

## MASTER

### The impact of new item requests development of an item-specific charge on the basis of activity based costing

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# The impact of new item requests

Development of an item-specific charge on the basis of  
Activity Based Costing

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**NIET  
UITLEENBAAR**

December 2002  
Eefje Meulepas

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# The impact of new item requests

Development of an item-specific charge on the basis of  
Activity Based Costing

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Veghel, December 2002

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## **Abstract**

At this moment Masterfoods is not able to quantify the impact of new item requests on the factory. This report contains the investigation to find and the application of a suitable method to calculate this impact. Besides, it includes a design in which the specific characteristics of the new item request can be filled in, which results in the total amount of extra costs.

## **Preface**

A research study has to be done in completion of the study of Industrial Engineering and Management science at the Eindhoven University of Technology. This report describes my research study that was carried out from April to December 2002 at Masterfoods in Veghel. I got the assignment to find a suitable method to determine the cost impact of certain item requests. On the basis of this method a design needed to be developed to be able to calculate the extra costs of these requests.

At the beginning of this project I had another desk to work at every day. Fortunately, the fact that I did not have a fixed place did not impede my effectiveness, it even turned out very well. Because I roamed over the entire department, I learned to know many people which was not only very nice, but also useful for my project. I liked the atmosphere in the open office, but the factory was also a nice place to be. I already had a great time by just looking at the production process producing hundreds of bars per minute.

A lot of people within and outside Masterfoods helped me to bring my project to a favourable conclusion. Therefore, I would like to thank my coach within Masterfoods, Mr. Boon, for his support and especially for reading all the extensive documents I sent him. I also would like to thank all the employees from Masterfoods who were willing to help me during my project with information and useful input. Furthermore, I would like to thank my supervisors from the Eindhoven University of Technology, Mr. van Ooijen and Mr. Verdaasdonk for their critical view on my project. Finally, a special thanks to my family and friends who supported me by listening to all my stories.

Eefje Meulepas  
Veghel, December 2002

## Summary

### Problem situation

At this moment Masterfoods' Snackfood assortment contains 2280 items. From these 2280 items, eight items account for the first 10% of the turnover, while the last 10% is generated by  $\pm 1200$  items.

From the retailers Masterfoods experiences a pressure to reduce their assortment, because space on the shelves is limited. Only the profitable products should be put on the shelves. Furthermore, a large variety of items leads to complicated processes in the factory as well as the supportive departments, which causes extra costs.

In the current situation the large number of requests for new items is handled by the department of Industrial Engineering (IE). IE does not know how to quantify the cost impact caused by the new item. So, these extra costs are not taken into account in the item specific cost price. The fact that IE is not able to quantify the effects of certain item introductions has two important consequences:

1. *IE cannot raise a hurdle for the markets.*
2. *Decisions to introduce or retain an item are based on incomplete information.*

On the basis of this, the following problem definition arises:

The department of IE cannot challenge requests from the markets, because they do not know how to quantify the cost impact of introducing and producing an extra item. The total costs for the factory are thus not known and decisions are made based on incomplete information.

The research objective that follows from the defined problem can be defined as follows:

Determine a suitable method, which can be used to calculate the cost impact of new item requests. Use this method as the basis for a design that can help the department of IE when they are confronted with new item requests. Pay also attention to the implementation process.

### Scope

The focus in this project lies on the supply chain from the suppliers until the products leave the Hays Central Warehouse. Furthermore, it is chosen to investigate the large number of items caused by a *variety of packaging* within existing brands. This choice is made because by far most new items are a result of new packaging. The method and resulting design have to be generally applicable for the production lines in Europe. In this report, line 3 is chosen to serve as a pilot line. This line produces Mars<sup>®</sup>, Snickers<sup>®</sup> and Snickers Cruncher<sup>®</sup> and has an annual output of about 60.000 ton.

### Choice suitable method

Several methods are available to gain insight into the costs connected with item introductions.

- *Cashflow based approach* in which the actual economic consequences are forecasted. This approach is not suitable since it focuses on the spending of resources while this project's goal is to identify the consumption of resources.
- *Cost allocation methods* are used to distribute the costs to different products within one organisation. Within this category several methods can be identified; two traditional costs allocation methods and one more recent one.
  - a. Absorption cost method
  - b. Cost allocation table
  - c. Activity Based Costing method

The traditional systems do not take into account the differences of relative use of overhead and neglect the fact that complexity causes indirect costs. The Activity Based Costing method *does* recognise that

overhead costs not only vary with volume but also with the range of items manufactured – that is, their diversity and complexity. Furthermore, the characteristics of a good ABC environment are present at Masterfoods.

The Activity Based Costing method is the most suitable method and will be used to gain insight in the item-specific costs.

Several steps can be distinguished in the ABC-concept (figure 1).

1. Identify the major activities performed in the facility.
2. Determine the cost of those activities. In this process allocation the costs of the resources are allocated to the activities on the basis of the amount of resources that are used in behalf of activities.
3. Identify what drove those activities, determine the so-called activity drivers.
4. Determine the quantities of each cost driver associated with every product.
5. Compute activity based production costs.

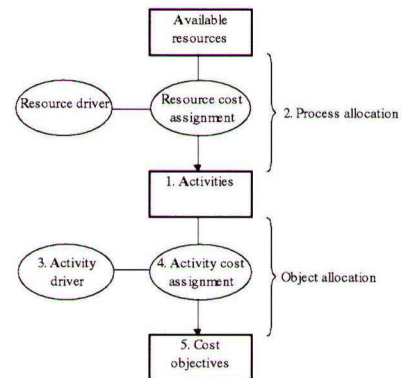


Figure 1: Activity Based Costing

These are the standard steps that are found in the literature regarding the ABC-method. In practice, however, this method needs some small adjustments due to the information available. This resulted in three slightly different methods that are applied to the current situation within Masterfoods.

### Activity analysis

First the current situation is described that forms the basis for the activity analysis. This description is made in two parts as figure 2 shows. When a request arrives, an introduction process is started up. This introduction process consists of a development process until the go/no-go decision is made and an implementation process. Only this last process is taken into account in this project.

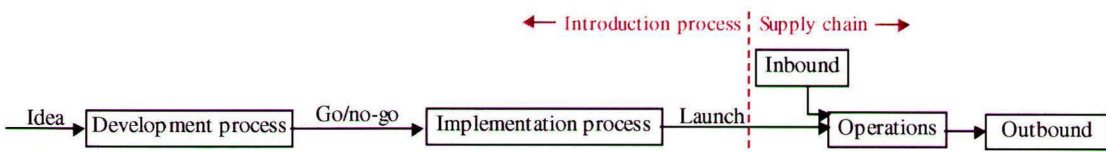


Figure 2: Current situation

The implementation process consists of a Packaging Origination Request process to confirm timings for production and delivery of packaging material. For this process several preparations have to be made and the process itself consists of input given by several departments concerning the packaging material that has to be ordered. The POR-process is followed by a Graphics process during which the preparations are made for actually printing the materials. The same implementation process is followed when existing items need to be updated as a result of changes in recipe or brandflag. This process is called “update-process” in the rest of the research.

The supply chain is divided into three parts:

- *Inbound logistics*: the packaging material is delivered at the Hays Packaging Warehouse and is transported to the factory when the production department calls off the materials. The packaging materials are brought from the despatch area to the lines.
- *Operations*: produce and pack the bars, palletise the cases and make the pallets ready for transportation.

- *Outbound logistics*: transport the finished products to the Hays Central Warehouse, store them and handle the pallets out again to load the trucks.

Within these three parts a distinction is also made between the primary process and the supporting flows.

### Calculate tariffs

For the activities identified in the activity analysis it is investigated which resources they consume for example personnel, equipment and information systems. At the same time the costs for these resources are determined. On the basis of these costs per activity and the activity drivers a tariff for the activities is determined. These tariffs are used as input for the design.

### Design Request Impact Charge

The tariffs have to be connected to the items in the design: the Request Impact Charge (RIC). This is done on the basis of the extra use the item makes of the activity in comparison to an average item. Important characteristics of the request that have to be indicated in the RIC are: time span, pack size or pack variant, replacing or extra item and pack type (figure 3). Furthermore, other characteristics of the request can be indicated in the tables: request specific data, average input data implementation process and average input data supply chain. The part of the RIC that is shown in this figure contains all the input fields and also shows the outcome of the request impact charge (light red fields). The total costs are calculated on the basis of all the activities with their tariffs and extra use. The tables with this information underlie the RIC. A distinction is made between the one-off and on-going costs. The one-off costs contain the costs for executing the implementation process, while the on-going costs consist of the update process and supply chain costs.

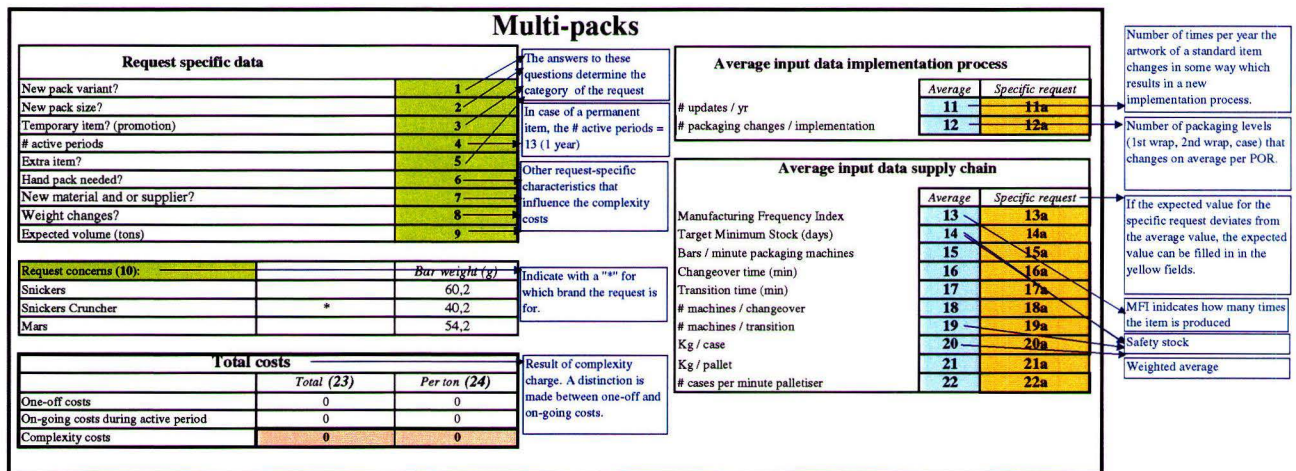


Figure 3: Request Impact Charge

### Implementation

The associates concerned have a positive attitude towards the RIC and are able to use it after some training had been given. It has to be updated once a year by the Local Industrial Engineers.

Furthermore, the RIC might also be used in the yearly transfer price update process in a couple of years.

### Conclusions

- The Activity Based Costing method is the most suitable method found in literature to allocate costs more realistically. It is not a decision making tool.
- The differences in extra costs per ton between large volume and small volume items are substantial.



- It is difficult to draw general conclusions about the extra costs since only line 3 is investigated and a few examples are calculated. The following things were striking:
  - Supply chain costs form the largest part of the total extra costs calculated by the RIC.
  - From these supply chain costs, the costs for packaging material handling are substantial followed by the costs for changing over the packaging machines in case of a new pack size.
  - The implementation costs and update costs are independent of the type of item that is introduced.
  - The speed of the packaging machines is the most influential input variable.
- The RIC can be used immediately to challenge requests from the markets, but extra research is necessary to be able to take the design into account in the TP.

