Foreword

You are reading the first page of my report about packaging materials used at Impress. Some of you might know Impress as a producer of packaging materials, namely cans, and think that the cans will be the subject of this research. Wrong!

The subject of this research is the packaging materials used to transport the cans to the customer; it is about pallets, layer pads and frames. No big deal, you would think. That is what I thought at the beginning as well, but it turned out to be quit different.

A special department of Impress, called MEET, is responsible for the handling of the packaging materials for Impress facilities located in the Netherlands. In this report you can read about the costs of the packaging materials and about ways to reduce these costs.

To be able to do my research, I received a lot of information from employees working at the department responsible for packaging materials. Therefore, I would like to thank all employees of the packaging materials department and especially R. Klunder, H. Feenstra and A. Dijkstra.

I would also like to thank my supervisors from the University of Twente, S. Morssinkhof and W. Bandsma for their help and support.

Last but not least I would like to thank P. Woodruff for improving the usage of the English language in this report.

I hope you will enjoy reading this report.

W. Diepenmaat
Enschede, August 2008.


Impress

Management summary

This is a thesis report of a research conducted at a special department of Impress, namely MEET (Magazijn Emballage Expeditie Transport). MEET is responsible for the handling of packaging materials of Impress' production departments located in the Netherlands. The goal of this research is to provide management of MEET with information about their current cost position and to identify options to reduce costs.

To be able to provide management of MEET with information about their cost position, the current process and current cost price calculation were analyzed. The current process was described with the help of flow charts.
The currently used cost price was calculated several years ago by an employee of Impress. Because of several shortfalls of this cost price calculation a new cost price per trip per type of packaging material was calculated during this research with the help of Activity Based Costing (ABC).

With ABC costs of MEET are first linked to activities executed at MEET and via these activities to the different types of packaging materials.
Data used to calculate the ABC cost prices was verified and the ABC cost price was compared with the current cost price and the current trip price.
While verifying the data used in the calculation it appeared that three types of packaging materials are sensitive to changes in input-parameters.
The current arrangement of activities and allocation of costs is considered reliable and valid.

The second part of this research is about the reduction of costs. Per activity options to reduce costs were identified. Per identified options the yearly savings the option generates and the needed investment were calculated.
For the fourteen options that generate savings the impact of the introduction of the option was also described. A difference was made between options that only have an impact on MEET and options that also have an impact on other departments of Impress or on customers.

The fourteen options were ranked with the help of two investment appraisal methods. The first investment appraisal method uses as main criterion the payback period, the second the Net Present Value.

The ranking of the two methods is generally the same, the main difference is that some options should not be implemented according to the payback period and should be implemented according to the NPV method. It is up to the management of MEET to decide which method is used. However, according to the theory, the NPV method is preferable to the payback period.


Impress

Table of contents

1. Research Project

This chapter provides some basic information about the organization where this research is executed and it describes the goal of this research and the research approach.

1.1. Impress[1]

Impress is an international can manufacturer that designs, makes and sells metal cans. Cans are produced in many shapes and sizes, in steel and in tinplate, in three piece and two piece construction and in stackable or nestable designs depending on the needs of the customer and the market.
Impress also produces can ends, partial aperture openings have been developed for liquid products such as evaporated milk. The range of Easy Peel® Ends brings added convenience to an increasingly wide variety of products, both dry and processed. Direct Peel® ends provide cost effective solutions for dry powdered products.
All these cans and ends have to be transported to the customer with the help of packaging materials. In the Benelux, MEET (Magazijn Emballage Expeditie Transport), a 100% subsidiary of Impress, is responsible for the handling of packaging materials.

1.2. MEET (Magazijn Emballage Expeditie Transport)

The core products of MEET are packaging materials. MEET is a service department; its goal is to provide the production departments with packaging materials that fulfill the quality restrictions, at the right time and for the lowest costs. Furthermore, MEET, as a department, has a social function. Employees who are no longer able to do their current job are transferred, if possible, to MEET.
MEET is responsible for the handling of packaging materials of Impress' production departments located in the Benelux. MEET has three sorting units located in Deventer, Leeuwarden and Hoogeveen.

- Packaging materials of Hoogeveen are used to transport cans and ends produced for the diary industry. Packaging materials need to be clean and of high quality. Hoogeveen uses therefore only the so called first quality packaging materials.

- Second quality packaging materials are used in Deventer. Here are cans and ends produced for the preserved food industry.

- Leeuwarden produces cans and ends for the chemical and aerosols industry. Low quality packaging materials are used, the so called third quality packaging materials.

A quality manual has been written with the quality restrictions for first, second and third quality packaging materials, so each employee of MEET knows when a packaging material belongs to a specific quality group.

[1] www.impressgroup.com

To transport the cans and ends to the customer, different types of packaging materials are used, like pallets, layer pads and frames. MEET uses more than 110.000 pallets, 1.800.000 carton layer pads and 90.000 frames, these packaging materials are used several times per year. 19 FTE's are working at MEET to guarantee that there is always enough packaging material available for the production departments.

The packaging materials are inventories of MEET. The value of the assets was in 2007 €146.000, the value of the inventory was €1.700.000[2]. Because it is impossible to value each packaging material separately, it is assumed that on average the packaging materials are worth half of the purchase price. The value of the inventory is therefore 50% of the purchase price of the packaging materials times the number of packaging materials owned.

The costs occurring in the handling and purchasing of the packaging materials have to be paid by MEET. Income is generated by fees which have to be paid by the customer every time a packaging material is used for transport, the so called trip price. These customers have to return the packaging material to MEET.
If packaging material is transported to other facilities of Impress (the so called inter-company deliveries), the packaging materials are sold.

MEET can be considered as a revenue centre for Impress for two reasons. First, the management is held accountable for the number of packaging materials that are sorted and second, the management is also accountable for the sorting expenses, such as the wages of the employees, but these costs are only a small part of the total costs of manufacturing and selling the cans.
If MEET wants to invest, it has to request the investment officially. An investment budget has to be requested, this request is judged by a special department of Impress. The main criterion to appraise investment on is the pay back time of the investment.

In this research the current cost position of MEET is analyzed and options to reduce the costs of MEET are identified. The way this research is conducted and composed is described in the next section.

[2] Layer pads are not included on the balance sheet, because the total value of this type of packaging material cannot be estimated reliably (according to the accountants and bookkeepers of Impress).

1.3. Research Objective

1.3.1. Problem description

The main reason for this research is that the total costs of the packaging materials used at Impress need to be reduced. A decade ago packaging material was of subordinated meaning for Impress. It had to be there when the production department needed it and the costs did not matter.
In recent years, however, new competitors have entered the market. Globalization gave competitors the possibility to enter the home markets of Impress. As a consequence, Impress needs to reduce its costs. MEET, as a 100% subsidiary of Impress has to reduce its costs as well.

1.3.2. Research question

The problem described in section 1.3.1 leads to the following research question:

What are the current costs per trip for MEET per type of packaging material
and
how can these costs be reduced?

To answer this research question, the following sub questions need to be answered.

1. What is the cost price of the different types of packaging materials per trip?
    - 1.1. What is the physical flow of packaging material and how can it be described (section 2.2 and 3.1)?
    - 1.2. Where in the flow of packaging material occur costs of MEET (section 4.1)?
    - 1.3. What other costs does MEET make, like building costs or management costs (section 4.1)?
    - 1.4. What are the different costing systems and which one should be used in this research (section 2.3)?
    - 1.5. How can costs be assigned to packaging materials and trips (section 4.3 till section 6.3)?
    - 1.6. How robust and reliable is the new cost price calculation (section 7)?

2. How can the costs of MEET be reduced?
    - 2.1. Which possible options to reduce costs can be identified (section 8)?
    - 2.2. What is the impact of these options on MEET, other Impress departments and customers (section 9.1)?
    - 2.3. What is the ranking of the identified options if Impress' criteria are used (section 9.2)?

2.4. What are the different investment appraisal methods and which one should be used in this research (section 2.4)?
2.5. What is the ranking of identified options if the NPV method is used (section 9.3)?

In the next section the scope of this research is described, so it is clear to all parties what possibilities and exceptions are included and excluded in this research.

1.3.3. Scope

The following restrictions are not included in this research. However, it could well be that money can be saved by changing one of the following premises. The restrictions can therefore be subjects of further research or can be an option to reduce costs.

Only costs of MEET
Only costs occurring at MEET are taken in account in this research. Costs made by the production departments due to handling of packaging materials are not included in this research. Transportation costs of transports from customers located outside the Benelux to MEET are not included, because these costs are paid by the production departments.

Allocation of costs that cannot be influenced
MEET pays Impress for supporting activities, like controlling, support of Human Resource Management and support of the Information Technology department. These costs are allocated to MEET by the plants and MEET does not have any influence on these costs. The allocation of these costs is not part of this research.

Only returnable packaging
For most deliveries are the so called returnable packaging materials used. This means that customers have to return the packaging materials to MEET, so the packaging materials can be reused.
The packaging materials are sold to a few customers for two reasons. First, it appeared that these customers never returned their packaging materials or, second, it is too expensive to transport the packaging materials back to MEET. Reducing the costs of packaging materials that are sold is not included in this research.
An option might be to sell the packaging materials to all customers. This option is included in this research.

Quality restrictions
In this research it is assumed that Hoogeveen only uses first quality packaging materials, Deventer second quality packaging materials and Leeuwarden third quality packaging materials. In practice, however, packaging materials can get mixed up.
In this research it is assumed that mixing up of packaging materials does not occur.

1.4. Research approach

The first step in this research is the analysis of the current physical flow of packaging materials. The physical flow of packaging material will be described in a model. The financial consequences of these physical movements are analyzed and added to the model.
The second step is the analysis of the current cost situation. The current cost price calculation is based on direct costing and takes only a few cost components in account. A new updated cost price is estimated with the help of Activity Based Costing. Differences between the current cost price, the ABC cost price and the current trip price are analyzed.

The third step in this research is the estimation of options to reduce costs. Per activity (the activities are identified in the ABC cost price calculation) several options to reduce costs are identified.
The fourth step in this research is the ranking of the identified options to reduce costs. Two investment appraisal methods are used to rank the identified options. The fist method is the method used at Impress, the payback period, the other method is the Net Present Value.
The fifth and final step is a recommendation to MEET how it can reduce its costs.

Data collection is necessary to determine the costs of the current situation and the height of the savings other options generate. One data source is the information system of Impress. Furthermore, employees of MEET have a lot of information. With the help of interviews, this information is collected.
Further more, books, articles and web pages about:

- how to set up a research,
- Activity Based Costing and Management,
- production management and
- investment appraisal methods

are consulted for information.

In the next chapter the theory used in this research is described.


Impress

2. Theoretical Framework

The theory used in this research is explained in this chapter. The first section describes which data collection methods are used. The second section describes how the process is modeled. The third section explains two costing systems, which are used to estimate a cost price. The fourth section describes several techniques to appraise investments.

2.1. Data collection techniques[3]

Two data collection techniques can be distinguished, the observation approach and the communication approach. Both approaches are used in this research and are further explained below.

Observation approach

When an observation approach is used, a researcher inspects the activities of a subject or the nature of some material without attempting to elicit responses from anyone.
There are several ways to collect data with the help of the observation approach. The two methods used in this research are described below.

- Record analysis

This involves the usage of historical and current records of data. One way record analysis is used in this research is by the estimation of how many packaging materials are sorted in a certain time period. In this research only historical data is used (2007). This data can be used in this research, because circumstances are comparable. So, the outcomes of this research are not influenced by the usage of data of last year.

- Process analysis

A process analysis is an observation by a time study of stages in a process. In this research this technique is used to protract the current flow of packaging materials. Several activities are timed, because no records were available.

Communication approach

In the communication approach, the researcher questions the subjects and collects their responses by personal or impersonal means. The communication approach can be executed in three ways; the self-administered survey, the phone interview and the personal interview. Each of these manners has advantages and disadvantages. Based on these advantages and disadvantages it is chosen to use the personal interview as a method to gather data.
A personal interview is a two-way conversation between an interviewer and a participant. The greatest advantage lies in the depth of information and detail that can be secured. The interviewer also has the possibility to improve the quality of the information received. Disadvantages are that interviews are costly in terms of money and time. Another disadvantage is that the results can be affected adversely by interviewers who alter the questions asked or in other ways bias the results.

[3] Source: Business Research Methods, Cooper & Schindler

The type of personal interview that is used in this research is the semi structured interview. A semi structured interview starts with a few specific questions and then follows the individual's tangents of thoughts with interviewer probes.
This interview type was used for two reasons. The first reason is that an advantage of the semi-structured interview is that not only answers are provided, but also the reasons for the answers. The second reason is that in this research the interviewer did not know in advance what kind of information the participant had. The subjects were therefore identified upfront and the questions specified during the interview.

2.2. Process Flowchart

A process flowchart is used for viewing the sequence of steps involved in producing the product and the flow of the product through the process. It is useful for seeing the totality of the operation and for identifying potential problem areas.[4]
In this research the process flowchart is used to describe the flow of packaging material from MEET to the customer and back.
There is no exact format for flowchart design. In this research arrows are used to represent flows, inverted triangles to represent buffers and rectangles represent tasks.

2.3. Costing Systems

In this section are two different costing systems explained and their advantages and disadvantages are identified. Thereafter the system that is chosen to apply in this research is explained in more detail.

Different costing systems[5]
Two types of costing systems can be used to assign costs to cost objects, traditional costing systems and Activity Based Costing.
Traditional costing systems were developed in the early 1900s and are still widely used. The traditional costing systems rely extensively on arbitrary costs allocations. The other costing system, Activity Based Costing (ABC), emerged in the late 1980s. The ABC system uses cause-and-effect cost allocations.

Traditional costing systems are usually simplistic and inexpensive to operate[6], but it is likely that the usage results in inaccurate cost assignments and the reporting of inaccurate costs.
According to Turney (1991), the traditional costing systems fail to show what really matters to customers, do not reveal how profitable its customers and products are and do not identify opportunities for improvements.
Johnson and Kaplan (1995) state that with the traditional costing systems management accounting information is produced too late, too aggregated and too distorted to be relevant for managers' planning and control systems.

[4] Source: Operations Management, Reid & Sanders, page 68
[5] Source: Management and Cost Accounting, Drury, page 58
[6] Source: Management and Cost Accounting, Drury, page 58

Another disadvantage is that traditional costing systems do not provide detailed information on process efficiencies; they focus too narrowly on inputs and fail to provide accurate product costs.

The criticisms stated above resulted in the emergence of the ABC system.
ABC systems have a high level of accuracy and minimize the costs of errors, but are on the other hand expensive to operate.
A traditional costing system can still be used and in practice is still used in 70-80% of the organizations. Traditional costing systems are optimal when the indirect costs are a low percentage of the total costs and when the product range is standardized.
The ABC system is an optimal costing system for organizations with a high proportion of indirect costs and for organizations with products that consume organizational resources in different proportions.

In this research ABC is chosen to estimate a cost price per trip per type of packaging material for several reasons:

- The purpose of this research is to identify opportunities for MEET to improve their current cost situation. One of the advantages of ABC is that it gives the management a clear view of their performance and the opportunities for improvement, while traditional costing systems fail to provide this information.

- The indirect costs are more than 60% of the total costs of MEET[7]. ABC is an optimal costing system for organizations with a high proportion of indirect costs. Direct costing systems would in this situation conclude in a too high cost price for high volume products and a too low cost price for low volume products.

- The product range of MEET is wide. Different types of packaging materials are used, each having different quality restrictions. This is another reason to use ABC; this system supports a wide product range, while direct costing systems perform best in organizations with a small product range.

- Another reason to choose for the ABC system is the availability of data. Data is available to calculate a cost price based on ABC, while there is a lack of data to estimate a cost price based on direct costing. Data could be collected, but because of time restriction and the little added value of a direct costing system, it is decided to not further research this option.

There exists, however, no correct or real cost price. With ABC the accuracy of a cost price calculation can be improved from 50% to 80%. Achieving an accuracy of 100% takes too much time and leads to the illusion of punctuality.[8]

[7] On average, only 35% of the trip price of the packaging materials consists of direct traceable costs.
[8] Source: Activity Based Costing: de praktijk., De Weerd.

In the next section the steps in an ABC cost price calculation are explained.

ABC in detail
The basic steps in the execution of an ABC calculation are the following[9]:

Step 1: Determine the nature of cost elements. Cost elements can be:
- Direct traceable costs
- Activity traceable costs
- Non-traceable costs

Direct costs are costs that have a direct relationship to the cost object. An example is the raw materials used to produce a product.
Activity traceable costs are accounted for per activity.
Non-traceable costs cannot be assigned to any activity or cost object; an example is the management expenses. These costs can be allocated to cost objects in proportion to other costs.

Step 2: Account for all traceable costs per activity.
Activities consume resources, or in other words, activities cause costs. Cost elements that are activity traceable are costed to the activity centers to determine the operating costs of the activities.

Step 3: Determine cost drivers and calculate activity recovery rates.
Cost drivers are factors or transactions that are significant determinants of costs. An example of a cost driver for the purchasing department might be the number of purchase orders. Cost drivers are directly linked to output measures; output measures are the numbers behind the cost drivers.
There are two options to calculate the activity recovery rate, also called the 'activity costs per unit'. The first one takes the capacity output as basis for the calculations, the second the actual output. According to Glad and Becker (1997), the method that takes the capacity output as basis is the preferred method, because cost objects are costed accurately when cost drivers measure the use of activities directly or correlate closely with their use.
Activity rates are estimated with the following formulas:

$$\text{Activity cost per unit (capacity based)} = \frac{\text{Activity cost}}{\text{Output measure capacity}}$$

$$\text{Activity cost per unit (actual output based)} = \frac{\text{Activity cost}}{\text{Output measure actual}}$$

[9] Source: Activity Based Costing and Management, Glad & Becker, chapter 2 and 3.

Step 4: Compile a bill of activities for each cost object.
Cost objects are usually physical products. This is also the case in this research; the cost objects are the different types of packaging materials. For each of the cost objects a bill of activities has to be compiled. The bill of activities is the description of the routing of that a product takes through the activities. It can be compared with the bill of materials. The bill of activities represents a list of all the activities and relative quantities required by a particular cost object.

Step 5: Calculate activity traced costs
To calculate the activity traced costs, the activity recovery rates (as estimated in step 3) have to be multiplied with the quantity of output consumed as specified in the bill of activities.

Step 6: Add direct and non-traceable cost.
The last step is to add direct and non-traceable costs to the activity traced costs (which are calculated in step 5). Direct costs can be associated with the cost object specifically. Non-traceable costs can be added on an arbitrary basis, provided for in the profit margin or allocated in proportion to other costs.

2.4. Investment appraisal methods[10]

Three methods of investments appraisal can be used to appraise investments on and are considered using in this research.

- Accounting Rate of Return Method (ARR). The use of the ARR method involves estimating the ARR on the proposed project and comparing it with a target ARR. If the estimated rate of the proposed project exceeds the target rate, the project should be undertaken. The main criticism of the ARR is that it does not take in account the timing of profits generated from the investment. The model assumes that the profits earned in the first year are equivalent in terms of value to profit in later years; the method ignores the time value of money.

- The payback period. The payback period is defined as the periods it takes the cash inflows from an investment project to equal the cash outflows. The payback of opportunities can be compared with each other or with a target value. There are two criticisms of the payback method. The first is that cash flows after the payback period are ignored. The second criticism is that this method, just like the ARR method, does not take into account the time value of money.

[10] Source: Accounting in a Business Context, Berry & Jarvis

- Discounted cash flow (DCF) is an investment appraisal technique which takes into account both the time value of money and the total cash flows over a project's life. It is therefore often argued that DCF is a superior method to both ARR and the payback period[11].

Impress uses the payback period for the appraisal of their investments. Because of the shortfalls of this method, the DCF method is also used in this research for two reasons.
First, some options that reduce costs generate savings after the payback period. The payback method does not take this in account the value of these savings.
Second, both ARR and the payback period do not take in account the time value of money, while a euro today is not the same as a euro in ten years. It is therefore important to take in account the time value of money.

There are two main investment appraisal methods that use the discounted cash flow technique, Net Present Value (NPV) and Internal Rate of Return (IRR). Both are discussed below in more detail.

- Net Present Value (NPV): The NPV is the present value of future cash inflows minus the present value of the future cash outflows. If the NPV is positive it means that the cash inflows from the investment yield a return in excess of the cost of capital and therefore the investment project should be undertaken. If the NPV is negative it means that the cash inflows from the investment yield a return less than the cost of capital and therefore the opportunity should be rejected. If the NPV is zero, it means that the investment has generated exactly the required returns to compensate for the costs of capital, without a surplus. In this case it is up to the management to decide whether or not to invest.

- Internal Rate of Return (IRR): In the application of the IRR method it is necessary to calculate the exact DCF rate of return which an investment opportunity is expected to achieve, that is the rate of return at which the NPV is equal to 0 and compare this with a target rate, which should be the project's cost of capital. If the expected rate of return exceeds the target rate of return, the project should be undertaken. If the expected rate of return is less that the target the investment should be rejected

In almost every situation the internal rate of return results in the same decision as the net present value method. There is only one exception, namely when projects are mutually exclusive.
According to Drury (2004) a problem with IRR is that it expresses the result as a percentage rather than in monetary terms, as is the case with NPV. Comparison of percentage returns can be misleading.

