. When interdependence is low, simple coordination modes, like standard operating procedures, suffice. By contrast, high interdependence increases the need for a common formalized language in order to enable the exchange of information among sub-units. If sub-units of a firm need to exchange information and materials, then ERP should facilitate this flow. After all, data standards eliminate the burden of reconciling or translating information that is inconsistently defined across two or more sub-units. Data standards also do away with the potential for translation or reconciliation errors as well as ambiguity about a field's true meaning. Finally, ERP improves the timeliness of information."

On the other hand costs of a standardized system, such as ERP, increase in proportion to the degree of sub-unit differentiation, which is the uniqueness of tasks, technologies, environment, goals, etc. across sub-units. (Gattiker & Goodhue, 2003)

Decision support
Holsapple & Sena (2005) researched the consequence of the introduction of an ERP-system on decision making. Beyond the need for decision support via ERP, they found evidence that ERP indeed offers features that support decision making. "Processing, decision reliability, decisional substantiation, competitiveness, decision-making speed, and treatment of large-scale/complex problems are features that benefit from an integrated ERP-system."

Implementation & evaluation of ERP-systems
Determinants for (successful) future use of an information system are described by Lucas (1997)
These 6 factors are:
- *Users's personal stake.* the importance of the system for the user.
- *System characteristics.* The reliability, ease of use and relevance for the task the system supports.
- *User demographics.* Characteristics of the user, such as age and computer experience.
- *Organizational support.* Support received from the project implementation team and other organizational units.
- *Performance.* The better the system supports employees in their working processes, the more they will use it.
- *Satisfaction.* The more satisfied users are with the system, the more they will use it.

Adel M. Aladwani proposes that many ERP-systems fail because of workers' resistance (2001, page 266). He therefore suggests an integrated, process-oriented conceptual framework for implementation consisting of three phases: knowledge formulation, strategy implementation and status evaluation (pages 269-273).
- *Knowledge formulation.* The first step in effectively managing change introduced by IT is to identify and evaluate the attitudes of individual users and influential groups.
- *Strategy implementation phase.* Using the knowledge about attitudes, an effective strategy can be developed to change overcome users resistance.

- *Status evaluation.* A timely, accurate and systematic evaluation can provide dynamic feedback to management. This way the achievement of business outcomes can be evaluated.

This evaluation can be done by comparing the implementation with the critical factors for successful implementation as defined by Nah, Lau and Kuang (2001). The identified the following eleven factors (taken and summarized from page 289 to 294):

ERP-teamwork and composition
The ERP-team should consist of the best people from the organization. The team should have a mix of consultants and internal staff so the internal staff can develop the necessary skills for design and implementation. The team should be familiar with the business functions and products so they know how to support business processes. (page 289)

Top management support.
Top management needs to publicly and explicly identify the project as a top priority and organization and role of the new system should be communicated to employees. (page 289)

Business plan and vision
A clear business plan and vision to steer the direction of the ERP is needed and goals and benefits should be identified and tracked. (page 291)

Effective communication
Expectations at every level need to be communicated. User input should be managed in acquiring their requirements, comments, reactions and approval (page 291)

Project management
Good project management is essential and there should be planning of well-defined tasks and accurate estimation of required effort.(page 292)

Project champion
Someone should be placed in charge and the project leader should ``champion'' the project throughout the organization. (page 292)

Appropriate business and legacy systems
Appropriate business and legacy systems are important in the initial phase of the project and a stable and successful business setting is essential. (page 292) Holland et al. (1999) propose that "legacy systems encapsulate the existing business processes, organization structure, culture, and information technology. Therefore, they cannot be controlled by a company in the same way as the other variables in the model. Inevitably, they determine the amount of organizational change required to successfully implement an ERP system and will dictate the starting point for implementation."

Change management program and culture
"A culture with shared values and common aims is conducive to success. Organizations should have a strong corporate identity that is open to change. An emphasis on quality, a strong computing ability, and a strong willingness to accept new technology would aid in implementation efforts. Management should also have a strong commitment to use the system for achieving business aims (Roberts and Barrar, 1992). Users must be trained, and concerns must be addressed through regular communication, working with change agents, leveraging corporate culture and identifying job aids for different users (Rosario, 2000). As part of the change management efforts, users should be involved in design and implementation of business processes and the ERP system, and formal education and training should be provided to help them do so". (page293)

Business process reengineering (BPR) and minimum customization
It is inevitable that business processes are molded to fit the new system (Bingi et al., 1999). Aligning the business process to the software implementation is critical (Holland et al., 1999; Sumner, 1999). Organizations should be willing to change the business to fit the software with minimal customization. (page 293)

Software development, testing and troubleshooting
Software development, testing and troubleshooting is essential, beginning in the project phase. The overall ERP architecture should be established before deployment, taking into account the most important requirements of the implementation. This prevents reconfiguration at every stage of implementation (Wee, 2000) (page 294)

Monitoring and evaluation of performance
Milestones and targets are important to keep track of progress. Achievements should be measured against project goals. The progress of the project should be monitored actively through set milestones and targets. Monitoring and feedback include the exchange of information between the project team members and analysis of user feedback (Holland et al., 1999). There should be an early proof of success to manage skepticism (Rosario, 2000)." Page(294-295)

Data Flow Diagrams
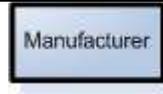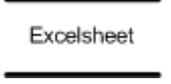The diagrams in this rapport use the following symbols to show the former physical and logical information systems:

Used symbols			
	This symbol represents a process where data is transformed. The executing department is stated in bold		This symbol represents an external entity.
	This symbol represents a datastore.		This symbol represents a flow of data.

Table 7: Used symbols (DeMarco & Yourdan sets)

A flow of data can be best understood as data in motion. Actions or work performed on this data is being done during processes, for example checking a received invoice. Data is at rest in a Because time was limited, the data flow diagrams in this rapport are not very strictly drawn according to all rules and conventions, and only used to create more insight into situations and explain certain situations across a language-barrier.

Tools and techniques
The following techniques are used to research certain situations and processes. They are listed in the order of appearance in the rapport.

STEP:
Better known as PEST-analysis, the STEP acronym provides a more positive view on the surrounding environment. The social, technological & environmental factors provide a clear context for making a decent analysis of the internal environment.

SWOT:
A SWOT-analysis can be used for auditing an organization and its environment. By placing a company onto two dimensions, it is possible to evaluate it at 4 different aspects: opportunities, threats and strengths and weaknesses.

Problem knot:

Often problems occurring in an organisation are interrelated. A problem knot tries to find the root of these problems by drawing the cause- and effect relations between these problems. A cause can be identified because no other effects flow to these points. (Source: Heerkens, 2001)

Value chain:
The value chain categorizes the generic value-adding activities of an organization. The "primary activities" include: inbound logistics, operations (production), outbound logistics, sales and marketing, and service (maintenance). The "support activities" include: administrative infrastructure management, human resources management, R&D, and procurement. The costs and value drivers are identified for each value activity. By now the concept has been extended beyond individual organizations. It can apply to whole supply chains and distribution networks, each managing its own value chain. (Source: http://www.netmba.com/strategy/value-chain/)

Information intensity matrix:
Porter and Millar (1985) proposed the use of an information intensity matrix to assess IT's role in an organization. The matrix evaluates the information intensity of the value chain against that of the product. They suggested that IT will play a strategic role in an industry that is characterised by high information intensity in both the value chain and the product. Their representation of the matrix is reproduced in table 8.
(Source: ttp://www.anu.edu.au/people/Roger.Clarke/SOS/StratISTh.html)

		Information content of the product	
		LOW	HIGH
Information intensity of the value chain	HIGH	Oil refining	Newspapers Banking Airlines
	LOW	Cement	

Table 8: Information intensity matrix

Appendix B: Five forces of Porter

To estimate the attractiveness of a market, the five forces model of Porter can be used. In the following paragraph this model is used to make an assessment of the markets on which DMT operates. This analysis is taken completely from the work of Koster (2006).

Internal rivalry
At the moment the most important competitors are other Dutch deliverers of naval equipment, who are also serving Dutch marine industry market. Some names are: Kraayeveld (http://www.winches.nl), Ridderinkhof (http://www.ridderinkhof.nl), SEC (http://www.secnl.com) and EMCE (http://www.emce.nl). Because of the current globalization there are many other important competitors, from all over the world, for instance from the United States of America.

Threat of substitutes
This threat is relatively small, because most of the delivered products are custom made and can therefore not easily be substituted. One of the main threats in this field can be found in the traders of second-hand winches. Dutch companies performing these businesses are Tenwolde (http://www.tenwolde.com) and Marine Equipment Supply (http://www.mestrading.com).

Buyer power
In the current industry the buyer decides exactly what he wants. He asks different suppliers to offer a proposal and the best supplier will receive the order. Because there are relatively few customers, of which Damen Shipyards is the most important one, this buyer power is very large and companies like DMT need to satisfy their customers very well. The one advantage is that once an order is given, it is very difficult for the buyer to switch.

Supplier power
The supplier power is moderate. The components used for the equipments can be delivered by many different companies. The subcontractors, who produce the DMT equipment, have more power. Forward integration is possible, because these companies get to see all drawings and know how to assemble equipment. The advantage for DMT is that there are many possible manufacturers in the steel working field and all of them need orders, because many of their machines are standing still.

Barriers to entry
The know-how about the products (explicated in drawings) is based on experience. Next to that, because there are so few possible clients, a network within the field is needed. These two aspects make it difficult to enter the market.

Appendix C   Extended function & process overview

This appendix gives an extended overview of DMT Design's company functions and running processes. The first paragraph uses a model as described by Slack to analyze the company's functions and provides a total overview of the primary process. The last paragraph gives some more details about an important part of this process: the creation of calculations.

Slack's model of a company.
Slack (2001) describes company's by identifying three core functions, and different support functions, like in figure 2:
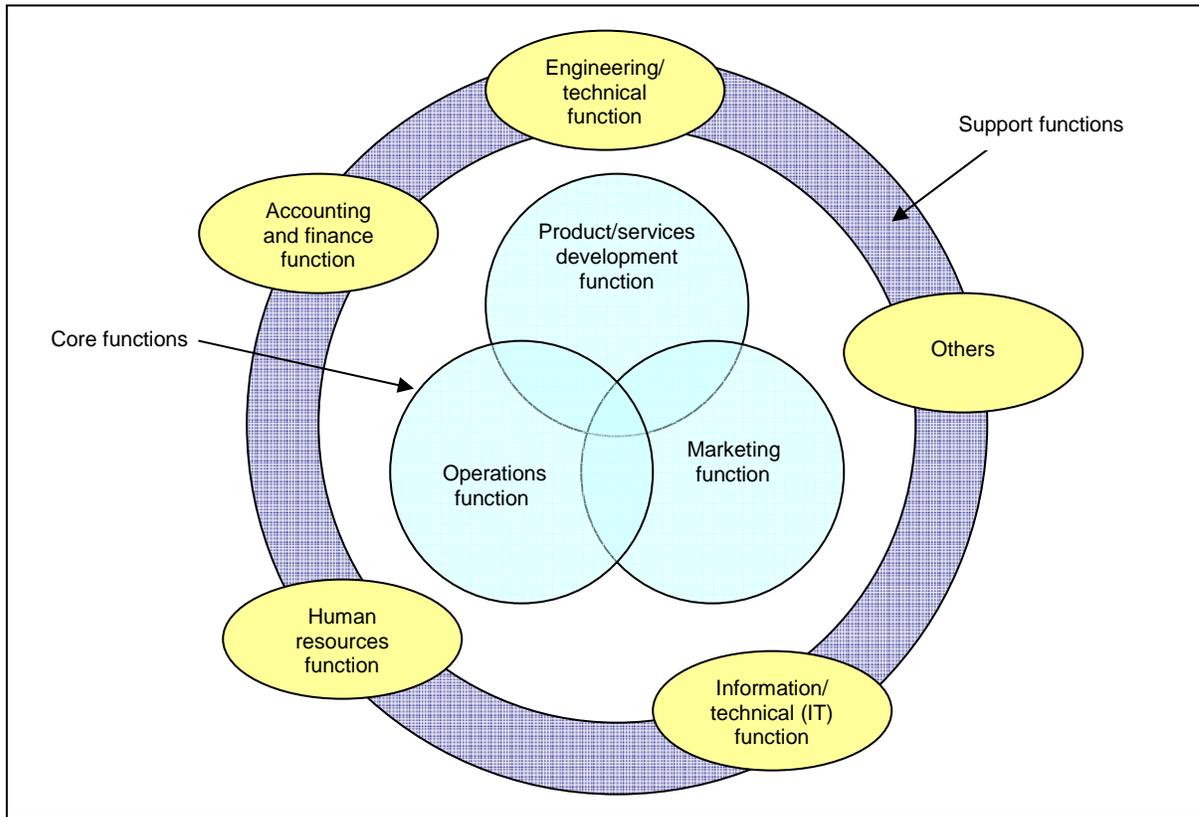
Figure 5 : Core and support functions (source: Slack, 2001)

The 3 core-functions of the company are coupled with the model in the following way:

Model functions	Actual function
Operations function	• Purchasing, logistics, import /export • Production / quality
Marketing function	• Sales / Projects
Product / services development function	• Engineering
Support	• Legal • Finance • Office management • IT-Systems

Table 9: Linking functions to Slack model

Slack mentions that functional names, boundaries and responsibilities between departments and functions often vary (page 7). As can be seen from the figure, boundaries between departments are always somewhat blurred. In DMT practice this means that for example employees from purchasing also fix problems in production and logistics. The following figure is an extension from the primary process as can be found in chapter 2.5:
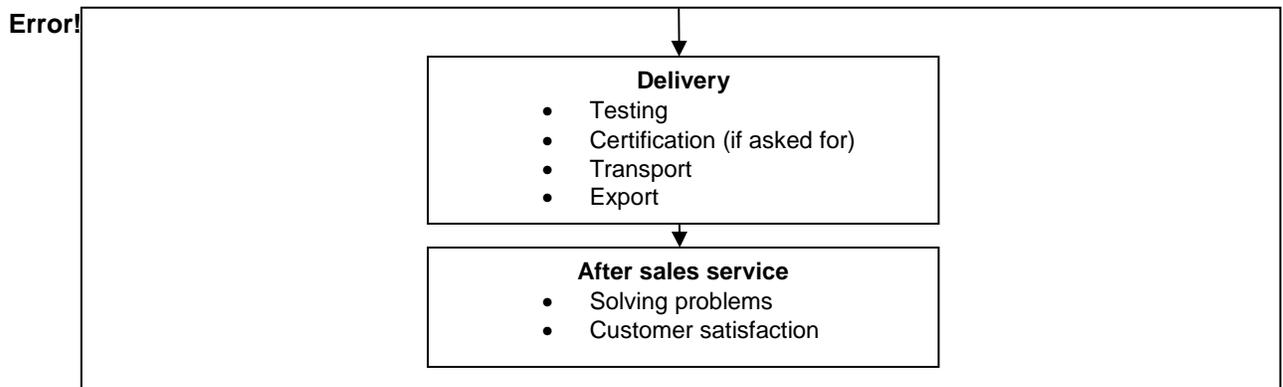
Active selling
- Exhibitions
- Approaching
- Meeting

Offering

| Receive inquiry |

| Register inquiry |

| Preliminary design |

Find subcontractors
- Manufacturing
- Components

| Inquire/receive prices |

| Proposal |

Negotiating

Technical
- Design
- Quality
- Certification

Commercial
- Price
- Delivery time
- Payment
- Transport

Confirm order
- Specifications
- Conditions

Design
- Drawings
- Parts lists

Purchasing

| Inquire prices of components | Contact preferred production supplier |

| Negotiating | Negotiation with producer |

| Buy components | Send manufacturing order |

| Arrange transport and import |

Production
- Deliver drawings
- Quality controls
- Keep an eye on delivery time

41

Error!

```
                              ┌─────────────────────────────┐
                              │         Delivery            │
                              │   • Testing                 │
                              │   • Certification (if asked for) │
                              │   • Transport               │
                              │   • Export                  │
                              └─────────────────────────────┘
                              ┌─────────────────────────────┐
                              │     After sales service     │
                              │   • Solving problems        │
                              │   • Customer satisfaction   │
                              └─────────────────────────────┘
```

Figure 6: Extended primary process overview (Source: Koster (2006))

This shows more detailed how a process stage is generally done or what is important in that stage. There are a few remarks.

- For the offering stage a distinction between 'winches' and 'other' is made. Winches are always designed by DMT and produced elsewhere. Though it is also possible for a client to deliver the drawings; then DMT in fact only takes care of production of the products at one of its subcontractors. When this is the case, of course every step around the Engineering function disappears from the scheme.
- For the purchasing stage there are two tracks: buying the components to be delivered by DMT and finding a suitable subcontractor to manufacture the products to be delivered.
- After sales service is an important part of the primary process, to solve probable problems with the delivered products in order to keep clients satisfied.

Supporting processes (taken from Koster, 2006; with modifications)
There are four supporting functions inside DMT, in order to keep an optimal primary process ongoing. Three people are in charge for this. The functions and their responsibilities are described below.

Financial Management
The supporting function about Financial Management is responsible for paying received invoices and payroll, sending invoices to customers and taking care that everything is paid. Bookkeeping is another important task, as well as some financial projects, for example getting a credit line.

Legal Management
DMT Group employs its own lawyer, who is responsible for contract elaboration, obeying contracts and (Romanian) laws and preventing the company for legal problems. Especially in a country like Romania with much legislation, this is necessary.

HRM
The HRM function is a combined function of the financial manager and the lawyer. They are together responsible for labour contracts and negotiation with (governmental) labour organization. The 'soft' part of HRM is most of the time done by Ter Schure himself.