#### **Recommendations**

- The RIC should also be applied to the other production lines within Masterfoods.
- Further research is necessary to be able to take the RIC into account in the transfer prices calculations.
- It is recommended to use the RIC in the Activity Recommendation process since it is easy to use and it provides IE with more insight in the extra costs .
- Industrial Engineering and Finance should work closely together in the AR-process to get a complete outline of the extra costs.
- The effect of this RIC on the attitudes of the different markets should be investigated.

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## Introduction

This report describes the results of a research that is executed at Masterfoods Veghel B.V. It was aimed to determine a suitable method which can be used to gain insight in the cost impact of certain item requests. This method forms the basis for a design to calculate the total extra costs for a request. The structure of the report is as follows:

In the first chapter, a general description of Mars Incorporated is given. In addition, some characteristics of Masterfoods Europe, the Veghel factory and the department of Industrial Engineering, where this project took place, are indicated.

The second chapter pays attention to the background of this research and the definition of the research assignment. Furthermore, the scope of the assignment and the research model are subject of discussion.

In chapter three the most suitable method for calculating realistic costs is chosen on the basis of several methods found in literature. The basic principles of the chosen method are given in the form of a number of steps and the approach to execute the first step is explained.

Chapter four describes the current situation in which a distinction is made between the introduction process and all the activities that are executed in the supply chain. This chapter results in a complete overview of the relevant activities, which is the first step of the chosen method.

The method chosen is applied further in chapter five. In this chapter all the costs of the activities are calculated and the drivers of these costs are determined. This results in a tariff for all the activities defined.

The sixth chapter pays attention to the development of a design that is based on the chosen method. It is investigated which characteristics of new item requests are important to take into account and how the items make use of the activities defined. After an explanation of the functioning of the design, some results for one production line are given.

Chapter seven shows an implementation plan which consists of a description of the organisational changes and how the design should be updated. Besides, it contains a rough time plan.

In the final chapter conclusions are drawn, recommendations are given and a reflection is made concerning the whole project.

Appendix 1 contains a glossary with an explanation of the Masterfoods specific terms and abbreviations. The other appendices all have a direct relation with a chapter.

## 1. Business description

*This chapter is written for background information. In the first section, a general description of Mars Incorporated is given. Then, the European division of Mars Incorporated, Masterfoods Europe, is outlined. Section 3 deals with a description of Masterfoods Veghel and the activities of the department of Industrial Engineering, which has hosted this project, are described in the fourth section. The last section gives a summary of the whole chapter*

### 1.1 Mars Incorporated

In 1911, Frank C. Mars started in Tacoma, Washington the production of candy and chocolate bars, on a small scale, using his own kitchen. Soon demand grew enormously and he had to move to a factory. He had a major breakthrough with the Milky Way<sup>®</sup> bar (later known as the Mars<sup>®</sup> bar in Europe) in 1923. Mars Incorporated was founded in the same year.

In 1932, his son Forrest E. Mars came to Europe and started the first European factory in the United Kingdom near Slough. After the introduction of the Mars<sup>®</sup> bar in continental Europe in the early 40's, the demand increased in such a way that the production capacity had to be expanded. That is why Mars decided to build a factory in Veghel in 1962. In the following years, more factories were built in Europe. During the years, the assortment of snacks increased and in 1986 Mars Incorporated also started to produce ice cream.

In the beginning, the company focused on the production and sales of candy and chocolate bars. Soon, Mars Incorporated also aimed at the production and sales of pet food like Pedigree<sup>®</sup> and Whiskas<sup>®</sup> (1935), meal products like Uncle Ben's<sup>®</sup> and Dolmio<sup>®</sup> (1940), and vending machines like Flavia<sup>®</sup> (1955). Mars Incorporated currently consists of 50 production sites and employs more than 35.000 people in 60 different countries. The company has an annual turnover of approximately 13 billion USD. Mars Incorporated is still privately owned and managed by the Mars-family. The company develops strong brands, which are world-wide leading brands.

At Mars Incorporated, there are certain special beliefs about the business and how it should be run. The organisational policy is based on five principles: *quality, responsibility, mutuality, efficiency and freedom*, which distinguish Mars Incorporated from other companies. These are well posted on every site to increase the awareness of the associates.

### 1.2 Masterfoods Europe

In Europe, the three categories of Food, Petcare and Snackfood are united into one organisation: Masterfoods Europe. Masterfoods Veghel, where this project is carried out, is part of the Snackfood division.

Snackfood consists of a variety of sweets, chocolate bars, ice cream products and savoury snacks. This division accounts for approximately 44% of the annual European turnover of Masterfoods Europe. The Snackfood division currently has eight different production sites in Europe. The factory in Porici produces sugar products, and the factory in Olen makes savoury snacks (like Rispingo's<sup>®</sup>). The production of ice cream is located in Steinbourg, while sweets and chocolate bars are produced at the other sites. Table 1.1 outlines the actual production in 2001 and the forecasted production for 2002 at the eight sites.

Table 1.1: Production of finished products at the different sites (in tons \* 1000)

| Site                       | Actual production in 2001 | Forecast production 2002 |
|----------------------------|---------------------------|--------------------------|
| 1. Slough, United Kingdom  | 176,8                     | 159,3                    |
| 2. Veghel, The Netherlands | 171,8                     | 177,7                    |
| 3. Haguenau, France        | 58,4                      | 60                       |
| 4. Viersen, Germany        | 44,2                      | 50,1                     |
| 5. Sochaczew, Poland       | 27,6                      | 24,2                     |
| 6. Breitenbrunn, Austria   | 11,4                      | 12,6                     |
| 7. Porici, Czech Republic  | 11,9                      | 12,2                     |
| 8. Olen, Belgium           | 0                         | 0,9                      |
| 9. Steinbourg, France      | 30,4                      | 30,1                     |
| <b>Total</b>               | <b>532,4</b>              | <b>527,1</b>             |

### 1.3 Masterfoods Veghel

Veghel was chosen as the place for the first production site on the continent, because of its favourable location and the availability of sufficient labour. In 1963, Masterfoods Veghel started production. Today, Masterfoods Veghel employs 1250 people of whom 600 work in manufacturing. With a forecasted output of about 175.000 tons of finished products and 25.000 tons of semi-finished products (chocolate and peanuts) for 2002, it is the largest Masterfoods Snackfood factory in Europe. About 90% of the finished product volume is exported to more than 30 countries in Europe and the Middle East.

#### THE SUPPLY MARKET

The raw materials (snackfood ingredients) are imported from several countries; nuts from the USA and China, cocoa from West Africa, coconut from the Philippines, and sugar, milk and others from countries surrounding the Netherlands.

#### PRODUCTION

Production aims to make finished products and semi-finished products to a specified level of quality and quantity, at the agreed moment and at the lowest costs. Masterfoods Veghel currently produces nine brands. Products can be made in six sizes: Kingsize, Standard, Snacksized, Mini, Miniature and Bitesized. The current production is scheduled on eight different lines (table 1.2). Line 2 has been moved from Veghel to Sochaczew (Poland).

After the actual production on the process part of the line, the products can be packed in many different variations, called "items". The packaging materials are available in different measures and with different language combinations. Many combinations are possible, which leads to an enormous diversity of finished products (items). Most products have a freshness guarantee of 31 weeks. If products are kept in cold storage, for example in the Middle-East, the freshness guarantee is 52 weeks.

Table 1.2: Scheduling of products per line

| Line | Brand   | Size                           |
|------|---|--------------------------------|
| 1    | Bounty <sup>®</sup> (Milk and Dark)   | Standard                       |
| 3    | Mars <sup>®</sup> , Snickers <sup>®</sup> , Snickers Cruncher <sup>®</sup>  | Kingsize, Standard, Snacksized |
| 4    | Mars <sup>®</sup> , Snickers <sup>®</sup> , Milky Way <sup>®</sup>  | Mini                           |
| 5    | Twix <sup>®</sup>   | Standard                       |
| 6    | Mars <sup>®</sup> , Snickers <sup>®</sup> , Bounty <sup>®</sup> (Milk), Milky way <sup>®</sup> , Topic <sup>®</sup> | Miniature                      |
| 7    | Twix <sup>®</sup>   | Miniature                      |
| 8    | Maltesers <sup>®</sup>  | Bitesized                      |
| 9    | Celebrations <sup>®</sup>   | Miniature                      |

The Veghel factory continuously produces; three shifts a day during seven days a week. The are divided into morning, afternoon and night shifts. There are five production crews of operators (red, purple, green, blue and violet) and each crew works during two mornings, two afternoons and two

nights in succession, followed by four days off (table 1.3). Every production crew has four shift managers who are responsible for a specific part of the factory.

Table 1.3: Example of a production crew schedule during one week

|           | Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|-----------|--------|--------|---------|-----------|----------|--------|----------|
| Morning   | Red    | Purple | Purple  | Green     | Green    | Blue   | Blue     |
| Afternoon | Violet | Red    | Red     | Purple    | Purple   | Green  | Green    |
| Night     | Blue   | Violet | Violet  | Red       | Red      | Purple | Purple   |

#### THE SALES MARKET

The major European markets have their own Marketing & Sales Department which is directly responsible for marketing and sales of Snackfoods in their market. Other – smaller – markets are allowed to make use of the expertise of the European Activity Management department. The sales market can be split up into grocery channels and impulse channels. The grocery channels are large-quantity, multi-product type stores, like supermarkets. Impulse channels include petrol stations, kiosks, vending machines and cinemas.

### 1.4 Industrial Engineering

The Industrial Engineering (IE) department in Veghel has offered the facilities for carrying out this project. The mission of IE is: “Optimise pipeline performance to achieve maximum profitability and enduring profitable growth”. This can be achieved by designing, improving, and continuously evaluating the interaction of people, materials, equipment and systems in relation to the products. The Industrial Engineering department has two important tasks:

1. It acts as an interface between the Marketing and the Operations Department: new market ideas are evaluated and judged for their technical and economical feasibility.
2. It develops strategic projects like:
  - Expansion of production capacity.
  - Calculation of the “co-packing” concept. This project focuses on outsourcing packaging activities to professional organisations so that the complexity of the wrapping process can be reduced.
  - Allocation of products to a production site on the basis of for example the lowest production costs.

### 1.5 Summary

In this chapter information has been given about the organisation where this project took place. It described four levels of the Mars Company.

1. Mars Incorporated, the worldwide organisation.
2. Masterfoods Europe with its food, snack food and pet food component.
3. Masterfoods Veghel which is the largest Snackfood production site in Europe.
4. Department of Industrial Engineering where this project has been carried out. IE wants to optimise the pipeline performance to achieve maximum profitability and enduring profitable growth.

The information provided in this chapter is needed to understand the research description and scope that will be described in the next chapter.

## 2. Research description

*This chapter begins with describing the initial research description followed by the background of this project, which results in the problem identification and research objective in section 2.3. In the fourth section attention is paid to the scope of the project after which the research model and research questions are presented in the fifth section. The chapter is concluded with a summary*

### 2.1 Initial research description

At this moment Masterfoods' Snackfood assortment contains 2280 items. From these 2280 items, eight items account for the first 10% of the turnover, while the last 10% is generated by  $\pm 1200$  items. According to the department of IE, these small and instinctively expensive items are introduced because the barrier in the introduction procedure is not high enough. At the moment a cost price is calculated for every item, but this price does not always reflect the real costs. The consequence of this is that the markets do not have an incentive to choose for a more standard and cheap item. The initial research description that follows from this is:

Analyse the supply chain to determine what the real costs are for a new or existing product to go through the whole supply chain. Develop on the basis of this cost calculation a charge that the department of IE can assign to the product.