[11] Source: Accounting in a Business Context, Berry & Jarvis, page 408

Another disadvantage of IRR is that it assumes that all proceeds from a project can be reinvested to earn a return equal to the IRR, while the NPV method assumes that the cash flows generated from an investment will be reinvested at the cost of capital. In practice, these can only be reinvested at the cost of capital
When a project has unconventional cash flows (the sign of the new cash flows changes in successive periods), the IRR has a technical shortcoming. It is possible to calculate as many internal rates of return as there are sign changes.

Because of these arguments is in this research the NPV method used to estimate whether or not an investment should be appraised.

Net Present Value (NPV)
The NPV is the present value of cash inflows minus the present value of the cash outflows. The present value of a future sum of money can be calculated by:

$PV \quad FV \times \left(1/(1+r)^n\right)$, where

PV = Present Value
FV = Future Value
r = compound rate of return per time period
n = number of time periods

These formulas are used in this research to calculate the NPV of the options to reduce costs of MEET.

The theory described in this chapter is necessary to achieve the goal of this research, estimate the current cost position of MEET and identify options to reduce the costs.
The research starts with a description of the current situation of MEET. Theory about process flowcharts and data collection is needed.
Thereafter a new cost price is calculated, where theory about cost allocation and, again, data collection is used.
In the last chapter of this thesis several options to reduce costs are identified, theory about how to appraise investments is needed.

In the next chapter the current situation of MEET is described.


Impress

3. The current situation

To be able to improve the current cost situation of MEET, the current cost situation and thus the current process has to be explored. This chapter describes the current process and costs that occur during this process. The current cost price calculation is also explained in this chapter.

3.1. Physical flow of packaging materials

The standard flow of returnable packaging materials starts with the customers returning packaging materials to MEET. This standard flow is described in section 3.1.1. The exceptions are described in section 3.1.2. A graphical overview can be found in Figure 1, Physical flow of packaging materials.

3.1.1. Customer deliveries

Empty packaging materials are transported with a truck from the customer back to one of the three sorting units of MEET. The customer returns the packaging materials to the unit where it has received the packaging materials from. The truck is unloaded by employees of MEET with the help of a fork lift truck.

Packaging materials that are returned by the customer have to be sorted before they can be reused in the production process. Each piece of packaging material is checked and classified in a specific quality group. For each type of packaging material there exist several quality groups. Standard pallets, for example, are classified in three different quality groups, depending on the quality of the pallet. For carton layer pads nine quality groups exists, not only depending on the quality of the layer pad, but also on the dimension and the radius of the corners. An overview of all the possible quality groups can be found in Appendix B, Quality groups of packaging materials. The quality group determines for which types of (semi-) finished goods and for which type of customer the packaging materials can be used.

The sorting of packaging materials is executed in several ways, depending on the type of packaging material. For wooden pallets and for steel and wooden frames there are two options, they can be sorted with or without a sorting line. Which method is used depends on the type of pallet and whether or not a sorting line is available (in Leeuwarden no sorting line is available). Synthetic pallets are sorted manually. Sometimes it is necessary to clean the synthetic pallets before they can be reused in the production process.
Layer pads are sorted manually. A special tool is available to make the sorting of layer pads less labour-intensive. Synthetic layer pads are (manually) cleaned and at the same time sorted.

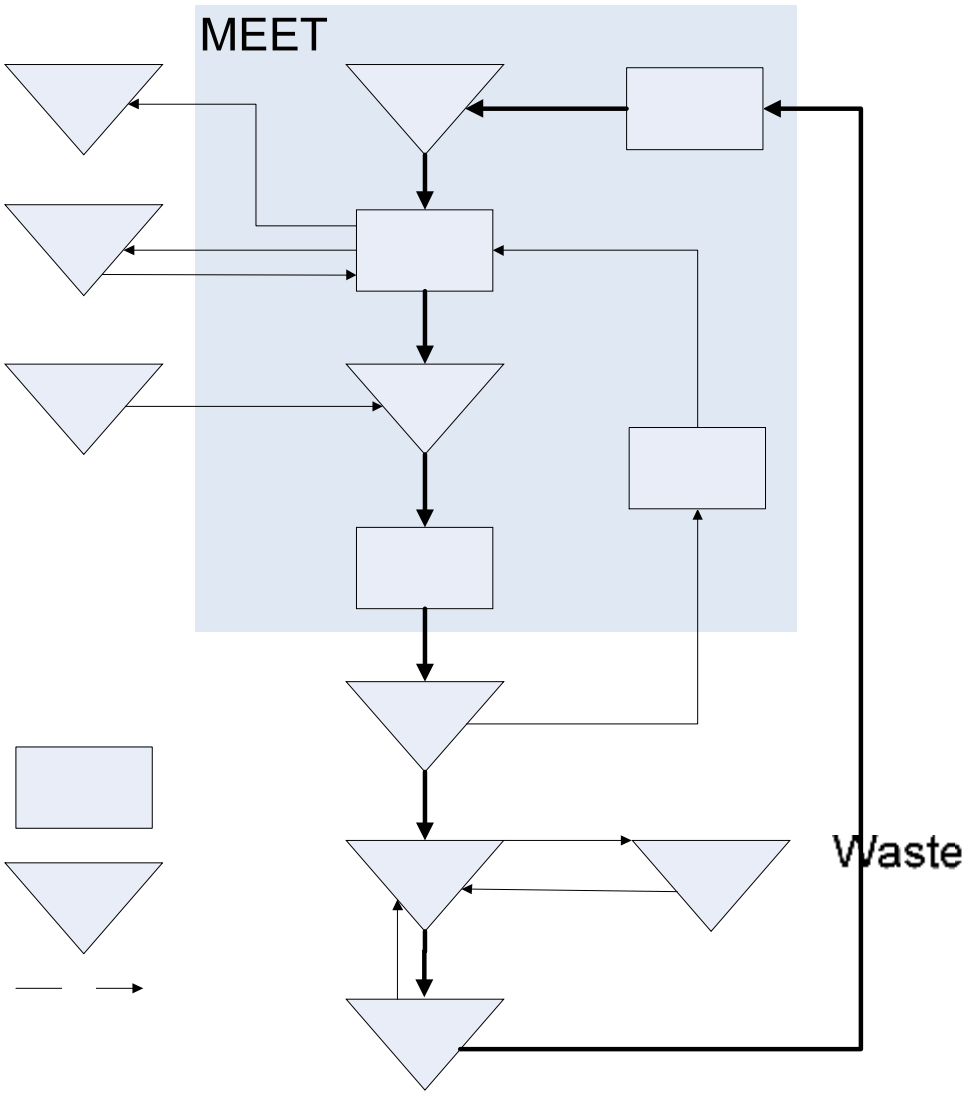


Figure 1, Physical flow of packaging materials

After sorting, the packaging materials are moved to a buffer by employees of MEET with the help of a fork lift truck. When these packaging materials are needed in the production process they are transported to another buffer, this transport is also executed by employees of MEET again with the help of a fork lift truck.
As of this buffer the handling of packaging materials is taken over by fork lift truck drivers of the production department.
The packaging materials are used in the production process; packaging materials are filled with (semi-)finished products. The (semi-)finished products are delivered to the customer.

Impress has two types of customers, external customers and internal (the so-called inter-company) customers. Inter-company customers are other facilities of Impress. As already described, the inter-company customer buys the packaging materials from MEET. The external customer, however, has to return the packaging material to MEET.

This standard flow is described in Figure 1 with a fat line.

The next section describes the exceptions on this flow and how these exceptions are caused.

3.1.2. Exceptions

Packaging materials are not only returned to the sorting units of MEET by customers, but also by the production department. The packaging materials are returned by the production department because that type of packaging material is no longer needed in the production process. These packaging materials are transported to the buffer of the sorting units by fork lift truck drivers of the production department. These packaging materials have to be resorted before they can be reused in the production process. This resorting is executed in two steps; in the first step are the packaging materials sorted by type. This step is executed with the help of a fork lift truck and is executed by employees of MEET. Hereafter it is still necessary to go through the standard sorting process, because the fork lift driver is unable to estimate the quality of the packaging materials while he is driving a fork lift truck. The second step is therefore the standard sorting procedure.

Another exception is the delivery of new packaging material to the sorting units. These materials are transported to the sorting units by truck and have to be unloaded by employees of MEET with the help of a fork lift truck.

If, while sorting, packaging materials are discovered that do not fulfill the quality restrictions there are two options. The first option is reparation of packaging materials. The standard pallet is the only type of packaging material that is repaired. Reparation of pallets is only executed if it is considered efficient. It is outsourced to an external organization. This external organization picks up, repairs and delivers back the broken packaging materials.
If reparation is not efficient, the packaging material is considered as waste. Paper and carton packaging materials are sold, pallets are thrown away.

The flow of packaging materials is also registered in the information system of Impress. In Appendix C, Information flow of packaging materials more details can be found about the information flow connected to the physical flow of packaging materials.

The movement and handling of packaging materials as described above also has financial consequences. These financial consequences are described in the next section.

3.2. Financial consequences for MEET

Each physical movement or handling of packaging materials has financial consequences. In other words, each movement costs money or generates revenues. Figure 2 shows the financial consequences of each flow of packaging material (costs are displayed at the arrows). The current cost price calculation, which is explained in the next section, is based on this figure.

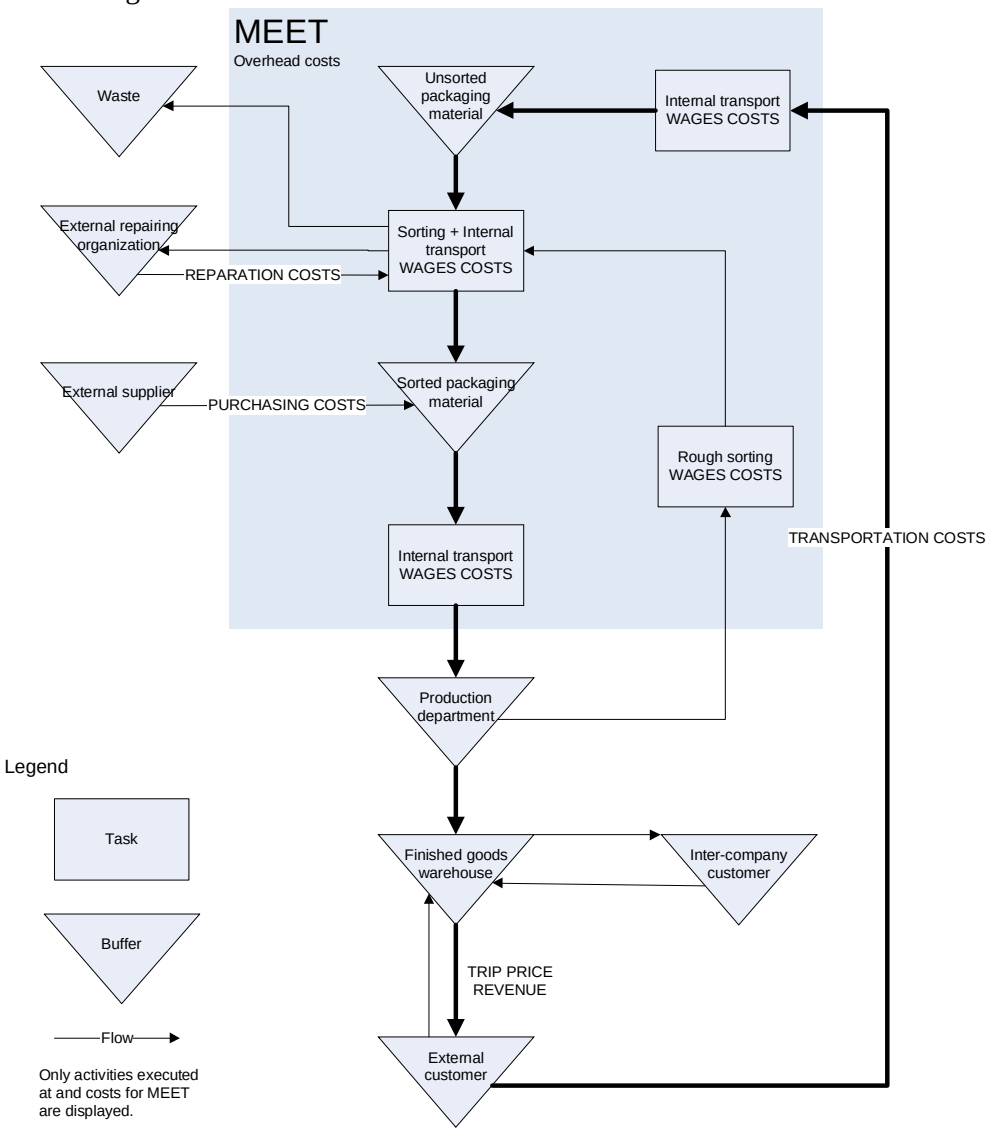


Figure 2, Financial consequences of flow of packaging materials

The cost occurring when there are physical movements of packaging materials were used to estimate the current costs per trip per type of packaging material.

3.3. Current cost price

As can be seen in Figure 2, the current cost price per trip is based on four cost components (the cost components are written by the flow arrows). A fifth cost component was added, namely overhead costs, to include other costs (like rent for buildings and fork lift trucks). In Figure 3, the current cost price calculation of a pallet can be found. With the help of this example each cost component is discussed in more detail.

	pallet, costprijs per trip	
Purchasing costs	0,24	euro 4,80 / 20 x uses
Wages costs	0,22	10 per hour * euro 21,56 per hour
Reparation costs	0,43	10% of all pallets, costs euro 4,75 per pallet
Transportation costs	0,28	330 pallets, euro 100,67 per transport
Overhead costs	0,09	8% of subtotal
total	1,26	

Figure 3, Example current cost price calculation (source: current cost price calculation)

- Purchasing costs. This component is based on the number of times a packaging material can be used and on the replacement value of that type of packaging material. The number of times a packaging material can be used was estimated with the help of research conducted by an employee of Impress. This research was based on purchase data and experience of the management of MEET and at that time considered as reasonable. The replacement value of first and second quality packaging material is equal to half of the purchase price of that type of packaging material. The replacement value of third quality packaging materials is equal to zero.

- Wages costs. This component is calculated by multiplying the average costs of MEET for one employee working one hour with the amount of packaging material an employee can handle in one hour.

- Reparation costs. The percentage of packaging materials that need to be repaired before they can be reused in the production process was estimated at 10% (based on experience). At the time this cost price was calculated only pallets and frames were repaired and the reparation was executed by employees of MEET. The reparation costs are wages costs and costs of raw materials.
  Currently, the reparation of packaging materials is outsourced to an external organization.

- Transportation costs. To estimate the transportation costs per type of packaging material per trip are first the average costs of a transport from the customer back to the sorting unit of MEET calculated. This amount is divided by the number of packaging materials that fit in a truck. Result: the average transportation costs per type of packaging material per trip.

- Overhead. The overhead costs are 8% of the subtotal of the above described four components. The overhead costs were introduced to cover costs like rent paid for buildings, fork lift truck etc. This percentage was estimated in a discussion with management and the bookkeeper of MEET.

The costs of all these components were added and form the current cost price. With the help of these cost prices the current trip prices per packaging material were estimated. The results per type of packaging material can be found in Table 1.

	Current cost price	Current trip price	Difference
Pallet			
H*	€2,24	€2,12	€0,12
D**	€1,26	€1,50	€0,24
L***	€0,71	€1,50	€0,79
End pallet			
H	€1,78	€2,36	€0,58
D	NA	€2,36	-
L	NA	€2,36	-
Euro pallet			
D	€0,77	€1,13	€0,36
L	€0,77	€1,13	€0,36
Synthetic pallet			
D	€3,16	€3,38	€0,22
Wooden frame			
H	€0,96	€1,57	€0,61
D	€0,96	€1,57	€0,61
L	€0,96	€1,57	€0,61
Steel frame			
D	€2,17	€1,97	-€0,20
Carton layer pads			
H	€0,21	€0,25	€0,04
D	€0,17	€0,18	€0,01
L	€0,17	€0,18	€0,01
Synthetic layer pads			
D	€0,25	€0,44	€0,19
Carton covers			
D	€1,08	€1,47	€0,39

* Hoogeveen
** Deventer
*** Leeuwarden

Table 1, Comparing current cost price with current trip price

As can be seen in Table 1, the cost price does not equal the trip price. The trip price of some types of packaging materials is below the cost price, while for others it is above the cost price.

Management of MEET had decided in that time to not adjust the trip prices for two reasons. The first reason is that at the end of each year MEET made a profit. The second reason is that no complains about costs were received from the production departments, sales departments or customers. So, there was no reason to change the trip prices.

In the next section the technique behind the current cost price calculation is analyzed.

3.4. Comments on the current cost situation

The current cost price calculation does not fit the current process, because of several reasons.

First of all, some costs are not separately included in this calculation but added to the component wages costs or overhead costs. Examples are the wages costs of the fork lift truck drivers, the rent for the fork lift trucks and the rent for the buildings. Costs would be more transparent when more cost types are identified.
Some costs, like management costs, are not at all included in this cost price calculation. Management costs, however, have increased in the last years. More managerial tasks are needed to keep control over the process.
Furthermore, this cost price calculation is based on data that stems from 2003 and is thus based on outdated data.

Due to these reasons and the disadvantages of the currently used costing system, direct costing (see section 2.3), it was decided to calculate a new cost price. This cost price is based on the ABC technique.


Impress

4. Costs and activity identification

As is explained in the last chapter, the current cost price calculation does not cover the current process. Therefore a new cost price is calculated based on Activity Based Costing. To be able to use Activity Based Costing, all cost elements and activities have to be identified.
In the first section of this chapter the costs of MEET are identified and split up in several cost elements. The second part of this chapter identifies and describes the activities executed at MEET in more detail.
In the third and fourth section of this chapter the first two steps of the calculation of the activity based cost price are executed.

4.1. Detailed description of costs occurring at MEET

Using the balance sheet, the profit and loss account of MEET of 2007 and the process description of section 3.1, the following main costs are identified.

- Wages costs sorters
- Wages costs fork lift truck drivers
- Management costs
- Purchasing costs
- Reparation costs
- External transportation costs
- Rent fork lift trucks
- Rent buildings
- Costs of cleaning the department

Details about these costs, like elements and drivers, can be found on page 31.

A new graphical overview of the financial consequences is edited (see Figure 4) to give a more detailed and accurate view of the costs occurring at MEET. Differences between Figure 2 and Figure 4 are marked red.

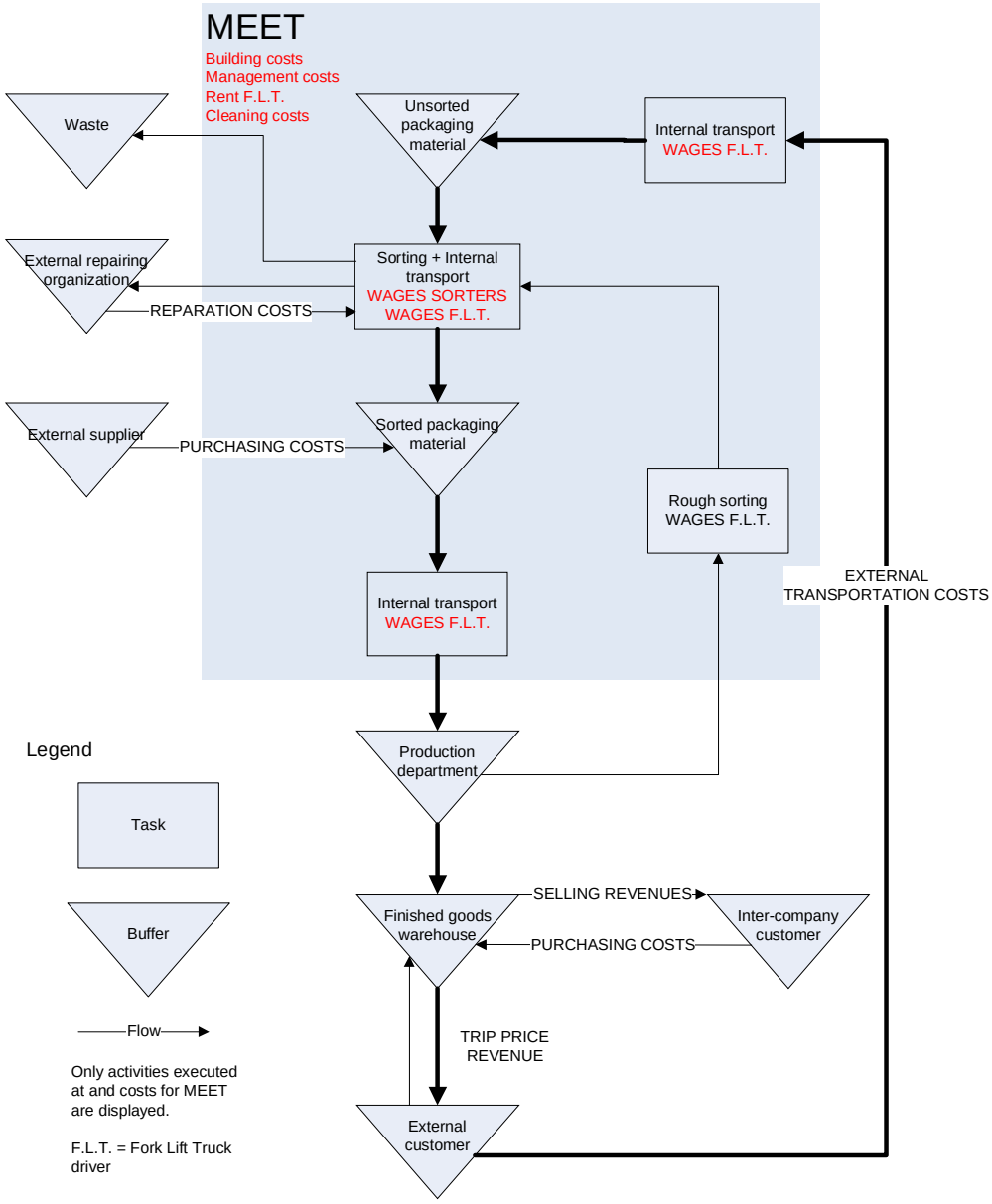


Figure 4, Financial consequences of physical flow version 2

As can be seen in Figure 4, some costs occur when activities are executed or occur when the physical location of the packaging material changes. Other costs occur even when no activities or physical movements are executed.