Facility management
Iulia Grigore is in charge for facility management. This function consists of cleaning the office and taking care of food and drinks for all employees. (from Koster)

IT-Systems

Dorin from the department of engineering takes of the IT-infrastructure in the company. The company has one central server and around 23 local workplaces, all connected to one workgroup. Programming the database was the responsibility of temporal trainees together with a consultant from Tempo-Labour. Currently Liviu T. is made responsible for handing out new passwords and maintaining the database. .

Managing processes
Management just introduced new guidelines for handling human resources. Every department now has a "team leader" who is responsible for team performance and the personal atmosphere this is to reduce pressure from Piet. It also sets clear who is in charge when Piet is in the Netherlands. This happens about one out of three weeks and then Cornel has the lead in the office. There is a document in which all tasks, responsibilities and competences of all employees are worked out. This document is somewhat old, but with a low turnover of employees and a stable organization, everyone knows what is expected from him or her to do.

Former process of creating calculations.

This part of the appendix describes the former processes of creating pre- and after calculations. It also supplies an overview of the created data-storages.

Creating pre-calculations.
When a customer asks for an offer with certain specifications, employees of the department of Sales start browsing in their inquiry/order archive. This is in fact just a folder with all past-projects. Based upon experience they select a similar project, and alter the specifications. Recent prices and updates are taken from an extensive list with prices, from memory, from received mail and from direct questions. When more time is available and the project doesn't have similar antecedents the general specifications go the department of engineering. They make a pre-design which is transferred back to employees from Sales, who fill in the details.
Some standard costs are then added like transport and customs fee. (Standard does not imply they are always the same, in fact they are often highly variable). After this the product-price is decided and offered back to the customer. This customer starts the extensive negotiations about specifications and the price. Specifications change and after agreement, the price becomes fixed and the inquiry becomes an order.

A graphical overview of the spreadsheet.
Not a single general template was found for making pre-calculations. The average calculation looked like the calculation as in figure 7 on the next page. No legend supplied, and a lot of unclear remarks.

The spreadsheet contains in fact rather only simple components and calculations. But meaning of the colors and formules differs sheet by sheet, and is only known to the person who made the sheet. And generally speaking, this sheet contains all financial information known about an order.

2 sets of Anchor mooring equipment			DT/place: 2005-2006 / Armenie SY						
UP-DATED cost estim	1 SET/DT 2005								
Inquiry DMT 466	Ex order		2004-350						
drawing no.			New 6102 - 5236 Rev.1						
ELECTRIC WITH FREQUENCY DRIVING VARIANT									
purchase item	weight	NOP	company	BRP/pcs	P/Kg	TV			
winch	210-Efq36	633	1	CRISTI BV	3798	6,00	3798		
winch	110-Efq320	333333	1	CRISTI BV	1399999	4,20	1399998,6		
Main shaft 1		0	0		0	7,00	0		
Main shaft 2		0	0		0	1,50	0		
extra cost brake lining 1			0		45		0	Ferrodo lin 31,6	
extra cost brake lining 2			0		34		0		
extra cost bearings 1			0		23		0		
extra cost bearings 2			0		22		0		
extra cost fittings			1		244		244		
motors 11 KW without frequency			1	MARIAN S	555		555		
motors 7,5 KW without frequency			1	MARIAN S	66		66		
Extra push button box			0	keter	5		0	not included in order	
Extra prop. handle			2	werkina	4		8	prop. handle included	
cylinder			1	MARIAN S	333		333	295	
name plate			2	dorian	333		666		
steel wire70m/32			1	MARIAN S	54		54	586	
Ruflex torque limiter			0	MARIAN S	343		0		
anchors HHP Pool FB	1710		2	MARIAN S	232	0,14	464	3100	
anchors HHP Pool-N S	1305		1	MARIAN S	2323	1,78	2323	2400	
chain	70/36K2		2	MARIAN S	2323		4646	2265	
superbox			3	keter	550		1650	311	
winch desi	210-Efq36	633	1	dmt sa	189,9	0,30	189,9		
winch desi	110-Efq320	333333	1	dmt sa	99999,9	0,30	99999,9		
Coupling w	2801 Rev.3	600	0		2300	4,5	0	2700	2100	4,5	3,5
purchase price 1 without transport, GL						1514995,4			
Sales price without transport, GL				XX%		1908894	1817994,48	XX%	
Survey GL winches, incl. materials		2		600		1200			
transport purchase items Hol-Ukra		1		800		800			
transport items Holland	5 tons	1		1600		1600			
transport items Sevast	10 tons	1		1000		1000			
customs fee imp-exp		1		75		75			
purchase price 2						4675			
Total purchase price with transport, GL						1519670,4	1419480,6		
Total sales price with transport, GL				XX%		1913569	1818069,48	1,196358	
Offer price/1 set delivery in Czechie			sent offer	4%		57.000 €	8.989.898 €	sent offer	
Difference			07,09,2005			-1.462.670 €		12,07,2006	
CALCULATION VALID UNTIL END 2006							89.989 €	sent offer	
								26,08,2003	
Agreed price for two orders (sets)						565.656 €	09,09,2005		
Extra prop. handle		2	werkina	340		680			

Figure 7: Example of pre-calculation, order 25108 (All facts and numbers altered, but still confident)

Creating after-calculations

Once in a while management decides it needs clear information about past-performance of the company. Then it is needed to compare the real order values with the pre-calculated value.

Employees from the department of Purchasing are then saddled up with the task of setting up a new calculation from scratch. They use the huge amount of information available from the payed invoices for supplies and manufacturing, and try to re-calculate as much orders as possible. This is an enormous amount of work, and takes many hours. Figure B shows the after-calculation of the same order as above.

DUTCH MARINE TRADING

DMT pre- and aft calculation

order number		25108		order date sales		19/09/2005		estem. Total purchase pr			118570	
winch type		210-E32		order date design		19/09/2005		real total purchase pr.			55608	
drawing number		6102		order in production		01.03.2006		difference in EUR			62962	
weight		2300		delivery date		week 17/21		paid			1934	

item	produc.	Order/date p/pc/kg	qty	tot.pr	pre est.pr.	difference	dwn pmnt	amount	rest invoice	del. Date	deliverer y/ remarks
winch	tripomet	y	4,2	1	6000	3434	-2566	25	1500	4500	week 17/21	
extra cost	tripomet						0		0	0		
motor	corner proc	y	950	1	700	343	-357	60	420	280	week 11	
brake					0		0		0	0		
reductor set												
el/hy set					0		0		0	0		
el/hy S set					0		0		0	0		
pn rotor	bosch	n	0	0	0	3	3		0	0		
pn cl brk					0		0		0	0		
pn cl frict					0		0		0	0		
hydr cyl.					0		0		0	0		
start box	retec	n	0	1	0	343	343	15	0	0		
indicators					0		0		0	0		
remote ctr					0		0		0	0		
force meas.					0		0		0	0		
length meas.					0		0		0	0		
chain	schmit	y	2375	1	45454	34343	-11111		0	45454		
anchor	schmit	y	3675	1	454	343	-111		0	454		
anchor	sec	y	3495	1	1541	3434	1893		0	1541		
swivel					0		0		0	0		
superbox	tripomet	y	543	2	56	343	287	25	14	42		
steel wire	70/28	y	585	1	565	3434	2869		0	565		
ferrodo	intertech	y	140	1	140	34344	34204		0	140		
transport		y	1250	1	6	34343	34337		0	6	week 17/21	
class. Costs	GL	n	3		6	43	37	0	0	6		
design costs	design s.a	y	0,3		565	43	-522		0	565		
commercial					56	3434	3378		0	56		
unexpected							0		0	0		
nameplate	adorian	y	15	1	65	343	278		0	65		

Figure 8 Example after-calculation, order 25108 (All facts and numbers altered, but still confident)

Because one employee made a lot of after-calculations in short time, one format could be identified. As can be seen this format totally does not match the pre-calculation format. This is an extra source of work.

Appendix D: Overview of information-flows.

To get a clear view of the current ongoing information exchange[7] between departments, data-flow diagrams have been drawn. For acquiring insight and reference to the information as exchanged during the primary process, these are very helpful. (An explanation about DFD can be found below) The primary process at DMT consists at two major sub processes: creating an inquiry and fulfilling an order. For intelligibility, these two processes are also separated in the diagrams. The second part of this appendix provides information about the new information-system.

Figure 9: **Overview of information flows during inquiry-phase**.

---

[7] Important to note: date of final revision: 09-06-06

Figure 10: Overview of information flows during order-phase.

The IS before starting the internship

This appendix contains all necessary information about the IS I started working with. In short, the structure and its functions are explained here. Also some screenshot are presented here. This overview is rather basic. For rather extensive information about this system the rapport of Koster (2006) is advised for further study.

Introduction

A previous trainee designed a new IS to restructure all information flows in the company. This IS tries to structure and standardize the exchange of information concerning orders between departments. While I started my internship at DMT-Design this new system was just introduced. It took a couple of weeks before it was accepted by all employees and they started working with it. Management emphasized the need of using it, so after a while all employees were using the system.

Basics of the information system.

The IS consists of 7 databases. The following diagram describes how these databases are related to each other:
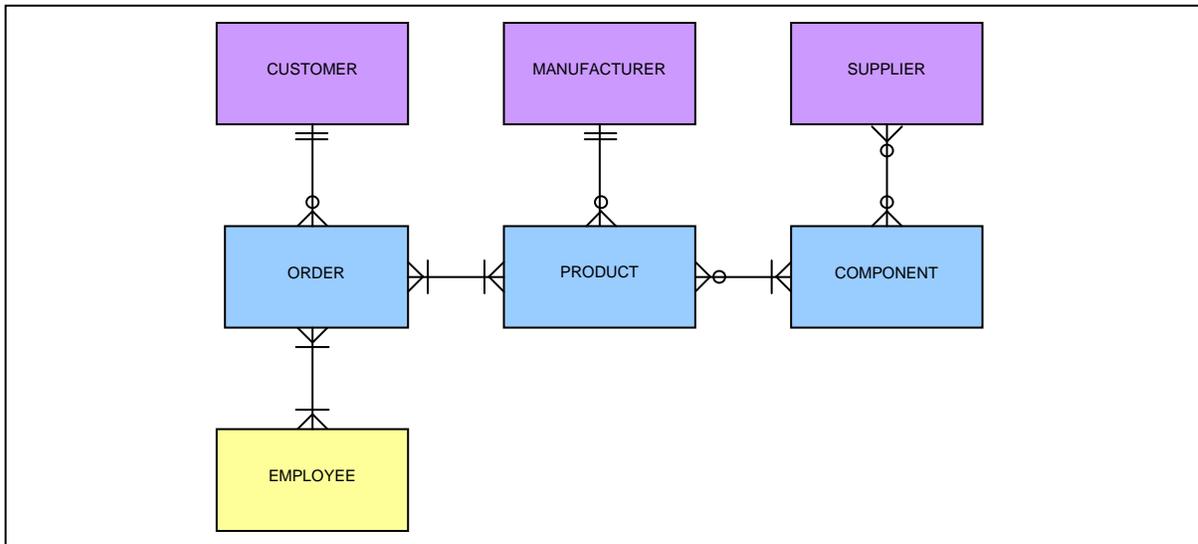
Figure 11 E-R diagram *Source: Koster (2006)*

Entity	Meaning
Customer	A company DMT delivers an order to.
Order	Demand for one or more products that DMT delivers.
Product	A unit that DMT creates and that consist of one or more components.
Manufacturer	A company which assembles the components to products.
Component	An item with the possibility to be assembled to a product.
Supplier	A company which supplies components.

Table 10: Meaning of entities.

Every database holds specific information about the entities they represent. Some examples:

Which database	Example data
Customers	Contact information, links to certain order
Manufacturers	Contact information, links to certain order
Suppliers	Contact information, links to certain products
Order	Date of delivery, Order number, link to certain customers & employees & products
Product	Description, links to certain components
Component	Price, description, links to certain product
Employee	Contact information, function, links to certain order

Table 11: Examples of data in databases.

The primary process.
The system is built around the current primary process and supports the flow of information as defined above. To give an overview of functionality, the use of the system during different phases of the primary process is summarized below. This overview is rather basic, but gives a clear insight in how the current system works.

Incoming request for proposal: A customer asks for the conditions for which DMT Design SA can deliver a certain product. Employees then create an inquiry in the system. This inquiry is built from old (delivered) products, which is built from specific components. The products are linked to the specific customer. Other conditions, like the delivery date are added. A price is calculated separate in a spreadsheet. Afterwards inquiry-details and price are returned to the customer.

Negotiating about inquiry: A customer often asks for inquiry-changes and negotiates about certain specifications. Employees register all following changes in the system.

Producing an order: After a customer decides to accept the inquiry, employees transform the inquiry into an order. The status of the order is registered, depending on the department the order is in. Departments can attach separate documents to the order. Also the delivery-date of an order can also be checked and controlled.

Functions
The system only had basic functionality. It created a platform in wich it was able to maintain all necessary information about a project (order or inquiry) and all relations it holds with stakeholders and underlying components. The usage of statuses and the possibility to assign certain deadlines to these projects give the ability to plan the creation of a product.

The creation of functional overviews for each department made it possible to see all running work for this department. This is very useful for planning and controlling purposes.

Overview
This paragraph contains some screenshots of the system just before it was introduced.
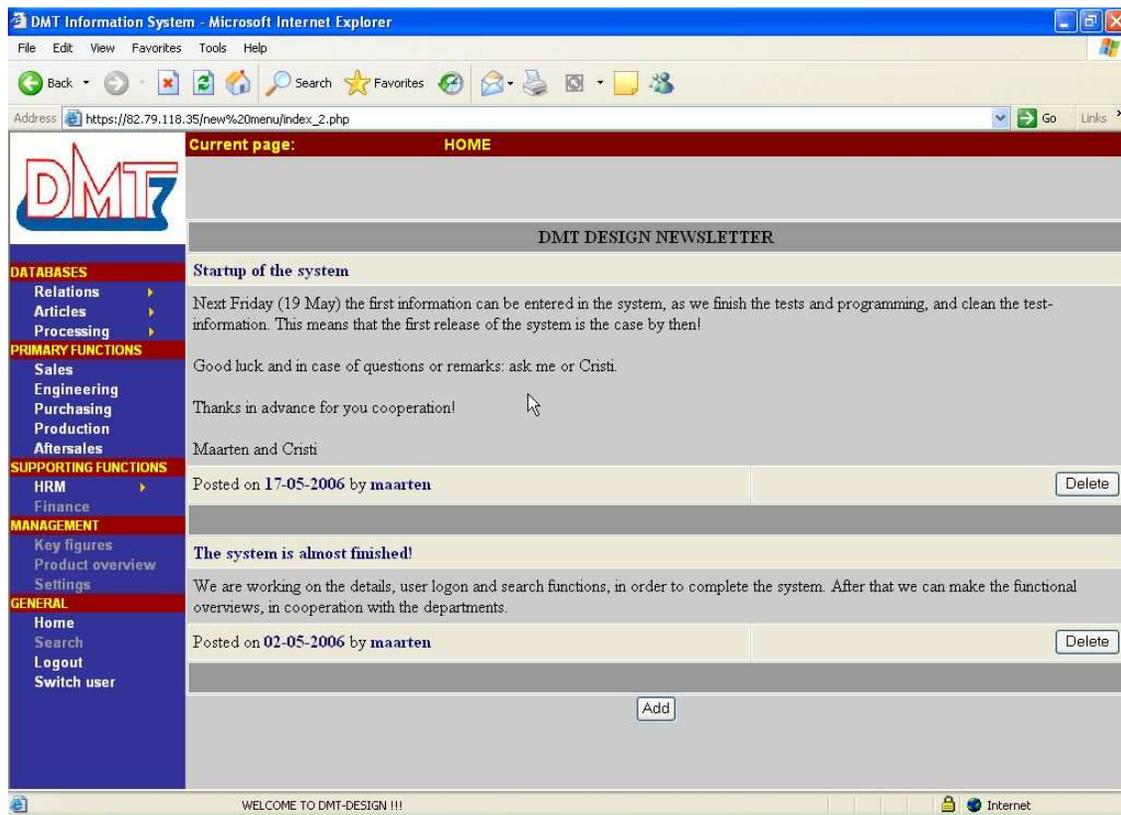
Figure 12 The *homepage* of the system. Browsing is possible using the buttons at the left. In the main screen news and messages can be displayed.
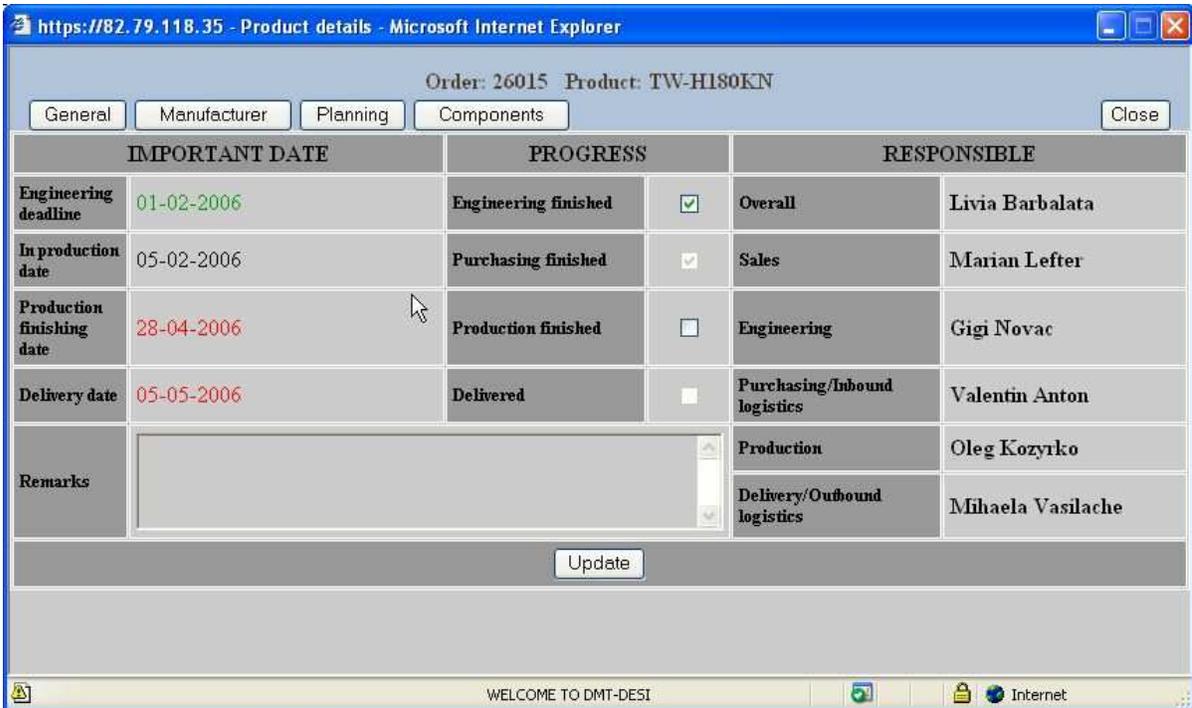
Figure 13: An overview with all information about an project. Tabs to browse are at the top of the page. Deadlines and responsibilities can be assigned to this project.
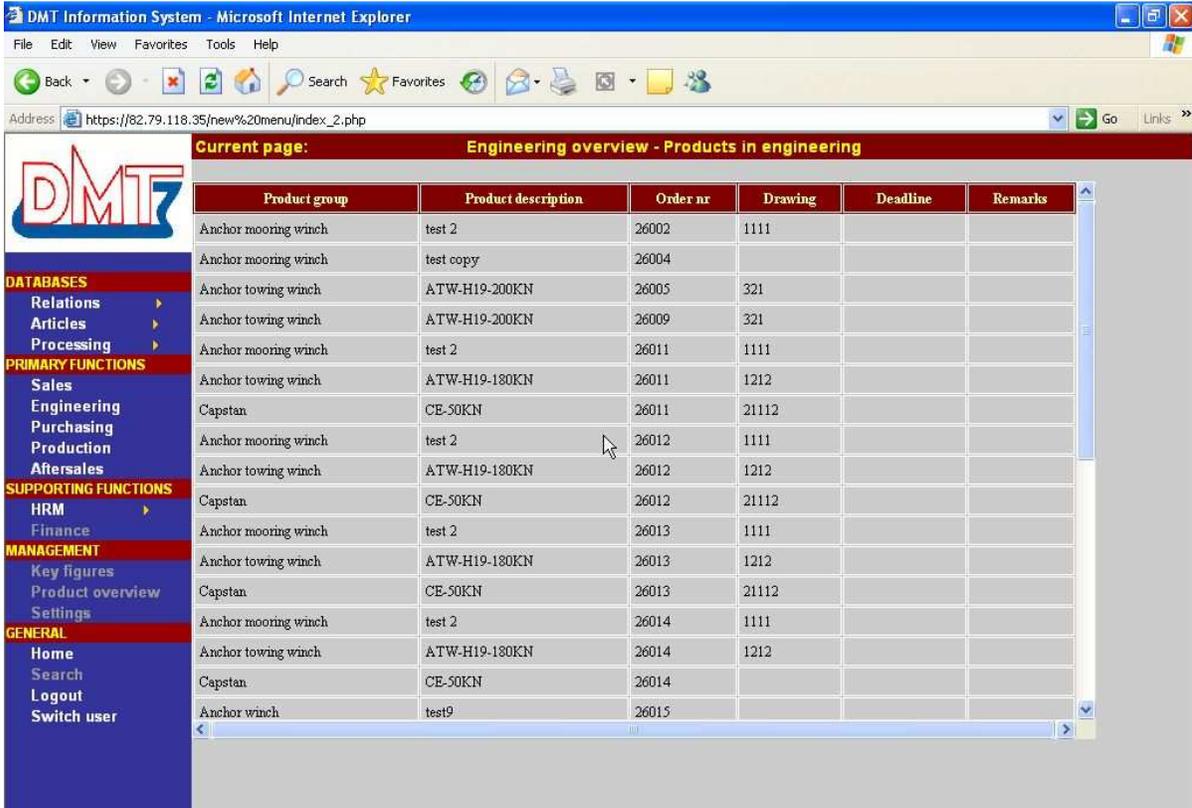
Figure 14 Functional overview for the department of engineering. An overview can be created directly to see which products are currently processed by this department.