### 2.2 Background

Two motives can be distinguished that support the goal of this research. The first one – pressure from retailers - is a trend that is seen in the whole branch nowadays, while the second one – complex processes in the supply chain caused by extra items - is experienced within Masterfoods.

#### 2.2.1 Pressure from retailers

At this moment, producers of fast moving consumer goods experience a pressure to reduce their assortment. On one hand cutting in the assortment is driven by the ambition to reduce storage and production costs (less products means more advantages of scale). However, more important is the struggle with the large retailers, with whom the producers battle out a fight for shelf space. The last ten years, the number of products in the average supermarket in the Netherlands is doubled to about 20.000. More and more producers arise with new and innovative products, but the number of square meters of shelf space remains - pretty much - the same [Dirks, 2002]. So, producers have to fight harder to obtain space for their products. The result of this development is that there is no space at the retailers for an extensive assortment of every producer. Besides, during the last years the power in the chain moved from the producers (“Congratulations, you may sell our products under this conditions”) to the retailer (“If you can fulfil our supply conditions, you may deliver us”) [Hoek, 2000]. In the limited shelf space a producer gets, the producers' best assortment has to be presented. Because the margins are small in the fast moving consumer goods business, producers should choose to put the most profitable products on the shelf.

Masterfoods also experiences this problem. As was seen in section 2.1, Masterfoods has many items that all take shelf space and a lot of them are expensive to produce (see section 2.2.2).

#### 2.2.2 Complex processes in the supply chain

A large assortment not only causes tension at the retailers, but also within Masterfoods. Continuous changes in production mix and volumes and the introduction of new products have resulted in a complex manufacturing operation over the years. Thus, the large number of items – and the resulting complexity – has crept in slowly. Complexity is used in this situation as a characteristic to describe a



production situation. According to Bertrand et al. [1998] the degree of complexity is determined among other things by the variety in products, the number of times the products or processes are updated and the dynamics of the market that asks for a large variety in volume, mix and delivery times. Not only the direct production process become more complex as the above-mentioned aspects increase, also the planning activities, the document supply and the transport to and from the warehouse become more complex. High complexity asks for a lot of information processing and coordination.

The large number of items within Masterfoods is mainly caused by the demand from the markets, Masterfoods' sales organisations, that becomes more and more diverse (customisation). Because the candy bar is often bought by the consumer on an impulse (70%), markets constantly want new and flashy packages to draw the consumers attention. A promotional item is most of the times only active for a few periods and even the standard items change about once a year. Furthermore, 90% of the production from Masterfoods Veghel is exported, which means that Veghel has to cope with a lot of different countries that each have its own wishes.

While the market (sales organisation) asks for new items, the factory wants to slow down the increase of items and changes of those items. The factory would prefer a more standard product catalogue, because introducing and changing items leads to extra use of resources as was described above. For every change or implementation, several departments spend time to deliver input and make sure the right packaging materials are present on time. Extra resources are above all also used in the factory where extra changeovers and packaging material handling are necessary when an extra item has to be produced. Besides this extra resource usage, variety also has more or less hidden consequences. If for example the number of packaging materials grows, it is likely that the number of mistakes also grows. It is more difficult to have all the right materials ready at the right time, which can result in a reduced line speed or stagnation of the line. All these consequences (can) lead to extra costs.

In conclusion, a field of tension can be observed between the factory's wishes - a more standard production catalogue -, and what the markets desire - constantly new and innovative items.

In short:

- The space on the shelves at the retailers is limited so producers should only have the profitable products on the shelves.
- The production of a large variety of items leads to complicated processes in the factory as well as the supportive departments, which causes extra costs.

### **2.3 Problem identification**

The rising number of items in itself does not have to lead to complexity as long as the following quote is taken into account:

*“Complexity reduction must recognise the need for product variety in order to be competitive and flexible.*

*Variety which adds value can be defined as ‘flexibility’.*

*Variety which does not add value can be defined as ‘complexity’.”[Masterfoods, 2002].*

The conclusion is that it does not matter whether the variety in products is large or the products are often updated as long as the customer pays for the extra costs. However, the problem within Masterfoods is that one does not know what the extra costs for a specific item are and they are thus not correctly passed on to the market.

In the current situation the large number of requests for new items is handled by the department of IE. They have a clear insight in the overall processes in the factory and determine the feasibility of the requests. The requests IE receives are judged by IE on the basis of three aspects:

1. Capacity  
Do we have the capacity on the production line to produce this new item?
2. Capability  
Can this request be fulfilled with the current machines/techniques?
3. Costs  
What are the costs of carrying out this request?

Especially with regard to the cost question, IE does not know how to quantify all the impact caused by the new item. Only the directly visible extra costs are taken into account. So, the other extra costs are not taken into account in the item specific cost price. Of course these costs are covered somewhere, but not always in the right place. In the current situation the large volume items pay for the small volume items and there is not much price diversity between those two. This is a result of the fact that the current cost price calculation is based on *standards per ton* while Zimmerman [1997] states that many costs in a plant are driven not so much by the number of units produced as by the number of transactions, such as machine-setups, purchase orders or shipments. So, allocating these transaction-based costs based on unit volume causes products with large production volumes to be assigned too large a share of these costs.

The fact that IE is not able to quantify the cost effects of item introductions and these are thus not taken into account in the cost price has two important consequences.

A. *IE cannot challenge requests from the markets.*

They can only indicate the impact in a qualitative way, but that does not influence the profit of the market. Markets have no incentive to change to another product. If the extra costs would be quantified and taken into account in the cost price, markets would more thoroughly think about certain item introductions. In that case they would have an incentive to choose for a more standard item instead of a completely new one.

B. *Decisions to introduce or retain an item are based on incomplete information.*

On item level it is currently unknown whether an item is really profitable for the whole business or is joined in with a standard large volume item. The financial indicators are based on the current cost price. Because the most profitable items should be on the shelves it is important to know the real costs. Not only for decisions concerning new introductions the wrong numbers are taken, but also for the standard item portfolio. The real cost price for these items should be lower than the current one. If these lower cost prices would be reflected in the transfer price to the markets, the sales for these items would - probably - rise.

On the basis of this, the following problem definition arises:

The department of IE cannot challenge requests from the markets, because they do not know how to quantify the cost impact of introducing and producing an extra item. The total costs for the factory are thus not known and decisions are made based on incomplete information.

Masterfoods and especially the department of IE want to know how the extra costs for a request can be calculated. The method used to calculate the costs should result in a design that gives IE insight in the total extra costs for a specific item based on real resource consumption so that they can take these costs into account in decision making. This total amount of extra costs is passed on to the department of Finance, which takes it into account in the cost price. This results in a more realistic and fair price and thus a more realistic margin (Group Margin After Conversion). This GMAC is one of the criteria

Masterfoods uses to decide whether an item is introduced or not. The formula for this margin is described in appendix 2.1. This last step, pass the costs on to the cost price, is not a part of this project.

The research objective can be defined as follows:

Determine a suitable method, which can be used to calculate the cost impact of new item requests. Use this method as the basis for a design that can help the department of IE when they are confronted with new item requests. Pay also attention to the implementation process.

## 2.3 Research scope

In this section, the scope of this project is described. First it is explained which part of the supply chain is involved in this research, after which the type of requests for further research is selected. In the last subsection one production line is chosen for further research.

### 2.3.1 Part of the supply chain

Figure 2.1 shows the supply chain of Masterfoods Veghel. This research examines the part of the supply chain from the suppliers until the products leave the Hays Central Warehouse.

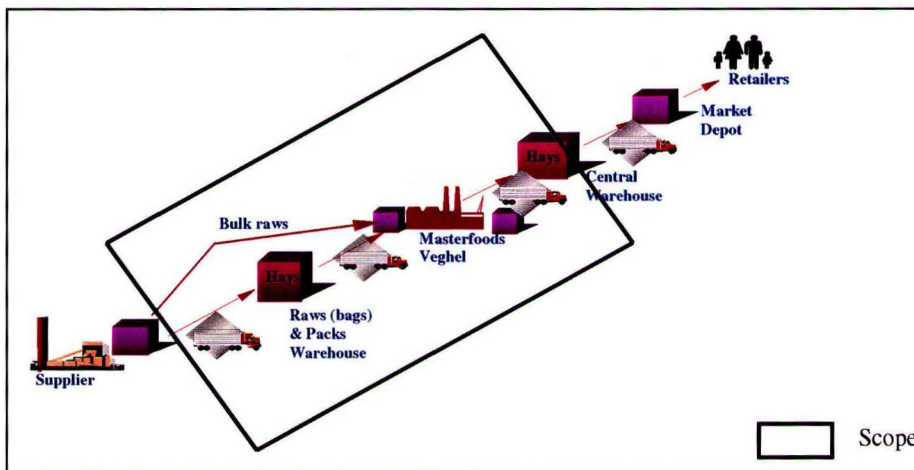


Figure 2.1: Research scope in the Masterfoods supply chain

The Hays Central Warehouse is the last party in the supply chain that is taken into account, since from this warehouse the products are distributed to one of the market depots that are the warehouses for the markets. Besides, this project focuses on the costs for the factory and not the markets. The transfer price ex works from the factory includes the costs until the products are loaded at the Central Warehouse for transport to the different market depots. This transfer price ex works is given to the markets. So, it is chosen to stop with the analysis at the point where the costs for activities executed are not included in the factory transfer price ex works anymore.

### 2.3.2 Item introductions

Activities like the introduction of new products, new flavours or varieties, new pack sizes, legal text changes, promotion packages or roll-outs to a new market lead to the implementation of new items and thus a change in assortment. This project focuses on the large number of items caused by a variety of packaging within existing brands. This choice is made, because by far most new items are a result of new packaging (pack sizes and pack variants in figure 2.2). The combination of sizes, languages and promotion packs leads to a large number of items. Corbey [1997] calls this: “*type flexibility; the ability to meet the demand for new product types within a product family.*” The request from the markets for a new promotion pack or a new case count of an existing product are example of this type flexibility.

Besides, the costs of flexibility in recipes has just been investigated by another researcher. Additionally, it is more feasible to come up with average amounts if you focus on variety caused by packaging instead of whole new products. In the last case every project is completely different and requires project-specific investments.

### 2.3.3 Capacity

The method and resulting design have to be generally applicable for the production lines in Europe. Because it is not feasible to investigate all the lines within the available time, one line is chosen. In this way one can get an idea about the order of magnitude of the amounts. Because this project is carried out at Masterfoods Veghel, it is decided to choose one production line in Veghel.

The production capacity of Masterfoods Veghel can be split into eight production lines, with each its own product groups. These eight production lines have to be examined further. Appendix 2.2 shows the product groups, the number of items, the utilisation and the actual production in 2001 made on a specific production line.

After an analysis of the different production lines, line 3 has been chosen for further research. The reasons for this choice are summarised below:

- Line 3 is an important line in Veghel because of its large output (about 60.000 ton or 34% of the total production volume in Veghel).
- Line 3 is a line which produces three strong brands and a lot of different pack sizes and pack variants. New item requests frequently relate to this line.
- Line 3 is a mature line with a predictable constant output.