Costs that occur when the physical location changes or when activities are executed:

- Wages costs of sorters and fork lift truck drivers. These costs are the wages costs of the employees sorting the packaging materials and the wages costs of the employees driving the fork lift trucks. Sorters are needed to sort the different types of packaging materials. The fork lift truck drivers are needed when the physical location of packaging materials changes.

- External transportation cost. Transports that are not executed by employees of MEET, but where MEET does have to pay for fall under the scope of the external transportation costs. External transportation costs are made when packaging materials are picked up at the customer and transported to MEET. An agreement is made with the production facilities of Impress that MEET only has to pay for external transports from customers to MEET if the customer is located in the Benelux.
  In Leeuwarden extra external transportation costs occur. The sorting unit in Leeuwarden is located 500 meters from the production department. Every day, several trucks drive from the sorting unit to the production department with packaging materials that can be used in the production process. These costs are included in the external transportation costs of Leeuwarden.

- Reparation costs. Reparation of packaging materials (only pallets are repaired and not, as in the current cost price calculation, the frames) is outsourced an external organization (and not as in the current cost price calculation executed by employees of MEET). A fixed price has to be paid per pallet that is repaired, not depending on the type of reparation. MEET has the policy that only first and second quality pallets are repaired and that the reparation needs to be efficient.

- Purchasing costs. These costs are made when new packaging materials are bought. During the process, old packaging materials need to be replaced by new, because packaging materials are damaged, do not fulfill the quality restrictions any longer or get lost during the process.

Other costs occur even when no activities or physical movements are executed. These are:

- Rent buildings. MEET has three sorting units. The buildings are rented from the production departments of Impress. This rent also includes the service for housekeeping, maintenance, Human Resource Management, Environment & Safety and plant management.

- Costs of cleaning the department. The department is cleaned by employees of MEET each day. Costs of cleaning the department are therefore the wages costs of the hours the employees of MEET spend on cleaning the department.

- Management costs. The flow of packaging materials needs to be managed. The general management team of MEET consists of one general manager and an assistant. Furthermore, each sorting unit has its own foreman, who is responsible for the administration of that unit. The management costs are the wages of the general management team plus the wages costs of the hours the foremen are executing administrative activities.

- Rent for the fork lift trucks. The fork lift trucks are rented from an external organization. MEET rents in total six fork lift trucks, three in Deventer, two in Hoogeveen and one in Leeuwarden. Every month, a fixed amount has to be paid to the external organization where the fork lift trucks are rented from.

MEET has three revenue sources, namely the trip price, the revenues received from inter-company deliveries and the revenues received for selling broken or depreciated packaging materials.
Broken packaging materials are either thrown away (wooden packaging materials) or sold (carton packaging materials). The revenues of selling the carton packaging materials are too low to influence the costs price and are therefore neglected[12].
Another revenue source is the revenues received when packaging materials are sold to inter-company customers. However, these materials have to be bought back for the same price, because they are needed at MEET. On balance, cost equal revenues.
So, MEET has only one significant revenue source, namely the trip price that is paid by the customers.

4.2. Activities

The basis of Activity Based Costing is tracing the several cost types to several activities. The next step is therefore the identification of activities.
From the detailed description of the physical flow of packaging materials in section 3.1 the following activities are identified.

- Sorting pallets with the help of a sorting line. Only in Deventer and Hoogeveen a pallet sorting line is available. A fork lift truck driver places the pallets at the start of the sorting line. A conveyer-belt transports the pallets through a besom, to the sorter (an employee of MEET), who is responsible for checking the quality of the pallets. If the pallet fulfills the quality requirements it moves to the end of the conveyer-belt. The pallets that do fulfill the quality restrictions are automatically piled at the end of the sorting line. A fork lift truck removes the pallets from the end of the sorting line and transports them to the buffer. When the quality of the pallet is too low or the pallet needs to be repaired, the sorter removes the pallet from the conveyer belt with the help of a lifting tool.

[12] Revenues are €8.000. These revenues have to be divided over 6.000.000 layer pads. This amount can be neglected.

- Sorting pallets without the help of a sorting line. In Leeuwarden no sorting line is available, so all pallets are sorted without a sorting line. In Deventer and Hoogeveen the pallets that do not fit on the sorting line are sorted without the help of a sorting line.
  Sorting pallets without a sorting line is executed as follows. A fork lift truck puts several small piles (at most five pallets) on the ground. A sorter checks the quality of these pallets. Because these five pallets are piled together, the quality checks are not as accurate as when sorting is executed with the help of a sorting line. Another disadvantage is that two employees are needed, one sorter and one fork lift truck driver.

- Sorting of carton layer pads. Carton layer pads are sorted by an employee of MEET with the help of a special tool, to make the sorting of layer pads less labour intensive.

- Cleaning of synthetic pallets. The synthetic pallets are first sorted without a sorting line, if they are dirty and do not fulfill the quality requirements, they are cleaned. This cleaning is executed manually by two employees, one fork lift truck driver and one cleaner. The fork lift truck driver lifts the pallets so the sorter can easily clean the pallet.

- Cleaning of synthetic layer pads. Synthetic layer pads are cleaned and sorted at the same time. Every synthetic layer pad needs to be cleaned before it can be reused in the production process. Synthetic layer pads are cleaned manually by the employees of MEET.

- Reparation of pallets. Reparation of pallets is outsourced to an external organization.

- External transportation of packaging materials. An external transport organization takes care of the transportation of the packaging materials from the customer back to the sorting units. Customers call the MEET assistant with the notification that they have empty packaging material ready to be picked up. The MEET assistance phones the external transport organization to arrange a transport. When the truck arrives at the sorting unit, the fork lift truck driver unloads the truck.

- Internal transportation of packaging materials. Internal transportation is the handling of packaging materials in the sorting units. Internal transportation is only necessary in Deventer and Hoogeveen, because these units have several buffers located outside the sorting unit where employees of MEET transport packaging material to with the help of fork lift trucks.

- Rough sorting of packaging materials. Rough sorting is executed for two reasons. It occurs when packaging materials that are no longer needed in the production department are returned to the MEET sorting unit. These packaging materials are not split per type. Before the standard sorting process can start, the packaging materials need to be sorted per type by a fork lift truck driver. Thereafter the packaging materials have to go through the normal sorting process.
  Another reason for rough sorting of packaging materials is the delivery of packaging materials from the production department back to the sorting unit. These packaging materials are not always split per type.

The next step is to determine whether the costs identified in section 4.1 can be traced to one of the in section 4.3 identified activities or are direct or non-traceable costs.

4.3. ABC Step 1: Determination of the nature of cost elements

The first step in the calculation of an Activity Based Costing (ABC) based cost price is the determination of the nature of the cost elements. Costs can be direct traceable, activity traceable or non-traceable. Table 2 gives an overview of the cost elements and their nature. The nature of the cost elements is estimated with the help of the detailed cost description of section 4.1.
The first step is to identify the direct traceable costs; these costs can be traced to the packaging materials easily. The next step is to identify the activity traceable costs. Activity traceable costs need to be traced to activities first and then to packaging materials. The last step is to identify the untraceable costs; these costs are traced in proportion to other costs.

	Direct Traceable	Activity Traceable	Non-Traceable
Purchasing costs	✓		
Building costs	✓		
Costs of cleaning the department	✓		
Wages costs sorters		✓	
Wages costs fork-lift truck drivers		✓	
External transportation costs		✓	
Reparation costs		✓	
Rent fork-lift trucks		✓	
Management costs			✓

Table 2, Nature of cost elements

In this research the direct traceable costs are the costs of purchasing new packaging materials, the rent of the buildings and the costs of cleaning the department. The other costs cannot be traced directly to the packaging materials. Wages for sorters, wages for fork-lift trucks drivers, rent for the fork-lift trucks, external transportation costs and reparation costs are activity traceable costs. These costs are traced to packaging materials via the identified activities.
The wages costs of the management team are not traceable to packaging materials directly or via activities. These are non-traceable costs and are traced to the packaging materials in proportion to other costs.

The next step in the calculation of the ABC cost price per trip is tracing the activity traceable costs to activities.

4.4. ABC Step 2: Accounting for all traceable costs per activity

From the detailed description of the activities in section 4.2, the activity traceable cost elements are linked to the activities. In Table 3, an overview can be found of the activities and the activity traceable costs (as identified in Table 2) occurring while executing these activities.

	Wages sorters	Wages fork-lift truck drivers	Transportation cost	Reparation costs	Rent fork-lift trucks
Sorting packaging materials with help of sorting line**	✓	✓			✓
Sorting packaging materials without help of sorting line	✓	✓			✓
Sorting carton layer pads	✓	✓			✓
Cleaning synthetic pallets*	✓	✓			✓
Cleaning synthetic layer pads*	✓				
Reparation of pallets				✓	
External transportation		✓	✓		✓
Internal transportation**		✓			✓
Rough sorting	✓	✓			✓

* Only in Deventer
** Only in Deventer and Hoogeveen

Table 3, Traceable costs per activity

The activities described in Table 3 are not all executed on all three sorting units.

- Cleaning of synthetic packaging materials. Synthetic packaging materials are only used in Deventer, so cleaning of these packaging materials is also only executed in Deventer.
- Sorting with a sorting line. Sorting pallets with the help of a sorting line is only executed in Deventer and Hoogeveen; in Leeuwarden no sorting line is present. Here, all packaging materials are sorted manually.
- Internal transportation is only necessary in Deventer and Hoogeveen. These units have several buffers located outside the sorting unit where employees of MEET transport packaging material to with the help of fork lift trucks.

The next step in the calculation of the ABC cost price is estimating the costs per activity and their allocation to the different types of packaging materials. This is the subject of the next chapter.

5. Activity traceable costs

In this chapter steps 3 till 5 of the ABC-cost price calculation are executed.
In step 3 the cost drivers per activity and the activity recovery rates are estimated, in step 4 the bill of activities for the different types of packaging materials is identified and in step 5 the activity traceable costs per type of packaging material are calculated.
The costs are estimated with the help of the balance sheet and profit & loss account of MEET of the year 2007. As is already explained in section 2.1, the data of 2007 can be used, because circumstances did not change. The average hourly wages per sorting unit are requested at the controller of MEET.
Furthermore, several employees of MEET and the management team of MEET are interviewed to gather the information needed.
The end results of this chapter are checked by the management and bookkeeper of MEET.

5.1. ABC Step 3: Determination of cost drivers and calculation of activity recovery rates

This section is split up into three subsections. In the first subsection the activity cost matrices are determined; in the second subsection the output measures are determined and in the third subsection the activity rates are calculated.
A difference is made between the three sorting units for two reasons. The first reason is that each unit uses packaging materials with different quality requirements (Hoogeveen first quality, Deventer second quality and Leeuwarden third quality). The costs occurring at a sorting unit can therefore be linked to the packaging materials per quality group[13].
The second reason is that costs (like transportation costs and wages costs) differ per location. Averaging would not give a clear overview of the costs occurring at a trip for a packaging material of a certain quality group.

5.1.1. Activity cost matrix

In Table 4 till Table 6 the activity cost matrix per sorting unit can be found. The figures are based on data of 2007 and are amounts per year.

[13] In this research it is assumed that mixing up of packaging materials does not occur. According to the foremen of the sorting units this is a reasonable assumption.

	Wages sorting	Wages F.L.T.*	Transportation	Reparation	Rent F.L.T.*	Total
Sorting with line	€50.531	€34.571	€0	€0	€6.365	€91.467
Sorting without line	€18.065	€9.032	€0	€0	€1.663	€28.760
Sorting carton layer pads	€82.070**	€4.112	€0	€0	€757	€86.939
Cleaning synthetic pallets	€1.556	€778	€0	€0	€143	€2.478
Cleaning synthetic layer pads	€4.905	€0	€0	€0	€0	€4.905
Reparation of pallets	€0	€0	€0	€28.888	€0	€28.888
External transportation	€0	€11.938	€164.876**	€0	€2.198	€179.012
Internal transportation	€0	€36.246	€0	€0	€6.674	€42.920
Rough sorting	€6.107	€10.244	€0	€0	€1.886	€18.237

* F.L.T. Fork Lift Trucks

** These numbers attract attention, details can be found in section 5.3

Table 4, Activity cost matrix Deventer

	Wages sorting	Wages F.L.T.	Transportation	Reparation	Rent F.L.T.	Total
Sorting without line	€52.179	€7.542	€0	€0	€2.819	€62.541
Sorting carton layer pads	€50.654*	€0	€0	€0	€0	€50.654
Reparation of pallets	€0	€0	€0	€10,192	€0	€10.192
External transportation	€0	€5.593	€176.163*	€0	€2.091	€183.847
Rough sorting	€2.581	€2.581	€0	€0	€965	€6.126

*These numbers attract attention, details can be found in section 5.3

Table 5, Activity cost matrix Leeuwarden

	Wages sorting	Wages F.L.T.	Transportation	Reparation	Rent F.L.T.	Total
Sorting with line	€32.830	€22.544	€0	€0	€5.266	€60.640
Sorting without line	€2.263	€2.263	€0	€0	€529	€5.054
Sorting carton layer pads	€43.165*	€4.111	€0	€0	€960	€48.227
Reparation of pallets	€0	€0	€0	€18.042	€0	€18.042
External transportation	€0	€6.788	€155.617*	€0	€1.586	€163.991
Internal transportation	€0	€12.260	€0	€0	€2.846	€15.124
Rough sorting	€19.768	€14.826	€0	€0	€3.463	€38.057

*These numbers attract attention, details can be found in section 5.3

Table 6, Activity cost matrix Hoogeveen

'Wages sorters' can be estimated per activity because data is available to estimate how many hours an employee spends on sorting with a sorting line, without a sorting line, sorting layer pads and rough sorting. This data is registered as follows. At the end of each day, each employee writes down on a form how many packaging materials he has sorted of each type and how much time it took. The total amount of hours an employee has driven on a fork lift truck is also recorded. This data is processed in an overview (excel sheet) and checked against the average efficiency numbers. Furthermore, the accuracy of the registration by the employees is checked (with test samples); the amount that is sorted is recounted by the foreman of the sorting unit and checked with the number recorded at the form. Only small deviations were found (less than 1%).
It can be concluded that the data recorded by employees is reliable. From now on, this data source is revered to as 'sorting data'[14].
Multiplying this data with the average hourly wages of the employees gives the costs of sorting packaging materials.

Tracing of 'Wages F.L.T.' and 'Rent F.L.T.' is based on timing the different activities and on the experience of employees of MEET. First, experts are interviewed and the time they think it costs to execute an activity with the fork lift truck is recorded. Thereafter, the time it takes to execute an activity is recorded. The results of the interview and the recorded times are compared. This procedure was followed to estimate the time the fork lift truck is needed by the following activities: sorting with line, sorting layer pads, cleaning synthetic pallets, external transportation and rough sorting.

[14] This data source consists of several excel sheets, received from the management team of MEET.

The time it takes to execute the other activities, sorting without line and internal transportation, is based on the opinion of experts, no timing of these activities is possible.

A detailed explanation about tracing fork lift truck hours and rent of the fork lift trucks to activities can be found in Appendix D, Tracing details.

Reparation costs of pallets are traced to the three sorting units based on the percentage of the total amount sorted at that sorting unit. The policy is that only first and second quality pallets are repaired and that the reparation needs to be efficient.

MEET only has to pay for external transports from the customer back to the sorting unit, if the customer is located in the Benelux. Other external transports are paid by the production department of Impress. For each transport is recorded at which sorting unit the packaging materials are delivered, so the external transportation costs can be calculated per sorting unit. The bills received from the organizations responsible for the external transports are used to estimate how high the transportation costs were in 2007.

The next step in the ABC cost price calculation is the determination of the output measures.

5.1.2. Output measures

As described in section 2.3, it is preferred to take the capacity output as basis for the output measures. In this research this method cannot be applied for two reasons.

- Most of the work is executed manually; it depends on the employee how many packaging materials are sorted per hour. Because of high differences in the level of training of employees working at MEET (varying from ground school to university), it is not possible to take the output numbers of one employee as basis for the calculation. An average of the actual output (based on data of 2007) is therefore taken as basis for the calculation.
- The sorting of pallets with the help of a sorting line is automated and the capacity of the sorting line is 125 pallets per hour. In Hoogeveen and Deventer, however, actual amounts sorted per hour differ significantly from the capacity of the line. The cost price per trip would not reflect the actual situation if the capacity is taken as output measure.

In this research is therefore the actual output chosen as basis for the calculations.

Activity	Output measure (per year)
Sorting with line	# sorted packaging materials with sorting line
Sorting without line	# sorted packaging materials without sorting line
Sorting carton layer pads	# sorted carton layer pads
Cleaning synthetic pallets	# cleaned synthetic pallets
Cleaning synthetic layer pads	# cleaned synthetic layer pads
Reparation of pallets	# repaired pallets
External transportation	# transports
Internal transportation	# sorted packaging materials (excluding layer pads)
Rough sorting	# sorted packaging materials (including number of bales of layer pads)*

* Layer pads are sorted in bales of 300 layer pads. Because the huge amount of layer pads that are sorted in less time, these are included per bale.

The actual output of 2007 is used as actual output.
To estimate the amount sorted per year, the data source 'sorting data' (excel sheet) is used. The number of repaired packaging materials is estimated from the bills received from the organization responsible for reparation. The number of transports is based on the bills received from the organizations responsible for the external transports.

Results can be found in Table 7.

Activity	Actual output Deventer	Actual Output Leeuwarden	Actual Output Hoogeveen
Sorting with line	455.608	-	172.214
Sorting without line	40.796	233.853	3.867
Sorting carton layer pads	3.005.836	1.459.998	1.502.567
Cleaning of synthetic pallets	3.600	-	-
Cleaning of synthetic layer pads	5.898	-	-
Reparation of pallets	252.704	89.155	157.820
External transportation	1.389	867	990
Internal transportation	496.404	-	176.081
Rough sorting	506.423	238.720	181.090

Table 7, Output measures

With the help of the actual output measures and the activity traced costs, the activity rated can be calculated. This is the subject of the next section.

5.1.3. Activity rates

In section 2.3 is explained how the activity rates can be calculated (dividing the activity traced costs by the actual output). The results can be found in Table 8.

Activity	Activity rates Deventer	Activity rates Leeuwarden	Activity Rate Hoogeveen
Sorting with line	€0,20	-	€0,35
Sorting without line	€0,70	€0,27	€1,31*
Sorting layer pads	€0,03	€0,03	€0,03
Cleaning of synthetic pallets	€0,69	-	-
Cleaning of synthetic layer pads	€0,83	-	-
Reparation of pallets	€0,11	€0,11	€0,11
External transportation	€128,88	€212,05*	€165,65
Internal transportation	€0,09	-	€0,09
Rough sorting	€0,04	€0,03	€0,21*

* These numbers attract attention, details can be found in section

Table 8, Activity rates per sorting unit

The next step in the cost price calculation is the compilation of the bill of activities. With the bill of activities, the activities are linked to packaging materials.

5.2. ABC Step 4: Compilation of a bill of activities for each cost object

The first step in the compilation of the bill of activities is the identification of the cost objects; the second step is to compile for each cost object a bill of activities.

5.2.1. Cost objects

The costs have to be allocated, via activities, to cost objects. In this research are the costs objects the different types of packaging materials.

- Standard pallets
- End pallets (used to transport can ends on)
- Euro pallets (only used in Leeuwarden and Deventer)
- Syrup pallets (only used in Deventer)
- Synthetic pallets (only used in Deventer)
- Wooden frames
- Steel frames (only used in Deventer)
- Carton layer pads
- Carton euro layer pads (only used in Leeuwarden)
- Synthetic layer pads (only used in Deventer)
- Carton covers (only used in Deventer)

For each of these costs objects a bill of activities has to be compiled. This is the subject of the next section.

5.2.2. Bill of activities per cost object

For each of the identified cost objects a bill of activities is compiled. Table 9 gives an overview of the bill of activities for each cost object per sorting unit (H=Hoogeveen, D=Deventer, L=Leeuwarden). The numbers in the table represent the amount of the activity that is needed for that type of packaging material. For example, the pallet in Deventer needs 1 sorting with line, 1 reparation, 1 internal transportation, 1 rough sorting and 1/360 of an external transportation.

The Bill of Activities is estimated with the help of process information gathered during interviews with management and employees of MEET and by screening the current process.