Appendix E: Extensive problem elaboration

In interviews with employees some very different problems became visible. These problems are at first structured with the following list:

- Important (calculation) information is not shared across departmental boundaries
  - Employees think they are omitted in supplying (important) knowledge.
  - Attitude
  - Less understanding of work.
  - Recent cost-drivers are unknown and slow reaction on changes.
  - There is a lot of traffic with invoices.
  - Lack of (knowledge of) responsibilities and competences
    - Unclear procedures
    - Disturb during work (incoming phone calls)
- Lack of control over production process
  - Low reliability of subcontractors
  - Low influence on production process
  - (Sometimes) delivery of poor quality
  - (Sometimes) exceeding of delivery time
  - Friction between both quality and delivery time
  - Growth of cost prices
    - Increasing steel price
    - Increasing energy price
- Large dependency of only one customer (Damen Shipyards Group)
  - Risks
- Overview in financials
  - Cost price calculations and comparison pre-after calculation is not always carried out.
- Too strong growth (of orders)?
  - High work pressure.
  - Difficulty of hiring of qualified employees
    - Employees are forced to do low-skilled "emergency-work"
  - Time to familiarize new employees
  - Chance for failures
  - Office space

To structure these problems the following problem knot was used. A problem knot displays the separate variables which are often interrelated. By drawing arrows which define causal relations, the underlying problems could be found. It was chosen to exclude the lack of control over production process from the problem knot, because it was outside the scope of the research.

Figure 15 Problem knot

In the problem knot the following underlying causes (orange) can be distinguished:
1. There is no connection between pre-calculation & real time data.
2. No planning of future cash flows is sent from sales / purchasing to finance.
3. Invoices are often incorrect.
4. There is a shortage in employees.
5. The customer demand is rising spectacular.

The final consequence of these causes is a lower margin and profits. But these causes are not per se problems. The fifth cause is for example a very positive fact. Nevertheless, the growth causes some problems at some specific places in the organization. Therefore different employees say there is a shortage in employees. But this research can't act upon this cause. The same goes for the fact that delivered invoices are often incorrect. The east-European way doing business demands for accepting this fact. Nevertheless, in the final report some recommendations will also be made for solutions which are initially out of reach.

The focus of the research will therefore be on the first two causes. Further research will focus on extensive sharing of financial information across departmental boundaries. With this shared financial information a decent financial planning system can be developed.

In addition, because of the high work-pressure two important processes are not always carried out. These are the making of an after-calculation and checking of invoices.
A secondary research will try to find solutions or workarounds for this problem.

Also the lack of financial inside information asks for a 3rd research for acquiring management information from the existing database.

In summary, the research tries to implement solutions for the following problems:
- Because of local calculations, important cost drivers are unknown.
- (Short-term) planning of future cash flows is not available.
- There is no available management information, so decision-making is more difficult.

Appendix F: Framework interview

This interview is designed to introduce myself in the company, learn other employees and to get a rough view on processes occurring in the office.

Introduction
- Short introducing interview (about one hour)
- Reasons for interview
  - For myself
    - Get to know you all better. A lot of people, with all different backgrounds, competences and ideas.
  - For my assignment
    - To implement (financial) decision support systems in the IS and to evaluate the current work.
  - For yourself: to have influence things go in the office.

- Tell more about myself
  - Pieter Vernooij
  - 22 years old
  - Born and raised on a farm near Utrecht, in the middle of Holland.
  - Background
    - Family : 3 brothers, 1 sister
    - Hobbies: cycling, swimming, running
  - Student at the University of Twente, the Netherlands
  - Industrial Engineering & Management
  - Internship (abroad - AIESEC)
    - Learn a new language
    - Meet new people and get to know different culture

Objectives
Main objective
- Get to know the people in general.
- Get to know how the new IS is received.

Sub objectives
- Get to know the person and his/her function.
  - What is happening (company/functions)
  - Why are things happening
  - How do things get done
- Identify existing or possible problems
- Vision on current information system
- Vision on company/own function

Interview questions
Personal information
1. Can you tell something more about your background?
   a. What did you study?
   b. What are your hobbies?
2. How long have you been working here?
3. What is your current function?
4. Did you fulfill other functions before?

Internal processes
1. What is your personal daily work?
   a. What are you doing on an average day?
   b. Where is this happening?

c. Why are you doing this?
d. How do you do this?
e. How much time does it cost?
f. Are you only working for your department or also for others?
g. With what kind of information do you work?
    For example: technical, financial, quantities etc.. (more possible)
h. Where do you obtain this information and where do you store it?

2. Did you work with the new Information System?
    a. How did you like it? OR WHY DIDN'T YOU
    b. Is your work changed by the new Information System? Why, changed positively, negatively?
    c. Which features are most useful in your opinion? Why?
    d. Which features do you miss? Why?

3. Do you communicate/interact with other people in your daily work?
    a. With whom do you communicate most?
    b. Why?
    c. How do you communicate then?
    d. About what?
    e. And how often?
    f. Is the way you communicate changed by the new IS? Positively / negatively / why?
    g. Do you miss this feature?

4. What do you think that are critical incidents during the process?

Problems/things that go wrong
1. Can you mention things that go wrong?
2. Can you give examples?
3. Who are involved then?
4. Why are these things going wrong?
5. Could the IS support solutions for these problems? No, Yes, why?
6. Can you give possible solutions for these problems arising?

Vision on the company
1. How do you think the company is performing at the moment?
2. What do you think that will be the performance in the future?
3. Where is the company in 2 years?
4. What are you doing in 2 years?
5. What are the directions/what should be strategy?
6. What can be done better (and how)?

Appendix G : The prototyping system developing method

Because of the availability of IT-specialist Cristi the prototyping-approach for development was chosen. This method distinguishes some different phases for system development, which structures this research. The following figure displays the prototyping methodology, from Hoffer page 26 (2002) .
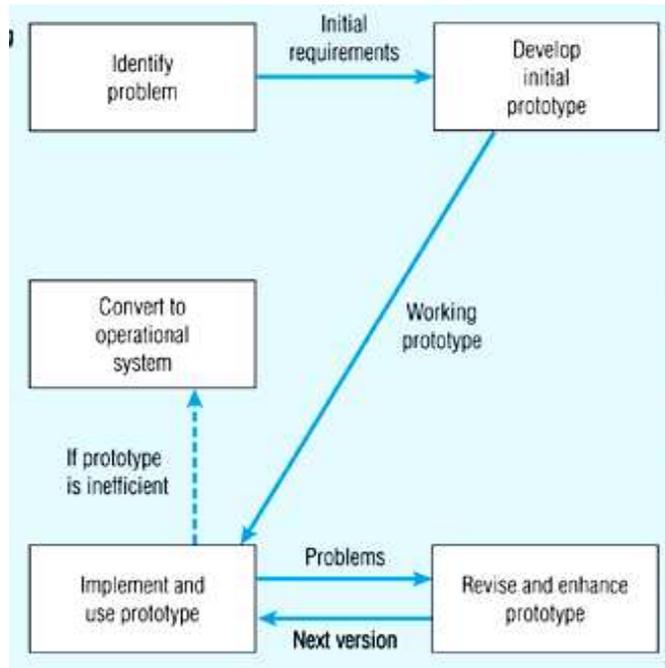
Figure 16: Prototyping development cycle

By working directly with working prototypes it was easy to make abstract concepts more tangible. Also it was easier to involve employees with the problem. A disadvantage of this system is the less efficient way of working the systems offer.

This methodology is different than the original chosen *traditional system development life cycle*, as can be read in the appendix about the plan of approach, appendix M.

Nevertheless the choice was made to include some aspects of this traditional system development life cycle. Especially the structure of the rapport is a remainder of this system. This was chosen to give the rapport a decent and good composition. This method can be found in appendix J.

Appendix H: Requirements & development

In this appendix the requirements and scenario's like I restructured them are presented. The information used to create these overviews came from very different sources and a lot of negotiating and talking with employees. The restructuring lead to the design of the different menu's as I did in Excel.   The second part of the appendix consists of some of the examples of the developments following from these structures.

Planning accounts receivables

To give an overview of future accounts receivable and to streamline invoice-processing it is desirable to introduce a tool to make short-term planning of future receivables possible.

Needed actions / functions

Orders which are registered have a probable time of final delivery. Employees of the department of sales enter these specifications in the system. The time of delivery leads automatically to the creation of an invoice with a certain deadline. Because of fluctuations in deliverytime, confirmation is needed in the database to confirm the creation of an invoice.
Graphically:
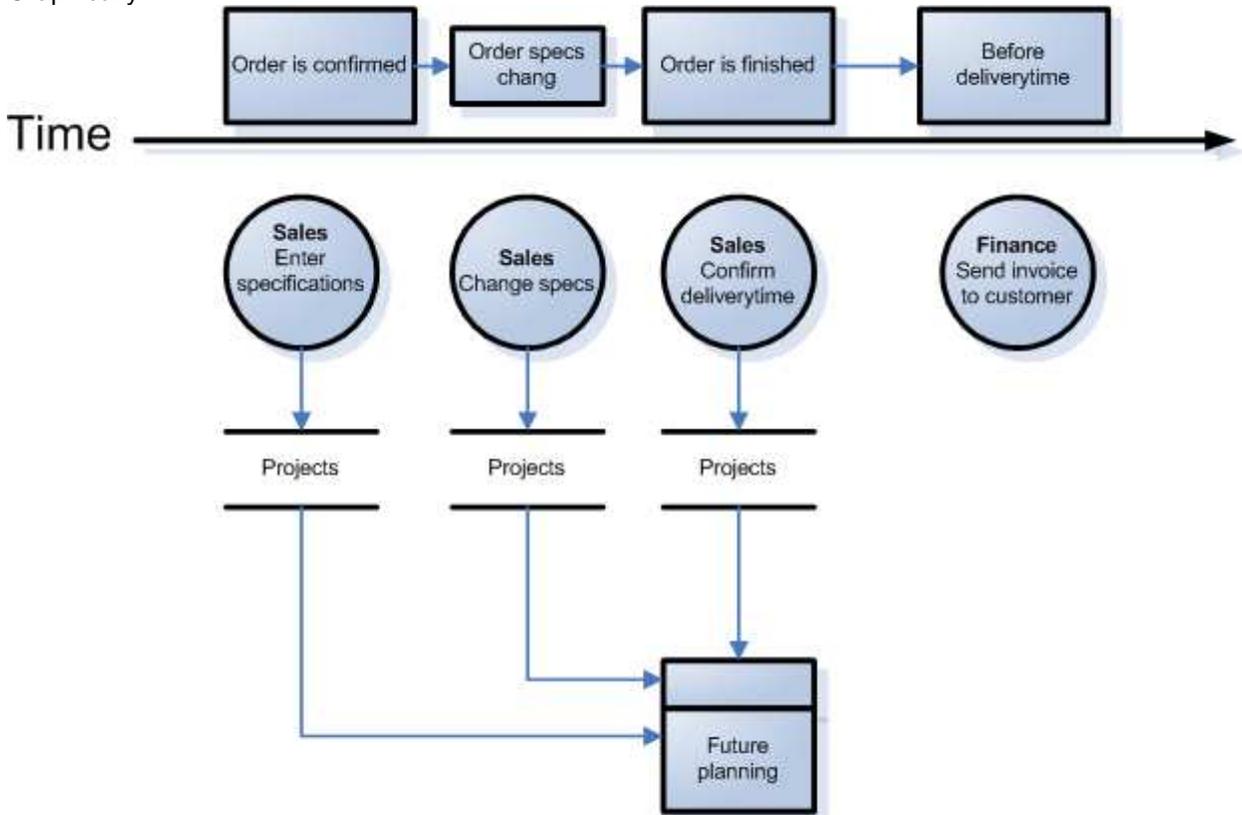
Figure 17: Invoice sending overview

Available information	Needed information
Forecast of delivery date	Confirmation Delivery date / time
Order nr.	Customer specification
Value?	Downpayment?
	Order nr.
	Pay or not to pay?
	Price
	Product description

Gadgets: Automatic creation

Planning purchasing products & components
To give an overview of future payments and to streamline invoice-processing it is desirable to introduce a tool to make short-term planning of future payments possible.

Needed actions / functions
Employees who purchase goods, enter the specifications in the system. The time of purchase time leads automatically to a delivery time of the products. This parameter leads to the arrival of an invoice which has to be paid in a certain time.