## 2.4 Research method

The research questions that arise from the problem definition and research objective are the following:

- Which method should be used to calculate the costs for a new item request?
- What characteristics of the new item request are important to take into account?
- How can the total costs for specific item requests be determined by the department of IE?
- What is the order of magnitude of the amounts? And which costs account for the largest part of the total costs?
- How should the design be implemented?

These research questions result in the research model [Verschuren and Van der Bij, 1998] that is represented in figure 2.3. This model is a schematic representation of the main steps that have to be taken in this project. The different stages in this model will be briefly described.

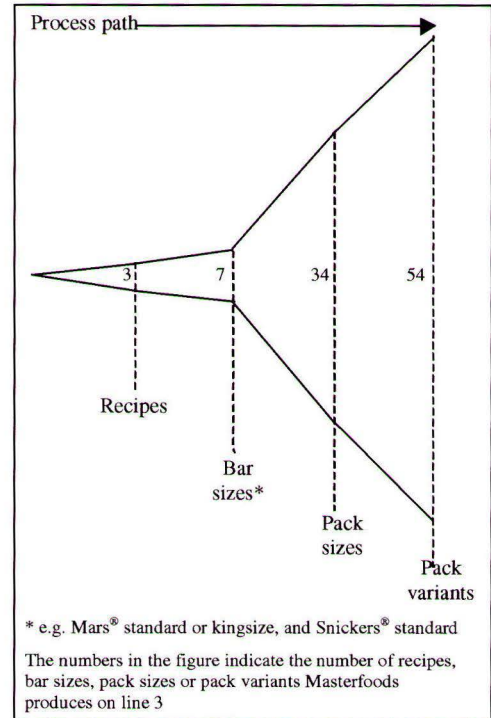


Figure 2.2: Production variety funnel for line 3 [Hines, 1997]

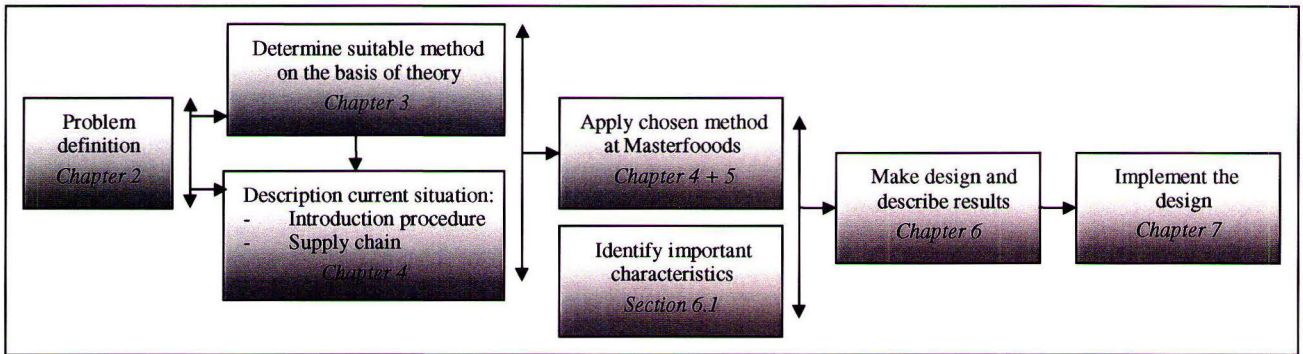


Figure 2.3: Research model

On the basis of the problem definition and defined research objective in this chapter, an appropriate method will be chosen on the basis of theory (ch 3). This chosen method will influence the description of the current situation (ch 4). In this description a distinction will be made between the introduction process and the supply chain from supplier to the Central Warehouse (figure 2.4).

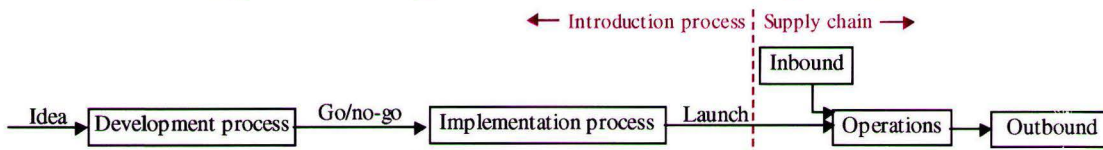


Figure 2.4: Description of the current situation in two parts

The most suitable method has to be applied to this current situation (ch 5). The characteristics and costs of line 3 will be used in this chapter. On the basis of the chosen method a design will be made that enables Masterfoods to calculate the extra costs for a specific request. In this design the most important characteristics of a request will have to be taken into account. This design and the results for production line 3 will be shown in chapter 6. The last part is the implementation of the method and design (ch 7).

## 2.5 Summary

This chapter began with the background for this research: the limited shelf space at the retailers and the increasing complexity in the factory. This background led to a problem definition and the research objective. During this research a suitable method needs to be determined which can be used to calculate more realistic costs for an item. On the basis of this method a design has to be made that can help the department of IE when they are confronted with new item requests. In the third section it was chosen to focus in this project on:

- the part of the supply chain from the suppliers until the products leave the Central Warehouse,
- the large number of items caused by the variety in packages,
- production line 3.

To structure this research five research questions were formulated that formed the basis for a research model. To reach the goal of this project the steps in this research model have to be executed.

In the next chapter the available methods to calculate costs are described after which the most suitable method is chosen.

### 3. Description of the suitable method

As was concluded in chapter 2, the goal of this project is to gain insight in the costs that are connected with the introduction and production of items: the cost impact of the new item requests. This insight can be obtained via different routes. In this chapter the available methods are described and one method is chosen: Activity Based Costing (ABC). The basic principles of this method are explained in the second section. The third section pays attention to the way the first step of the ABC-method is executed after which a summary is given in the last section.

#### 3.1 Available methods

##### 3.1.1 Cashflow based approach

To calculate the item-specific costs a cashflow based approach could be used. This approach enables management to forecast the *actual* economic consequences of the operations decisions [Theeuwes and Adriaansen, 1994]. It asks for a long term detailed view of the costs, in which e.g. the contracts with suppliers are also involved. The basic idea of this cashflow-based approach is shown in figure 3.1. The sales income and the resource spending are inputs to calculate the *actual* company earnings.

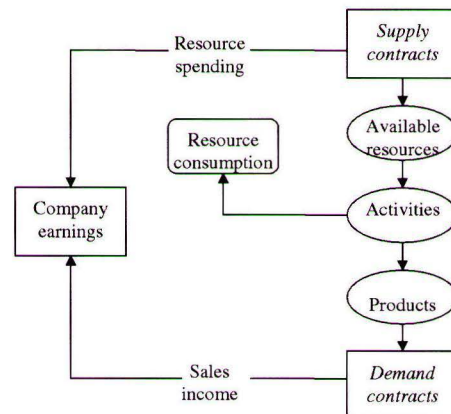


Figure 3.1: The basic concept of a cashflow based approach [Theeuwes and Adriaansen, 1994]

In this project, however, is chosen for another approach than this cashflow-based approach. The goal of this research is to take *also* the activities into account that might not involve extra costs *directly* -like the activities at the supporting departments-, but that *do* use extra resources. So, the focus in this research lies on the actual resource consumption and not on the resources spending which is the case in the cash flow based approach.

##### 3.1.2 Cost allocation methods

Cost allocation can be defined as: “the distribution and assignment of indirect, common, or joint costs to different departments, or products within an organisation” [Zimmerman, 1997]. In general, three standard cost allocation methods are described in literature; two traditional cost allocation methods (1 and 2), and a more recent one (3):

1. Absorption cost method
2. Cost allocation table method (in Dutch: kostenplaatsmethode)
3. Activity Based Costing method (ABC-method)

These methods are described in more detail in appendix 3.1.

The traditional systems do not take into account the differences of relative use of overhead and neglect the fact that complexity causes indirect costs. The costs caused by variety are hidden in ‘overhead’ in traditional allocation methods [Boons et al., 1991]. As a result traditional cost allocation methods lead to cost prices that are too high for large volume products and too low for small volume products, which is also the case within Masterfoods at the moment. ABC-systems do not experience this problem and are more detailed than the traditional methods. Furthermore, ABC is a suitable method in situations that meet, among other things, the following characteristics [Cooper, 1988; Cagwin and Bouwman, 2000]:

- Large diversity in products
- Large diversity in volume
- Competitive markets
- Importance of costs in decision making process

These characteristics certainly apply for Masterfoods. So, ABC is the most suitable method to solve the problem defined in the previous chapter.

The Activity Based Costing method is the most suitable method and will be used to gain insight in the item-specific costs.

### 3.2 Basic concept of Activity Based Costing

*“The Activity Based Costing method recognises that overhead costs vary not only with volume but also with the range of items manufactured – that is, their diversity and complexity”* [Zimmerman, 1997].

The activities performed by many resources are not demanded in proportion to the total volume of units produced (or sold) [Cooper and Kaplan, 1992]. The central question is: which parts of the organisation tend to grow as the company increases the diversity of its product line, its processing technology, its customer base, its marketing channel or its supplier base? [Cooper and Kaplan, 1988]

The costs that can be assigned to products directly, the so-called prime costs, do not require thorough investigation. They are known and are item-specific. The current indirect costs on the other hand can be assigned more specifically using an ABC-method. The assignment of these costs needs thorough investigation in several steps (figure 3.2).

The Activity Based Costing method consists of five steps [Cooper, 1990A]:

- Identify the major activities performed in the facility (chapter 4)
- Determine the cost of those activities. This is the process allocation in figure 3.2. In this process allocation the costs of the resources are allocated to the activities on the basis of the amount of resources that are used in behalf of activities [Van Damme, 2000]. These amounts are measured with the help of resource drivers (chapter 5).
- Identify what drove those activities, determine the so-called activity drivers (chapter 5). The activity drivers can be classified into one of four mutually exclusive categories [Zimmerman, 1997]:
  - Unit-level costs (volume related) arise from activities that are performed at least once for each unit of product.
  - Batch level costs arise from activities performed once for each batch or lot of products, e.g. machine set-ups and pallet handling.
  - Product level costs arise from activities to support the production of the product type or model.
  - Facility level costs arise from all remaining activities required for the overall operation of the factory. These are the costs that do not have a causal relation with the cost objects such as security and administration.
- Determine the quantities of each cost driver associated with every product (chapter 6).
- Compute activity based production costs (chapter 6).

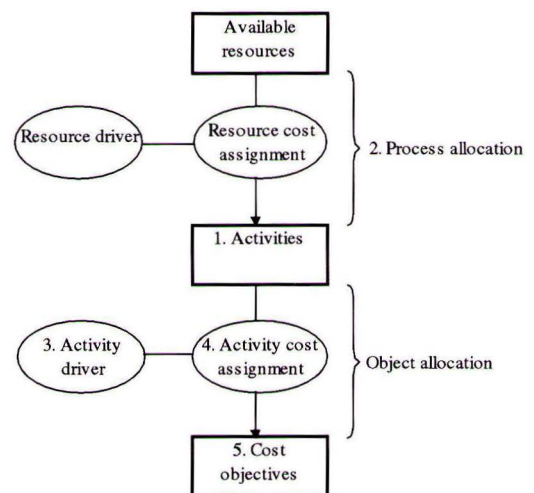


Figure 3.2: Activity Based Costing [Van Damme and Van der Zon, 1999]

Assign the activities to the cost objectives via activity drivers is called the object allocation.