- Each type of packaging material has to be sorted before it can be reused in the production process. Standard pallets are sorted with the sorting line, together with the wooden and steel frames. The other pallets are sorted without the sorting line. An exception is the sorting unit in Leeuwarden. In this unit no sorting line is available, each pallet and frame is sorted without a sorting line.

- Each layer pad in each sorting unit is sorted as described in section 4.2.

- The synthetic layer pads are cleaned by employees of MEET, sorting is executed while cleaning the layer pads.

- The synthetic pallets are sorted and cleaned by employees of MEET. With the help of data analysis is estimated that 2 out of 7 synthetic pallets need to be cleaned before they can be reused in the production process.

- Only standard pallets are repaired. Other types of packaging materials are not repaired, because it is not efficient.

- The billing of the external transportation costs is based on the amount of packaging materials that fit in a standard truck. For example, 360 standard pallets fit in a standard truck, so each pallet gets 1/360 of the costs of an average external transport.

- During interviews with employees it became clear that only pallets and frames are transported internally. Layer pads and carton covers are not transported to other buffers, because the chances are higher that these packaging materials get damaged or wet during this transport, so no internal transportation occurs for these packaging materials.

	Sorting with fine	Sorting without fine	Sorting layer pads	Cleaning synthetic pallets	Cleaning synthetic layer pads	Reparation of pallets	External transport-tation	Internal transport-tation	Rough sorting
Pallet									
H	1	0	0	0	0	1	1/360	1	1
D	1	0	0	0	0	1	1/360	1	1
L	-	1	0	0	0	1	1/360	-	1
End pallet									
H	0	1	0	0	0	0	1/360	1	1
D	0	1	0	0	0	0	1/360	1	1
L	-	1	0	0	0	0	1/360	-	1
Euro pallet									
D	0	1	0	0	0	0	1/576	1	1
L	-		0	0	0	0	1/576	-	1
Syrup pallet									
D	0	1	0	0	0	0	1/390	1	1
Synthetic pallet									
D	0	1	0	2/7	0	0	1/520	1	1
Wooden frame									
H	1	0	0	0	0	0	1/1800	1	1
D	1	0	0	0	0	0	1/1800	1	1
L	-	1	0	0	0	0	1/1800	-	1
Steel frame									
D	1	0	0	0	0	0	1/1800	1	1
Carton layer pad									
H	0	0	1	0	0	0	1/10800	0	0
D	0	0	1	0	0	0	1/10800	0	1
L	-	0	1	0	0	0	1/10800	-	1
Euro layer pad									
L	-	0	1	0	0	0	1/10800	-	1
Synthetic layer pad									
D	0	0	0	0	1	0	1/10800	0	1
Carton cover									
D	0	1	0	0	0	0	1/1800	0	1

- = not possible

0, 1/360, 1 etc. = amount of activity needed.

Table 9, Bill of Activities (source: interviews and screening current process).

- Furthermore, each type of packaging material has to be roughly sorted (sorted by type) before the standard sorting process can start. There is only one exception, during the interviews it appeared that the carton layer pads used in Hoogeveen are never roughly sorted.

The next step is the calculation of the ABC cost price is the calculation of the activity traced costs per type of packaging material.

5.3. ABC Step 5: Calculate activity traced costs

The activity traced costs are calculated by multiplying the bill of activities with the activity rates. Table 10 gives an overview of the activity traced costs per cost object and per sorting unit.

Some numbers (marked with a * in Table 10) attract attention and are further explained below.

- Costs of sorting with a sorting line. The same sorting line is installed in Deventer and Hoogeveen. However, it is more expensive to sort a pallet with the sorting line in Hoogeveen then in Deventer. This is caused by the high quality restrictions in Hoogeveen. Here, every pallet is checked extensively; so it takes more time to sort a pallet. In Deventer the quality restriction are more tolerant and sorting with a sorting line can be executed faster.

- Costs of sorting without a sorting line. As can be seen in Table 10, the costs of sorting without a sorting line differ between the three sorting units. Sorting without a sorting line is most expensive in Hoogeveen; this is because the quality of the packaging materials needs to be high. Sorting without the sorting line takes more time, each packaging material is checked extensively, one at the time. In Deventer the costs are lower, because quality restrictions are not that strict. In Leeuwarden this sorting is cheapest. Quality restrictions are most tolerant and packaging materials are sorted in piles of five.

- Costs of sorting carton layer pads. The costs of sorting carton layer pads are equal at each sorting unit. Numbers do differ from up to three decimals.

- External transportation costs. The external transportation costs are highest in Leeuwarden, because the costs of the transport of packaging materials from the sorting unit to the production department are also included.

- Internal transportation costs. The costs of internal transportation are equal for Deventer and Hoogeveen. Calculations behind these numbers are rechecked but no mistakes are found.

- Rough sorting costs. Rough sorting is most expensive in Hoogeveen. The foreman of Hoogeveen was interviewed to find an explanation for these (high) costs. Besides the standard rough sorting activities in Hoogeveen, extra activities, like the handling of the waste containers, are executed. MEET is not paid for executing these extra activities.

The activity traceable costs are traced to the packaging materials. The next step of the ABC cost price calculation is to calculate the direct costs and the untraceable costs.

	Sorting with line	Sorting without line	Sorting layer pads	Cleaning synthetic pallet	Cleaning synthetic layer pads	Reparation of packaging	External transportation	Internal transportation	Rough sorting	Total
Pallet										
H	€0,35	€0	€0	€0	€0	€0,11	€0,46	€0,09	€0,21	€1,22
D	€0,20	€0	€0	€0	€0	€0,11	€0,36	€0,09	€0,04	€0,80
L	-	€0,27	€0	€0	€0	€0,11	€0,59		€0,03	€ 1
End pallet										
H	€0	€1,31	€0	€0	€0	€0	€0,46	€0,09	€0,21	€2,07
D	€0	€0,70	€0	€0	€0	€0	€0,36	€0,09	€0,04	€1,19
L	-	€0,27	€0	€0	€0	€0	€0,59		€0,03	€0,89
Euro pallet										
D	€0	€0,70	€0	€0	€0	€0	€0,22	€0,09	€0,04	€1,05
L	-	€0,27	€0	€0	€0	€0	€0,37		€0,03	€0,67
Syrup pallet										
D	€0	€0,70	€0	€0	€0	€0	€0,33	€0,09	€0,04	€1,16
Synthetic pallet										
D	€0	€0,70	€0	€ 0,20	€0	€0	€0,25	€0,09	€0,04	€1,28
Wooden frame										
H	€0,35	€0	€0	€0	€0	€0	€0,09	€0,09	€0,21	€0,74
D	€0,20	€0	€0	€0	€0	€0	€0,07	€0,09	€0,04	€0,40
L	-	€0,27	€0	€0	€0	€0	€0,12		€0,03	€0,42
Steel frame										
D	€0,20	€0	€0	€0	€0	€0	€0,07	€0,09	€0,04	€0,40
Carton layer pad										
H	€0	€0	€0,03	€0	€0	€0	€0,02	€0	€0	€0,05
D	€0	€0	€0,03	€0	€0	€0	€0,01	€0	€0,04	€0,08
L	-	€0	€0,03	€0	€0	€0	€0,02		€0,03	€0,08
Euro layer pad										
L	-	€0	€0,03	€0	€0	€0	€0,02		€0,03	€0,08
Synthetic layer pad										
D	€0	€0	€0	€0	€0,83	€0	€0,01	€0	€0,04	€0,88
Carton cover										
D	€0	€0,70	€0	€0	€0	€0	€0,07	€0	€0,04	€0,81

- = not possible

€0, € 0,20 – costs of that activity.

Table 10, Activity Traceable Costs

6. Add direct costs and untraceable costs

6.1. ABC Step 6a: Direct costs

Direct costs can be traced directly to the packaging materials. As can be seen in Table 2, there are three types of costs that are direct costs, namely the purchasing costs, the rent for the buildings and the costs of cleaning the department.

6.1.1. Purchasing costs

New packaging materials are considered as first quality packaging materials. After using these packaging materials a few times, these packaging materials do not fulfill the quality restrictions of first quality packaging material any longer, so these packaging materials become second quality packaging materials and thereafter third quality packaging materials. The times a packaging material can be used is based on the experience of management and employees of MEET and on earlier research conducted by an employee of Impress.
To check whether these estimations are reliable, a research is conducted to estimate the number of trips a standard pallet can complete. The number of trips a standard pallet can complete (as estimated in this research) does not differ from the estimation of management and from the research conducted earlier. It can therefore be concluded that the estimation of management of MEET is reliable. Details can be found in Appendix E, Estimating the number of trips a pallet can complete.

Packaging materials that are used in all three units are depreciated when they are used in Hoogeveen and Deventer. At the time these materials are used in Leeuwarden, they are depreciated. [15] The consequences are that the purchasing costs of these types of packaging materials are for Leeuwarden zero, where for the other two sorting units, Deventer and Hoogeveen, the purchasing costs are equal to half of the new value of these packaging materials. If packaging materials were also depreciated in Leeuwarden, the purchasing costs in Deventer and Hoogeveen would be lower. However, packaging materials in Leeuwarden are of such a low quality, that it can be assumed that replacement value of these packaging materials is equal to zero.

Packaging materials that are only used in one sorting unit are depreciated in that unit; the replacement value is in this case equal to the purchase price. In Appendix D, Tracing details is explained more about the replacement costs. An overview of the replacement costs per type of packaging material can be found in Table 11, the second column.

The purchasing costs of one trip are determined by dividing the replacement costs by the number of times a pallet can be used.

[15] Exceptions are the layer pads and wooden frames. These are bought and used in every sorting unit and are thus also depreciated in Leeuwarden.

There are two exceptions.

- Euro pallets are bought by the production departments and the purchase costs of these materials are not costs of MEET. MEET is only responsible for the sorting of the euro pallets and has therefore no purchasing costs of this type of packaging material.
- The euro layer pads are not bought from an external supplier. Standard carton layer pads that are damaged on the sides are cut to euro format. The replacement costs of the euro layer pad are therefore the costs of cutting a standard layer pad into a euro layer pad.

An overview of the purchasing costs per type of packaging material can be found in Table 11.

	Replacement costs	# used	Purchasing costs per trip
Pallet			
H	€11	30	€0,37
D	€11	40	€0,28
L	€0	20	€0
End pallet			
H	€11	40	€0,28
D	€11	40	€0,28
L	€0	40	€0
Syrup pallet			
L	€16	100	€0,16
Synthetic pallet			
D	€50	50	€1
Wooden frame			
H	€5	25	€0,20
D	€5	25	€0,20
L	€5	50	€0,10
Steel frame			
D	€27	100	€0,27
Carton layer pad			
H	€0,85	7	€0,12
D	€0,85	7	€0,12
L	€0,85	7	€0,12
Euro carton layer pad			
L	€0,25	5	€0,05
Synthetic layer pad			
D	€5	50	€0,10
Carton cover			
D	€4,50	5	€0,90

Table 11, Usage costs per trip

The other direct costs are the rent for the buildings and the costs of cleaning the department. These are traced to the packaging materials in the next section.

6.1.2. Rent buildings and costs of cleaning the department

The rent of the buildings and the costs of cleaning the department can both be traced to the packaging materials by the percentage of m^2 that each type of packaging material covers.
In the Table 12 the total costs per year of the buildings and of cleaning the department can be found. The costs of the buildings are based on the balance sheet and profit and loss account of MEET of 2007. The costs of cleaning the department are based on the data source 'sorting data' (excel sheet).

	Building costs per year	Costs of cleaning department per year	Total costs per year
Hoogeveen	€127.438	€5.184	€132.622
Deventer	€125.802	€4.866	€130.688
Leeuwarden	€51.058	€2.796	€53.854

Table 12, Building and cleaning costs

The building costs in Leeuwarden are lowest because this is a smallest sorting unit. The building costs in Hoogeveen are highest; these costs are not in proportion with the number of m^2 of that unit.

The cleaning costs in Hoogeveen are highest, because this units needs to be clean. Law enforces that packaging materials used for the diary industry are stored and sorted in clean areas. Cleaning costs are lowest in Leeuwarden, because this is the smallest unit. Furthermore, packaging materials that are sorted in this unit are used for customers in the chemical industry. No clean environment in required.

The first step in tracing the building and cleaning costs to the packaging materials is estimating the percentage of m^2 each type of packaging material covers. This percentage determines the part of the building and cleaning costs that is traced to this type of packaging material. Dividing this amount by the number of sorted packaging materials results in the costs per trip.

	% of m^2	Costs	# sorted	Total costs per trip
Pallet	59 %	€77.503	252.704	€0,31
End pallet	1 %	€1.882	40.796*	€0,61
Euro pallet	1 %	€1.882	40.796*	€0,61
Syrup pallet	6 %	€7.529	40.796*	€0,61
Synthetic pallet	5 %	€6.654	40.796*	€0,61
Wooden frame	3 %	€3.480	202.904**	€0,03
Steel frame	3 %	€3.480	202.904**	€0,03
Carton layer pads	15 %	€19.458	3.005.836	€0,01
Synthetic layer pads	1 %	€1.882	5.898	€0,32
Carton covers*	5 %	€6.916	40.796*	€0,61

*This is the total amount of pallets sorted without the line; no amounts are available per type. The costs of these items are added together and divided by this number.

** This is the total amount of frames sorted with the line; no amounts are available per type. The costs of these items are added together and divided by this number.

Table 13, Building and cleaning costs Deventer

	% of m^2	Costs	# sorted	Costs per trip
Pallet	36 %	€19.533	115.503*	€0,14
End pallet	20 %	€10.894	115.503*	€0,14
Euro pallet	3 %	€1.793	115.503*	€0,14
Wooden frame	15 %	€7.991	118.350	€0,07
Carton layer pads (incl. euro format)	25 %	€13.643	1.459.998	€0,01

*This is the total amount of pallets sorted without the line; no amounts are available per type. The costs of these items are added together and divided by this number.

Table 14, Building and cleaning costs Leeuwarden

	% of m^2	Costs	# sorted	Costs per trip
Pallet	84 %	€111.424	157.820	€0,71
End pallet	1 %	€879	3.867	€0,23
Wooden frame	2 %	€2.636	14.394	€0,18
Carton layer pads	13 %	€17.836	1.502.567	€0,01

Table 15, Building and cleaning costs Hoogeveen

The direct traceable costs have to be added to the activity traceable costs, together with the untraceable costs. The next step is to estimate the untraceable costs.

6.2. ABC Step 6b: Untraceable costs

The last step in calculating the ABC cost price of each type of packaging material is adding the untraceable costs. Untraceable costs are the costs of the management team (including foreman, assistant and manager).

6.2.1. Management costs

Management costs include the costs of the management team and the costs of the foreman of each sorting unit. The management team (general manager and assistant) is responsible for all the three sorting units. Via interviewing it became clear that the management team divides its time equally over the three sorting units. Furthermore, most work of the management team is general and has advantages for all three sorting units. An example is the purchasing of new packaging materials; the advantage of a low purchase price is an advantage for all three sorting units. The costs of these two employees are therefore equally divided over the three sorting units.

The total management costs per unit are thus 1/3 of the general management costs plus the costs of the foreman. The data source for the costs of the general management team is the balance sheet and the profit and loss account of MEET of 2007. The costs of the foremen are estimated based on the data source 'sorting data' (excel sheet).
The total management costs per sorting unit can be found in Table 16.

Sorting unit	Management costs
Hoogeveen	€57.157
Deventer	€56.911
Leeuwarden	€55.094

Table 16, Management costs

The management costs are traced to the packaging materials via the activity traced costs. The percentage of the total activity traceable costs is used as a key to divide the management costs.
The tracing of the management costs in Deventer is taken as an example.

In the second column of Figure 5 the total costs per activity can be found. The third column gives the percentage of the costs of this activity of the total activity traced costs. This percentage is multiplied with the total management costs. The results can be found in the fourth column.
The next step is to calculate how much these management costs add to the activity traceable costs. This is calculated by dividing the management costs per activity by the activity rates of that activity. The results can be found in the fifth column.

Management	€	57,157				
Sorting with line	€	91,467	19%	€ 10,810	€	0.02
Sorting without line	€	28,760	6%	€ 3,399	€	0.08
Sorting layer pads	€	86,939	18%	€ 10,275	€	0.00
Cleaning pallets	€	2,478	1%	€ 293	€	0.08
Cleaning layer pads	€	4,905	1%	€ 580	€	0.10
Repairing packaging	€	28,888	6%	€ 3,414	€	0.01
Extern transport	€	179,012	37%	€ 21,157	€	15.23
Intern transport	€	42,920	9%	€ 5,073	€	0.01
Rough sorting	€	18,237	4%	€ 2,155	€	0.00
	€	483,607				

Figure 5, Tracing Management Costs of Deventer

The amounts in the fifth column are added to the original costs of each activity. An example, the sorting costs of sorting with the help of a sorting line are, without management costs, €0,20, with management costs included it costs €0,22.

The results for all the activities can be found in Table 17.

	Sorting with line	Sorting without line	Sorting layer pads	Cleaning synthetic pallet	Cleaning synthetic layer pads	Reparation of packaging	External transportation	Internal transportation	Rough sorting	Total
Pallet										
H	€0,41	0	0	0	0	€0,13	€0.54	€0,10	€0,24	€1,42
D	€0,22	0	0	0	0	€0,13	€0.40	€0,10	€0,04	€0,89
L	-	€0,31	0	0	0	€0,13	€0.69	-	€0,03	€1,16
Lid pallet										
H	0	€1,52	0	0	0	0	€0.54	€0,10	€0,24	€2,40
D	0	€0,79	0	0	0	0	€0.40	€0,10	€0,04	€1,33
L	-	€0,31	0	0	0	0	€0.69	-	€0,03	€1,03
Euro pallet										
D	0	€0,79	0	0	0	0	€0,25	€0,10	€0,04	€1,18
L	-	€0,31	0	0	0	0	€0.43	-	€0,03	€0,77
Syrup pallet										
D	0	€0,79	0	0	0	0	€0.37	€0,10	€0,04	€1,30
Synthetic pallet										
D	0	€0,79	0	€ 0.28	0	0	€0.28	€0,10	€0,04	€1,49
Wooden frame										
H	€0,41	0	0	0	0	0	€0.11	€0,10	€0,24	€0,86
D	€0,22	0	0	0	0	0	€0,08	€0,10	€0,04	€0,44
L	-	€0,31	0	0	0	0	€0.14	-	€0,03	€0,48
Steel frame										
D	€0,22	0	0	0	0	0	€0,08	€0,10	€0,04	€0,44
Carton layer pads										
H	0	0	€ 0,04	0	0	0	€0,02	0	0	€0,06
D	0	0	€ 0,03	0	0	0	€0,01	0	€0,04	€0,08
L	-	0	€ 0,04	0	0	0	€0,02	-	€0,03	€0,09
Euro layer pad										
L	-	0	€ 0,04	0	0	0	€0,02	-	€0,03	€0,09
Synthetic layer pads										
D	0	0	0	0	€0,93	0	€0,01	0	€0,04	€0,98
Carton covers										
D	0	€0,79	0	0	0	0	€0,08	0	€0,04	€0,91

- = not possible

€0, € 0,20 – costs of that activity.

Table 17. Management costs traced to the activity traceable costs.

6.3. ABC Step 6c: Total costs per trip per packaging item

The total costs per trip per type of packaging material is the sum of the activity traced costs (estimated in section 5.3), the purchasing costs (estimated in section 6.1.1), the building costs and the cleaning costs (estimated in section 6.1.2) and the management costs (estimated in section 6.2). The cost per trip per type of packaging material can be found in Table 18.

	Activity traced costs (incl. management costs) per trip	Purchasing costs per trip	Building + Cleaning costs per trip	Total costs per trip
Pallet				
H	€1,42	€0,37	€0,71	€2,50
D	€0,89	€0,28	€0,31	€1,48
L	€1,16	€0	€0,14	€1,30
End pallet				
H	€2,40	€0,28	€0,23	€2,91
D	€1,33	€0,28	€0,61	€2,22
L	€1,03	€0	€0,14	€1,17
Euro pallet				
D	€1,18	€0	€0,61	€1,79
L	€0,77	€0	€0,14	€0,91
Syrup pallet				
D	€1,30	€0,16	€0,61	€2,07
Synthetic pallet				
D	€1,49	€1	€0,61	€3,10
Wooden frame				
H	€0,86	€0,20	€0,18	€1,24
D	€0,44	€0,20	€0,03	€0,67
L	€0,48	€0,10	€0,07	€0,65
Steel frame				
D	€0,44	€0,27	€0,03	€0,74
Carton layer pad				
H	€0,06	€0,12	€0,01	€0,19
D	€0,08	€0,12	€0,01	€0,21
L	€0,09	€0,12	€0,01	€0,22
Euro layer pad				
L	€0,09	€0,05	€0,01	€0,15
Synthetic layer pad				
D	€0,98	€0,10	€0,32	€1,40
Carton cover				
D	€0,91	€0,90	€0,61	€2,42

Table 18, Cost price per item per trip

The ABC cost price does not only provide information about the trip prices per type of packaging material, it also gives the management team of MEET more insight in the factors that influence the trip price.

Part of the goal of MEET is to provide the production department with packaging materials for costs as low as possible. With the help of the ABC cost price, more insight is provided in which types of costs and which activities influence the trip price.
For each of these activities several options to reduce costs are identified (see section 8).