Graphically:
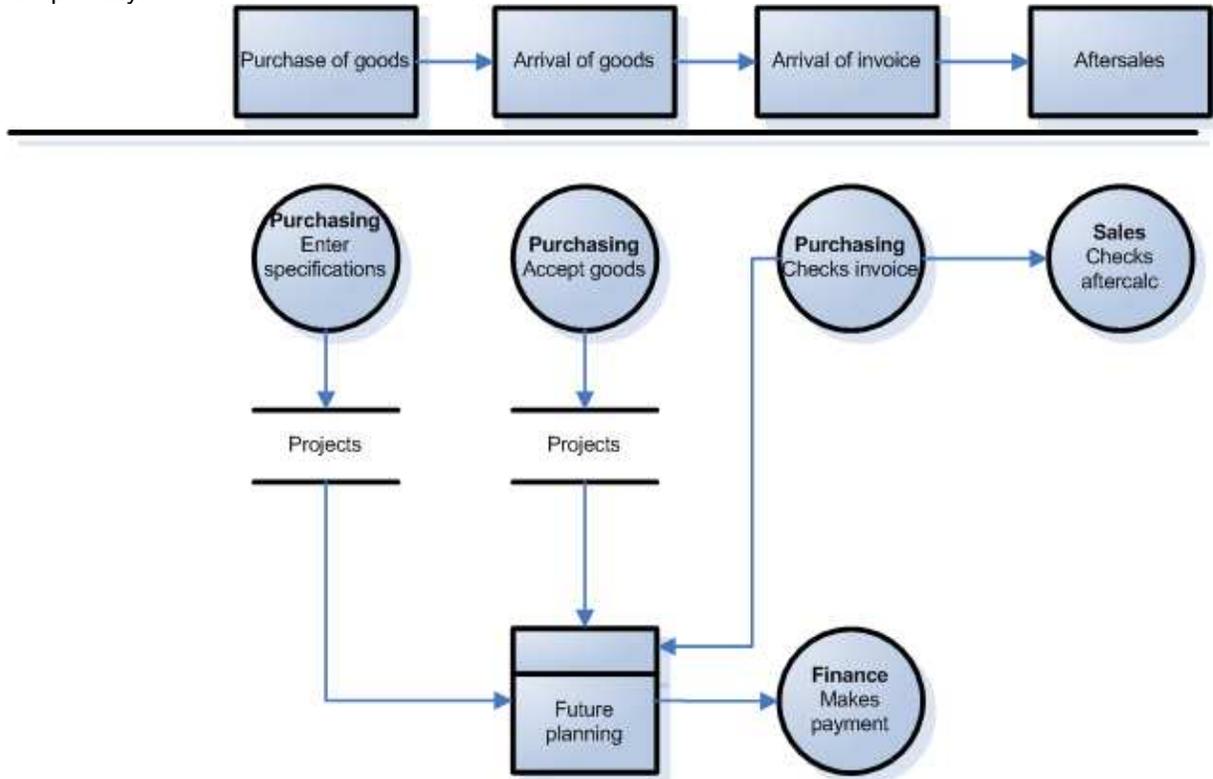
Figure 18: Invoice receiving tool

Available information	Needed information
Product	Down payment?
Order nr.	Price
Data delivered (scheduled)	Order nr.
	Product description
	Confirmation to pay
	Client specification

Gadgets: Exportable management information ,automatic creation!

This scenario leads to the design of the following menu:

Supporting functions   Financial ->Running invoice

Ability to select on order number, supplier, week to pay
Ability to sort: ordernumer, value, supplier, week to pay

Running

Order	Supplier	Product	Component	Description	Week to pay	Downpayment	Value	Paid
number	Camexip	Anchor mooring Bottom door	Electric Motor Solid Component	5,1 ABZPKA 132M-8/4 2,5/4,2 kw 343dfdf	w15-2007	YES / NO	4545	checkbox (not checked)

Ability to select on order number, supplier, week to pay
Ability to sort: ordernumer, value, supplier, date paid

Supporting functions   Financial ->History of invoice

Order	Supplier	Product	Component	Description	Date paid	Downpayment	Value
number	Camexip	Anchor mooring Bottom door	Electric Motor	5,1 ABZPKA 132M-8/4 2,5/4,2 kw	w11-2005	YES/NO	4545

Figure 19: Final design of invoice sending/receiving

Calculation module
To determine the opportunity costs of capital , the following choices were made.
Each order has a highly variable lead time and corresponding variable time taking stages of cost driving activities. It is therefore unknown during the inquiry stage of an order when this activities are carried out and what the total lead time of the project will be. It is therefore needed to make certain assumptions to estimate the opportunity cost of capital, which were extensively discussed with employees:

Paying supplies:
1. After 4 weeks when an order is placed, around 25% of the total purchasing value needs to be paid.
2. After 8 weeks when an order is placed, another 25% of the total purchasing value needs to be paid.

Receiving payments
1. Some customers will pay around 20% of the total order value as a down payment after 4 weeks when an order is placed.
2. Final payments will be made on average 4 weeks after the order is delivered to the customer.

Nevertheless, only a very few customers pay down-payments for an order to DMT. These accounts for a total value that doesn't make up for the down payments as paid by DMT, although these order values are higher than the purchasing values. Therefore it is chosen to calculate the opportunity cost of capital only over the outgoing amount of money. This was done by creating the following formula:

$$\text{Cost of capital} =$$

$$\text{Downpayment 1} \times \text{Purchasing value} \times \left((1+\text{interest})^{\frac{(\text{leadtime} + Z - N)}{52}} - 1\right)$$

$$+$$

$$\text{Downpayment 2} \times \text{Purchasing value} \times \left((1+\text{interest})^{\frac{(\text{leadtime} + Z - T)}{52}} - 1\right)$$

$$\text{Cost of capital} =$$

$$\text{Downpayment 1} \times \text{Purchasing value} \times \left((1+\text{interest})^{\frac{(\text{leadtime} + Z - N)}{52}} - 1\right)$$

$$+$$

$$\text{Downpayment 2} \times \text{Purchasing value} \times \left((1+\text{interest})^{\frac{(\text{leadtime} + Z - T)}{52}} - 1\right)$$

To use this formula, some parameters for every order need to be filled in. The final design of the calculation module looked like the following graphical overview (figure 20):

	TOTAL PURCHASING	TOTAL SALES PRICE		TOTAL OFFER	
	72464	496562		50000	

<table>
<tr><td>Checkbox</td><td colspan="6">PRODUCTS</td></tr>
</table>

Denominat	Type	Supplier	Unit	Price/ unit	Nr. Units	Total valua		Actual
Mettalic co	3534-dfd	Promex	KG	3,5	6000	21000		
Hydraulic N	343-#df	Azewijn	PCs	6000	1	6000		
Ferado bar	234-bnb	Henk	Meter	400	23	9200		
Componen	ee1	23	PCs	32	1	32		
PURCHASE PRICE						36232		
DESIGN						18000		
UNEXPECTED						1000		
MARGIN						182928		
Transport						10023		
Certification						23		
Customs fee						75		
SALES						248281		
OFFER						25000		

<table>
<tr><td>Checkbox</td><td colspan="6">PRODUCTS</td></tr>
</table>

Denominat	Type	Supplier	Unit	Price/ unit	Nr. Units	Total valua		Actual
Mettalic co	3534-dfd	Promex	KG	3,5	6000	21000		
Hydraulic N	343-#df	Azewijn	PCs	6000	1	6000		
Ferado bar	234-bnb	Henk	Meter	400	23	9200		
Componen	ee1	23	PCs	32	1	32		
TOTAL PURCHASE PRICE						36232		
DESIGN						18000		
UNEXPECTED						1000		
MARGIN						182928		
Transport						10023		
Certification						23		
Customs fee						75		
TOTAL SALES						248281		
OFFER						25000		

Figure 20: **A first overview was created which Cristi could use for creating the first calculation**.

Appendix I: Design of solutions.

This appendix contains the visual development of the different developed extensions of the IS.

The calculation-module:

Figure 21: The first calculation module was able to calculate the total price of an offer, by including and excluding certain products (which already needed to have components. By adding some cost-drivers, like transport, design, certification, margin, customs & extra costs the costs price could be modified.

Figure 22: Final inquiry overview

This overview offers structure and all information needed. It offers a clear overview of the cost price, sales price & offer price and smartly uses colors to identify incorrect component prices. Also a lot of small intermitting functions where added which make working with it for more easier.

This inquiry could be made an "order" which finally looked like figure 23.

Figure 23: Order overview

This order overview looks more or less the same as the inquiry overview. Although the main color is red (for the prevention of mistakes) it has the same functions and just takes all data from the inquiry phase. Nevertheless, the order-calculation also has its own specific functions and gadgets. For example, it connected to a revisions database where old-revisions can be re-used. The

63

following two screen shots offer two examples from pop-ups which can be opened in inquiry &n order phase tot add transport or extra costs. (The second cost-driver uses some built in formulas to calculate cost-drivers like cost of capital and the cost of valuta exchange. Parameters for these formulas can be changed by using the screen with management-settings.)

Figure 24: Transport-cost pop-up

Figure 25: Extra costs pop-up

Sending invoices:

The following figure show the solution as developed for the process of receiving invoices.

Current page:	Financial - Running Invoices					CONVERTOR VALUTAR
Running							
Order	Component	Supplier	Qty	Description	Week to	Value	Paid
30001	TEST GROUP	Going	200	Test comp 2	34	4200 €	NO
30001	Hydraulic motor	A. van der Velden	4	HM C045 P-45-20-FM3-X	34	12800 €	NO
26063	Steel construction	Ipromet	10		35	10 €	NO
29999	TEST GROUP	Going	50	Test comp 2	38	1050 €	NO
29999	Hydraulic motor	A. van der Velden	1	HM C045 P-45-20-FM3-X	38	3200 €	NO
29999	TEST GROUP	Braha Emy	2	Test comp 1	39	300 €	NO
26063	Steel construction	Ipromet	10		40	6990 €	NO

Figure 26: Received invoices

When components are bought they are automatically added to this overview, only available for some selected employees. By offering some different selection mechanism, the employee can easily check for different types of invoices. Also some additional buttons are made for converting valuta, and changing invoice-statuses to "paid".

More about the shown solutions can be found in appendix M; the user manual. In this manual the different systems are explained thoroughly.

Appendix J: Plan of approach

Before starting the assignment a plan of approach was made in advance. After 2 weeks of problem-analysis, this plan of approach is corrected to the new perceptions and insight information. [8]

Main question
The current problems are extensively described in appendix E with the use of a problem knot. After analyzing this knot it can be concluded that it is needed to exchange financial information more efficient en effective between departmental boundaries. This will lead to lower work pressure and a better insight in some planning and general financial processes.
The main question of the research will therefore be:

How to implement certain desirable extensions of the current information system to coordinate a better flow of financial information between departments? "

To be more specific, the research tries to implement extensions for the following problems:
- Because after calculation is not always carried out, (change) of important cost drivers are unknown.
- (Short-term) planning of future cash flows is not available.
- There is no available management information, so decision-making is more difficult.

Stakeholders
A stakeholder is someone who comes into contact with the changes following from this research and has an interest in the continuation of the company.[9] Director of the company, Piet ter Schure, is the main stakeholder. He initiated this project to improve the information technology used in the company. Next to Piet, the employees are important stakeholders. They need to work with the system, and probable need to change their way of working. Especially the employees from the departments of sales, finance and purchasing need to work with the system.

Responsibility
The responsibility for the assignment lies by me, but of course it is necessary to keep in close contact with and report to the management of the company, because they have to work with these solutions. Next to that the university tutor can be consulted for advices.

Method
According to Hoffer (2002) some different types of system development methods can be distinguished, dependent on the new IS characteristics (page 17). To develop a transaction processing system (TPS) the used research method needs a process-orientation. This concerns a focus for capturing, validating and storing data.

Because management also wants the system to include management information, the data must also be available and accessible in a variety of ways, and relationships between data must be clear. The method used in this research will therefore have a process and data orientation. Because of the availability of IT-specialist Christi the prototyping-approach for development was chosen. This method distinguishes some different phases for system development.

To plan the different needed activities and tasks, the system development life cycle as stated by Hoffer will be used. This method distinguishes some different but nevertheless important phases for system development.

---

[8] This document contains also somewhat redundant information for the sake of creating a overview procedure which can be read independently from the main report.

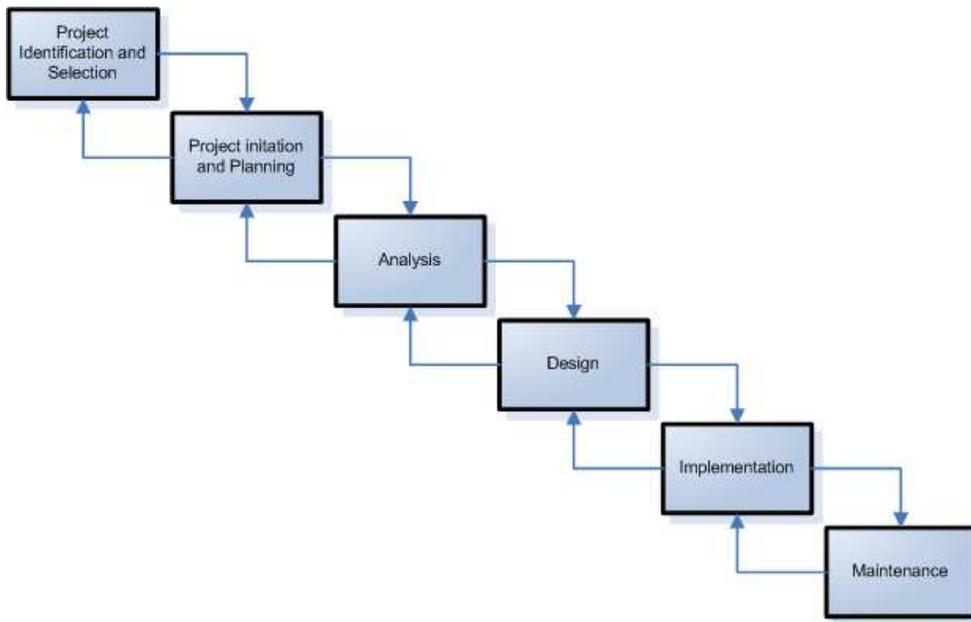[9] This is the definition as used by Associate Professor Van Riemsdijk.

Figure 27: System development life cycle (as stated by Hoffer)

Because the available time is limited, this cycle is carried out with the emphasis on analysis, design and implementation. These phases will be carried out almost parallel to shorten development-time. A close contact with users and IT-specialists is therefore necessary. Ongoing processes in these important phases are summarized below:

Requirements analysis
- Very detailed user information must be gathered to give shape to the specific processes. User wish list will be made.
  Which information is in use in the different departments? How does this information flow? Is this efficient and effective? Which problems occur?

- Information flow requirements must be verified in the current database design.
  What is technically possible with the current database structure? Which technical extensions are needed? Which information is therefore needed?

- Theory from literature about introducing new (financial) extensions will be collected to acquire theoretical background.
  What does theory advice on introducing extensions to existing systems? Which information can be used to create management reports?

Design
- For the different requirements, different alternative solutions will be made together with the IT specialist.
  In what format do users want to receive their new information? How can this desired format be translated in a specific technical design?

Implementation
- Together with users the best solution will be implemented.
  How to deploy the new extension and train the new users?
- This solution needs to be evaluated extensively.

On which criteria should the extension be evaluated? Are users satisfied with the extension?

Conditions

Of course the assignment has limitations and has to meet some conditions:
- Time is limited. In a maximum of 14 weeks the assignment needs to be designed, implemented and evaluated.
- The chosen solution has to work together with the existing information systems. An extension of this system is therefore preferable.
- Some information has to be used discrete.
- Important choices shall be made by the company management.

Time planning

The available time during the internship is limited; therefore it is necessary to keep a schedule. An overview of this planning is given in Table 1. An addition to this planning can be found in the last paragraph.

Week	Activity
1	Koster can show me the ropes in the first week. Also get used to a new living environment, the company and the people working for it. Start with first analysis of the company by doing interviews with employees.
2	Finish interviews and structure information about financial processes, information flows and problems within this field. Write and send plan of approach.
3-4	Extensive analysis of the problems: establish a theoretical background, to structure information and to analyse the things happening and do the analysis itself, by working with the people and see literally what is going on.
5-6	Find a solution to the problem and work it out, with again theory as a background. Also contact the IT-specialist for technical possibilities.
7	Discuss solution with the management and change where necessary. Start with the implementation (plan).
8-9	Further development of the implementation plan for the chosen solution and an early start of the real implementation. It is important to get key figures in the organisation involved in the process.
10-11	Start implementing the chosen solution; this will be likely to do in cooperation with the IT specialist in the company. Also make the employees of the upcoming changes. Train the employees in possible new ways of working and give a presentation of work done so far.
12	Evaluation of the solution and its implementation and possibly formulate recommendations for further research.
13	Room for delay and working on the final report.

Table 12: Time schedule

Results

The output of the research will eventually be a final report, in which every important part is summarized:

- A complete analysis of the process information (flows) within the organisation;
- The current problems with this and its causes;
- The solution for the problem, worked out in detail;
- The implementation plan for the solution.

The most valuable results will although be practical. After all, the goal of the whole assignment is in fact improving the organisation. So at the end primary process information will be more structured, most likely with an improvement of the information system and probably training of the employees to work in a new way.

Proposed final report structure

The final report will be the main deliverable. It will have the following structure:

- Front page
- Title page
- Preface
- Table of contents
- Introduction
- Part I: Description of the internship organisation
    1. Key facts
    2. Main products
    3. The process
    4. The market
    5. Strategy
    6. External environment
    7. Internal environment
    8. Organisational structure
- Part II: The assignment
    1. Problem identification
    2. Problem analysis
    3. Solution
    4. Implementation plan
- Appendices

Appendix K: Evaluation

This appendix contains an extensive evaluation of the implementation of the information system. The framework of Nah et al. as explained in appendix F is used.

ERP teamwork and composition
Business and technical knowledge was available in the project-team and the workload was good manageable.

Top management support
The assignment and implementation had strong management-support. This was extremely important because the introduction did not have priority for 80% of the employees. This is against the advice of Nah et al. to assign top-priority to the project. In addition, Laughlin proposes in the work of Gupta et al. (2006) that "during the implementation process the strategic business perspective emphasizing cooperative and cross-functional approach should be clearly communicated across functional areas by top management of the company." Sometimes it was unclear how the new organizational structure, roles and responsibilities should be established, although management tried to get things as clear as possible. Strategic goals and objectives were not always clear with all users. Probably work pressure was interfering with this objective.