These are the standard steps that can be found in the literature regarding the ABC-method. In practice, however, this method needs some small adjustments due to the information available. These adjustments are described in chapter 5 after the activity analysis. This order is followed, because only

just after the activity analysis one has gained enough insight into the executed activities and the information that is available concerning the activities to adapt the theoretical ABC-method. Besides, the first step - an activity analysis – can be executed independently of the information available. The approach regarding this activity analysis is explained in the next section.

### 3.3 Approach for activity analysis

#### 3.3.1 Value chain concept

For the activity analysis, which is the first step of the ABC-analysis, the basis of the value chain concept described by Porter [1985] is used. The use of this concept as starting point of the ABC-analysis is recommended by several authors [Mabberley, 1998; Boons et al., 1991], including Porter himself, because the value chain model depicts a logical sequence of components or processes within a business operation. The sequence of operations of the whole production and creation process are clearly reflected. The distinction between the primary components and support components is also useful. The general model is described in this chapter and will be made Masterfoods specific in the next chapter.

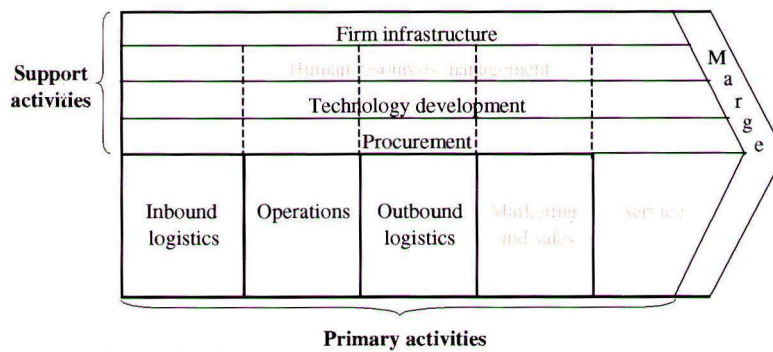


Figure 3.3: Value chain of Porter

Porter divides the value chain in primary and supportive activities (figure 3.3). Primary activities are directly concerned with the creation or delivery of a product or service and can be grouped into five main areas:

- *Inbound logistics* are the activities concerned with receiving, storing and distributing the inputs to the product.
- *Operations* are the activities associated with transforming inputs into the final product, such as packaging and assembly.
- *Outbound logistics* are the activities associated with collecting, storing, and distributing the product to customers, such as warehousing, materials handling and transport.
- *Marketing and sales* are the activities concerned with providing a means by which consumers can purchase the product and inducing them to do so, such as advertising and promotion.
- *Service* are the activities associated with providing service to enhance or maintain the value of a product or service, such as installation, repair and spares.

The last two categories are not included in the activity analysis, because marketing and sales, and service is done by the markets Masterfoods Veghel produces for. These markets are outside the scope of this research.

The support activities help to improve the effectiveness and/or efficiency of primary activities. These activities can be divided into four areas:

- *Procurement* refers to the processes for acquiring the various resource inputs to the primary activities. This procurement function can be divided into two categories [Van Weele, 2001]:
  - Initial procurement function: specify the needed material, select a suitable supplier and contract the supplier.
  - Obtain function: order material from the supplier, control and after-care.



- *Technology development* consists of a range of activities that can be broadly grouped into efforts to improve the product and process.
- *Human resource management* consists of activities involved in the recruiting, hiring, training, developing and compensation of all types of personnel within an organization. This part of the value chain is left out completely in the activity analysis. After interviews, it turned out that it has no bond with the variety in packaging.
- *Infrastructure* consists of a number of activities including general management, planning, finance, and accounting.

### 3.3.2 Level of detail

When appointing the different activities it is important to think about the level of detail (figure 3.4). Theoretically it is possible to divide every activity in sub-activities and those in other sub-activities again. A weighing has to be made: a high level of detail gives more accurate cost information, but such a system is hard to maintain and expensive [Van Damme and Van der Zon, 1999].

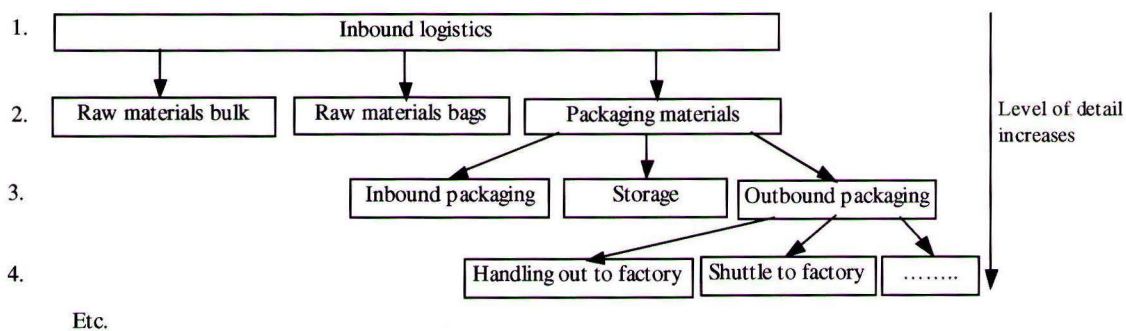


Figure 3.4: Example concerning the level of detail of the activity analysis

The activity analysis in the next two chapters contains activities on the levels 3 and 4, in the first instance. However, it is chosen to deliver an activity analysis with only level 3 activities. This means that some activities have to be aggregated, which is done at the end of chapter 4. This choice is made because of two reasons:

1. Level 2 was excluded immediately, because it does not provide enough detail while an ABC-analysis on level 4 would mean that the system becomes pretty complicated and, more important, cost and process information are not always known on that level.
2. It is possible to use activities from detail level 3 and 4 mixed up, dependent on the cost information available about the activities. However, this would make the model more complicated and thus less accessible.

### 3.4 Summary

This chapter explained the methods available to determine the tariffs for the activities. It was chosen to use an ABC-method since this method recognises that costs not only vary with volume but also with the range of items manufactured. The first step in this ABC-method is identifying the relevant activities. This is done on the basis of the value chain model developed by Porter. Attention was also paid to the level of activities which has to be the same for all activities.

In the next chapter the activity analysis for the implementation process and supply chain will be executed which results in a Masterfoods specific value chain.

## 4. Activity analysis

In this chapter is first described briefly how the current situation looks like. Subsequently is outlined what steps are followed when an item is introduced (section 4.2) and how the item runs through the supply chain after introduction (section 4.3). The description in these two sections leads to an overview of all the relevant activities in the final section; the first step in the ABC-method (figure 4.1).

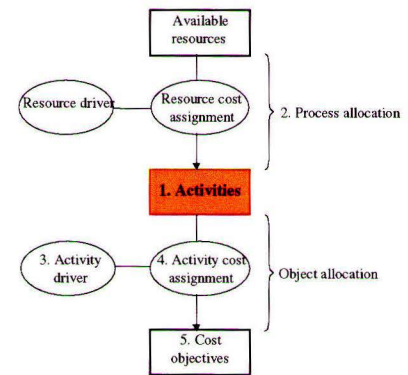


Figure 4.1: ABC-method

### 4.1 Current situation

When Masterfoods receives a request from the market for the introduction of a new item, an introduction process is started up to investigate if the request should be granted. This introduction process consists of a development process until the go/no-go decision is made and an implementation process. During this implementation process the timings for production and delivery of packaging material are confirmed and the preparations are made for printing the material. After this process is finished, packaging material can be printed, delivered and brought to the production lines in the Veghel factory. When the bars are successively produced, packed and palletised, they can be transported to the Central Warehouse from where the distribution to the market depots takes place. This whole process from request to distribution will be described more extensively in the next two sections. A distinction is made between the introduction process until the item can be produced and the activities that take place during the inbound logistics, operations and outbound logistics in the supply chain.

### 4.2 Current introduction process

The current introduction process for a new item is described in this section (figure 4.2). First the different levels of introductions that can be distinguished are mentioned, after which the scope regarding the introduction process is described. In the third part, the emphasis lies on the description of the implementation process.

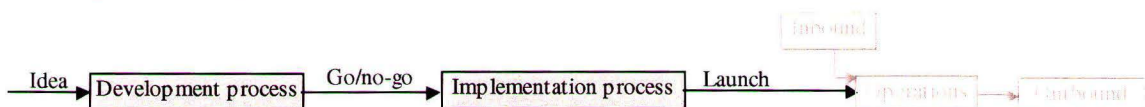


Figure 4.2: Focus in this section: introduction process

#### 4.2.1 Categories of activities

An introduction process has to be started up for every new item. However, this process differs depending on the category of the new introduction. The activities within the introduction process are categorised, based on two main questions:

- Will the activity change the consumer's long-term perception of the brand?
- How high is the level of brand, capital and resource investment?

Masterfoods talks about "activities" in this context, but these activities are thus not the same activities as those in the ABC-analysis. An activity within Masterfoods can be defined as: "any project which involves delivering to the trade a pack or a product format which in any way differs from an existing pack format." So, an activity is not only the introduction of a new item, but also the update or change to an existing item. The items that are already in the assortment need to be updated during their lifetime as a result of changes in e.g. the recipe declaration, the address or the brandflag. This updating can be seen as the maintenance process of existing items. Every standard item in the assortment is updated once per year on average, for which extra resources are necessary. Since the introduction and update process consist of the same activities, they are described together in the rest of this research until a distinction becomes necessary.

Four categories of new activities are distinguished:

- |                   |  |
|-------------------|--|
| <i>A-activity</i> | New product or brand / a major change to product recipe or product format / new pack type requiring new technology   |
| <i>B-activity</i> | New flavour or variety/ new product or pack size of an existing product recipe   |
| <i>C-activity</i> | New pack (existing format) / minor changes to weight recipe / brand flag changes / local activities with supply constraints / roll-outs to new markets / promotion packs |
| <i>D-activity</i> | Local activities –volume, value, price or theme promotion – with no supply constraints.  |
- Only few activities have the A- or B-status, so most new activities are in the C- and D-category.

#### 4.2.2 Scope regarding the introduction process

An overview of the introduction process is given in figure 4.3. Every part of this introduction process generates costs. However, not the whole introduction process will be included in the activity analysis and cost allocation. Only the part after the approval of the Activity Recommendation (AR) -the implementation process- is taken into account. Several reasons can be given for this choice.

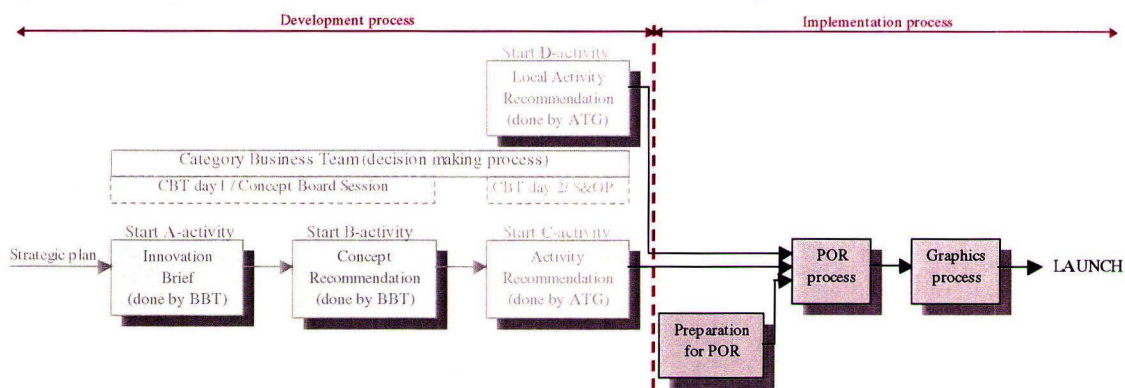


Figure 4.3: Overview of the introduction process

The Innovation Brief (IB), Concept Recommendation (CR) and AR are part of the development process for a new item. The AR is the last step in the development process, in which the actual approval for the expenditure of money for implementation is given. The AR is important in this research, because in an AR, the actual advice about the introduction of a new item is given. However, this development process is not important when calculating the costs, because the costs for this development process are already made at the moment Masterfoods decides to introduce an item (the AR-approval). Masterfoods cannot influence these costs anymore. Besides, in the CR is already decided to release money for the development process. The choice to leave the development phase out of the ABC-analysis is also made by Cooper and Kaplan [1988]: *“The research and development for new products is excluded from an Activity Based Cost system. The modifications and improvements that relate to existing products can be traced to the products.”* The preparations for the Packaging Origination Request (POR), the POR itself and Graphics process are taken into account when determining the costs, because that is where the actual implementation begins and the POR-process starts after the decision to produce a product is made.