With the help of Table 17 and Table 18 the consequences of the locations of the sorting units with respect to the location of the production department can be analyzed.
In Leeuwarden the external transportation costs are high, because sorted packaging materials are transported with a truck to the production department. In Hoogeveen internal transportation costs are high (compared to the inventory of packaging materials of that unit), because packaging materials are transported from the sorting unit to the production department with the help of a fork lift truck by an employee of MEET.
So, locating a sorting unit far from the production department (transport with the help of a fork lift truck is impossible) causes high external transportation costs, but has as advantage that no internal transportation is needed. Locating a sorting unit outside the production facility causes high internal transportation costs.
Management of MEET can use this information for future decisions about locations of sorting units.

Furthermore, the consequences of the execution of activities where MEET is not paid for (handling of waste containers caused high rough sorting costs of Hoogeveen) became visible.

The sorting unit of MEET in Deventer also handles packaging materials that do not belong to MEET (for example trays). In the future, management of MEET can more easily calculate the costs of the handling of these types of packaging materials.

In the next chapter the ABC cost price is verified and compared with the old cost price and with the current trip price.


Impress

7. Verification of ABC cost price

In the first section of this chapter the data used in the calculation of the ABC cost price is verified. In the second section the impact of the parameters that are likely to change in the nearby future on the ABC cost price is discussed in more detail. The third section compares the ABC costs price, with the current trip price and the current cost price and analysis the differences.

7.1. Verification of input-data

Data is used to estimate the ABC cost price. This can be raw input data, like how many pallets are sorted per hour, but also data received when interviewing employees about the way costs can be traced to activities.
This data has to be verified before the ABC cost price can be considered as reliable and valid.

The ABC cost price depends on the way activities are identified and costs are traced to these activities. The current arrangement of activities and allocation of costs is considered reliable and valid for several reasons.

- The activities are identified based on process information. While building an ABC cost price model for MEET, a deliberation was made between the complexity of the model and the level of detail that is included. Several activities, like the sorting activities, can be split up, so a more reliable cost price can be estimated. A disadvantage is that more data processing is necessary and that the model becomes more complex.

- Another disadvantage is that this more detailed data is less reliable. Some employees register data about a specific activity in one category, while another employee registers it in a different category.

- Furthermore, according to the management team of MEET, the ABC cost price model as presented in this thesis reflects the current process best.
  They prefer a less complex model based on reliable data above a more detailed and more complex model based on less reliable data.

- Calculating the cost price with the help of ABC instead of traditional costing methods is preferred because of the availability of data. Data is available to calculate a cost price based on ABC, while there is a lack of data to estimate a cost price based on direct costing. Data could be collected, but because of time restriction and the little added value of a direct costing system, the ABC system is used.

Furthermore, raw data used to calculate the ABC cost price has to be verified.
The following data are used to calculate the ABC cost price.

1. Average hourly wages. The average hourly wages are requested at the controller of MEET. The values are checked by the bookkeeper and by the manager of MEET. These values can be considered as reliable and are highly unlikely to change.

2. Sorting data recorded by the employees of MEET (referred to as 'sorting data' in the report). As is described earlier, data is available to estimate how many hours an employee spends on sorting with a sorting line, sorting without a sorting line, sorting layer pads and rough sorting.
   At the end of each day, each employee writes down how many packaging materials he has sorted of each type and how much time it took. The total amount of hours an employee has driven on a fork lift truck is also recorded. This data is processed in an overview and checked against the average efficiency numbers. Furthermore, the accuracy of the registration by the employees is checked (with test samples); the amount that is sorted is recounted by the foreman of the sorting unit and checked with the number recorded at the form. Only small deviations were found (less than 1%). It can be concluded that the data recorded by employees is reliable.

3. Rent of buildings, reparation costs, management costs and rent of fork lift trucks are based on the profit and loss account of MEET of 2007. These numbers are checked by the financial director of Impress and can be considered as reliable and unlikely to change in the future.

4. The transportation costs and the number of transports are based on the bills received from the organizations responsible for external transports. The bookkeeper has based the profit and loss accounts on the same bills; these amounts can be considered reliable. However, due to the current economic circumstances (fast rising oil prices) it is very likely that the transportation costs will rise in the nearby future.

5. The amounts of packaging materials that fit in one truck are based on the current dimensions of a standard truck. The law in Germany already enforces that trucks cannot be broader than 2,50 meters (in the Netherlands are still trucks used that are 2,55 meters broad). There are rumors that this law will also be enforced in the Netherlands in the coming years. If this law is enforced, less packaging materials fit in a truck and transportation costs per packaging material will rise.

6. The number of square meters each packaging material takes of the building is measured. In Deventer this measurement is based on a map of the future situation of the buffer. The actual rearrangement of the buffer will take place shortly after this research is ended. These numbers are reliable and will not change in the nearby future.

The results of the research on the number of trips a pallet can complete (see for details
7. Appendix E, Estimating the number of trips a pallet can complete) are the same as the experience of the management team of MEET and research conducted earlier. The number of trips a pallet can complete can therefore be considered as reliable.
   The estimation of the number of trips of carton covers and layer pads can be considered as reliable as well, suppliers, employees and management have the same opinion about the number of trips these packaging materials can complete during their lifetime.

8. Purchasing costs. The purchase prices used in this thesis are based on the latest purchasing prices of each type of packaging material. However, the prices of carton are varying, so it could well be that in a few months the purchasing costs of layer pads and covers are higher or lower. There are small changes in the prices of the pallets, but the influences of these small changes are negligible. The prices of the wooden frames do vary, the prices of steel frames not[16].

From the analysis above can be concluded that the values of three parameters (number 4,5 and 8) are likely to change in the nearby future. The impact of changing this data on the ABC cost price is discussed in the next section.

7.2. Parameters that are likely to change in the nearby future

There are three parameters that are likely to change in the nearby future. These are the number of packaging materials that fit in a truck (expectations are that these numbers will decrease), the transportation costs (expectation are that these costs will increase) and the purchase price of the packaging materials (which varies both up and down). Per parameter the impact of the change is discussed.

7.2.1. Number of packaging materials that fit in a truck

The current dimensions of a standard truck are 2,55 x 13,60 meters. The amounts that fit in a standard truck are used to calculate the transportation costs per packaging material. However, there are rumors that trucks become smaller in the nearby future, namely 2,50 meters broad.
As can be seen in Table 19, only the cost price of the standard pallet, the synthetic pallet and the wooden frames are influenced by this change. The influence on the cost price of the synthetic pallet and wooden frames is low (less than 3%) and can therefore be neglected. The only type of packaging material that is sensitive to this change is the third quality standard pallet; this trip price rises with €0,08 or 6,15%.

[16] Prices of steel do vary, but MEET can buy the steel frames from other Impress facilities for a fixed price.

According to management of MEET, this is not a big issue. The current trip price of this type of pallet (€1,50) will not be reduced. So, even when this trip price rises with 6,15%, still a profit is made on this type of packaging material.

	ABC cost price 2,55 meter	ABC cost price 2,50 meters	Difference (%)
Pallet			
H	€2,50	€2,55	2,00%
D	€1,48	€1,52	2,15%
L	€1,30	€1,38	6,15%
End pallet			
H	€2,91	€2,91	0%
D	€2,22	€2,22	0%
L	€1,17	€1,17	0%
Euro pallet			
D	€1,79	€1,79	0%
L	€ 0,91	€0,91	0%
Syrup pallet			
D	€2,07	€2,07	0%
Synthetic pallet			
D	€3,10	€3,18	2,58%
Wooden frame			
H	€1,24	€1,26	1,61%
D	€0,67	€0,68	1,49%
L	€0,65	€0,66	1,54%
Steel frame			
D	€0,74	€0,74	0%
Carton layer pad			
H	€0,19	€0,19	0%
D	€0,21	€0,21	0%
L	€0,22	€0,22	0%
Euro layer pad			
L	€0,15	€0,15	0%
Synthetic layer pad			
D	€1,40	€1,40	0%
Carton cover			
D	€2,42	€2,42	0%

Table 19, Verification truck seize

7.2.2. External transportation costs

In the current contracts with the organizations responsible for the external transports is the following agreement included: “Each time the fuel price rises with three eurocents the price of a transport rises with 1%.”

With the current economic circumstances it is not impossible that the average trip price rises with 10%.
It became clear that the impact of a rise in the fuel prices can be neglected for the sorting units in Deventer and Hoogeveen. In Leeuwarden this impact is bigger, this is caused by the already high external transportation costs of that unit. The influence of a rise of the external transportation costs on the cost price of frames and layer pads can be neglected, but the trip price of pallets rises with 4,5%.
It can be concluded that the trip price of pallets used in Leeuwarden is sensitive to changes of the external transportation costs caused by rising fuel prices.

7.2.3. Purchase price packaging materials

The purchase prices of three types of packaging materials vary, this includes the purchase prices of the wooden frames, the carton layer pads and the carton covers. The lowest and highest purchase price of these packaging materials in 2007 and 2008 are used to estimate the impact of this component on the cost price of these packaging materials.
The price of the wooden frames varies from €4,84 to €5,75.
The price of the layer pads varies the last year from €0,72 to €0,90.
The price of the carton covers varies from €3,98 to €4,54.

	ABC cost price lowest value	ABC cost price highest value	Difference (%)
Wooden frame			
H	€1,24	€1,27	2,92%
D	€0,67	€0,71	5,97%
L	€0,64	€0,66	3,13%
Carton layer pad			
H	€0,17	€0,20	17,65%
D	€0,20	€0,22	10,00%
L	€0,21	€0,23	9,52%
Carton cover			
D	€2,31	€2,42	4,76%

Table 20, Verification Purchase Prices

In particular the trip price of the layer pads is influenced by variance in the purchase price. This is because in this cost price calculation no difference is made between the different types of layer pads that are used. Layer pads vary in dimension and the big layer pads are more expensive then the small ones. At the moment, MEET receives the same trip price for both types of layer pads. This situation will not change in the future, processing this extra information is considered too complex. Therefore, no difference is made between the different types of layer pads.

The influence of changes of the purchase prices on the cost prices of the other types of packaging materials is negligible.

From the analysis of these two sections (section 7.1 and section 7.2) can be concluded that the current arrangement of activities and allocation of costs is reliable and valid.

In the next section the ABC cost price is compared with the current cost price and the current trip price.

7.3. Comparing ABC cost price with current cost price and trip price

In this section first the cost price is compared with the actual costs of MEET. The second part of this section compares the ABC cost price with the current cost price.
The third part of this section compares the ABC cost price with the current trip price.

ABC cost price versus actual costs
The costs per trip per type of packaging material are recalculated with the help of Activity Based Costing.
The ABC cost price per trip is compared with the actual costs per sorting unit by multiplying the calculated trip price with the amounts sorted per year. A maximum deviation is found of €10.000, which is negligible compared to the total costs of MEET. Furthermore, in a discussion with the management and bookkeeper of MEET it became clear that the ABC cost price reflects the current cost situation and process best.

ABC cost price versus current cost price
In Table 21 an overview can be found with the current cost price, the ABC cost price and the current price per trip.
The ABC cost price per trip differs from the current cost price for each type of packaging material, because two different costing techniques (direct costing versus ABC) are used. Another reason for the difference is that more types of costs are identified and are traced to packaging materials instead of taking a fixed percentage for overhead costs and add these to the cost price per trip.

It is important to keep in mind that there exists no correct or real cost price. With ABC the accuracy of a cost price calculation can be improved from 50% to 80%. Achieving an accuracy of 100% takes too much time and leads to the illusion of punctuality[17].

[17] Source: Activity Based Costing: de praktijk., De Weerd

		Current cost price	ABC cost price	Current trip price
Pallet				
	H	€2,24	€2,50	€2,12
	D	€1,26	€1,48	€1,50
	L	€0,71	€1,30	€1,50
End pallet				
	H	€1,78	€2,91	€2,36
	D	NA[18]	€2,22	€2,36
	L	NA	€1,17	€2,36
Euro pallet				
	D	€0,77	€1,79	€1,13
	L	€0,77	€0,91	€1,13
Syrup pallet				
	D	NA	€2,07	€1,57
Synthetic pallet				
	D	€3,16	€3,10	€3,38
Wooden frame				
	H	€0,96	€1,24	€1,57
	D	€0,96	€0,67	€1,57
	L	€0,96	€0,65	€1,57
Steel frame				
	D	€2,17	€0,74	€1,97
Carton layer pad				
	H	€0,21	€0,19	€0,25
	D	€0,17	€0,21	€0,18
	L	€0,17	€0,22	€0,18
Euro layer pad				
	L	NA	€0,15	€0,18
Synthetic layer pad				
	D	€0,25	€1,40	€0,44
Carton cover				
	D	€1,08	€2,42	€1,47

Table 21, Comparison

ABC cost price versus current trip price

Comparing the ABC cost price with the current trip price results in the conclusion that the trip price of some packaging materials is below cost price and for other types the trip price is above cost price.

Taken this comparison to a higher level, take also in account the amount of packaging materials that are sorted of each type in each sorting unit, results in the conclusion that the sorting units of Deventer and Leeuwarden 'sponsor' the sorting unit of Hoogeveen.

[18] NA: Not Available

In Hoogeveen costs are higher than revenues, while in the other sorting units, this is the other way around.

As a consequence, the trip prices of Hoogeveen need to increase. Because of the small profit margins on cans in Hoogeveen, the production department (and the customer) will not accept a rise in the costs of packaging materials[19].

Costs of MEET were, with the help of Activity Based Costing allocated to the different types of packaging materials, which is the first goal of this research. The second goal of this research is to reduce the costs of MEET. This is the subject of chapter 8. In chapter 9 the identified options are ranked based on two investment appraisal methods.

[19] A partial solution for this problem is given in the Recommendations.

8. Options to reduce costs

With the help of the ABC model cost are linked to activities and to packaging materials. In this chapter options to reduce costs are identified.
In this chapter is not yet concluded which of the identified options should be implemented first, this is the subject of the next chapter. In this chapter provides a detailed description about the options to reduce costs, the saving an option generates per year (based on experience of experts) and the needed investment (requested at suppliers). Furthermore, if an option would cause costs to rise or when management of MEET has already decided to implement the option, the option is no longer included in this research.

8.1. Options for the sorting activities

Sorting of packaging materials is executed on several ways, depending on the type of packaging material. Pallets are sorted with and without a sorting line, while layer pads are sorted with the help of a special sorting tool. Furthermore, rough sorting is necessary to sort the packaging materials per type. In this section possible options to reduce costs are identified for each of these four sorting activities.

Sorting with sorting line:
Currently it is possible to sort 125 pallets per hour with the sorting line. For some employees of MEET the speed of the conveyer-belt is too low; they are waiting till the next pallet arrives. According to these employees it is feasible to speed up the sorting line, so it costs less time and thus less wages costs to sort one pallet. With the current set up of the sorting line, the conveyer-belt cannot be accelerated. A modification of the sorting line is necessary to speed it up, so a one time investment is needed. An offer from the supplier of the sorting line for pallets is requested. The estimated price for this modification is €1.500. The management of MEET has already approved this investment. This option is no longer included in this research, because this option is already implemented.

Some employees of MEET stop the sorting line too often. The employee sorting the pallets panics and stops the line, while, according to other employees, there is no reason for any panic[20]. The slower employees sort 75-90 pallets per hour, instead of 100 pallets per hour. As a consequence, it takes more time to sort one pallet (and the wages cost per pallet are higher). An option to reduce costs is therefore to stop the sorting line less often. Management of MEET has estimated that the same amount of pallets can be sorted in 90% of the time if the sorting line is stopped less often. As a consequence, the trip price of one pallet with the sorting line (including management costs) drops in Deventer from €1,48 to €1,47 and in Hoogeveen from €2,50 to €2,48. On a yearly basis a saving can be realized in Deventer of approximately €2,900 and in Hoogeveen €3.200. No investment is needed.

[20] Source: Interview employees of MEET

Sorting without line
In Deventer and Hoogeveen sorting pallets without a sorting line is more expensive than sorting pallets with the help of a sorting line. One option to reduce the costs of sorting without a sorting line is an adjustment of the sorting line, to allow more types of pallets to be sorted with the help of a sorting line.
On a yearly basis there are approximately 20.000 pallets sorted without the sorting line, including all types of pallets like end pallets, syrup pallets, synthetic pallets, euro pallets etc. However, for some types of these pallets it is not efficient to sort these with the sorting line.

- Synthetic pallets cannot be sorted with the help of a sorting line, because each synthetic pallet needs to be checked thoroughly. These pallets are used in the meat-industry, and need to be clean and of good quality. If the sorting of this type of pallet is executed with the help of a sorting line, the line has to stop for each pallet. This would take too much time; time the sorting line cannot be used for other, more efficient, sorting activities.
- The other pallets that are sorted without the sorting line have different dimensions and amounts per batch are low. Sorting these pallets with the help of a sorting line is not efficient, because for each batch the setup of the sorting line has to be changed. This takes too much time.
- Furthermore, the sorting line has to be adjusted as the pallets that are currently sorted without the sorting line are too small, they fall in between the sorting line. So an investment is needed.

Because of these reasons it is not an option to adjust the sorting line, as no savings can be realized.

A second option to reduce the costs of sorting without a sorting line is to introduce a sorting line in the sorting unit of Leeuwarden. If the costs of sorting a pallet without a sorting line in Leeuwarden (€0,27) are compared to the costs of sorting a pallet with the help of a line in Deventer (€0,20), it can be concluded that a saving of maximal €0,07 per pallet can be realized[21]. In 2007 235.000 pallets are sorted without a sorting line Leeuwarden. This means that a maximal saving of €17.000 can be realized (yearly). An investment is necessary of €70.000 (the price of a new sorting line for pallets).

Sorting layer pads
In the current situation all layer pads are sorted with the help of a special sorting tool. To reduce the time it takes to sort one layer pad, a sorting line for layer pads can be introduced in the sorting unit of Deventer. These sorting lines can sort 1250 layer pads per hour, so it takes approximately 3 seconds to sort one layer pad.

[21] According to an employee working at both sorting units, the circumstances, like the types of pallets used in both sorting units and the routing in the sorting unit, are comparable and the amount of pallets sorted per hour in Deventer can also be sorted in Leeuwarden.

This has the following consequences for the costs of sorting costs of one layer pad:
In Deventer the costs of sorting one layer pad drop from €0,03 to €0,02[22]. On a yearly basis a saving can be realized of €30.000.
An investment is needed of €80.000.

Another option to reduce the costs of sorting layer pads is the introduction of layer pads that can only be used once. This option is described in section 8.6, here the option to use packaging materials that can only be used once is described in more detail.

Rough sorting
As is described in section 4.2, rough sorting is executed because packaging materials that are returned by the production department and by customers are not sorted per type. An extra sorting activity is necessary.
An option to lower the costs of the rough sorting activity is that the fork lift truck drivers of the production department split the packaging materials by type, so it is no longer necessary to roughly sort packaging materials that are returned by the production department.
In the current situation, it takes the fork lift truck driver of MEET approximately 2 hours per day to sort the packaging material by type and to transport them to the buffer.
Based on experience of the fork lift truck drivers and on timing it is estimated that when this sorting is executed by fork lift truck drivers of the production department, it would take the fork lift truck drivers of MEET only half an hour to roughly sort the packaging materials that are returned by the production department. So, a saving of 1,5 hours of wages costs per day in Deventer can be realized. This means that the costs of roughly sorting a packaging material in Deventer shrink from €0,04 to €0,02. On a yearly basis a saving can be realized of €10.000[23]. No investment is needed.

8.2. Options for the cleaning activity

The cleaning activity is split up in cleaning synthetic pallets and cleaning synthetic layer pads. In this section options to reduce costs of both activities are identified.

Cleaning of pallets
Synthetic pallets are cleaned manually by employees of MEET. Two employees are needed to clean a synthetic pallet. The quality of this cleaning is low.
An option to reduce the costs of cleaning synthetic pallets might be outsourcing this activity to an external organization; these organizations clean the pallets with the help of a washing machine for pallets. The quality of this cleaning is higher than the quality obtained with the current cleaning process.
After contacting a supplier that was able to clean the pallets, it appeared that the price of cleaning one synthetic pallet is €1,60.

[22] Numbers are round off.
[23] It is assumed that it takes the fork lift truck drivers of the production department the same time as it takes them now to transport the packaging materials to MEET. According to the fork lift truck drivers this is a reasonable assumption.

This price does not include the transportation costs of the transport of the synthetic pallets from Deventer to this supplier and back, these are €800. No investment is needed.

The costs per trip for a synthetic pallet increases with almost €2[24] (due to the high external transportation costs), but the quality of the synthetic pallets is higher. A suggestion is therefore to find a supplier located closer to Deventer and check what this supplier can offer.

Cleaning layer pads
Cleaning and sorting of synthetic layer pads is executed manually by employees of MEET. While the synthetic layer pads are cleaned, they are, at the same time, sorted.
A possibility to cut costs is to outsource the cleaning and sorting of synthetic layer pads. The price of the external organization for cleaning and sorting one synthetic layer pad is approximately €0,50; this includes the transports costs of transporting the synthetic layer pads from the customer to the cleaning organization and from the cleaning organization back to MEET.
Roughly sorting this type of packaging material is no longer necessary, because synthetic layer pads are delivered to MEET sorted, washed and piled.
The costs of one trip drop from €1,40 to €0,98. On a yearly basis a saving can be realized of €2.800. No investment is needed.