Business plan and vision
Making a university-thesis from this project helped in defining concrete problems, causal relations and a decent outline. Also the background of the company needed to be studied extensively. This appeared to be a good basic plan to steer the development by good project management, as described under the next bullet. Nevertheless, uncertainty about the business strategy and vision sometimes delayed work and created uncertainty under employees.

Effective communication
Because of the small size of the company and the short and informal lines of contact, communication was easy. User wishes, demands and expectations were gathered almost continuously. But this counts only for short moments and with little questions. On key-moments it was difficult to involve users very effective, for example for longer times of testing and practice (longer than 10 minutes). Communication was therefore not always as efficient as possible. It was tried to keep management and end-users in contact with proceedings, but this failed sometimes because of the high work pressure and the lack of priority.

Project management
Responsibilities in the project-team were clearly defined. The scope of the project was generally defined and limited only to some extent. This somewhat more general scope matched the nature of the assignment, as an independent research-project and the assigned limitations did not threatened the boundaries and deliveries of the project. Milestones and deliveries were planned in detail so management knew when to expect results, what helped to maintain credibility. This also helped in working with Cristi, who knew exactly how to plan programming.

Project champion
During the project Piet ter Schure was the "transformational leader who had the power to set goals and legitimize change" as Falkowski et al. recommends in Nah et al. (2002). This was indeed important because he was able to create credibility in the organization and was able to steer the direction according to his vision. His presence increased the workability and fastened implementation.

Appropriate business and legacy systems
The available business and legacy systems were relatively uncomplicated and well-defined. The only difficulty was the lack of knowledge available during pre-calculation and the rich product-portfolio. Because business process were defined and analyzed it was possible to evaluate this important source of information and it's fit with the new system.

Change management program and culture
Because the daily pressure it was understandable that not all employees had "change" as top priority, although this was different for different employees. Some accepted the need for change and accepted it more easily and even advocated this. Creating the willingness for change was therefore recognized as important during the project. Users were extensively involved in lay-out and interface issues. Also a strategy was developed to make the ""live-going" phase more easily. Training was give on-site and a manual was developed to support users and management. Preparing employees for change was an ongoing process which was carried out continuously, especially during small talks.

Business process re-engineering and minimum customization
"Aligning the business process to the software implementation is critical" according to Holland et al (1999). This statement applies to introducing complete standard-solutions. But DMT chose to build a complete system from scratch, roughly fitting to previous running processes. (see Koster, 2006) But it was chosen to change procedures and guidelines in the company, for example who should be responsible for after calculation etc. Nevertheless complete re-engineering was not carried out: minimization of customization is applicable. This provided the problem that it took quite a lot of time before the calculation-module was finally finished and all user wishes were integrated.

Software development, testing and troubleshooting.
A clear software structure was already present before starting this project, which was supported by extensive requirements determination and structuring. The availability of Cristi provided the opportunity (and the necessity) to use a prototyping approach with its cons and pro's. Coding, testing, troubleshooting and revisions occurred parallel. It can be concluded that the development was not very efficient, with sometimes writing and removing code on the same day. This was also because user wishes changed sometimes. Programming followed user wishes closely and was sensitive for these fluctuations. Nevertheless, this approach did offer the benefits of developing a very highly customized product. To prevent future troubleshooting, training was given and a manual was developed.

Monitoring and evaluation of performance (Business achievements)
Planning together with Cristi was dependent on the setting of certain milestones and achievements. These milestones and the progress were often as possible evaluated with management; also users were often confronted with results. Management supported the achieved milestones and tried to improve implementation but this didn't prevented skepticism from employees.

Appendix L: Further steps & company improvements.

This chapter deals with an extensive explanation of the steps to follow after the current project is finished. I would like to give my ideas about this: it will be useful for my successor, and can also partly serve as an introduction for this person. Because I worked quite a long time in DMT as a relative outsider, I also gathered some other ideas which are outside the scope of the project. These will be presented in the second part of this appendix.

Part 1: Improvement of the information system

This part describes my point of view about the further development of the information system.

Side-effects and start-up problems from history.

The project as carried out was in fact as logical extension of the basic structure as deployed by Koster early in 2006. Koster finished quite optimistically with a large list of possible improvements. I completely agree with this list, but I think some unexpected side-effects occurred which changed the outlook on the path of development.

The system went live 3 month at the time of writing, but still most employees are hesitating to use it. This is partly because of the high working pressure (as employees call it) and partly because of a resistance to change. Different systems are now developed which still wait to be used seriously companywide. Employees are hesitating to get dependant on the system: an understandable problem but something they have to get over. The system needs critical mass and therefore it is seriously needed that the system gets time and attention from management to get working. Currently some employees have the feeling they fill the database because they have to, not because their colleagues are using it. This has to change.

Time-out

This project will finish with the calculation module and the planning of outgoing cash flows. After this it is crucial to take a time-out: the company needs to adept to the system and start using it. This will go more slowly than Koster (and I at first) expected it would go. Concretely: Sales needs to start making all calculations with the system and purchasing needs to update all component-information and add all purchasing information to the orders. Then the department of finance can start trusting this financial information as provided by these departments. This will take time, probably till the end of 2006. It is tried to give employees extensive personal training, something they often reject because of a lack of time. Therefore the manual is adjusted so that employees can walk trough a tutorial for self-learning.

Further steps.

An extensive company-wide evaluation is then needed to track weaknesses and find the ongoing problems and their causes. I found that a lot of the menus developed by Koster are not used, especially in the *primary functions-part* of the system. These menus need to be evaluated thoroughly, and employees need to be pointed on their usefulness.

While writing this, all important financial information is being made accessible with the system. This is a huge step for the system, but the advantages which can be used after a couple of months are also extensive. After a positive evaluation of the system and the quality of data it contains the next financial extensions can be introduced. These will not be very difficult to introduce because the basics are already created during the current development. In the following paragraph some possible extensions from my point of view are described, for more creative extensions I recommend the work of Koster (2006).

After-calculation.

All calculation-information is currently being administered into the database, just as the real prices of components. The overview of how an after-calculation menu should (or could) look is already created, and included in this rapport. A positive evaluation of the data in the system and how people use the system should mean that the creation of an order after-calculation gets top-priority.

This way it becomes really clear how DMT and its employees perform, and which products are successful and which not. Important for after-calculation is that employees can really trust the information they find their.

Management information
The next step should be to introduce the creation of management-information by the system. Also for this extension the entire structure is ready, and also for this option the quality of data should be researched before. It will not be difficult to gather the needed information from the system, and also the needed graphical php-plugins are already installed to the server.

It is needed to take a good look on the structure of the calculation-module; especially on all places were dates and values are combined. This will be very useful to make this information accessible.

Part 2: Suggestions for company improvements

In this part some suggestions and ideas for improving company processes outside the scope of this rapport will be discussed. Read it for your own interest because it will probably reflects my personal opinion quite strongly.

The introduction of new employees.
What directly came to my attention was the lack of procedures appearing when new employees are introduced in the company. DMT has a rather stable staff without a lot of changes but the company is growing and in the three months I was in the company 3 new persons were hired. They received only a very, very small introduction; and they just started working and had to introduce themselves.

Also a document with company rules and very useful information exists but none of these employees received this, just like the lack of an email-address and access to the database. I think it would be better if every new employee was asked to write something about him/herself, and mailed this around with their new email-address; they would be included in the company-wide mails directly. It would also be an improvement if they would receive around 30 minutes of training in the information system directly, independent of their function. How DMT works is then also directly visible and can be easily illustrated by using the system.

Also the distribution of new email-addresses could be done somewhat more systematical. They now look all totally different, with very different lay-outs. I was wondering often who I should mail.. lt@dmt-design.ro ,lb@dmt-design.ro or livia.barbalata@dmt-design.ro. Some structure as for example *firstletteroffirstname.fullsurname@dmt-design.ro* would be useful.

Appendix M   DMT information system user manual

This appendix contains the user manual which was adjusted quite rigorously to support new users of the information system. The old manual as created by Koster was used as a basic structure (and knowledge-base about the information system), but in addition extensive support for new users was added in the form of a decent introduction and department-based tutorials. The manual tries to find a balance between adding rich pictures to guide users and making it a heavy and expensive to print and save document.

Information system manual

Authors:	May 2006	Maarten Koster
	August 2006	Pieter Vernooij

Contents

Introduction

In 2006 DMT Design introduced a new information system which keeps track of the entire primary process. It was custom built to support *your* work and this manual was created to support you in learning to use it. In this first part of the manual, some backgrounds will be discussed and the following questions will be answered:

- Why is there a new DMT information system?
- How is the system structured and what does it look like?
- What is your role in this?

After these first questions the department of Sales, Purchasing and Finance each have their own chapter about the specific functions the systems offers. If you are an (new) employee of these departments you should read these chapters thoroughly. It is strongly recommended to read the other department-specific chapters and the final chapter which gives a general overview of all functions.

But at first: ask the current IT-Administrator, Livu Trimbitaru, for access to the system.

Why using an information system?
The DMT information system is made for several reasons. The main objective is the following:

> *All primary process information, up-to-date and easy to access, add and edit, should be available all over the world, from a central stored place;*

This makes communication easier, which will have positive impacts on the work performed. Some examples for this are:
- Up-to-date component prices make it easier to make proper calculations;
- Alerts in the planning system will provide the company from problems with the delivery time;
- A total overview of all running/pending inquiries and orders can be shown;
- Contacting customers, manufacturers and suppliers will be easier, with the relations modules.

How does it work?
The basics of the system are in the inquiries/offers and orders. All other relevant entities around are available in the system as databases.

There is chosen for an extensive menu, which is divided in the following parts:
- *Databases:* these are the views for the basic databases, with all information in it, about relations, articles and most importantly: inquiries and orders.
- *Primary functions:* the primary process is performed by some departments. In the primary function overviews, one can see the relevant information for or about the concerning departments.
- *Supporting functions:* for the supporting (non-value adding) functions, different information is available. So far not so many modules are added for these, but it is not difficult to extend the system in this way.
- *Management:* in this part the management overviews and statistics will be shown, on which decisions can be based, but so far these have not been finished. Another aspect that can be made is a page where some settings can be changed.
- *General:* here some general functions are displayed, as the home page, search page (not finished) and logout and switch user functions.

What do I have to do?
Important to remark is that the system will only be successful if information is up-to-date. And as information is added by the people within DMT, **you** are the most important! It happens that some information seems irrelevant for you, but it can be very interesting for others, so fill in everything possible.

Another important thing is improvement. This can be done the best with input from the end-user: you again! So if there are remarks, comments or questions, just state those and we try to fix the problems or make improvements as soon as possible.

Some general remarks
To give a good explanation of how the system is working, this will all be described in the following parts. In this section, some general remarks will be made about the system in total.

- To open the system, follow the URL: https://82.79.118.35/new%20menu. You can login with your username and password. If you don't have a username and a password contact the IT-responsible at the office. The current responsible is Liviu Trimbitaru.
- The system contains different pages, with tables in almost all of them. Those tables only contain some primary information, but all of them are clickable to open pop-ups with more relevant information, structured by tabs, and functionalities. Because there are many pop-ups, it is relevant to **turn off your pop-up blocker** for this website.
- In the pop-ups there are some general functions, used for every database record:
  - *Delete,* to delete the record from the database.
  - *Close,* to close the pop-up window.
- The functionality you can use **depends on the user rights** you have. This manual explains all possible functionalities, but it can be possible that you don not see all of the buttons or you do not have the rights to change information.

For every department a general tutorial was created to practice with the database by yourself. Because the system is rapidly evolving the pictures don't always show the latest state, slight difference could appear. Don't worry; it will not affect the way of working… just try it out!

Now you can start following your own tutorial! Succes..or better: noroc!

Maarten Koster
Pieter Vernooij

The tutorial for the department of Sales

As an employee of sales the system offers great possibilities to keep track of inquiries and orders. The following chapter will show the possibilities it offers, and the way you can manage these. It will only show you some general remarks and information about how it works. If you want more specific information reading the specific chapter about the concerning subject is recommended. Just follow this walkthrough to get your first impression of the system.

Adding an inquiry
Every order of DMT starts as an inquiry. In the main screen you can click in the left under *Databases* on Processing / inquiries/offers. This will lead you to the inquiry screen, where you can add a new inquiry with the button on top ([add inquiry]). If you push this button the situation as in picture 1 appears. In this pop-up the first information about this specific inquiry can be added. For example let's make a "test-inquiry" by typing "test" in the *Description* and C*omments* field. Just select a customer and don't worry: we will delete this inquiry later!
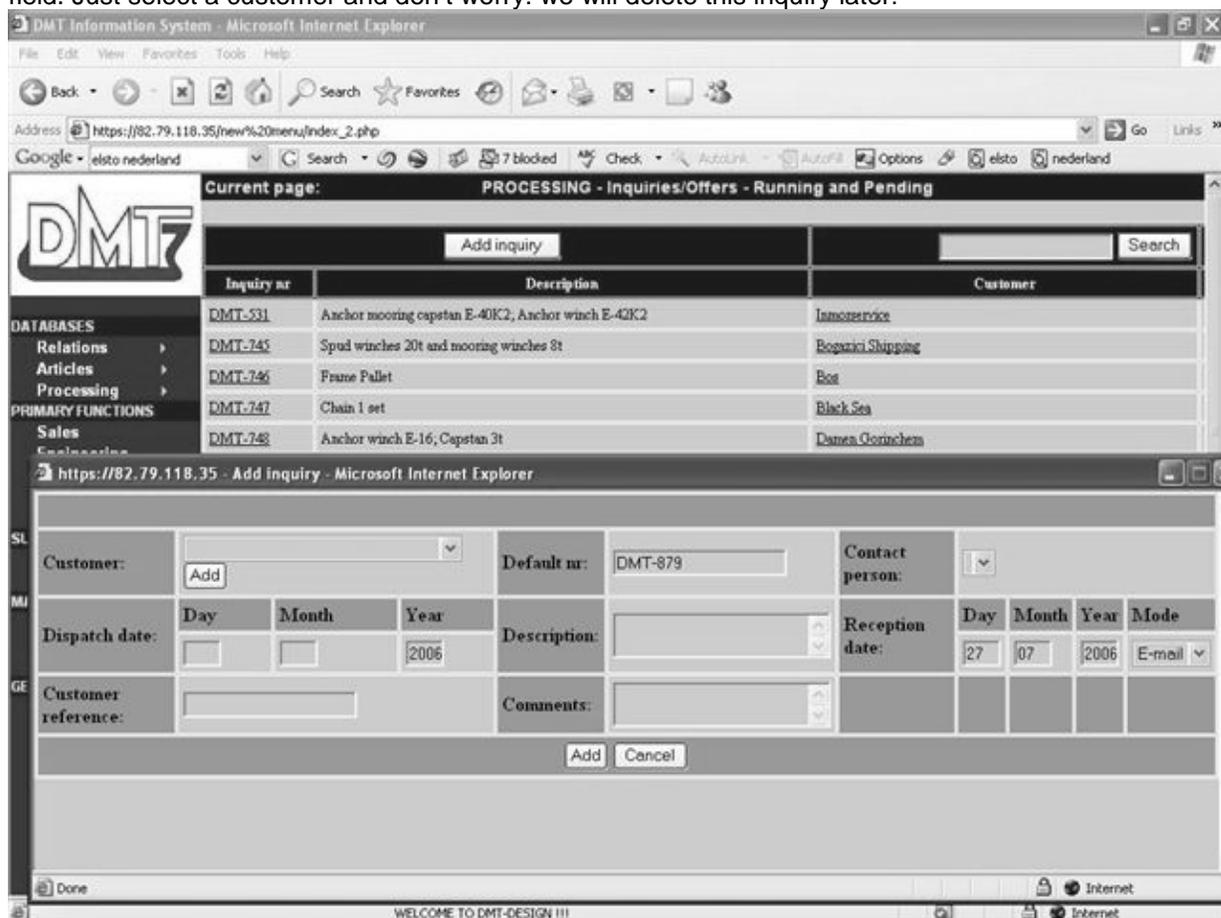
Picture 1: add inquiry

After you press [add] the inquiry is added to the system. Automatically it gets a certain inquiry number, and the inquiry is opened.

Managing an inquiry and creating calculations.
The open inquiry shows different tabs on top of the screen, like *General, People, Customer, Products* and *Offers.* If you see this for the first time: browse through it and read the information in the chapter about the basic structure of the database. This is very useful! You can add information about this specific inquiry here.