Only the implementation process, which consists of the preparations for the POR, the POR itself and the Graphics process, will be included in the activity analysis and the cost allocation.

The steps that are taken in the development process are described in appendix 4.1, which serves as background information.

### 4.2.3 Implementation process

After the go/no-go decision is made, the implementation process starts. This process consists of the POR-process - and the preparations for this process - and the Graphics process. These parts are described in this section.

#### **Preparations for the POR**

Before the POR can be started the following things have to be made and approved:

- (Local) Activity Recommendation. An AR is made by an Activity Task Group with representatives of different departments to gain insight in the detailed operational and financial implementation of an activity. This AR is outside the scope, since it is part of the development process.
- Artwork approved by Graphics if new artwork is needed. Artwork is developed by an external artwork agency by order of the market. The costs for making this artwork are paid from a budget the markets reserve for this activity. These costs are not included in the factory transfer price and are thus outside the scope of this research. The file with the final artwork is sent to the department of Graphics that does the final check with regard to print technical issues.
- TradeMark Authorization Request. This is a checklist filled in by the European Brand Leader or Local Brand Manager with regard to the presence of trade market registrations, the right use of the logo, colours etc. This activity is outside the scope of the project, because it is done by associates of the markets.
- Technical specifications for packaging from Packaging Development. The preparations for these specifications can already be made during the AR-process. When a new pack size is introduced, new technical specifications are necessary, while in case of a new pack variant, the specifications already exist most of the times.

#### **Packaging Origination Request**

The POR is in fact the implementation document. The goal of starting up a POR is to confirm timings for production and delivery of packaging material. The result of a POR is the packaging confirmation and the final commitment to customers and suppliers.

The POR-process begins with a POR-inputsheet sent by the initiator of the activity to the department of Business Data Administration (BDA), which is responsible for the POR-process. BDA checks the input, puts everything in a computer system, and checks the POR lead-times. The standard lead-time for brand flag changes, and multi-brand or multi-market promotions is 12 weeks (start production – 12 weeks = start POR). This section describes what normally happens during those weeks (figure 4.4). When all the documents, described above, are approved Business Data Administration makes codes available in the Item Database, SAP, and all other systems. For every item, a new item code has to be defined. Different departments have to deliver input in the POR-document. BDA decides which departments are necessary for a particular POR and makes a routing. The participating departments are always consulted in the same order, because they need the information from their predecessors. However, not all departments are included in every POR. This depends on the characteristics of the new item. The following departments can take part in the POR-process:

1. *Quality Assurance* checks the working & declared weight,.
2. *Graphics* is responsible for the delivery of all graphical packaging changes. In the POR, they fill in the number of printed colours (print codes), number of cylinders needed, and the expected converter.
3. *Packaging Development* takes care of the calculation and definition of the palletisation, and carries out manufacturing line trials – if necessary - before the POR starts.
4. *Industrial Engineering* gives input concerning extra investments, extra labour costs (for example for inserts) and supply constraints.

5. *Buying* defines the definite supplier and makes price agreements with him. Another task is to coordinate supplier changes and ensure the correct price per pack is put into the system.
6. *Co-pack Buying* is not often involved in the POR-process, because only a limited number of items need co-packing. If this department takes part in the process, they define the co-packer and make prices agreements. They also give input concerning the co-pack costs per case.
7. *Supply Services Packaging* is concerned with the actual ordering of packaging material and defines the number of packaging calls.
8. *Service & Finance* gives input concerning the extra packaging costs and also calculates the provisional transfer price, and freight costs.

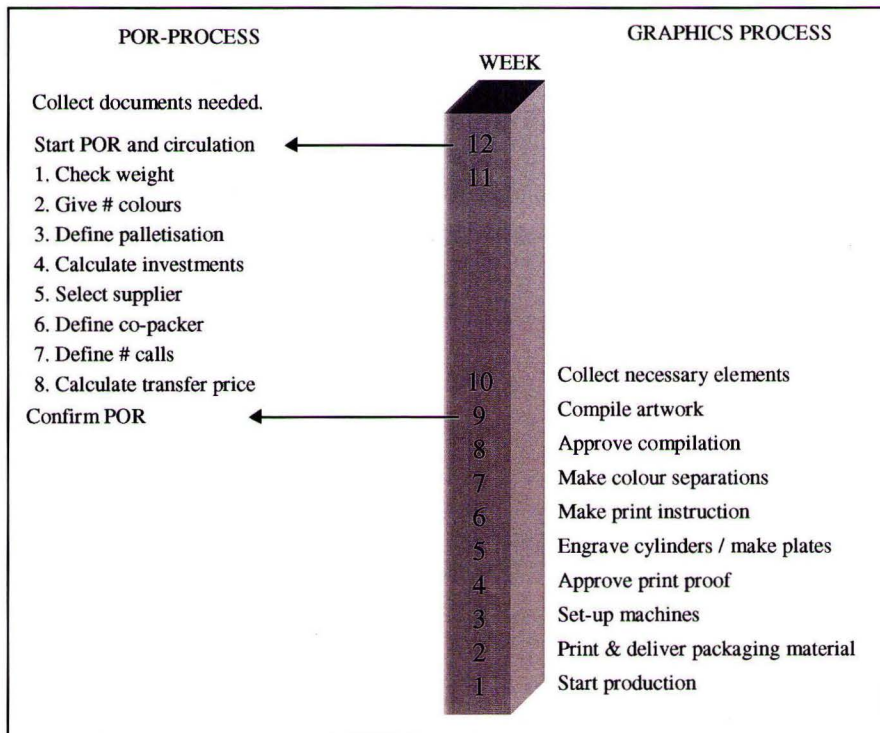


Figure 4.4: The POR-process and graphics process

The Legal department does not take part in the POR-process, but is informed. This department checks issues of legality (recipes, on-pack declarations and address changes) and provides the legal text specifications for the Graphics department. The legal text does not have to be attached to the POR and can already be made during the AR. Furthermore, the Production Planning Department also receives the POR, so that they can process the changes in their planning system.

BDA checks whether everybody delivers his input on time. When this process is finished, BDA collects all the elements, checks whether everything is complete and confirms the POR. After this confirmation the POR is final and costs for packaging can be made.

### Graphics process

After the weight, palletisation and supplier are known, the department of Graphics can collect the artwork, technical packaging specification and legal text. All these documents are sent to the Graphics Production Centre (GPC), which is a company that takes care of the artwork compilation, and also the colour separations. The department of Graphics gets a file back with the complete artwork from the GPC and sends this to the European Activity Manager or Local Brand Manager for approval. When the artwork is approved, it is forwarded to the printer together with print instructions. The printer sends everything to the plate maker, who engraves the cylinders, plates and/or clichés, depending on the specific packaging material, needed to print the packaging. The department of Graphics gets at least

one print proof somewhere in the process to give their final approval. After this approval, the printing machines can be set-up and the packaging material can be printed.

The activities surrounding the engraving of the cylinders, plates and clichés, and setting up the printing machines are not taken into account in the rest of this research. The Standard Packaging & Transfer Price Analyst from the Finance department is specialised in the calculation concerning the costs for engraving, but also the variable packaging costs and set-up costs. For every new request these costs are already taken into account very thoroughly and based on real consumption. This research would only result in averages for these activities and are thus excluded from further investigation.

### 4.3 Current supply chain

This section describes how an item runs through the supply chain and which activities are necessary to supply the right materials and produce and distribute the items (figure 4.5). The supply chain is split into three parts: inbound logistics, operations, and outbound logistics until the trucks are loaded. After a description of the primary flows through the supply chain, the supportive activities in the supply chain are described.



Figure 4.5: Focus in this section: supply chain

#### 4.3.1 Primary process

Figure 4.6 shows the primary flows in the Masterfoods Veghel supply chain.

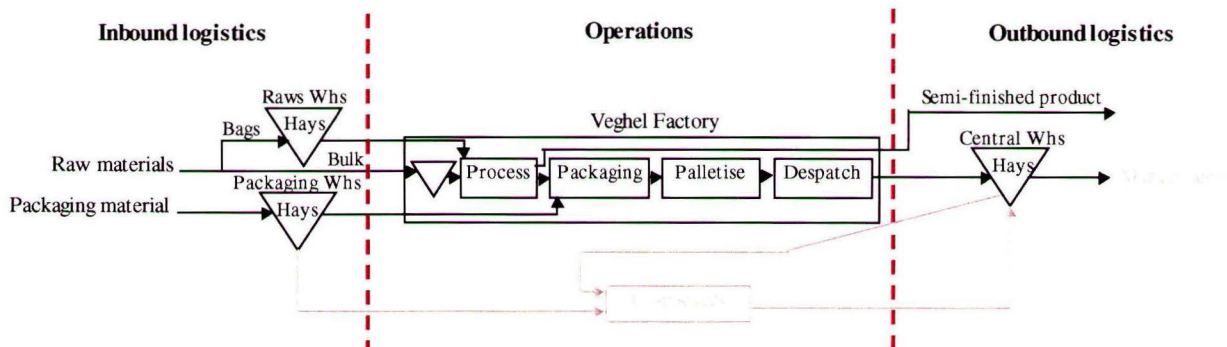


Figure 4.6: Primary process in the supply chain

#### Inbound logistics

Inbound logistics can be divided into two parts: the supply of raw materials and the supply of packaging material.

##### 1. RAW MATERIALS

Two different streams of raw materials can be distinguished. The bulk raws (cocoa, sugar, milk etc.) go straight to the silos that are located on the factory site. Raws that are delivered in bags, like peanuts and coconuts, first go to the raws warehouse and are not transported to the factory until the production department orders them.

##### 2. PACKAGING MATERIAL

All the suppliers send their packaging material to the packaging warehouse and they are the owners of the material until Masterfoods actually uses the materials. When the Production department orders the packaging materials, Hays takes the materials out of the warehouse and transports the pallets to the factory. The packaging materials arrive in hal A and have to be brought to the line by the packaging material handlers.

The warehouse and handling activities concerning bagged raw materials and packaging materials are outsourced to Hays Logistics. They take care of the inbound logistics, storage of the materials and transport to the factory.