8.3. Options for the reparation activity

In the current situation pallets are only repaired (in batches of maximal 500 pallets) when it is considered efficient (this is something the sorter has to determine no strict requirements are defined). To implement one of the following options, no investment is needed.

- The first option to save reparation costs is to abandon the reparation of pallets. The external reparation costs are reduced to zero, but every pallet that is currently repaired needs to be replaced by a new one.

Currently, a pallet can complete 90 trips during its lifetime (see Appendix E, Estimating the number of trips a pallet can complete). If the reparation of pallets is abandoned, the pallet can only complete 80 trips. Details about this calculation can be found in Appendix F, Details of identified options to reduce costs. The distribution of the total number of trips a pallet can complete in each quality group changes. In Hoogeveen a pallet can complete 25 instead of 30 trips, in Deventer 35 instead of 40 trips and in Leeuwarden is the number of trips not changing (20 trips). As a consequence, the purchasing costs per trip per pallet rise.

[24] It is assumed that all synthetic pallets are cleaned and not, as in the ABC cost price calculation, only two out of seven. The reason for this is that if this option is going to be implemented, management of MEET wants to clean all synthetic pallets with the help of a sorting line and not only the most dirty once (because of the better obtained quality)

Therefore, a saving can be realized of €44.000[25] and not of €57.000 which are the current reparation costs. This saving includes the savings made on management costs, because management costs of this activity are no longer needed.

- The second option to save reparation costs is to set limits on the age of pallets that are repaired. With the help of Excel is calculated that pallets should not be repaired if they are older than 13 years.
  The pallet has a mark with its age, but the age marked on most pallets is hard to read. Therefore is the limit currently set on pallets with an Impress logo, because logos are easier to read than ages (before 1996 pallets were marked with the Thomassen and Drijver logo, Impress merged with this company in 1996). However, for the coming years it will be difficult to estimate how old the pallet is and whether or not is should be repaired. A recommendation is therefore to print the age of pallets on a place where less erosion occurs.
  If this option is implemented, the reparation costs will drop by 75% (to €14.300) and the average amount of trips a pallet can complete is instead of 90, 89 trips. Details about this calculation can be found in Appendix F, Details of identified options to reduce costs. The number of trips in Hoogeveen and Deventer stay the same (respectively 40 and 30 trips). The number of trips a pallet can complete in Leeuwarden drop from 20 to 19. A saving can be realized of €49.000[26]. This saving includes the savings made on management costs, because these costs are, partially, no longer needed.

- Another option is to repair in-house again. From the past it turned out that it is not feasible to repair the pallets in-house. However, low quality equipment was used to repair the packaging materials and not every tool needed was available.
  From the organization responsible for the reparation of pallets information was requested about the time it takes to repair one pallet. It appeared that an employee is able to repair a pallet in five minutes. If the employees of MEET are able to repair a pallet in the same amount of time, it means that the wages costs per pallet are €1,70. The costs of the raw materials are approximately €3,00 per pallet (prices requested by the supplier). This means that the total reparation costs per pallet are minimal €4,70, which is more than the current reparation costs per pallet (€4,20).
  It is not a feasible option to repair in-house again, reparation costs would increase. This option is therefore no longer included in this research.

- The final option is to find another supplier. The current costs of the reparation of one pallet are €4,20, another supplier delivers the same service for €4,00. A yearly saving can be realized of €2.800.

[25] This saving can be realized because of the assumption that pallets are already depreciated if they enter the pool of Leeuwarden.
[26] This saving can be realized because of the assumption that pallets are already depreciated if they enter the pool of Leeuwarden.

8.4. Options for the transportation activities

As is discussed before, the transportation activity is split up in internal transportation and external transportation. For both activities possible options to reduce costs are identified and discussed in this section.

External transportation
The height of the costs of one external transport depends on the distance of the trip and the percentage of the truck that is loaded. In proportion, it is cheaper to transport packaging materials with trucks that are fully loaded. It is therefore cheaper to only transport packaging materials from the customer back to MEET if there are enough packaging materials located at the customer to load a truck fully. The management of MEET has already decided to only transport packaging materials from the customer to MEET if full truck loads are available. Bills of loading are checked and compared with the actual loaded meters of the truck. Differences are recorded, the external transport organization is contacted and the bill of loading and thus also the invoice is changed. This option is no longer included in this research, because this option is already implemented.

An option to reduce the external transportation costs of Leeuwarden is to enter a special contract for this specific transport with an external transport organization.
Whit this special contract, a truck plus driver is rented from the external transport organization. Costs per hour are €50. Each transport from the sorting unit to the production department takes on average two hours. Every day, on average, 1,5 transports from the unit to the production department are needed. This means that 3 hours per day the truck is needed at the MEET department. This would costs approximately €150 per day. The remaining hours, the truck is available for other transports of Impress.
The current costs of a transport from Leeuwarden sorting unit to Leeuwarden production department are €140. A saving can be realized of €70 per day, on a yearly basis a saving can be realized of €14.000[27]. No investment is needed.

Internal transportation
Because of the distances between the several buffers of the sorting units of Hoogeveen and Deventer, a lot of internal transportation is necessary in these sorting units.
A possible option to reduce internal transportation costs is to install Automatic Guided Vehicles (AGVs). AGVs can only be used efficiently if there is a standard route the AGV needs to take, in Deventer the usage of an AGV is therefore not an option. In Hoogeveen the AGV can be used for the transport from the sorting unit to the production department. Nowadays, an employee drives from to sorting unit to the production department and back all day long. Instead of a fork lift truck that is driven by an employee of MEET, the AGV takes care of this part of the internal transport. A saving can be realized of €33.000, the costs of one employee.

[27] Accounted for 200 days, the truck is not needed in the weekends for MEET and less during holidays (source: interview foreman Leeuwarden)

Furthermore, in Hoogeveen instead of two only one fork lift truck is needed, so the rent of one fork lift truck is another saving. A total saving of €40.000 (yearly) can be realized. An investment is needed of €200.000, not only the AGV needs to be bought, but also the equipment that is needed to let the AGV find its way.

Another possible option to reduce the internal transportation costs is to adjust the sorting line of pallets in Deventer, so piles of 24 pallets are stacked at the end of the sorting line (instead of piles of 16 pallets). Piles of 24 can be easily stored in the buffers, while piles of 16 pallets need to be restacked into piles of 24 pallets, so an extra action with the fork lift truck is needed. In Hoogeveen this extra restacking is not needed, so for Hoogeveen this is not an option to reduce its internal transportation costs.
With the help of interviews with experts and timing the activity it is estimated that instead of 10 minutes it only takes 8 minutes to unload the sorting line and transport the pallets to the buffer. A yearly saving can be realized of approximately €4.000. An investment is needed of approximately €2.500.

The third possible option to reduce internal transportation costs is to move the outside buffer of the sorting unit of Deventer closer to the sorting unit. A buffer is located approximately 100 meters from the sorting unit and is stored with pallets and frames that need to be sorted. A fork lift truck driver needs to drive there and back each time pallets and frames are needed. Moving this buffer closer to the sorting unit saves wages costs. However, moving the outside buffer of Deventer is not a feasible option, because no space is available.

8.5. Options for the purchasing costs

There are several options to reduce the purchasing costs of the packaging materials.

- Call-off contract. Currently the packaging materials are ordered when the need is high and the packaging materials are needed in one week. The negotiation position for MEET is in this situation bad and the prices are high. An option to reduce the purchasing costs is to enter a call-off contract with a supplier. This means that all packaging materials are ordered at the beginning of the year and the packaging materials are delivered and paid when needed. The amounts of packaging materials ordered are high, so the prices per packaging material are lower than they are in the current situation. A disadvantage is that the amounts needed in a year have to be known upfront.
  With the general sourcing manager of MEET and Impress is estimated that a saving can be realized of 3% on the current purchasing costs. A yearly saving can be realized of €27.000. No investment is needed.

- Cut layer pads in-house. At the moment the cutting of carton layer pads to euro format is outsourced. It could be cheaper to cut the layer pads in-house (at one of the MEET sorting units).

With the cutting machine it is possible to cut approximately 300 layer pads in an hour. Costs of cutting in-house, including wages costs and transportation costs, are approximately €0,10. The price paid to the external supplier is €0,25.
A saving can be realized of €0,15 per layer pad, on a yearly basis €35.500 can be saved.
An investment is needed of approximately €30.000 (for the cutting equipment).

- Another option is to use thinner layer pads. The purchasing costs of these layer pads are lower then the purchasing costs of the currently used layer pads. However, these thinner layer pads cannot be used in the production process. If cans are stacked at the thinner layer pads, piles become unstable and fall. The only option to implement the thinner layer pads is reducing the number of layers of cans on a pallet. This option has impact on several departments of Impress. The calculation of costs and savings of this option is considered too extensive for this research. It is therefore decided not to further investigate this option.

- Deposit system. In the current situation customers pay per packaging material a standard trip price. The chance is high that packaging materials get lost or are treated bad by customers, because customers do not value the packaging materials. When a deposit system is introduced, the chance of losing or bad treatment of packaging materials is lower. An example is the following; customers pay €22[28] when they receive a pallet. If the pallet is returned to Impress (this is no obligation, because the customer already paid for the pallet), the customers receive €17,50. With this system, the pallets have value for the customer; they will treat the pallets with more care.

  No data is available, but it is assumed that 2% of the pallets are lost in the process[29]. This means that each year 2.000 pallets get lost. In the worst case scenario, these pallets are also not returned by the customer if the deposit system is introduced, but with this system the customer does pay for the pallets it does not return. A saving can be realized of approximately €44.000 (€22 x 2.000 pallets).

8.6. Options that influence all activities

There are also options that influence the whole process and are substitutes for MEET as a department of Impress. These options are: outsourcing the handling of packaging materials and use packaging materials that can only be used once.

Join an existing pallet pool
MEET is the pallet pool for Impress facilities located in the Netherlands. There exist, however, several general pallet pools that might offer the same service for Impress for a lower price. Standard pallet pools generate their revenues in another way than MEET does.

[28] Numbers are just examples, extensive research is needed if this system is applied.
[29] Assumed by management of MEET and controllers of Impress.

Instead of paying per trip, rent has to be paid per day per piece of packaging material. During this research, employees of two pallet pools that are interested in taking over the pallet pool of MEET were interviewed.
From the information received from the employees working at the first pallet pool, it is calculated that the costs are higher if Impress would enter this pallet pool (costs per trip would almost double). Details about calculation can be found in Appendix F, Details of identified options to reduce costs.
The employee working at the second pallet pool did not want the pallets with the dimensions currently used at Impress in his pallet pool. During a discussion about the process of MEET and the process of the organization of this supplier, it became clear that the process at MEET is the best for this type of pallet. This employee advised to automate the process and not to enter an existing pallet pool.
Calculation about costs and further information about these existing pallet pools can be found in Appendix F, Details of identified options to reduce costs.

It can be concluded that it is not an option to enter an existing pallet pool, it is therefore decided to not include this option is this research any longer.

Use only one-time-usage packaging
In the current situation MEET uses the so called returnable packaging materials. An option might be to use packaging materials that can be used only once (one-time-usage packaging materials).
The prices of one-time-usage packaging materials are higher than the current price per trip. The price of a standard pallet is, for example, €7,00, while the trip price for a first quality standard pallet is only €2,50. The same price differences are found for the layer pads and frames.
Another disadvantage of the introduction of one-time-usage packaging material is that the quality is lower.
Furthermore, there could be problems with the automatic packers of Impress and the automatic packers of the customer. It is not sure whether these packers can handle these packaging materials. If not, investments are needed to adjust these automatic packers.
Because of these reasons, it is decided that it is not feasible to introduce one-time-usage packaging materials and this option is no longer included in this research.

8.7. Overview

In Table 22 an overview can be found of all options identified in this chapter that generate savings, the savings per year the option generates and the investment needed.

To estimate the height of the investment needed, offers are requested from several suppliers. This data can be considered as reliable.

The data used to estimate the height of the saving is based on the experience of three experts. The experience of these experts cannot be checked, there is a lack of quantitative data. The reliability of the height of these numbers can therefore be questioned.

Because of a lack of other data sources, this data is used in this research.

		Yearly savings (€)	One-time investment (€)
SORTING			
	Less stops	€6.100	€0
	Pallet sorting line Leeuwarden	€17.000	€70.000
	Layer pad sorting line	€30.000	€80.000
	Split at production department	€10.000	€0
CLEANING			
	Outsource synthetic layer pad cleaning	€2.800	€0
REPARATION			
	Reparation limits	€49.000	€0
	No more reparation	€44.000	€0
	Other supplier	€2.800	€0
TRANSPORTS			
	Transport contract	€14.000	€0
	AGV	€40.000	€200.000
	Piles of 24	€4.000	€2.500
PURCHASE			
	Call-off contract	€27.000	€0
	Cut layer pads in-house	€35.500	€30.000
	Deposit system	€44.000	€0

Table 22, Overview identified options

The options presented in Table 22 are options that generate savings. To generate these savings is, for some options, first an investment needed. The options can therefore not be compared to each other on the criterion savings per year.
Furthermore, some options to reduce costs also effect, beside employees of MEET, customers or other departments of Impress. These consequences are not reflected by the criterion savings per year.
In the next chapter the options are therefore ranked based on two other methods, the method Impress always uses to appraise investment and the Net Present Value (NPV) method.

9. Ranking of the identified options

In this chapter the identified options of chapter 8 are ranked. The options are not mutually exclusive, this means that if one option is implanted, it is still possible to implement the other options as well.
The ranking classifies the options therefore in a sequence of which option should be implemented first, which second, etc.
In the first section are the options regrouped, the second section ranks the options on the criteria Impress normally uses to decide whether to invest or not. The third section ranks the options on another criterion, namely the Net Present Value. The fourth section describes the difference and similarities between the two ranking methods.

9.1. Impact of identified options

The options identified in chapter 8 in this section are regrouped in two main groups. The first group consists of options that only have an impact on MEET; the second group consists of options that also influence other departments of Impress or customers, which could be a disadvantage of these options. The impact the options have, on employees, Impress departments or customers, is also discussed.

9.1.1. Options which only have an impact on MEET

1. Stop the pallet sorting line less often. To make the employees stop the sorting line less often, training of these employees is necessary.

2. Stack pallets in piles of 24. If this option is implemented, the pallets are stacked in piles of 24 pallets at the end of the sorting line (currently pallets are stacked in piles of 16 pallets). An advantage is that the fork lift truck driver does not have to restack the piles of pallets any longer. The sorter and fork lift truck driver have to get used to and learn how to deal with the height of the piles.

3. Introduce a layer pad sorting line. Employees are currently sorting the layer pads with the help of a special sorting tool, if this option is implemented employees have to learn how to work with this sorting line for layer pads.

4. Introduce a sorting line for pallets in Leeuwarden. In Leeuwarden all pallets are sorted without a sorting line, an option is to introduce a sorting line for pallets in Leeuwarden. Employees of MEET Leeuwarden have to learn how to work with the sorting line, so proper training of these employees is necessary.

5. Set limits on the age of pallets that are repaired. Currently, the sorter has to decide whether or not it is efficient to repair the pallets.
   If this option is implemented, the sorter has to check how old the pallets are. If the pallet is older than 13 years, the pallet should not be repaired. Employees have to be trained to work according to this procedure.

6. Abandon reparation of pallets. In the current situation the sorter has to decide whether pallets that are broken should be repaired or considered as waste. If reparation is abandoned, all broken pallets are considered as waste. Employees have to get used to this way of working, but eventually their work becomes easier.

7. Find an other supplier for the reparation of pallets. This has no influence on the way pallets are sorted. Management of MEET has to find a supplier that offers the reparation service for a lower price.

8. Close a transport contract (rent truck). This has no consequences for the way employees of MEET Leeuwarden are working. The management team of MEET has to communicate and arrange with other departments of Impress when the truck is needed at MEET and when it is available for other transports of Impress. Good planning is necessary.

9. Introduce Automatic Guided Vehicles (AGVs) in Hoogeveen. The AGV will take over the internal transportation of packaging materials from the sorting unit in Hoogeveen to the production department in Hoogeveen. Employees of MEET have to put ready sorted packaging material on a fixed location. The AGV will transport these packaging materials to a fixed location in the production department. Employees of MEET in Hoogeveen have to learn how to work with the AGV and have to get use to the situation.

10. Enter a call-off contract for the purchasing of packaging materials. The implementation of this option does not have any consequences for the way employees of MEET currently work. If this option is implemented the management team of MEET has to contact each year several suppliers and arrange contracts with these suppliers about deliveries and prices of packaging materials instead of contacting several suppliers several times per year. So, the purchasing activity for the management team of MEET changes.

11. Cut layer pads in-house. Employees of MEET have to be trained how to work with this machine.

9.1.2. Options which also have an impact on other Impress departments or customers

12. Split packaging materials per type at the production department. Employees of the production department have to split the packaging materials per type; they therefore have to do their work differently. Employees of MEET only have to pick up the packaging materials and transport them to the buffer, so their work becomes easier.

13. Outsource synthetic layer pad cleaning. The synthetic layer pads are picked up at the customer by the organization responsible for the cleaning of layer pads at other moments than the other packaging materials are picked up. Two different transport organizations will therefore contact the customer about picking up packaging materials.
Furthermore, management of MEET has to communicate to the external organization when and where synthetic layer pads are delivered.

14. Introduce a deposit system. Both the customer and other departments of Impress are influenced by the implementation of the deposit system. More bills have to be send to the customer (and the customer will receive more bills) to handle the financial consequences of the deposit system. Furthermore, chances of disputes with customers about packaging materials are higher, because money is involved.

The implementation of options 1, 2, 3, 8, 11 and 12 has consequences for the number of jobs available at MEET. It is estimated that in the worst case one FTE would be lost. Losing one FTE does not lead to any forced resignations, because of natural labor turnover. The financial consequences (less wages costs) are included in this research, other consequences, like a smaller amount of jobs available at MEET, not.

All fourteen options are ranked in the next section based on Impress' decision criteria.

9.2. Ranking based on Impress' decision criteria

As is discussed in section 1.2 Impress uses as the main criterion to determine whether or not to appraise an investment the pay back period. Investments with a pay back period longer than 2 years will not be implemented.
Furthermore, management of MEET uses the criterion implementation time. If it takes more than six months to implement the investment, the investment will not be approved. Data about the implementation time of each option is received by requesting this information at several suppliers and during an interview with the management of MEET.

The options that do fulfill both constraints are ranked based on the criterion 'savings per year'. The option with the highest saving should be implemented first.

In Table 23 an overview can be found of the options and their pay back time and implementation time.

		Savings, per year (€)	Pay Back Time (years)	Time to implement (months)
No impact, except for MEET				
1.	Reparation limits	€49.000	0	0
2.	Cut layer pads in-house	€37.500	0,40	3
3.	Buy earlier	€27.000	0	1
4.	Transport contract	€14.000	0	2
5.	Less stops	€7.900	0	3
6.	Piles of 24	€4.000	0,625	1
7.	Other reparation supplier	€2.800	0	1
	Abandon reparation	€44.000	0	0
	Layer pad sorting line	€30.000	2,67	>6
	Pallet sorting line Leeuwarden	€17000	4,1	4
	AGV	€33.000	6	>6
Impact on customer and / or other department of Impress				
1.	Split at production department	€10.000	0	1
2.	Outsource synthetic layer pad cleaning[30]	€2.800	0	1
	Deposit system	€44.000	0	>6

Table 23, Ranking based on Impress' decision criteria

Options that are marked yellow in Table 23 are not implemented because these exceed the pay back period of two years and / or have an implementation time longer than six months. The options ‘abandon reparation of pallets’ and ‘reparation limits’ are mutually exclusive; if one option is implemented, the other option cannot be implemented anymore. Based on the criterion savings per year is decided that the option abandon reparation of pallets is not implemented.

As can be seen in Table 23, the option that should be implemented first is the option ‘Reparation limits’.
The options that have as an extra disadvantage that they also influence other department of Impress or customers do not generate high savings compared to the savings generated by options that do not have this disadvantage.

[30] The quality of the cleaning of synthetic layer pads will increase, which is considered as an extra advantage of implementing this option.

According to the theory (see section 2.4) the criterion pay back time is not the best method to appraise investment. In the next section are the options ranked with the help of another method called Net Present Value.

9.3. Ranking based on NPV

As is already described in the theory, the pay back method is not the best method to decide whether or not an investment should be appraised. The options to reduce costs are therefore also ranked on their Net Present Value (NPV). The NPV takes also into account the time value of money and the cash inflows generated after the pay-back period.
To estimate the NPV of an option, the compound rate of return per time period and the number of time periods need to be estimated (see section 2.4).

The compound rate of return, yearly, of Impress is requested at the financial department of Impress and is 9,88%.
The number of time periods differs per identified option. Some options, like abandoning reparation, generate savings till infinity. Other options generate savings as long as the economic life time of the investment. An example is the layer pad sorting line, the economic life time of this line is ten years, so savings can be realized for ten years, thereafter an investment is needed again.

To be able to compare the options with each other, a period of ten year is taken for all options. The main reason for this is that most businesses (including Impress) make strategic plans for ten years.
It is not reasonable to assume that the situation of MEET, as described in this thesis, is still the same over ten years. So, the identified options to reduce costs are likely to generate savings for ten years, savings generated after these ten years are highly unlikely.