Below in the screen you see a large empty grey field, some figures and an [add prod] button. This is the calculation-field. To make a calculation for a customer you need to add products to the inquiry by pressing this button. A pop-up appears. Picture 2 shows what happens.
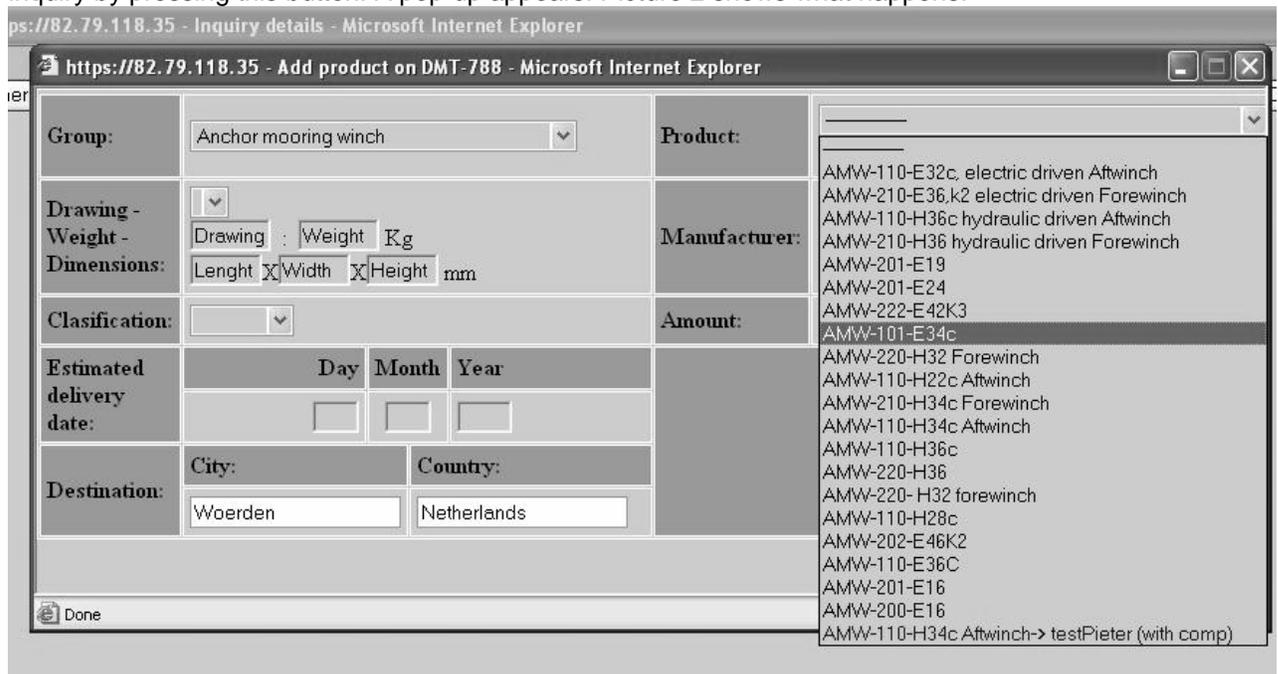
Picture 2: add product to inquiry

In this pop-up you can select the type of product the customer demands, by selecting the *Group* in the top-left corner. After selecting the group you can select a product from this group in the top-right screen. If the product is not produced before by DMT you have to add it, by pressing the [add] button to the right-top corner.

In the picture you see that some products are highlighted in blue. This means that they have a component-configuration attached to it. Of course (almost) every product (imagine a big winch) has components and if you select this, these components are automatically selected for this specific product. In the product-name you will also see the drawing-number.

If you press the [Info] under this product, you'll get all kind of information about the product, for example which exact components are in. Like this you choose the specific product you need.

In this *add-product screen* you can also add a lot of specifications like the estimated time of transport, number of products, drawing, weight etc. etc. Press [add] in the bottom to add this product to the inquiry and stop adding more products. Press [apply] to add the product and return directly to the add-product screen: you will directly be able to add more products to the inquiry. And remember: all information you enter is used elsewhere in the system: so try to enter as much as possible!

After adding products we return to the main-screen (*General)* but first we summarize: a product has a certain configuration. It is always built from components, depending on the characteristics. After you added the product you directly see this configuration. The components already defined in the product (by another employee in another order) are displayed. **Check always if these characteristics match the (new) expectations as defined by the customer!**

In this main screen you can change this component-list. You can add, and replace components by pushing different buttons. Try it! The small red crosses behind each component remove the component from the list, and by clicking on the name you can replace a component directly for a component from another group. If the product is "empty" (without any components) then you will have to add them. You can do it like this:

If you put the [add comp] button for example you can add new components. You get the following screen (picture 3):
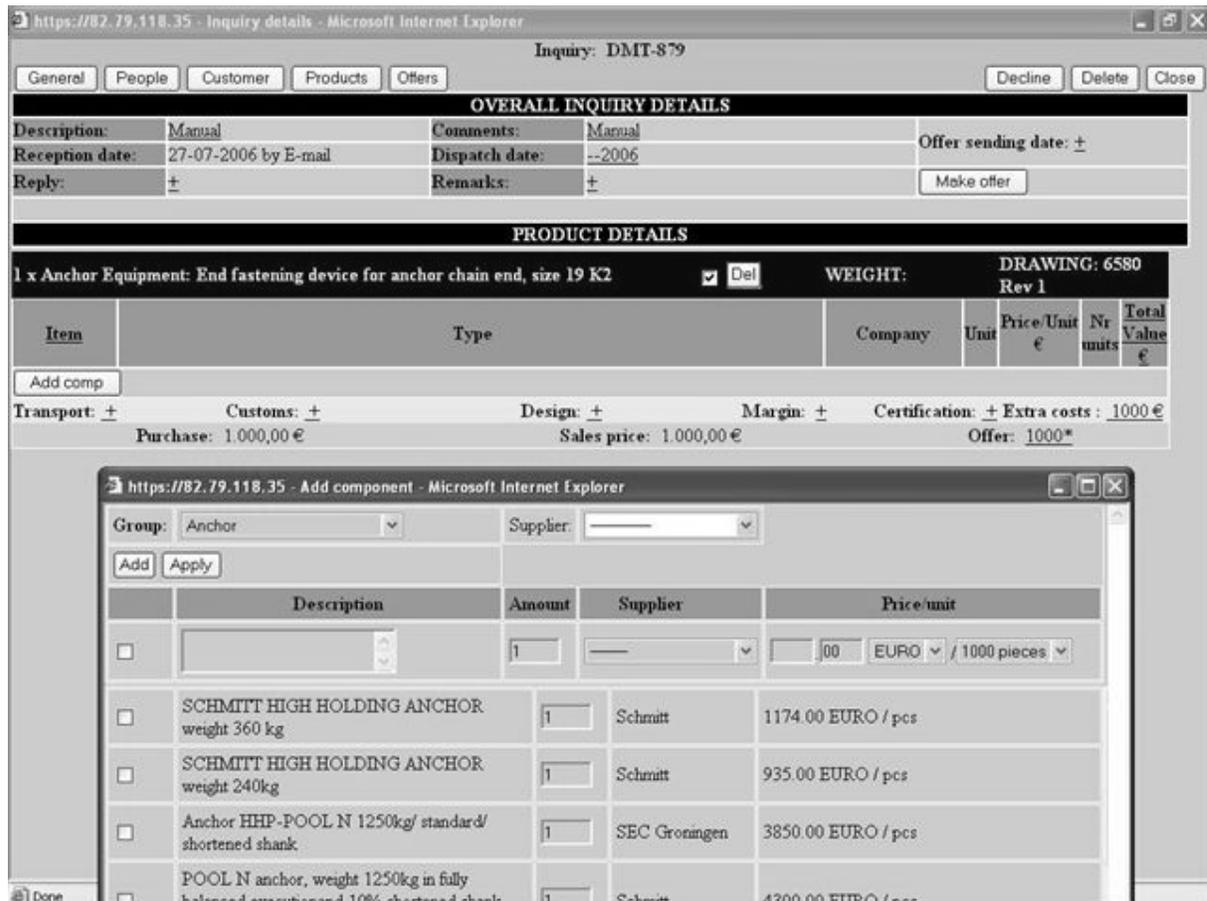
Picture 3: add component to product

Remember that you only have to add component for one product, no matter how many you products you added to the inquiry.

You see that you can choose the *component group* and the preferred *supplier.* This will automatically make a selection according to these choices. By clicking on a checkbox you're able to select the preferred component which will be added by pressing on [Add] or [Apply]. As an employee of Sales you will not have the ability to change the prices, you can only put in the quantity. If you don't know which component to use or what price it will have, use the upper-row in this component list. Mark the checkbox, enter a description, the quantity (in kg or pieces), the preferred supplier and the estimated price. The system will then enter this *general component* in the calculation.

There are all kind of groups defined where components are placed in. If you cannot find a component first look again in another group, than ask a colleague and otherwise enter just a *general component.*

Practice with the skill of finding and adding the components the way you want. It is an important skill to master and only practice will help you. Make for example a test-inquiry, and practice with it freely.

When you created a good calculation from the components, you can sort the component list by clicking on the headers in the table. For example, you can sort on value and on name. It is also possible to hide to component list. Try it out! It will make work easier when working with multiple products.

When you are finished with creating the preliminary part list, you can add all kind of other costs to the product.
Remember: you always need to consider the amount of identical products you are working with when adding these costs. This means you have to enter the total value for these costs for all identical products.[10] The costs are the following:

- *Transportation.* Three types of transport are defined to keep things comprehensible. *Inbound* logistics for all transport to Romania. *Outbound* logistics for all export from Romania and *Rest* which covers all transport where Romania is not intervening. Just enter the origin and destination, estimate the price and the system will add this to the purchasing price.
- *Design*: Enter a design-price/kg and the system will automatically calculate the costs of design, based upon the product weight. You can also add just an extra single value.
- *Customs*: Just enter the total expected value for customs.
- *Margin*: Based upon the rights you have to access this screen, you can add a certain margin on top of the product. You can also add a single value.
- *Certification.*
- *Extra costs.* In this screen you can enter the total value for unexpected costs, and the cost of capital. This value is calculated automatically by the system. You only have to add it.

In picture 4 you see an example of such a pop-up: the screen for entering design-costs.

---

[10] For example: you have 1 winch and you enter (an estimated) 75 euro for customs. Perfect! But when you have 3 identical winches and you think customs will take a total of 150 euro, enter this value. So remember: these are *total* prices!
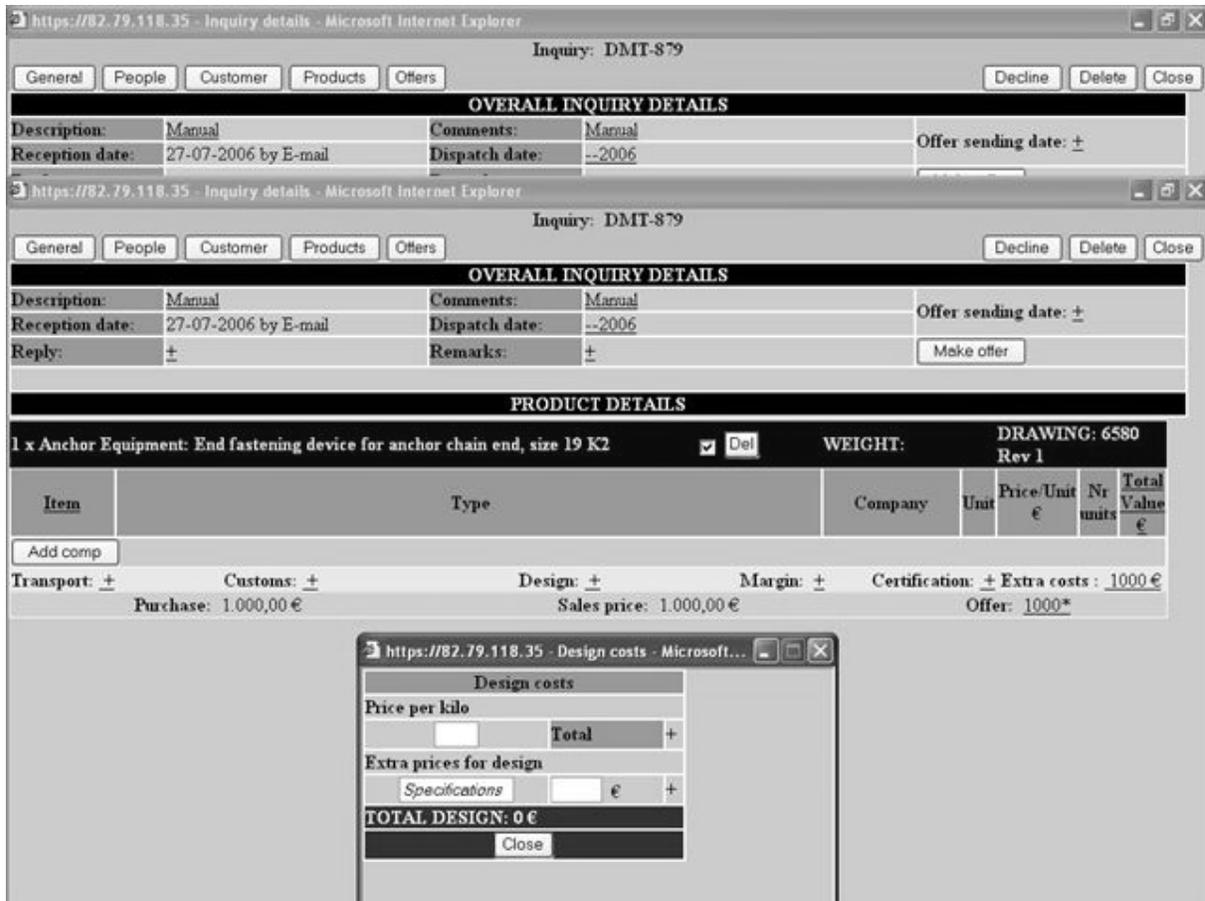
Picture 4: add other costs to product

Ok finished! You now see a purchase and sales price / item and you can modify the offer / item yourself. In this screen you can also add terms and dates of down payments. Down below in the main screen you see a total overview of the entire order. Satisfied? Press the [Make offer] button and you confirmed to the system that you send this configuration to the customer.[11]

You can now revise the offer the way you want it, of course depending on customer's specification, but using the methods as described above. Only remember to push the [Make offer] button on the moment you send a configuration to the customer.

After different revisions you may want to use products from previous offers. Of course this is possible. Just click on *Offers* in the inquiry main screen and you see the offer history of your inquiry. Look for the desired date, click on it and you will see the offer you made. You can select products and by pressing the [Add to current] button re-use these products. Also for this option counts: practice it!

Making an order
You have to make at least one offer before you are able to make an order from this inquiry. The rest is easy. After making your final offer, just click in the *Offer*-page (with the *Offer-history*) on the date you made your final offer. Your final project will appear, and in the top-right corner you'll see

---

[11] Every time you add something to the system or change a price, this is saved by the system. Therefore it is not needed to save your configuration by pressing the [Make offer] button.

a button with [Make order]. Click on this button and the following screen will appear (picture5)
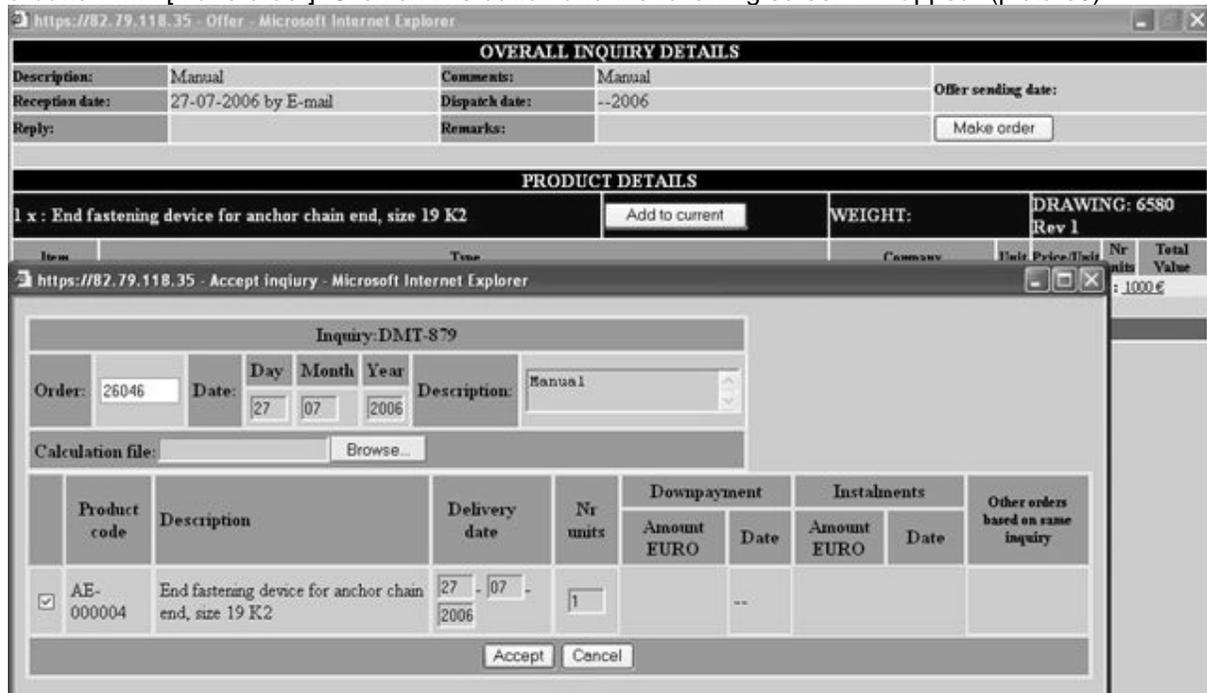
Picture 5: make order

You can use this screen select the products you want to have in your order, give an order number and delivery-date. If you press the [Accept] the order is created. **Don't press this button unless you are working with a "real inquiry", because orders cannot be deleted from the system.**

Let's delete this test-inquiry. Return to the main screen by closing all pop-ups you are in and verify you are in the *General*-screen of the inquiry. On the top-right corner of the screen you'll see a [Delete]-button. Just press it and your inquiry is deleted (and lost for always).

Working within an order
To see what you can do with orders in the system, read the chapter about the system basic structure but even better: just start working with the database when you receive a real inquiry from a customer.