### **Operations**

All production lines, except line 9 which only mixes the Celebrations<sup>®</sup>, can be divided into a process part and a packaging part. It is not easy to change the product/line combinations because all lines differ in process and the process is organised for producing specific product recipes. In general terms, the primary process can be described as follows. First, the raw material arrives at the factory. Some of the raw materials will be processed into semi-finished products, like chocolate and processed peanuts. These semi-finished products can be transported to other sites, but most of it goes to the production lines together with the rest of the raw materials. At the production lines, the bars are produced at the processing part of the line. The process part of the line has to deal with recipe changeovers. Line 3 produces three recipes: Mars<sup>®</sup>, Snickers<sup>®</sup> and Snickers Cruncher<sup>®</sup>.

After the actual production, the products can be packed in the pack-room in many different variations called “items”. Line 3 has nine packaging machines of which four are only suitable for showboxes, one only for multi-packs and four machines can produce showboxes as well as multi-packs. In appendix 4.2, a more profound description of line 3 can be found. Three packaging levels can be distinguished:

1. First wrap: to pack the naked bar
2. Second wrap: multipack or bag which are used to pack several products together  
Or showbox: some products have a carton showbox instead of a flexible second wrap.  
Or Single Traded Outer: a firm showbox, which also serves as the transportation unit. In this case no case is necessary.
3. Case: transportation unit

All the products are first-wrapped, but not all the products contain the packaging levels 2 and 3. An overview of the different possibilities is given in appendix 4.3. Every time another pack size has to be produced, the packaging machines have to be changed over. In case of another item (pack variant) with the same pack size, the packaging materials on the machines have to be changed; a so-called transition. Some products have to be packed manually.

After the products are packed in cases, they are automatically palletised in hal A. When the pallet is full it goes via a conveyer belt to the area where the pallets are stretched. After this, the pallets are provided with a label and set ready for transportation to the Hays’ warehouse (or in some cases directly to the customer).

Part of the products that are produced in Veghel are co-packed at different co-packers. Because this is only a small part of the production and the focus in this research lies on the Veghel factory, all the co-pack activities are outside the scope of this research.

### **Outbound logistics**

After the products are set ready for distribution in the factory, Hays transports the pallets to the Central Warehouse, handles them in and takes care of the storage. When the pallets have to be sent to the market depots, Hays handles the pallets out again en loads the truck or container.

#### *4.3.2 Supporting activities*

Figure 4.7 shows the information flows to support the supply chain. These supportive functions are described in the same three parts as the primary flow.

### Inbound logistics

The information flows concerning inbound logistics are different for the raw materials and the packaging materials.

#### 1. RAW MATERIALS

The department of Supply Services Raw Materials is responsible for the supply of raw materials for the whole factory and gets its weekly input data from the Production Planning department. The data, Supply Services Raw Materials uses from the Production Planning department, are:

- a. the start and end times of the recipe runs,
- b. the number of tons that have to be produced.

On base of these data, the actual stocks and the recipe bills-of-material, the program SAP (System Application Program) calculates the required volume (in ton) of each raw material. After that, the department of Supply Services Raw Materials sends orders to their suppliers with the required delivery date. The bags, stored in the Hays warehouse, are called off by the production on the basis of a detailed production schedule. The supply of raw materials is not taken into account in the rest of this research since the raw materials are not influenced by the variety in packages.

#### 2. PACKAGING MATERIAL

The department of Supply Services Packaging Material gets information from the Central Warehouse about the actual stock and from SAP concerning the necessary packaging materials. SAP contains a bill-of-material and calculates the packaging materials needed on the basis of the production schedule from the Production Planning department. A lot of packaging suppliers are integrated, which means that they can look in the systems of Masterfoods and decide on the basis of that information (about the requirements), what Masterfoods needs. However, for the cases in which the bars are transported, orders have to be sent to the suppliers. The Production department calls off the packaging materials from the warehouse when they need it.

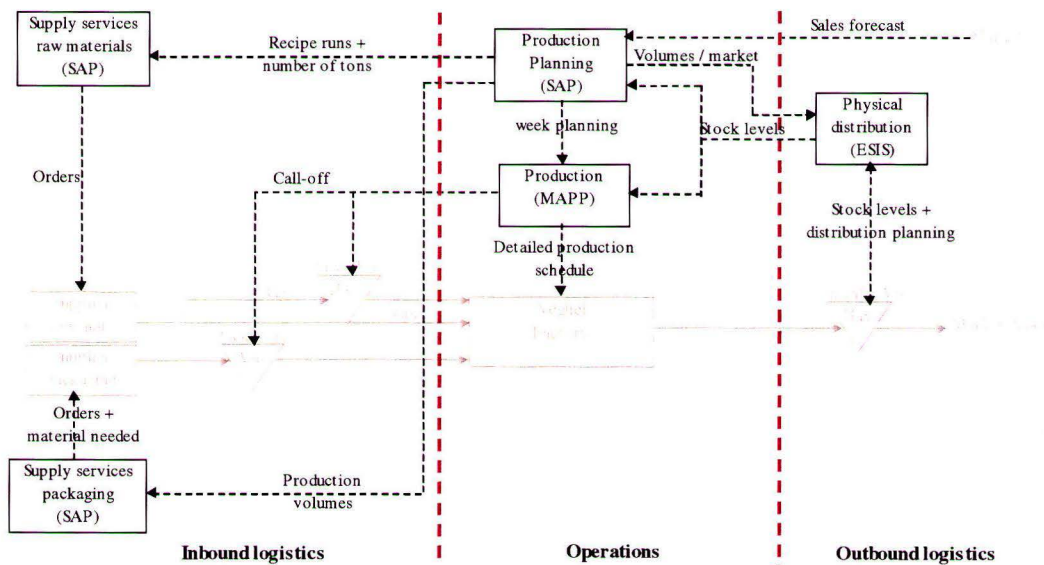


Figure 4.7: Supportive flows in the Masterfoods supply chain

### Operations

For production planning and inventory control, Masterfoods uses its self-developed Production and Planning System (PPS). PPS controls the pipeline stock and determines weekly production volumes per item per line. The main system inputs are:

- Capacities per production line (number of available shifts and number of tons per shift)
- Demand estimates of almost all markets provided by the business planner from the market
- The minimum stock level per pack group and the current stock levels
- The first production date and despatch date for a new item



PPS controls the pipeline stock of an item for almost every market. If pipeline stock is expected to drop under the minimum stock level, PPS places a production order. The main outputs PPS produces are:

- Production plan on a week basis
- Planned supply chain stock per product per market (in tons and days).

The weekly planned volumes are scheduled per line/wrapping machine and per shift using MAPP (MAsterfoods Planning Program). This more detailed line schedule is made by the Production department with input data from PPS.

### **Outbound logistics**

The markets give the sales estimates to the department of Production Planning, which is responsible for the stock levels of the products until they are at the market depot. They get information from the Production Planning department about the market allocation of each item. From the program ESIS (European Stock Information System), Physical Distribution gets information about:

- stock heights,
- location of stock,
- status of stock (for example in-transit, market depot, central warehouse).

ESIS is used by Masterfoods, Hays and the receiving markets. Every morning Physical Distribution receives the actual production volumes from the past day and starts allocating the stock with the help of an Excel sheet. After this allocation the actual freight to market can be planned.

## **4.4 Overview of activities**

In this section an aggregated overview of the relevant activities is given based on the description of the current situation in the previous two sections. Appendix 4.5 represents the detailed overview of the activities. The aggregation is necessary because no process and/or cost information is available on the detailed level and/or because it is clearer to present all the activities at the same level. All the aggregated activities are included in the value chain model in figure 4.8. This value chain model is made because of two reasons:

1. To give a clear overview of all the activities mentioned in the last two sections.
2. To indicate the place of the activities in the Masterfoods value chain.

The activities executed in the implementation process are indicated in green. The activities in the supply chain executed by Masterfoods are indicated in black while the activities done by Hays are red. As can be seen in this figure, the activities in the implementation process are (almost) all executed to support the whole supply chain, while the activities in the supply chain are connected to a specific part in this value chain.

The activities in figure 4.8 are all executed within Masterfoods or by Hays Logistics. Besides these activities, there is one activity that is executed by the GPC and cannot be placed in the value chain of Masterfoods. However, this activity, which is called “process artwork”, is important to take into account in the rest of the research.

|                        |   |   |   |  |
|------------------------|---|---|---|--|
| Infrastructure         | Make production planning<br>Process change in planning system   |   | Make distribution planning  |  |
| Technology development | Make specifications (+ do line trials)  |   |   |  |
| Procurement            | Order packaging material (obtain function)  | Coordinate POR-process + give input in POR (specify & select)<br>Coordinate packaging change (specify)<br>Make legal text (specify)   |   |  |
|                        | Handle in packaging material<br>Store wrappers/showboxes<br>Store cases<br>Handle out packaging material<br>Handle packaging material factory | Produce bars<br>Pack bars automatically<br>Pack bars manually<br>Change over packaging machines<br>Transition packaging machines<br>Palletise cases<br>Make pallets ready for transport | Handle in finished products<br>Store pallets<br>Handle out finished product |  |
|                        | Inbound logistics   | Operations  | Outbound logistics  |  |

Figure 4.8: Place of the activities in the Masterfoods Value chain

## 4.5 Summary

In this chapter the current situation was described and the activity analysis has been executed. First it was decided that only the implementation part of the introduction process is taken into account after which this process was described in three parts:

1. the preparations for the POR-process
2. the POR-process to confirm timings for production and delivery,
3. the Graphics process to make sure the packaging material can be printed.

In the second paragraph Masterfoods supply chain has been described. A distinction was made between the primary process and the supportive process and within these categories between inbound logistics, operations and outbound logistics. These descriptions resulted in an overview of all the relevant activities which is the first step of the ABC-method.

In the next chapter resources and costs will be assigned to these activities which results in a tariff per unit of activity.

## 5. Calculate tariffs per activity

In this chapter the steps 2 and 3 indicated in figure 5.1 are executed. So, the results of this chapter are the tariffs for the different activities which is an important part of quantifying the impact of new item requests. The steps that are described in figure 5.1 are adapted slightly in the first section since this method from the literature cannot be applied directly at Masterfoods. In the second section the different methods are applied to the activities in the implementation process after which this is also done for the supply chain activities in the third section. The chapter is concluded with a summary.

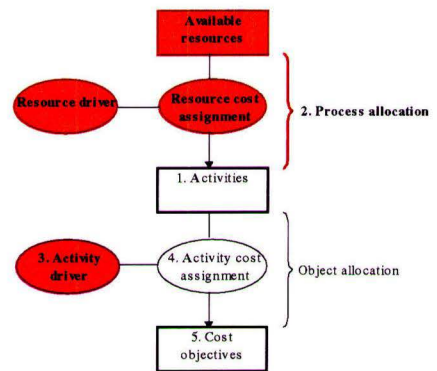


Figure 5.1: ABC-method

### 5.1 Different methods based on the ABC-principles

The ABC-analysis described in literature cannot always be applied exactly in that way in practice, because not all the information is available on the right level of detail. To calculate the costs per unit of activity, the costs of an activity (cost information that results from the process allocation) have to be known and these costs have to be divided by the amount of activity (process information or activity drivers) that is executed. In this section, the theoretical ABC-method is adapted to the situation within Masterfoods. It is investigated which information is available from all the activities and how tariffs can be calculated with that information. Three slightly different methods, that are applicable in different situations, resulted from this investigation. All these three methods are used in the rest of this chapter to calculate tariffs. To be clear, the methods described in this section enclose the steps 2 and 3 from figure 5.1. The last two steps from figure 5.1 can be executed in the same way for all the activities (chapter 6).