In Table 24 an overview can be found with the Net Present Values of the identified options.

- If the NPV is positive it means that the cash inflows from the investment yield a return in excess of the cost of capital and therefore the investment project should be undertaken.
- If the NPV is negative it means that the cash inflows from the investment yield a return less than the cost of capital and therefore the opportunity should be rejected.
- If the NPV is zero, it means that the investment has generated exactly the required returns to compensate for the costs of capital, without a surplus. In this case it is up to the management to decide whether or not to invest.

Only one of the identified options has a negative NPV and should therefore not be implemented (according to the NPV criterion). This is the option ‘AGV’, which is marked yellow in Table 24. All other options have a positive Net Present Value, which means, according to the theory, that all these options should be implemented.

The options ‘abandon reparation of pallets’ and ‘reparation limits’ are mutually exclusive. Based on the NPV criterion is decided that the option abandon reparation of pallets should not be implemented[31].

		# periods (in years)	NPV
No impact, except for MEET			
1.	Reparation limits	10	€302.000
2.	Cut layer pads in-house	10	€192.000
3.	Buy earlier	10	€166.000
4.	Layer pad sorting line	10	€112.000
5.	Transport contract	10	€86.000
6.	Less stops	10	€48.000
7.	Pallet sorting line Leeuwarden	10	€41.000
8.	Piles of 24	10	€22.500
9.	Other supplier	10	€17.000
	Abandon reparation	10	€270.000
	AGV	2 x 5[32]	-€48.000
Impact on customer and / or other department of Impress			
1.	Deposit system	10	€271.000
2.	Split at production department	10	€61.000
3.	Outsource synthetic layer pad cleaning	10	€17.000

Table 24, Ranking based on NPV

Based on the NPV criterion, the option ‘reparation limits’ should be implemented first.

In the next section the results of the two ranking methods are compared.

[31] There are other, more sophisticated techniques to compare alternatives with each other that are mutually exclusive. In this research, however, the NPV method is used to compare these two alternatives, which is also an application of this method.

[32] The economic life time of an AGV is five years. To make this option comparable with the other options, the NPV of this option is estimated as if over five years again an AGV is bought for the same price, which generates the same savings.

9.4. Difference and similarities between the investment appraisal methods

In this section the difference and similarities between the two investment appraisal methods are discussed.

Similarities

- Both investment appraisal methods come to the conclusion that the option 'reparation limits' should be implemented first and that therefore the option 'abandon reparation' should not be implemented (these two options are mutually exclusive).
- The option that suggests using an AGV for the transports of packaging materials from the sorting unit of Hoogeveen to the production department of Hoogeveen should not be implemented according to both methods.
- The sequence of the options that only have an impact on MEET is the same for both methods. Exceptions are the options that should not be implemented according to the pay back period and should be implemented according to the NPV method (see differences).
- The sequence of the options that also have an impact on customers and / or other department of Impress has not changed (except the option 'deposit system').

Differences

According to the standard Impress method the options 'Pallet sorting line in Leeuwarden', 'Layer pad sorting line' and 'Deposit system' should not be implemented. According to the NPV method, these three options should be implemented, all have a positive NPV. The layer pad sorting line is the fourth option that should be implemented according to the NPV method, the pallet sorting line in Leeuwarden should be implemented as seventh. The deposit principle has the second highest NPV, but a disadvantage is that it influences both customers and other departments of Impress.

The identified options are ranked with the help of two different investment appraisal methods. It is up to the management of MEET to decide which method is used. According to the theory, the NPV is preferable to the payback period (see also section Recommendations on page 85)


Impress

Conclusion

The aim of this research is to answer the following research question:

What are the current costs per trip for MEET per type of packaging material
and
how can these costs be reduced?

This research started with a description of the current flow of packaging materials. Costs of MEET were linked to this physical flow of packaging materials, so it became visible where in the process which costs were made.

The costs have to be linked to the different types of packaging materials. Two different costing systems that can be used to estimate the cost per trip were discussed, where Activity Based Costing was the method used in this research. The main reasons for this were:

- MEET has a high percentage of indirect costs; ABC supports this better than direct costing.
- MEET has a wide product range; ABC supports this better than direct costing.
- No data is available to estimate a cost price based on direct costing.

The data used in the calculation of the ABC cost price was and the impact parameters that are likely to change in the nearby future have on the ABC cost price was discussed in more detail. Furthermore the ABC costs price was compared with the current trip price and the current cost price and the difference were analyzed.
The arrangement of activities and allocation of costs was considered reliable and valid.

The ABC cost price did not only provide the management team of MEET with information about the trip prices per type of packaging material, but it also gives more insight in the factors that influence the trip price.

In the second part of this research were fourteen options to reduce costs identified.
The height of the yearly savings was estimated based on the experience of experts. This experience, however, cannot be checked; there is a lack of quantitative data. The reliability of the height of these numbers can therefore be questioned.
For the fourteen options that generate savings the impact of the introduction of the option was also described. A difference was made between options that only have an impact on MEET and options that also have an impact on other departments of Impress or on customers.

The options were ranked based on two methods. The ranking classifies the options in a sequence of which option should be implemented first, which second, etc.
The first ranking method is the method that is commonly used at Impress, the pay back period. The other ranking method is the Net Present Value (NPV) method. NPV was chosen to use because it takes into account both the time value of money and the total cash flows over a project's life. Furthermore it expresses the results in monetary terms and assumes that the cash flows generated from an investment will be reinvested at the cost of capital.

Both investment appraisal methods come to the conclusion that the option to set limit on the age of pallets that are being repaired should be implemented first.
The main difference between the two ranking methods is that some options should not be implemented according to the payback period and should be implemented according to the NPV method.

It is up to the management of MEET to decide which method is used. However, according to the theory, the NPV method is preferable to the payback period (see also section Recommendations).

Recommendations

In this section are options for further research and other recommendations identified.

- An option for further research is to investigate whether or not centralization of the sorting units is possible. The sorting of packaging materials is spread over three sorting units and rent has to be paid for three buildings. It could be an option to centralize the sorting of packaging materials in one central sorting unit. This central sorting unit needs two sorting lines for pallets and a layer pad sorting line. Packaging material is transported from this sorting unit to the three production departments of Impress.
  It could also be an option to only centralize the sorting of layer pads in one unit.

- Broken and depreciated packaging materials are currently just considered as waste, while MEET could earn money with this waste. Packaging materials of wood and carton can be sold when they cannot be used in the production process any longer. MEET has to find a customer for this 'waste'.

- Currently it is not known which customers treat their packaging materials bad and which customers do not return their packaging materials to MEET. When this data is available, bills can be sent to these customers.

- Communication between the production departments of Impress and MEET is poor. Nobody knows from each other which packaging materials are needed or available. Planning is not communicated, which causes stress for both departments. To improve this, meetings should be organized to communicate the latest problems and needs.

- The sorting units of Deventer and Leeuwarden ‘sponsor’ the sorting unit of Hoogeveen. It is not possible to increase the trip prices of Hoogeveen, because the production department (and the customer) will not accept a rise in the costs of packaging materials. One way to partly solve this is problem is the following.
  At the end of each year the profit of MEET is equally divided over the three sorting unit (in proportion to the amounts of packaging material used at each production department). It is an option to no longer give t he production department of Hoogeveen a part of the profit of MEET and divide the profit of MEET only over the production departments of Leeuwarden and Deventer.

- Impress and MEET currently use the payback period as a method to appraise investments. The NPV method as presented in this research is, according to the theory, a better method to use when investment are appraised.
  I strongly recommend Impress and MEET to use, instead of the payback period the NPV as a method to appraise investments. The NPV method does (and the payback period method does not) take in account the time value of money and cash inflows generated after the pay back period which are major advantages of this method. In this research some options are rejected by the pay back period method do have a high NPV and should be implemented.

- Last but not least, the current trip prices should be adjusted. The ABC cost price calculation made clear that the trip price of some types of packaging materials is below cost price and for others it is above cost price. The current trip prices should be adjusted to the ABC cost price levels.


Impress

References

Websites:

- www.impressgroup.com visited at 20 March 2008

Books

- Berry, A. & Jarvis, R. (1997). *Accounting in a Business Context.* London: Thomson Learning.
- Bhushan, N. & Rai, K. (2004). *Strategic Decision Making: Applying the Analytic Hierarchy Process.* London: Springer-Verlag.
- Cooper, R.C. & Schindler, P.S. (2006). *Business Research Methods.* New York: McGraw-Hill Education.
- Dijkstra, A. (2007). *Kwaliteitsborging MEET.* Deventer: Impress.
- Drury, C. (2004). *Management and Cost Accounting.* London: Thomson Learning.
- Glad, E. & Becker, H. (1996). *Activity-Based Costing and Management.* Chichester: John Wiley & Sons Ltd.
- Goodwin, P. & Wright, G. (1991). *Decision Analysis for Management Judgment.* New York: Wiley. (page 7-26)
- Hicks, J.H. (2004). *Problem Solving and Decision Making.* London: Thomson Learning
- Reid, R.D. & Sanders, N.R. (2002). *Operations Management.* New York: John Wiley & Sons, Inc.
- Turney, P.B.B. (1991). *Activity Based Costing: The Performance Breakthrough.* Portland: Cost Technology Inc.
- Vosselman, E.G.J. (2001). *Management accounting en control.* Utrecht: Lemma BV.

Articles

- De Weerd, R.J. *Activity Based Costing: de praktijk.* NIVE.


Impress

Appendix A, Abbreviations and definition

In this appendix an overview can be found of the abbreviation and definitions used in this report.

Abbreviations:

- ABC: Activity Based Costing
- AGV: Automatic Guided Vehicle
- ARR: Accounting Rate of Return
- D: Deventer
- DCF: Discounted Cash Flow
- FTE: Full Time Employee
- FV: Future Value
- H: Hoogeveen
- IRR: Internal Rate of Return
- L: Leeuwarden
- MEET: Magazijn Emballage Expeditie Transport
- N: number of time periods
- NA: Not Available
- NPV: Net Present Value
- PV: Present Value
- R: compound rate of return per time period

Definitions:

- Activity recovery rate: activity costs per unit
- Activity traceable costs: costs that are accounted for per activity
- Bill of Activities: represents a list of all the activities and relative quantities required by a particular cost object (comparable to a bill of materials).
- Cost drivers: factors or transactions that are significant determinants of costs
- Direct traceable costs: costs that have a direct relationship to cost object
- Process flowchart: used for viewing the sequence of steps involved in producing the product and the flow of the product through the process.
- Semi-structured interview: interview starts with a few specific questions and is followed by the individual's tangents of thoughts.
- Untraceable costs: costs that cannot be assigned to any activity or cost object.


Impress

Appendix B, Quality groups of packaging materials

For each type of packaging material exists different quality groups. The possible groups per type of packaging material can be found in Figure 6.

ITEM	OMSCHRIJVING	A	B	C	D	E	F	G	H	J	K	R	S	V
QNW000920A	PALLET 1300x1120 UK-SIZE	1ek											sort	vern
QLB000921A	TUSSENLEVEL 1300x1120 UK-SIZE	1ek											sort	vern
QMW000922A	RAAM HOUT 1300x1120 UK-SIZE	1ek											sort	vern
QMO000923A	RAAM STAAL 1300X1120 UK-SIZE	1ek											sort	vern
QMW000929A	RAAM HOUT 1250x1150	1ek											sort	vern
QPO000930A	PALLET KUNSTSTOF 1420x1120	1ek											sort	
QNW000931A	PALLET 1250x1150 DUITS-OPEN	1ek	2ek									rep	sort	vern
QNW000932A	PALLET 1420X1120 VERH Z/LAT	1ek	2ek								Gr.Klos	rep	sort	vern
QNW000933A	PALLET 1250x1150 DU-DICHT	1ek	2ek									rep	sort	vern
QHC000934A	DEKSEL 2-DLG KARTON DC	1ek											sort	
QMO000935A	RAAM STAAL 1250x1150 BREED	1ek										rep	sort	vern
QNW000936A	PALLET 1250X1150 KLEIN	1ek										rep	sort	vern
QLB000937A	TUSSENLEGVEL 1250x1150	dik	dun										sort	vern
QNW000938A	PALLET 1200X1000 STD	1ek	geslot									rep	sort	vern
QMW000939A	RAAM HOUT 1200x1000	1ek										rep	sort	vern
QLB000940A	TUSSENLEGVEL 1200x1000	1ek											sort	vern
QLS000941A	TUSSENLEGVEL 1420x1120 KUNSTST	1ek											sort	vern
QNW000942A	PALLET 1420x1120 VERHOOGD	1ek	2ek									rep	sort	vern
QMO000943A	RAAM STAAL 1250x1150 SMAL	1ek										rep	sort	vern
QMO000944A	RAAM ALUMINIUM 1250X1150	1ek										rep	sort	vern
QNW000945A	PALLET 1350x1200	1ek	2ek									rep	sort	vern
QLB000946A	TUSSENLEGVEL 1350X1200	1ek	2ek										sort	vern
QMW000947A	RAAM HOUT 1350X1200	1ek										rep	sort	vern
QMO000948A	RAAM GEGALVANISEERD 1250X1150	1ek										rep	sort	vern
QHC000949A	OMSLAG 2DL 1250X1150	1ek	2ek										sort	vern
QXO000950	DRAADBOX STAAL	1ek											sort	
QXO000951	CONTAINER	1ek											sort	
QEW000952A	DEKSELPALLET 1120x1120	1ek	2ek									rep	sort	vern
QMW000953A	RAAM HOUT 1420x1120	1ek	blauw									rep	sort	vern
QEM000954	DEKSELREK	1ek											sort	
QEM000955A	GITTERBOX	1ek										rep	sort	vern
QXO000956	HOUTEN KIST	1ek											sort	
QMO000957A	RAAM STAAL 1420X1120	1ek										rep	sort	vern
QEM000958	DRAADMAND	1ek											sort	
QNW000960A	PALLET 1420X1120	1ek	2ek	rode klos								rep	sort	vern
QHC000961A	OMSLAG 2DL 1420X1120	bl 1ek	bl 2ek		br 1ek	br 2ek				zw 1ek	zw 2ek		sort	vern
QLB000962A	TUSSENLEGVEL 1420X1120	ro 1ek	ro 2ek	zw.rnd 1ek	zw.rnd 2ek	eenm	blw.dik 1ek	alg. 3ek	gro 1ek				sort	vern
QNW000963A	PALLET 1200X800 EURO	1ek	2ek									rep	sort	vern
QNW000964	PALLET 1250X1150 IMPRESS DUITS	1ek											sort	
QEW000965A	DEKSELPALLET/HALF 1000X560	1ek	2ek									rep	sort	vern
QLB000966A	TUSSENLEGVEL 1200X800	1ek	2ek									rep	sort	vern
QES000967A	PALLET KUNSTSTOF 1200X1000	1ek											sort	vern
QEW000968A	DEKSELPALLET 1200x1000 GESLOTEN	1ek										rep	sort	vern
QMW000969A	RAAM HOUT 1200X800 EURO	1ek	2ek									rep	sort	vern
QEW000970A	DEKSELPALLET 1200x800 GESLOTEN	1ek	2ek									rep	sort	vern

Figure 6, Quality groups per type of packaging material (source: Kwaliteitsborging MEET, Dijkstra)

Explanation of abbreviations used in Figure 6:

- 1ek: First quality packaging materials.
- 2ek: Second quality packaging materials.
- 3ek: Third quality packaging materials.
- Rode klos: Third quality packaging materials, these are only used for customers active in the chemical industry.
- Gesl: The pallet has a closed bottom.
- Ro: Red layer pad or cover, the color relates to the dimensions of the packaging material.
- Bl: Bleu layer pad or cover, color relates to the dimensions of the packaging material.
- Zw: Black layer pad or cover, color relates to the dimensions of the packaging material.
- Br: Brown layer pad or cover, color relates to the dimensions of the packaging material.
- Blauw: Special kind of wooden frame, with an extra lath.
- Dik: Thick, layer pads can be thick of thin.
- Dun: Thin, layer pads can be thick of thin.
- Eenm: Packaging materials that can only be used one time.
- Gr klos: Raised pallet.
- Alg: General layer pads, third quality.
- Rnd: Layer pad with rounded corners.
- Rep: Packaging materials to repair.
- Sort: Packaging materials to sort.
- Vern: Waste.

Blanks are quality groups that do not exist for that type of packaging material.

Appendix C, Information flow of packaging materials

Each physical location movement of the packaging materials is registered in the information system of Impress. Different information systems are linked together and exchange information with each other. The word ‘location’ in this appendix is a location in the information systems.

External customer delivery

The physical buffers as described in Figure 1 have an other location name in the information system.

- Packaging materials located at the customer: ‘Customer number’
- Unsorted packaging materials buffer: ‘S’
- Sorted packaging materials buffer: ‘A’, ‘B’, ‘C’ etc. A detailed overview of all the possible locations of sorted packaging material can be found in Appendix B, Quality groups of packaging materials. The first row of this figure represents the location in the information system.
- Packaging materials that can be used in the production process: ‘Empty’
- (Semi-) finished goods warehouse: ‘Full’

In Figure 7 an overview can be found of the information flow connected with the physical movements of the packaging materials. The information flow is explained below in more detail.

If a customer returns packaging materials to MEET, a manual transaction (a manual transaction is an input in the information system that is not generated automatically) is executed by employees of MEET to change the location from ‘Customer number’ to ‘S’. If the unsorted packaging materials are sorted by employees of MEET, the location changes from ‘S’ to ‘A’, ‘B’, ‘C’, etc (depending on the type and quality of the packaging material). This is again a manual transaction executed by employees of MEET. If the production department needs a certain type of packaging material, employees of MEET transport the packaging materials to the buffer of the production department. This results in a transaction (manual by employees of MEET) from ‘A’, ‘B’, ‘C’, etc. to ‘Empty’. Hereafter the packaging materials are used in the production process and are filled with (semi-)finished products. Again the location changes, from ‘Empty’ to ‘Full’. This is an automatic transaction, a form is scanned (automatically) and the location change is directly processed in the information system.
The next step is that the (semi-)finished products are delivered to the customer. The order is picked which results in an automatic transaction that changes the location from ‘Full’ to ‘Customer number’.

The flow described above is pictured in Figure 7 with a fat line.

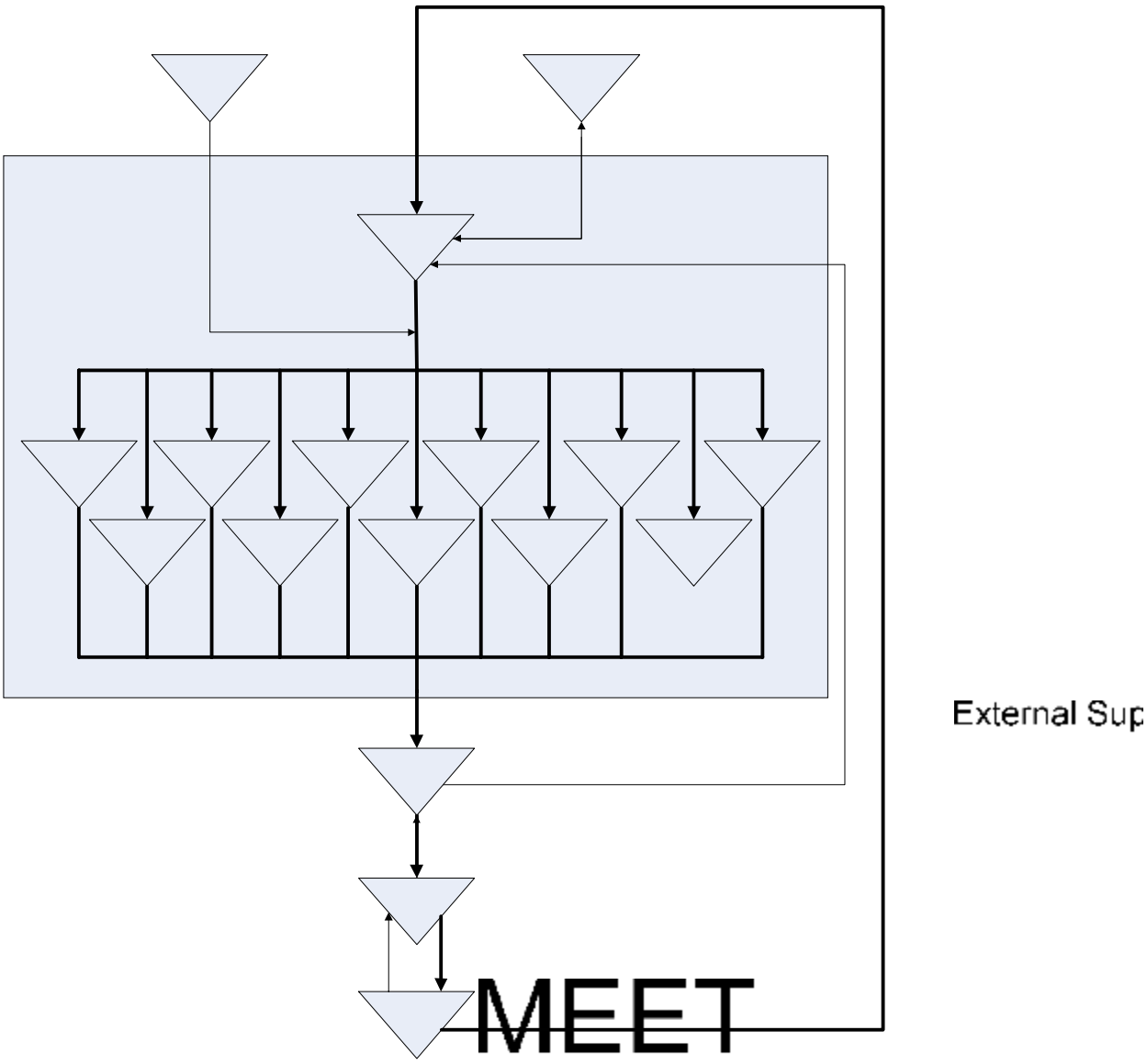


Figure 7, Flow chart of information flow packaging materials

In section 3.1.2 the exceptions on the standard flow are described. These exceptions are also registered in the information system.