When you create an order into the system from an inquiry, the total pre-calculation is copied to the order. From now on you can control the calculation by going into the order from the order list. Click on Processing / orders and you will see the order list. Click on the order-number you want information from and like this you can open the order. You will see a picture like this (6):

```
https://82.79.118.35 - Order details - Microsoft Internet Explorer        _ □ X
                              Order nr: 100011
[General] [Customer] [Products] [Revisions]                    [Cancel] [Close]
```

OVERALL ORDER DETAILS

x inquiry :	DMT-2004	Description:	testPieter
Order date:	2006-08-09	Remarks:	+

[Make revision]

PRODUCT DETAILS

x Anchor mooring winch: AMW-210-E36,k2 electric driven Forewinch-292 ☑ [Del] WEIGHT: DRAWING:

Item	Type	Company	Unit	Price/Unit €	Nr units	T Va
Bearings ⊗	6001	Rulm Com	pcs	1,14	1	1,1
Bush ⊗	algemene beschrijving	Adorian 2000	pcs	50,00	1	50,

[Add comp]

Transport: 500 €   Customs: +   Design: +   Certification: +Extra costs : 1000 € Purchase/item: 1.551,
        Margin: +   Sales price/item: 1.551,14 €   Offer/item: 1600*

x Anchor Equipment: End fastening device for anchor chain end, size 19 K2-293 ☑ [Del] WEIGHT: DRAWING:

Item	Type	Company	Unit	Price/Unit €	Nr units	T Va

[Add comp]

Transport: +   Customs: +   Design: 1000 €   Certification: +Extra costs : 1000 € Purchase/item: 2.000,
        Margin: +   Sales price/item: 2.000,00 €   Offer/item: 2000*

Picture 6: Order-calculation

You see that the order-calculation is in red, this is to emphasize the difference with the calculation in inquiry-phase. If you have major revisions you can do this here with the [Make revision] button on the top. This works exactly the same as with the [Offer] button in the inquiry calculation. **Remember: this order-calculation always resembles the contract with the customer. It is used as the basic for the after calculation, so <u>do not enter unexpected mishaps here</u>. This can be entered in after-calculation.**

This order-calculation works the same as the inquiry-calculation. In the other tabs for an order you can add and change a lot of variables. Try it! It is important you know what these variables do and how they work so test it out.

Purchasing components and saving a final product
After engineering defined the final product by making a drawing the final product can be ordered and purchased by the department of purchasing. They define the product by adding new components and replacing the components as you defined them before. Of course this happens on a special place inside the system and new within your calculation.

But because the department of sales also carries out some purchasing tasks you need to know how to purchase items officially according to the system. But of course, this is quite easy. Click on *Processing -> Orders* in the main screen (in the top-left corner). Now you get the total order-list. You can see a lot of information about the running orders.

There is one column with the products which are in an order. The name of the column is *Products / Status* and you can click on these products which are in. Find a specific order and click on a product. Do it! It will open a pop-up with all product-information, and different tabs on the top. You can see a components-tab. If you click on it you will see a screen like in picture 7.

The components which are directly from the pre-calculation are red in this component-list: if you change any variable or purchase them, they will become black. Later more about these actions. The department of purchasing is responsible to update this list to an exact copy of the parts list as

created by engineering, but Sales needs to purchase the components from some specific groups: for example the group of steel construction; find your steel-construction in this list and check if the characteristics like amount and description or supplier match your desired characteristics. If yes; the next step is adding and changing financial information. You can click on the *price* to change the price of the component for this order. If you negotiated about the price and received a lower price for it you can change it here. Next to the price you see the following columns:

- Total / amount: Total is the total quantity of identical components you are working with. Amount is the quantity of identical components which are in 1 product. Conclusion you are working with a *Total* number of identical components.
- (Down) payment. You can enter the amount of down payment and in which week DMT probably needs to pay this and the rest of the payment, and then press the plus button.

After this you can press the *Purchase*-button. The financial data is automatically copied to create the financial overview. Very helpful for other departments! You can always cancel the purchase or change the specific financial values: it will be updated automatically.

After some time your order is delivered, and your product is exactly defined as engineering drew it. In other words: it is time to save the product configuration. This is very easy.

Click in the order list on the specific order you want to open. Click on the products-tab. On the right you will see a *Configuration* column with a "Save" button. Click on it and all components as configured in the *Components-tab* are saved to the product, with some additional information like drawing number and so on. **Remember: a product has to be saved before you can re-use it in a new inquiry.**

This ends the tutorial. Noroc!

The tutorial for the department of purchasing

The department of purchasing forms the backbone of the information system by keeping track of the prices of the *free-supply* components.

Updating & adding components
In the main screen you see on the left the following buttons under *Databases:* Articles -> components. You will get a huge list of components, which you can sort using the buttons on top like "*Group*" and "*Supplier*". All kind of information is displayed, like supplier and price. The screen should look like this:

Picture 7: Component-list

If the price of a certain component is not updated for a certain time, it will turn red! So let's update a price. There are different opportunities to do this.

1) In the main screen you are in right now, you can just click on the latest price, and change it.
2) You can just double click on the date to the right, to set the time the latest date of price to today.
3) Click on the article-code. You will get a menu where you can also update all information.

As you can see; updating the information in the component list is quite easy. Adding new components is just as easy. In the main screen, just press the [add component] button, fill some details (quite clear) and the components will be entered in the system.
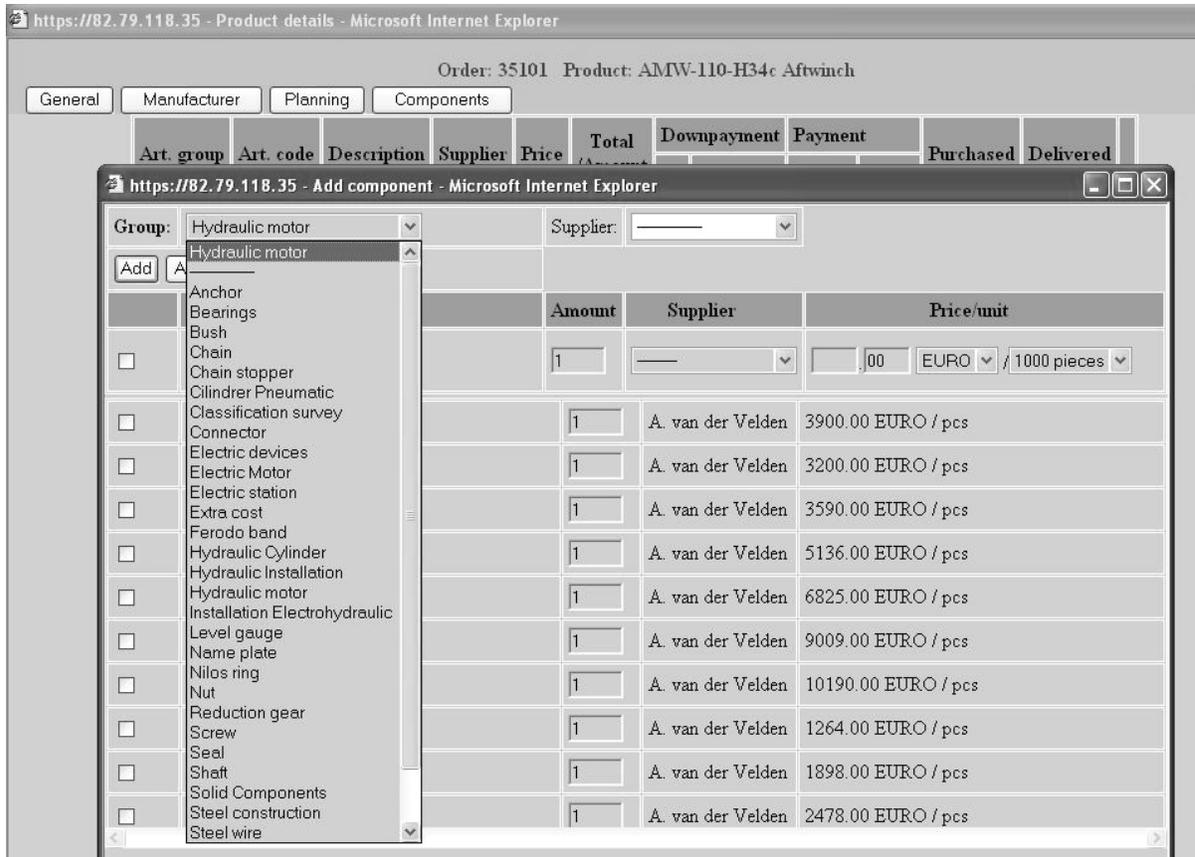
Adding components to an order
The second main task for the department of purchasing is adding components to ordered products and purchasing them. Of course, this is quite easy. Click on *Processing -> Orders* in the main screen (in the top-left corner). Now you get the total order-list. You can see a lot of information about the running orders.

There is one column with the products which are in an order. The name of the column is *Products / Status* and you can click on these products which are in. Find a specific order and click on a product. Do it! It will open a pop-up with all product-information, and different tabs on the top. You can see a components-tab. If you click on it you will see a screen like in picture 8:

Picture 8: overview of final components in order

It depends on the kind and history of the product how many components are in. Components included in an order during the making of a pre-calculation are copied automatically to this list. Therefore this list some does not resemble the final product. The components which are directly from the pre-calculation are blue in your component-list: if you change any variable or purchase them, they will become black. Later more about these actions; lets first find out how to add new components. The department of purchasing is responsible to update this list to an exact copy of the parts list as created by engineering. How you do that is quite easy; first click on the [Add] button on the bottom of the list. You will see the following screen:

https://82.79.118.35 - Product details - Microsoft Internet Explorer

Order: 35101   Product: AMW-110-H34c Aftwinch

[General] [Manufacturer] [Planning] [Components]

| Art. group | Art. code | Description | Supplier | Price | Total (Amount) | Downpayment | Payment | | Purchased | Delivered |

https://82.79.118.35 - Add component - Microsoft Internet Explorer

Group: [Hydraulic motor ▼]   Supplier: [——— ▼]

[Add] [A...]

Hydraulic motor
———
Anchor
Bearings
Bush
Chain
Chain stopper
Cilindrer Pneumatic
Classification survey
Connector
Electric devices
Electric Motor
Electric station
Extra cost
Ferodo band
Hydraulic Cylinder
Hydraulic Installation
Hydraulic motor
Installation Electrohydraulic
Level gauge
Name plate
Nilos ring
Nut
Reduction gear
Screw
Seal
Shaft
Solid Components
Steel construction
Steel wire

	Amount	Supplier	Price/unit
☐	1	———	[ ].00 EURO ▼ / 1000 pieces ▼
☐	1	A. van der Velden	3900.00 EURO / pcs
☐	1	A. van der Velden	3200.00 EURO / pcs
☐	1	A. van der Velden	3590.00 EURO / pcs
☐	1	A. van der Velden	5136.00 EURO / pcs
☐	1	A. van der Velden	6825.00 EURO / pcs
☐	1	A. van der Velden	9009.00 EURO / pcs
☐	1	A. van der Velden	10190.00 EURO / pcs
☐	1	A. van der Velden	1264.00 EURO / pcs
☐	1	A. van der Velden	1898.00 EURO / pcs
☐	1	A. van der Velden	2478.00 EURO / pcs

Picture 9: adding components

You see that you can choose the *component group*, the preferred *supplier.* This will automatically make a selection according to these choices. By clicking on a checkbox you're able to select the preferred component which will be added by pressing on [Add] or [Apply]. There are all kind of groups defined where components are placed in. If you cannot find a component first look again in another group, than ask a colleague and otherwise enter a new component to the list. Practice with the skill of finding and adding the components the way you want. It is an important skill to master and only practice will help you.

When you created a complete list of all components, you can sort the component list by clicking on the headers in the table. For example, you can sort on name and on the component-group.

Remember: it is very important to fully build up the products from the components. The department of Sales is able to save this information in a product, so it can be re-used in next orders. You will only have to do it once!

The next step is adding and changing financial information. You can click on the *price* to change the price of the component for this order. If you negotiated about the price and received a lower price for it you can change it here. Next to the price you see the following columns:
- Total / amount: Total is the quantity of identical products you are working with. Amount is the quantity of identical components which are in 1 product. Conclusion you are working with a *Total* number of identical components.
- (Down) payment. You can enter the amount of down payment and in which week DMT probably needs to pay this and the rest of the payment, and then press the plus button.

After this you can press the *Purchase*-button. The financial data is automatically copied to create financial overview. Very helpful for other departments! You can always cancel the purchase or change the specific financial values: it will be updated automatically.
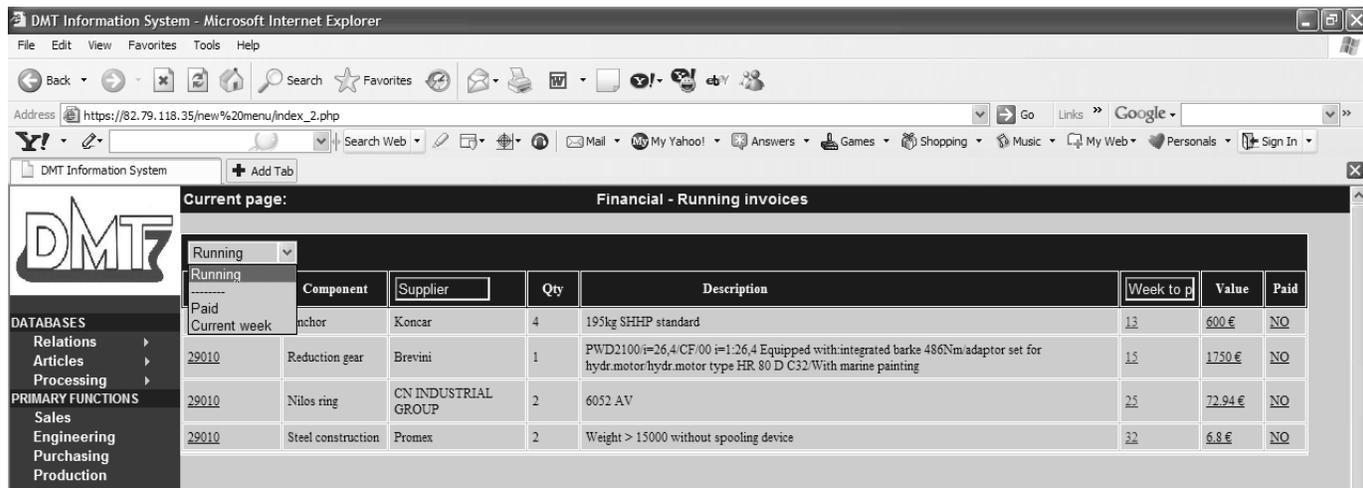
This ends the tutorial. Noroc!

The tutorial for the department of finance

Welcome to the DMT Information System! As a user from the department of finance you can extract valuable information from the database. Currently there is only one function in the system: the forecast of the costs of purchasing.

The forecast of coming cashflows
When the department of purchasing buys certain goods they also fill in some financial details. Let's show you how you can use this information. First, log in the database and look in the left-margin for the following buttons: *Financial-> Incoming invoices.* Click on it and you'll see the screen as in the following picture:

Picture 10: Running invoices

Every invoice has a status. "Running" means that the goods are purchased and an invoice is coming or waiting to be paid, and "paid" means that an invoice is paid and can be considered history. Let's go back to the screen. It is a very basic system but it has quite some (more or less hidden) functionalities. Therefore it is more or less a list. Excuzes-moi, but try to find each point I mention: it will really help you in your future-work.

You see different columns with different headers. Every row represents one component of an invoice. You can match the invoice to the row by looking at the order number and the supplier of the goods.
The other columns are:
- *Quantity:* the amount of components ordered
- *Description*: description of the components.
- *Week to pay*: The week in which you probably need to pay the components. It is an estimation, done by purchasing.
- *Value:* The amount of money you have to pay, in euros (without TVA)
- *Paid:* Under this header you find a button. If you press this button the status of the invoice changes from "running" to ""paid".

There are small other functions in the system. Try them!
- If you hold your mouse-pointer on the order number, you'll see the product it will be in for DMT.
- If you hold your mouse-pointer on the week to pay, you see the purchasing date.
- If you hold your mouse-pointer on the value, you'll see if it is a down-payment or not.
- Invoice which already passed their due-date turn red in the screen.

- On the top of the screen is a "to lei with TVA" calculator.

Imagine you have an incredible long list of invoices with different order numbers or suppliers. You just select on order number by typing it into the order-header of the table and if you click on the "supplier" you can just select it from the total list.
This ends the tutorial. Noroc!

The system's basic structure

The most important parts in the system are the databases. How you can work with them is explained below.

Relations
The relations databases contain information about relations from DMT, on supply- as well as demand site. The structure of the databases is the same for all of the relations.
- To add a relation, click the *Add [relation]* button, fill in the fields and after clicking the *Add* button, the total pop-up appears with the newly made relation.
- In the main screen there is a table with the basic information of a relation, of which the website is clickable to open the company website.
- With the search field, you can search for general terms in the specific database. A pop-up with the results (companies or contact persons) that match will appear.
- Every relation (company name) can be clicked for a pop-up with several tabs and functions. There are three main tabs, which return in every type of relation:
  - *General* contains general contact information for the relation and some remarks.
  - In *Contacts* you can add and delete contact persons for this relation. It is also possible to make a user account for contact persons, as external users. The rights for these users and an interface to logon need to be added later, as external use of the system was not one of the objectives.
  - In *Documents,* you can add document related to this company, like contracts or for instance price lists.

Customers
Specific tabs for the customers' pop-up are:
- *Inquiries*, where all inquiries done by this customer can be found.
- *Orders,* where all orders placed by this customer can be found.

Manufacturers
Specific tabs for the manufacturers' pop-up are:
- *Specs*, where typical specifications of a manufacturer can be checked, in order to make it easier to find a suitable manufacturer for some products.
- *Products,* where all products can be found that this manufacturer has produced (or is producing).

Suppliers
Specific tabs for the suppliers' pop-up are:
- *Components*, where can be found what components this supplier is able to deliver.

Articles
In the article databases all products and components that build these products (and are bought by DMT) can be found. Some general remarks are:
- All articles are divided in groups, to make it easier to find them back. To add, delete or update groups, you can click on the *Groups* button. Here all groups with their symbols can be found.
- To add a new article, you can click the *Add [article]* button. After it is added, the article pop-up will appear.
- Also here is a search function for the article databases, in order to find articles that match with the typed text. A pop-up with the search results will appear.