If the production department returns packaging materials to MEET a manual transaction is executed by employees of MEET to change the location from ‘Empty’ to ‘S’.
If customers return (semi-)finished products to Impress (for example due to quality problems) an automatic transaction (by scanning labels) is made from ‘Customer number’ to ‘Full’.

The delivery of new packaging materials is also registered in the information system; a manual transaction is executed to add packaging material to the locations ‘A’, ‘B’, ‘C’, etc.
Waste is also registered in the system; a special location is created in the information system, called ‘V’. When, while sorting, packaging materials are discovered which do not fulfill the quality requirements and cannot be repaired, a transaction is made (manually) from ‘S’ to ‘V’.
When, while sorting, pallets are discovered that need to be repaired, a transaction is made to change the location from ‘S’ to ‘R’. If the external organization responsible for the reparation of the packaging materials returns the packaging material, the vice versa transaction is executed, from ‘R’ to ‘S’. Both transactions are executed manually by employees of MEET.

The consignment of packaging materials (filled with (semi-)finished products) from inter-company customers is registered differently in the information system. This in explained in the next section.

Inter-company consignments

For the consignment of packaging materials (filled with (semi-)finished products) from inter- company customers, a special location in the information system is created, called ‘PUR’. Each packaging material filled with (semi-)finished goods that is received from an inter-company customer is registered at this location (executed by employees of the expedition centre).
There are three possibilities to leave the location ‘PUR’. The first option is delivery of the (semi-)finished goods to the customer. The second option is the delivery of the (semi-)finished goods to another inter-company facility. In both cases the products and packaging materials are stored at another production facility for a while.

The third possibility is that the (semi-)finished products are used in the production process. The packaging materials are emptied and processed via the system location ‘Empty’ (automatic transaction) back to the unsorted information system location ‘S’ (manual transaction). See also Figure 8, Flow chart inter-company delivery.

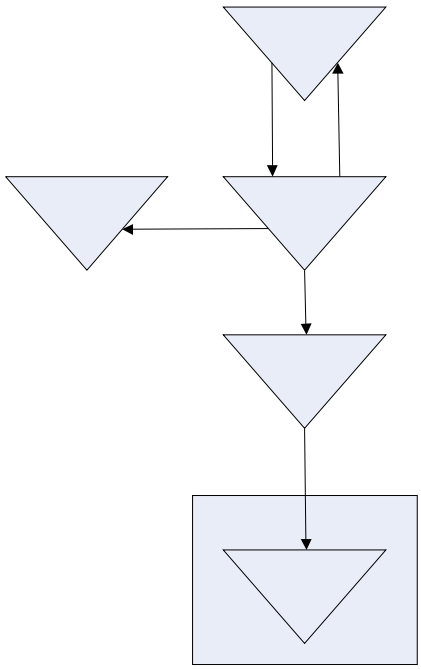


Figure 8, Flow chart inter-company delivery

Appendix D, Tracing details

This appendix is split up in two sections. Each section describes an element of the tracing process in more detail.

Tracing fork lift truck hours and rent of fork lift trucks

This section explains per activity what premises are made while tracing the fork lift truck hours and the rent paid for the fork lift truck to that activity.

The fork lift truck hours and the rent for the fork lift truck have to be traced to different activities. Every day is recorded by employees of MEET how many hours he has spend on driving a fork lift truck, it is therefore known how many hours in a year are spend on driving fork lift trucks. With the help of interviewing several fork lift truck drivers and the foremen of the sorting units and by timing the activities, the hours spend on fork lift truck driving are traced to the identified activities.
The rent for the fork lift trucks is traced to activities based on the percentage of the total fork lift truck hours that are traced to that activity.

Sorting with a sorting line:
In Deventer and Hoogeveen pallets are sorted with the help of a sorting line. With the help of timing this activity it is estimated that it takes 10 minutes (in Deventer) to transport a pile of 24 pallets to the sorting line, from the sorting line to the buffer for sorted packaging materials and from this buffer to the buffer of the production department.
In Hoogeveen this process takes 6 minutes.

Via the number of pallets sorted with the help of a sorting line it is then calculated how many fork lift truck hours are needed for sorting with a sorting line in a year.
In Leeuwarden no sorting line is available, so no fork lift truck is needed for this activity.

Sorting layer pads:
With the help of timing this activity it is estimated that it takes 5 minutes (in Deventer) to transport a pile of 1200 layer pads from the sorting station to the buffer for sorted packaging materials and from this buffer to the buffer of the production department.
In Hoogeveen this takes 6 minutes.
In Leeuwarden no fork lift truck is needed for this activity.
Via the number of sorted packaging materials it is then calculated how many fork lift truck hours are needed for sorting layer pads in a year.

External transportation:
Trucks arriving at the MEET sorting units are unloaded with the help of a fork lift truck. Trough timing it is estimated that it takes on average 20 minutes to unload a truck in Hoogeveen and Leeuwarden.

In Deventer three times a week a truck arrives with packaging materials that are mixed up.

Not only packaging materials that belong to MEET are delivered, but also packaging materials of Impress facilities in Italy and Germany. It takes on average an hour to unload this truck. The average time to unload a truck in Deventer is therefore 27 minutes.

Multiplying these times with the number of transports that arrive in a year at each sorting unit results in the total time per year a fork lift truck is needed for the external transportation activity.

Rough sorting:
The amount of fork lift truck hours that are needed for this activity is estimated via interviewing and timing.
One reason for rough sorting the packaging materials is that packaging materials that are returned by the customers are mixed up. This happens in every sorting unit. Via interviewing is estimated that in Deventer no fork lift truck is needed for this part of rough sorting activity. In Leeuwarden this activity is always executed with the help of a fork lift truck and in Hoogeveen in 75% of the time the rough sorting activity is executed a fork lift truck is needed.
Furthermore, in Deventer, each day packaging materials are returned to the sorting unit by the production department. It takes on averages two hours per day to roughly sort these packaging materials. This rough sorting is always executed with the help of a fork lift truck.

Sorting without line:
Via interviewing employees it appeared that in Deventer 50% of the time the activity sorting without a sorting line is executed, a fork lift truck is needed.
In Hoogeveen a fork lift truck is always needed for this activity.
In Leeuwarden no sorting line is available, so each pallet is sorted without the help of a sorting line. It is, however, not possible to record how much time it takes to sort one pallet. The remaining fork lift truck hours of Leeuwarden are therefore traced to sorting without the line.

Internal transportation:
In Deventer and Hoogeveen it is not possible to time or estimate how much time the activity internal transportation takes. The remaining fork lift truck hours are therefore traced to the internal transportation activity.
In Leeuwarden no internal transportation is executed.

Estimating replacement values
The first step in estimating the replacement values of the packaging materials is requesting the current price of new packaging materials at the suppliers of packaging materials. These prices can be found in the table below.

Packaging material	Price
Pallet	€22
End pallet	€22
Syrup pallet	€16
Synthetic pallet	€50
Wooden frame	€5
Steel frame	€27
Caron layer pads	€0,85
Synthetic layer pads	€5
Carton covers	€4,50

The pallet and end pallet are first used in Hoogeveen, then in Deventer and then in Leeuwarden. If the quality of these packaging materials is too low to use the packaging materials in Hoogeveen, they are transported to Deventer where these packaging materials do fulfill the quality requirements and where they can be reused. Packaging materials that cannot be used in Deventer anymore are reused in Leeuwarden.
This reusing of packaging materials influences the replacement values of the packaging materials; the prices of the new materials are in this case not the replacement values.
It is estimated that the replacement values are the following.

Packaging material	Hoogeveen	Deventer	Leeuwarden
Pallet	€11	€11	€0
End pallet	€11	€11	€0
Syrup pallet	€16	-	-
Synthetic pallet	€50	-	-
Wooden frame	€5	€5	€5
Steel frame	€27	-	-
Caron layer pads	€0,85	€0,85	€0,85
Synthetic layer pads	€5	-	-
Carton covers	€4,50	-	-

The pallet and end pallet used in Leeuwarden are of such a low quality, that it can be assumed that replacement value of these packaging materials is equal to zero, so pallets are depreciated when they are used in Hoogeveen and Deventer. The costs of buying a new pallet (€22) are equally divided over Hoogeveen and Deventer.

The syrup and synthetic pallets, the steel frame, the synthetic layer pads and the carton covers are only used in Deventer. In this case the prices of a new packaging material are used as the replacement values.
The wooden frames and carton layer pads are not reused in the three sorting units. Each unit buys new packaging materials, so the replacement values are the costs of buying a packaging material.

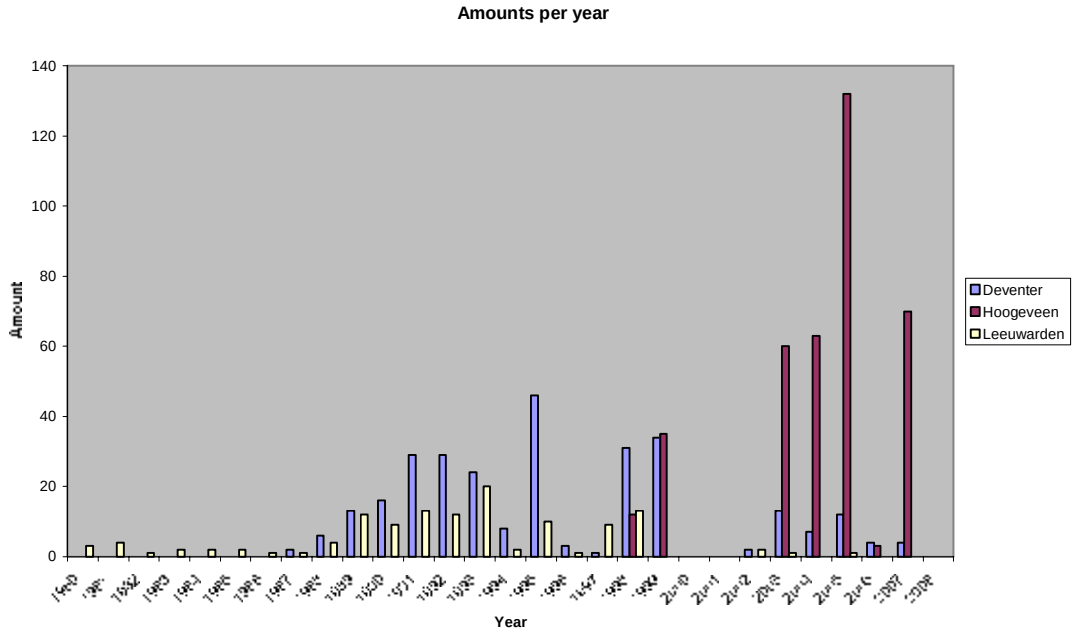

Impress

Appendix E, Estimating the number of trips a pallet can complete

Every standard pallet is marked with the year and month the pallet is delivered at Impress. These marks are used to estimate the average age of the standard pallet. Combined with the average inventory of pallets and the amounts sorted per year, the number of trips a pallet can complete during its lifetime is estimated.

Step 1: Average age of a pallet per sorting unit

For each sorting unit the years that are printed on the pallet are recorded. This gave the following result.



A problem that arose in Deventer and Leeuwarden is that the marks printed on the pallet are in some cases unreadable. A solution could be to just take the average age of the pallets that are readable. This would, however, not give a correct view of the current situation. Marks on older pallets are often not readable than marks on new pallets. To solve this problem, the following procedure is followed.

In Deventer and in Leeuwarden are still pallets used with the logo of Thomassen and Drijver (T&D). Impress has merged with Thomassen and Drijver in 1995. Pallets with the T&D logo are thus older than 13 years.

If the year printed on the pallets is readable this year is recorded, if it is not readable, the kind of pallet (T&D or Impress) is recorded. The average age of T&D pallets and the average age of Impress pallets are calculated. The percentage of the pallets that are T&D pallets and Impress pallets is also estimated. With these numbers the average age of a pallet per sorting unit is calculated.
The results of this calculation are an average age of the pallets used in Deventer of 13 years and in Leeuwarden of 17 years.

In Hoogeveen only pallets marked with an Impress logo are used. The above described procedure is therefore not used in this sorting unit. Here the average age of the pallets that are readable is taken, which resulted in an average age of the pallets in Hoogeveen of 4 years.

Step 2: Total number of trips

With the help of the average inventory of the pallets in 2007 and the amount sorted in 2007, the average number of trips that each pallet completes during a year is estimated. The average inventory per sorting unit is estimated with the help of the balance sheet of MEET of 2007. The amounts that are sorted are received from the data source 'sorting data' (excel sheet). The number of trips a pallet completes in a year is calculated by dividing the number of pallets sorted in a year by the average inventory. The results can be found in the table below.

	Average inventory	Number sorted	Number trips per year
Hoogeveen	20.000	157820	7,9
Deventer	60.000	252704	4,2
Leeuwarden	20.000	115503	5,8

Multiplying the number of trips per year by the number of years the pallet is used in a sorting unit gives the total number of trips a pallet can complete.
The results can be found in the table below. The numbers between brackets in the fourth column are the numbers estimated by the management team of MEET.

	Number trips per year	Years in sorting unit	Total number of trips
Hoogeveen	7,9	4	31 (30)
Deventer	4,2	9	40 (40)
Leeuwarden	5,8	4	23 (20)

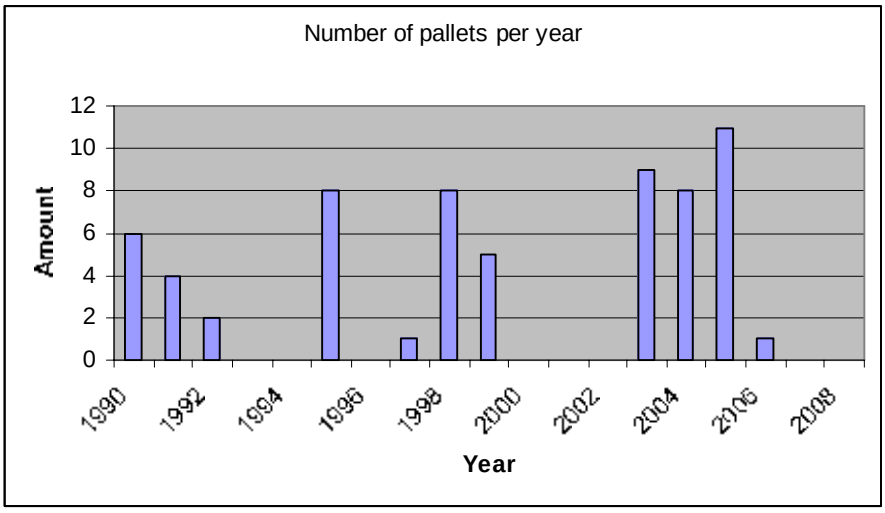
Appendix F, Details of identified options to reduce costs

Details about the calculation of the yearly savings of the options ‘abandon reparation’, ‘set limits on the age of pallets that are repaired’ and ‘enter an existing pallet pool’ can be found in this appendix.

Reparation

To calculate the height of the yearly savings for the options ‘abandon reparation’ and ‘set limits on the age of pallets that are repaired’, first the average age of the pallets that are repaired has to be estimated.

Every standard pallet is marked with the year and month the pallet is delivered at Impress. These marks are used to estimate the average age of the pallets that are being repaired.
This gives the following result.



The estimation of the average age of the pallets that are being repaired is executed in the same way as the estimation of the average age of pallets in Deventer and Leeuwarden (take also in account the difference between T&D and Impress pallets, see Appendix E, Estimating the number of trips a pallet can complete.
This resulted in an average age of the reparation pallets of 13 years.
On average are 15.200 pallets repaired each year. Each year, on average, 500.000 pallets are sorted. The pallets have an average life time of 17 years.
With these numbers the total number of trips a pallet can complete if reparation is abandoned or if limits are set is calculated.

Abandon reparations:
On average are 52% of the pallets repaired somewhere during their lifetime (15.200 reparations a year / 500.000 trips a year * 17 years).
If the reparation of pallets is abandoned, the average life time of a pallet will decline. 50% of the pallets have an average lifetime of 13 years (70 trips) and 50% of the pallets have an average lifetime of 17 years (90 trips). The new average lifetime of a pallet is 80 trips.
The number of trips a pallet can complete in Hoogeveen declines with five trips from 30 to 25 trips, in Deventer with five trips from 40 to 35 trips and number of trips in Leeuwarden stays the same, namely 20 trips.

Reparation costs and management costs for this activity drop to zero but pallets are depreciated in fewer trips, so the purchasing costs per trip are higher. A saving can be realized of €44.000 per year.

Set limits on the pallets that are being repaired
In the current situation pallets are already depreciated when they are used in Leeuwarden. Reparation of pallets is therefore only feasible when the pallet can still be used in Deventer or Hoogeveen. This means that reparation of pallets that are 13 years or older is not efficient.
Only 25% of the pallets that are currently being repaired are still repaired if the limit is set at 13 years. Reparation costs are reduced with 75%.
On average are, when this option is implemented, 13% of the pallets repaired in their lifetime (0,25x15.200 reparations a year / 500.000 trips a year * 17 years).
The average life time of a pallet will decline. 13 % of the pallets have an average lifetime of 15 years (82 trips) and 87% of the pallets have an average lifetime of 17 years (90 trips). The new average lifetime of a pallet is 89 trips.

The number of trips a pallet can complete stays the same in Hoogeveen and Deventer (respectively 30 and 40 trips) and number of trips in Leeuwarden decrease from 20 to 19 trips.
A saving can be realized of €49.000 (yearly), reparation costs are reduced with 75% (the purchasing costs are the same, because pallets are depreciated in the same amount of trips and management costs decline, because less reparation is needed).

Pallet pool
Employees of two different existing pallet pools were interviewed. Per pallet pool is in this section explained what the consequences are of entering this pallet pool and what the savings / costs are.

Supplier 1
In short, the following arrangement can be made with this organization.

- This organization wants to take over all the packaging materials of MEET, thus not only the pallets, but also the layer pads, frames and synthetic packaging materials.
- The organization is also willingly to take over the employees of MEET. The organization cannot promise, however, to take over all employees, because some activities that are currently executed by employees of MEET will be outsourced to another organization.
- The organization has a different way of collecting revenues than MEET has. Impress has to rent the packaging materials for a fixed price per day. This rent includes the costs of reparation, but does not include costs of the transport of packaging materials from the customer to the external organization and from this organization to Impress production departments. Furthermore, the costs of lost packaging materials are also not included. If packaging materials are lost at the customer or at Impress a bill will be sent to Impress.
- The organization has its own registration system, which can be linked to the registration system of Impress.
- A disadvantage of this supplier is that is a new player on the market. If Impress would enter this pallet pool, Impress would be the major customer of this pallet pool, while a major reason of entering a pallet pool is that Impress can benefit from the experience the existing pallet pool has.

With the information received from this supplier, a comparison can be made between the current costs per trip and the costs per trip if Impress would enter this pallet pool.
The rent per day is multiplied with the average amount of pallets Impress needs and with 365 (number of day in a year). This number is divided by amount of packaging material sorted per year.
As a result, the costs of pallets, on a yearly basis, would rise with approximately €500.000.
This calculation does not include the costs of broken packaging materials, costs of packaging materials that get lost in the process and handling costs.

Supplier 2
This supplier is not willingly to take over the current pallets of Impress. The pool only offers pallets with standard dimensions, the so called Euro-pallets and the variances of this type. As a consequence, Impress has to change their automatic packers and also the automatic packers of the customer have to change. Furthermore, less cans and ends fit on a pallet, so more pallets, layer pads and frames are needed.
This supplier also does not want to take over the sorting of layer pads, so this has to be executed by employees of MEET (currently no external organization exists that offers as a service the sorting of layer pads).

Furthermore, during the interview it became clear that the employee of this pallet pool was impressed by the way MEET is working. The best advice he could give is to speed up the process by automation and standardization of the pallet dimensions.

The same calculation as for supplier 1 is also executed for this option. As a result, the costs of pallets would decrease with approximately €50.000 per year. The current amount of pallets currently needed at Impress is used in the calculation, so the fact that more pallets are needed is not taken in account. As a consequence, savings will be lower.
The costs of reparation (which were in 2007 already more than €50.000), the costs of packaging materials that get lost during the process and the handling costs are also not included.

It can be concluded that entering an existing pallet pool would not generate a saving. The costs will rise if a contract is entered with supplier 1.
Supplier 2 advised not to enter his pallet pool, because he thinks that the way the packaging materials are handled currently at MEET is highly efficient for these types of pallets. Furthermore, no savings can be generated when his pool is entered.