Products

In the main screen all products with some general information can be found. Important about this database is that these are only **standard products**. These products can be added to one or more inquiries or orders, in which they can be changed locally. This database just makes it easier to handle products, because it is not necessary to make ever product for an order in the system. It also goes the other way around: if the product is changed locally, this will not change in an order.

The product description is clickable to open a pop-up. The tabs and a specific function will be described below:

- *General* displays the general information about the product. This information can be changed and updated. A product can have more drawings, which can be added and deleted.
- *Components* shows all the components of which this product consists. Components can be added and removed easily.
- *Orders* shows the orders in which this (standard) product is used, so it is easy to find how many of that product have been sold before.
- *Copy*. This function can be used to make a comparable product. This means that all components of the current product are transformed to a new one, with a different description, different drawings and a different weight. Afterwards the components can be changed too.

Components

The component database is a little more complicated as one component can be delivered by many suppliers, against different and even changing prices. For the Sales department these prices are relevant to make the calculations.

The pop-up, available after clicking the component description, contains the following tabs:

- *General* containing general information about the component, including the latest price per unit (which is chosen in the same screen).
- *Suppliers* showing all suppliers that can deliver this component, with their latest price. A mouse over *prices* will show all historical prices of this supplier.
- *Products* shows all **standard** products in which the component is used.

Another pop-up appears when the latest price in the main screen is displayed. Here all historical prices are displayed. In this screen it is also possible to delete prices.

To add a new price (from a random supplier), the '+' in front of the latest price should be clicked. Now the price, currency, date and supplier can be filled, to add a new price.

The last function is in the last column of the main screen. All prices have a date, because people should not work with outdated prices. When a price is older then three months, this date will appear in red. A new price should be entered. But when the price and supplier are still the same, it is also possible to double-click the green 'V', in order to update the latest price date in the date of the current day.

Stocks

The stocks function is not made yet, as DMT strives to work with a stock as small as possible. But when the amount of orders is growing, more components are to be ordered and it can be useful to buy larger amounts to gain discounts. Therefore this will be a functionality to be added later on in the further development of the system.

Processing

After describing the functionality of all the side-databases, we go on with the two most important databases containing the process data about Inquiries/Offers and Orders. Those two databases actually bring together all others. Also in these databases there is a search function to search on relevant entry fields.

Inquiries/Offers

Inquiries/Offers displays all correspondence with (possible) customers, who are probably willing to buy products from DMT. An inquiry can have several statuses:

- Running: this is an inquiry for which DMT needs to make and send an offer.
- Pending: DMT sent an offer and is waiting for a reply from the (possible) customer.
- Declined: an inquiry becomes declined when a customer decides not to take the offer.
- Ordered: when one or more orders appear from an inquiry, the status of it becomes ordered.

With the selection in the right upper corner, you can choose which inquiries/offers you would like to see. There are many ways in ways the status of an inquiry can change from one in another. This will become clear below.

An inquiry can be added with the *Add inquiry* button. There some fields can be filled, with general information, the customer and two dates: the reception date (on which the inquiry was received) and the dispatch date (when the salesperson is supposed to send an offer). The status becomes Running and the pop-up with the newly made inquiry becomes visible.

In the main screen the basis information appears in the table. The inquiry number can be clicked, to open a pop-up. The pop-up has the following tabs:

- *General*: the general information is displayed and can be updated. Remarkable are the possible status changes: if the offer sending date is filled (and updated) the status changes to Pending. Later on this can be changed back to Running again, when you change the dispatch date again.
- *People*: the responsible employees for this inquiry for Sales, Engineering and Purchasing can be selected.
- *Customer*: contact information for the customer is displayed. Next to that a contact person for this inquiry can be selected. If no contact person is defined for this customer, you can add one from this database, which will of course also be visible in the relations database.
- *Products*: in this section all products that the customer would like to have can be added, with the *Add* button. A preferred manufacturer can be selected (visible at mouse-over the description), the required drawing can be added and changed, the classification that the customer asks can be seen and the amount of products can be set. This is only useful when it is about one project. If there are more of the same products with different (preferred) delivery days or manufacturers, you should add one more product row. Also the dimension, estimated time of delivery, weight and destination can be added to create input for the calculation module (these are transportation-parameters)
- *Offer-history:* Every offer made is saved together with the date of offering in to this section. Specific products from history can be selected and re-used again from this screen with the button" add to current".

Calculation-module.

By adding products to an inquiry, it is possible to calculate the offer-price. When these products are produced for the first time by DMT, it is needed that these products are defined by the "*add com."* By pushing this button the different components can be selected and added to the product and inquiry. When products are re-used, they will re-use the components used before. Prices are then automatically updated to the latest developments, and not updated prices will turn red. But caution is still required when re-using products: always check the specifications of a product!

The following buttons also need input to complete the offer price. Pressing them creates a pop-up with the following fields to fill:

- *Transportation.* Three types of transport are defined to keep things comprehensible. *Inbound* logistics for all transport to Romania. *Outbound* logistics for all export from Romania and *Rest* which covers all transport where Romania is not intervening. Just enter the origin and destination, estimate the price and the system will add this to the purchasing price.

- *Design*: Enter a design-price/kg and the system will automatically calculate the costs of design, based upon the product weight. You can also add just an extra single value.
- *Customs*: Just enter the total expected value for customs.
- *Margin*: Based upon the rights you have to access this screen, you can add a certain margin on top of the product. You can also add a single value.
- *Certification.*
- *Extra costs.* In this screen you can enter the total value for unexpected costs, and the cost of capital. This value is calculated automatically by the system. You only have to the duration of the project from order-moment till delivery.

Provided with these cost-drivers the following totals are calculated automatically:

Purchasing price / unit =   total price all components + transport + design + certification + customs
                            fee
                              + unexpected.
Sales price / unit=   total price all components + design + unexpected + margin (over the
                            costdrivers specified before) + certification + transport + customs fee.

The checkboxes provided combine the different values of the purchasing and sales prices to some total order values for purchasing and sales when checked. It is also possible to sort the component-list by clicking on the Item or price/item header. Collapsing and expanding this complete component-list is possible by clicking on the product name.

Next to the calculation-information every product has a status: Active, Optional (when it is not sure if this order can be ordered) and History (when things changed in the inquiry). Next to that new products can be added and existing can be removed. To add a product it is required that the standard product is available in the product database.

The three specific functions for an inquiry are the following:

- *Make offer:* this buttons opens a new pop-up which gives the message that the current offer (product configuration) is saved to the offer-history, with the date of offering. From the offer-tab an order can be created with the next button:
  - o *Make order:* this buttons opens a new pop-up in which a new order can be made, with an automatically generated order number. The description field is copied from the inquiry, but can be changed. When making the order, it is possible to upload the calculation file, as it can be useful for the Purchasing responsible how much is calculated for every component. Most important in this screen are the products that go into the order (which can each be seen as a project, with a separate planning), and for which the delivery date should be set. The active ones are checked automatically, the optional ones can be checked if necessary and you are not able to check the historic ones. After the order is made, it appears in the order database and the status of the inquiry becomes Ordered, which cannot be changed anymore. The amount of products ordered, is taken from the amounts in the inquiry.
- *Decline:* this button declines the inquiry, after agreeing, when a customer decides that it does not want the offered products/prices. The status of the inquiry becomes Declined. It remains possible to make an order, if the customer asks for this later, status then changes in Ordered (and is not changeable anymore).

Orders

In the order database all the orders are stored, containing all one or more product (series), which are actually kind of projects. Every project has its own planning, with different delivery dates and the possibility to work with different manufacturers. This means that there are two kinds of pop-

ups: one for general information about the order and one or more others for the products (series) or projects.

These can both have different statuses that are linked to each other. An order can have several statuses:
- Running: this is an order for which the process is going on at the moment.
- Delivered: an order for which all products are delivered, gains the status delivered.
- Cancelled: it is possible that the customer (for some reason) cancels the order.

In the selection field on the upper right corner you can choose which orders you would like to display. But not only orders have a status. Also a product (series) has several statuses, which are described below. How statuses can be changed will be described later.
- Engineering: a product for which a design is being made by DMT at the moment.
- Preparation: the period between the Engineering (deadline) and the starting date of the production, which can be used for purchasing the components (although there is more time for that, in Engineering phase, for components that are already known, as well as during Production, for components that are needed later).
- Production: this means that the product (series) is in production at the moment.
- Testing: the product gets tested, transported and delivered.
- Delivered: the product is delivered at the customer.

The two main pop-ups in the order view can be displayed by clicking respectively the order number and the product (series) in the main screen. Those two will be described now.

The order pop-up resembles an inquiry pop-up, as some of the tabs are the same:
- *General*: the general information is displayed of which parts can be updated. The calculation file, which could be uploaded while accepting the inquiry, can be seen from this screen.
- *Customer*: contact information for the customer is displayed. This information is copied directly from the inquiry. The contact person can be changed with the *Update* button, if necessary.
- *Products*: in this section all products that the customer would like to have are shown, with some additional information. Just as in the main screen the product description is clickable for the product in order pop-up.

There is one function for an order:
- *Cancel:* with this button you can cancel the order, if the customer or DMT decides to for some reason. The status of the order will change from Running to Cancelled.

The product in order pop-up contains kind of a project, and has the following tabs:
- *General:* the general tab contains general information about the product, from description to drawing and from status to amount. Also an overall responsible for the 'project' can be chosen there. When the component list is extensive, a free supply file can be uploaded to the product.
- *Manufacturer:* this tab contains contact information about the manufacturer. In this screen the contact person can be chosen and updated. If the manufacturer changes, this has to be chosen in the order pop-up, described above.
- *Planning:* the most important tab of the product in order is the planning, where the planning for the project can be made and which displays alerts if deadlines are about to be broken. To make this planning the important dates: Engineering deadline, In Production date, Production finishing date and Delivery date should be filled.
The initial status of a project is Engineering, which should be finished before the Engineering deadline. If this date is not reached, the Engineering deadline date in the planning tab appears red. When the Engineering is finished you can check it and the status changes to Preparation, when it is before In production date and to Production when it is after the In production date. The purchasing should be finished as soon as possible. To show this in the system, all components shown in the Components tab,

which will be described below, should be Purchased and Delivered. If purchasing is not finished before production has started, the In production date appears in red. If the purchasing is finished and the Production finishing date is nearing three days, the date appears in blue. When the deadline is not reached (so the Production is not checked, while it is after the deadline), it appears in red. For Delivery of the product (series) the same goes: the deadline should be met, otherwise the deadline will appear in red. The alerts are although not only visible in the Planning tab. Also in the main screen the product appears in a certain colour if there are alerts.

The last important part of the Planning tab is the overview of responsible employees. The responsible people for Sales, Engineering and Purchasing are copied from the inquiry and the overall responsible is also visible in the general tab.

Furthermore some remarks about the planning and progress can be made in the special field and updated with the *Update* button.

- *Components:* in the last tab of the product in order, the components from the standard product (from the product database) are shown. Components can be deleted and added to the local product easily: the **standard product in the product database will not change due to these actions**! When a component is purchased and/or delivered, the corresponding checkboxes can be checked. When all are checked (or when there are no components), the purchasing is finished, which can be seen in the planning.

    By adding components also financial information is supplied to the department of finance.

When all products (series) in an order are delivered, the status of the complete order turns into Delivered. From then a new tab appears in the order pop-up, for *After Sales*. In this tab a new problem can be added, with some extra information about warranty, estimated and actual costs.

Primary functions

In the primary functions part of the system, information relevant for several departments in the primary process is shown. The screens resemble the database screens, but the tables have different columns, only containing information that is relevant for the concerning department. Also in these tables the relevant entries are clickable to open a pop-up.

Sales
In the Sales overview you can see almost the same as in the inquiry overview, but with some extra functionality. There is a row in the table that shows the sales responsible and with the filter you can show the inquiries you want to show for the defined responsible.

Engineering
In the Engineering overview you can see all products that need to be designed at the moment. Those are sorted on the Engineering deadline, as set in the planning tab of the product in order pop-up. Here it is also possible to upload the file with the free supply components.

Purchasing
For the Purchasing overview, all products that are in Engineering, Preparation or Production phase and for which not all components are bought yet, are shown in the table.

Production
For the Production overview, all products that are in production are shown.

After sales
The orders for which there were after sales problems that had to be solved are shown in this table. For After Sales there are three types of status: Research, Pending and Solved.

Supporting functions

The supporting functions part of the system contains information that is useful for those departments. At the moment most of these pages are not finished yet. Only for HRM some pages are ready to use. These will be described below.

HRM

In the HRM part of the system all employees are stored, and there is a page for the user administration, which contains all users for the system, their sources and their types (with the corresponding user rights).

Employees

The employee database contains information about all employees from DMT. This means that personal information can be stored there, as well as company related information.

- To add an employee, click the *Add [relation]* button, fill in the fields and after clicking the *Add* button, the total pop-up appears with the newly made relation. Employees become a user in the system automatically, if the type is chosen and a password is set.
- In the main screen there is a table with the basic information of the employees, with a clickable e-mail address and a telephone number.
- With the search field, you can search for general terms in the database. A pop-up with the results that match will appear.
- Every employee (user name) can be clicked for a pop-up with several tabs and functions. There are two main tabs:
    - *General* contains general contact information for the employee.
    - In *DMT* some company specific information can be stored, for instance about the job description: tasks, responsibilities and competences can be added. Another important field is the type: here the user type is defined, with which one can enter the system.

User admin

In the user administration the different users are stated and the rights they have. These rights are defined for every type of user. Many people can use the system, for which different sources are available:

- <u>Employee:</u> All employees are a user of the system automatically, when their type is defined. So when an employee is added to the database, it becomes a user also.
- <u>Relation:</u> Next to employees, also relations can become a user of the system. These users will have no rights for the moment, but in the future it can be possible to let customers or suppliers enter the system, where relevant information for them will be shown. To become a relational user, one should be contact person for one of the relations. They can be made user with the *Make user* button in the *Contact* tab of a relation.
- <u>External:</u> Next to employees it is possible to make extra (or external) users, which can have every type of rights. To add an external user, you can click the *Add external user* button in the main screen of the user admin page.

In the user administration all users are displayed, with their Source (Employee, Customer, Manufacturer, Supplier or External), their type, which restricts the user rights, and their function (if known). The most important is to set the proper rights for every type and to set the right type for every user. The types can be seen and changed with the *User types* button. A pop-up appears in which all types can be seen. A new type can be added there and the current types can be seen. When clicking on one of the buttons, a huge pop-up appears with all the user rights. The meaning of the small descriptions is described in table 12

Type	Group	Database	Function/right
Databases	*Relations*	Customer	Access
			View pop-up
			Add/Delete customer

			Update general
			Add/Delete/Update contact
			Add/Delete/Update document
			View inquiries
			View orders
		Manufacturer	Access
			View pop-up
			Add/Delete manufacturer
			Update general
			Add/Delete/Update contact
			Add/Delete/Update document
			View specs
			Update specs
			View products
		Supplier	Access
			View pop-up
			Add/Delete supplier
			Update general
			Add/Delete/Update contact
			Add/Delete/Update document
			View components
	Articles	Products	Access
			View pop-up
			Add/Delete/Copy product
			View groups
			Add/Delete/Edit groups
			Update general (incl. drawing)
			Add/Remove Components
			View orders
		Components	Access
			View pop-up
			Add/Delete/Copy product
			View groups
			Add/Delete/Edit groups
			Add/Delete/Update prices
			Update general
			Update favourite supplier
			View products
	Processing	Inquiries/offers	Access
			View pop-up
			Add/Delete inquiry
			Make/Decline inquiry
			Update general (incl. dispatch date)
			Update people
			Update customer
			Add/Remove/Update products
		Orders	Access
			View pop-up
			Cancel order
			Update general
			Update customer
			Add/Remove/Update products
			Add/Update After sales
		Product in orders	View pop-up
			Update general
			Update manufacturer
			Update planning

			Add/Remove/Update components
Primary functions	*Sales*		Access
	Engineering		Access
	Purchasing		Access
	Production		Access
	After sales		Access
Supporting functions	*HRM*	Employees	Access
			View pop-up
			Add/Delete employee
			Update general
			Update DMT
		User admin	Access
			View pop-up
			Add/Delete users
			View types
			Add/Delete/Update types
	Finance		Access
Management	*Key figures*		Access
	Product overview		Access
	Settings		Access
General	*Home*		Add/Delete news

Table 13: User rights explanation

Finance
Currently only one function for the department of finance is in the system. Employees can see the ordering value for all components being ordered by the department of purchasing. This is a real time overview (as long the department of purchasing keeps this up-to-date). An employee can push a button by which they can pinpoint they paid this bill. The system then changes the status of an invoice to paid. Different invoices statuses exist: paid, running and current.

Management

Key figures
On this page some relevant statistics can be shown, like for instance: the inquiry hit rate, the generated turnover and so on.

Product overview
At the moment the overview of orders is only displayed in a table. It can be relevant to have a visual overview of all running orders or products in orders. This page can be used for that.

Settings
In the current release of the system, most of the settings are inside the system, for instance the time for component prices to be old, or the time in which an alert should appear. For one formula already the settings are editable by management, this is for the cost of capital formula. Only manager Ter Schure has access to the settings. Also the setting for adding the right to see confidential information is currently in the system.

General

In this part of the system, some general functions are placed, to be used by every user. Only a short description is necessary, as this part is very easy to use.

Home
Returns you to the home page, where the DMT design newsletter can be found. Everyone who is interested can post his or her news here.
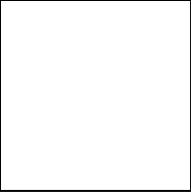
Search
The search page is not finished yet, but on this page there will be a possibility to search in all databases at once and a method to search advanced in the separated databases.
Logout
When *Logout* is clicked, you will be logged off from the system. No information will be available anymore, until you sign in again.

Switch user
With the *Switch user* function, you can logon as a different user. When you logged yourself out by mistake, you can logon again via this function.