#### 5.1.1 Method 1

The method that is shown in figure 5.2, is designed for the situation that the total costs for an activity can be calculated and the number of activity drivers is known - on the right level of detail. This means the ABC-method as described in literature can be applied. The method that is used for this category joins the cost information from the department of finance via the ABC-method with the process information concerning the activities.

Method 1 is suitable when cost information and process information about the specific activity are available on the right level of detail

This method is applicable to the following activities:

- Process artwork
- Handle packaging material in the factory
- Produce bars
- Pack bars manually
- Palletise cases
- Make pallets ready for transport
- Make packaging/production/distribution planning

In figure 5.2 is also indicated how the steps in this figure are linked with the model in figure 5.1. The steps 1 to 4 included are explained below.

#### Step 1: Define relevant activities

This step has already been executed in chapter 4 and thoroughly explained in section 3.3.

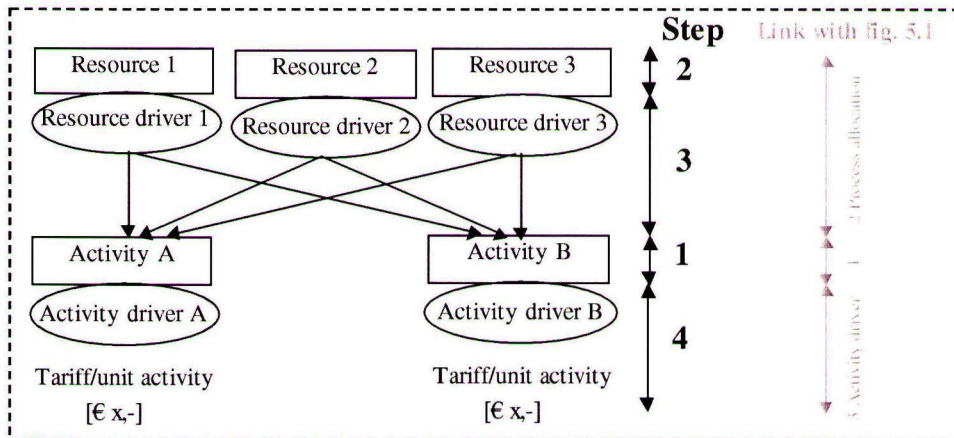


Figure 5.2: Model for method 1

### Step 2: Define resources

Resources are all the things that cost money and are put on to execute activities. The resources can be split up into a couple of general categories. This categorisation is made on the basis of literature [Van Damme and Van der Zon, 1999; Cooper, 1990A; Cooper, 1990B] and checked on completeness with help of the Profit & Loss of Masterfoods. It turned out that all the entries in the Profit & Loss fall under one of the categories below, and so the overview of categories can be considered complete.

- A. *Raw materials*: included are costs for the materials concerning the base recipe, and the fixed and variable packaging materials. The raw materials and variable packaging materials are *not included* because these costs are direct and are already item-specific in the current situation.
- B. *Personnel*: costs for salaries of the associates and expenses. Within this category a distinction can be made between permanent labour and temporary labour.
- C. *Machinery and equipment*: costs connected with this category are maintenance, depreciation and energy.
- D. *Information systems*: costs connected with this category are maintenance, depreciation and energy.
- E. *Buildings*: costs connected with this category are maintenance, depreciation and energy.

In this second step is investigated which resources are used during the execution of the defined activities.

### Step 3: Define resource drivers and distribute costs of resources

A relation has to be defined between the costs of resources and the activities. This is done via so-called resource drivers. These are factors that indicate in which extent the resources are used for executing the activities. The total costs for an activity are determined by multiplying the consumed amount of resource driver by the tariff per unit resource driver or by taking a percentage of the total costs for resources. When a resource has to be assigned to only one activity, the costs can be coupled directly. In this case the resource driver is: euros. This is for example the case for activities that are charged to Masterfoods by a fixed tariff per year such as the costs for processing the artwork. This fixed tariff indicates the total costs for that activity.

### Step 4: Define activity drivers and determine tariff

An activity driver is used to represent the costs per unit of executed activity. For example how much it costs to make one pallet ready for distribution. These costs per unit are called the tariff of the activity driver. This tariff is calculated according to formula 5.1 and is the ultimate object of the ABC-analysis.

Formula 5.1: Tariff activity driver

$$\text{Tariff activity driver} = \frac{\text{Total costs of activity ( per time unit)}}{\text{Total amount of activity driver (per time unit)}}$$

The total costs in the formula exist of the sum of the allocated costs of resources (step 3).

### 5.1.2 Method 2

In some cases the total costs for an activity cannot be calculated. The departments involved all carry out various activities of which only some are of interest for this research. However, it is not known how much time the departments spend on the activities of interest, which means that the total costs for the activity cannot be calculated.

Method 2 is suitable when only cost information and process information about the whole department that executes several activities is available.

This method is applicable to the following activities:

- All the inhouse activities in the implementation and update process.
- Activities in the pack room which include: pack bars automatically, change over packaging machines and transition packaging machines.

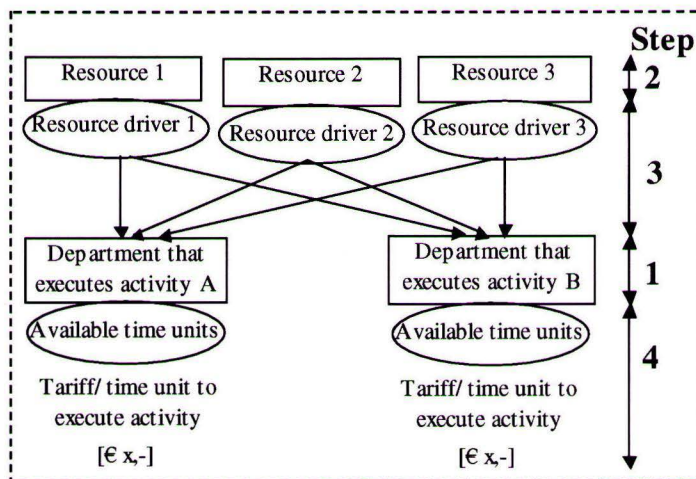


Figure 5.3: Model for method 2

After the activities and the departments that execute them are defined (**step 1**) the resources that are used by the department and thus activity are indicated (**step 2**). The same categories of resources as defined in subsection 5.1.1 are used. The total costs are then calculated per department (**step 3**) and not per activity as was done in method 1. In **step 4** these total costs are divided by the time available, which results in a tariff per time unit. This tariff indicates how much it costs to execute a random activity for one time unit. In this case the activity driver is always “available time units” since the information available about the separate activities is also per time unit; the associates from the departments *can* indicate how much time one activity in a certain situation takes. This use of time units for one activity is investigated in a later stage (chapter 6). Furthermore, the number of time units is the only process information that is known. The advantage of a tariff per time unit is that it is easy to convert a tariff per time unit to other activity drivers. If for example the time to execute one changeover is known, it is always possible to transform the tariff per time unit to a tariff per change over in a later stage.

### 5.1.3 Method 3

The last method is suitable for activities (executed by third parties) which are charged to Masterfoods via a tariff per activity executed.

Method 3 is suitable for activities with tariffs per piece

This method is applicable to the following activities:

- Hays activities concerning the inbound and outbound logistics
- Store packaging material and finished products

These tariffs are the costs per unit activity that is the goal of ABC. So, the whole ABC-analysis does not have to be executed. The only thing that has to be done in **step one** is the aggregation of some tariffs per detail activity into one tariff per aggregated activity. This is represented in figure 5.4.

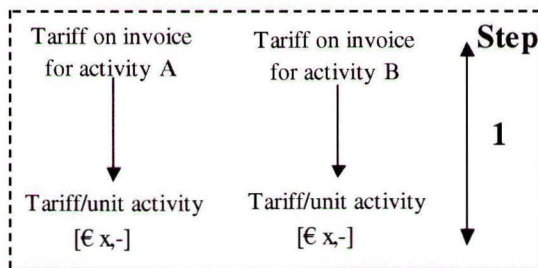


Figure 5.4: Model for method 3

## 5.2 Calculate tariffs for all the activities

The methods described in the previous section will be applied to the activities in the implementation process and supply chain in this section. The tariffs for the activities will not be calculated and explained per method, but the process as described in chapter 4 is followed. This means that a tariff is calculated for the activities in the implementation process followed by the activities in the supply chain which are divided again in inbound logistics, operations and outbound logistics.

### 5.2.1 Calculate tariffs for activities in the implementation process.

For all the activities during the implementation process is examined which associates, assets, space etc. are linked with the activity concerned. In appendix 5.1 an overview is given of the resources that are used per activity. In this way you can see which cost information is needed to calculate the total costs of an activity. The costs are discussed per aggregated activity. The tariffs are the same for the implementation and update process, so no distinction is made between those two in the rest of this chapter.

- PROCESS ARTWORK (DONE BY THE GPC)

For all the activities concerning “processing the artwork” Masterfoods pays a fixed tariff to the GPC. A resource driver is not necessary because all these costs can be assigned to the activity “process artwork”. The fixed tariff for processing artwork is based on 3.500 packaging changes per year. These 3.500 changes are also the activity drivers (table 5.1).

Table 5.1: Costs for processing artwork

| <b>Process artwork</b>                |                         |                    |                             |
|---------------------------------------|-------------------------|--------------------|-----------------------------|
| Resources used                        | Total costs (€ * 1.000) | # activity drivers | Tariff /activity driver (€) |
| <i>A. Raw materials (packs fixed)</i> |                         |                    |                             |
| Fixed tariff per year                 | ***                     | 3.500 pack changes | ***                         |

All the other activities that are executed during the implementation process consist of input given by different departments. For these activities an hourly tariff is given according to method two. First the total costs for the different departments are given, after which the costs per time unit are calculated.

The way the total costs per time unit for the departments are calculated is described below. An overview of the results for the different departments are shown in appendix 5.2.

- INHOUSE ACTIVITIES CONCERNING THE IMPLEMENTATION AND UPDATE PROCESS

The total costs for a department consist of several components:

**B. Personnel**

- *Salaries, Wages and Benefits* (SWB) for the personnel of the department concerned. It is investigated which job level the associate(s) who executes the activity has. Within Masterfoods the job levels are indicated in zones. The SWB per period (4 weeks) of the specific zone is used (formula 5.2).

*Formula 5.2 SWB department X*

$$\text{SWB per hour zone X} = \frac{\text{Total SWB costs per period zone X}}{\text{\# working hrs available per period}}$$

- *Expenses* for the department concerned for travel, training etc. The expenses are only included in the Profit & Loss per division and not per department (several department form one division). To estimate the costs for expenses per hour the ratio between the expenses and the SWB for the division the specific department belongs to is used according to formula 5.3.

*Formula 5.3: Tariff per hour for expenses*

$$\text{Tariff per hour expenses} = \frac{\text{Expenses division X (P\&L)}}{\text{SWB division X (P\&L)}} * \text{SWB per hour (formula 5.2)}$$

**C, D, E. Machinery and equipment, Information systems and Buildings**

- *Depreciation*

The depreciation for all these three things are not known on department or division level. All the depreciation for the office part of the factory is gathered into one big amount. The amount of depreciation for buildings is allocated to the office on the basis of the space the total office consumes (m<sup>2</sup>). Because Masterfoods has one big open office, it is almost unfeasible to measure the number of square meters per department. That is why it is chosen to allocate the depreciation of the building based on the number of employees in a department. This is a good approximation of the share of the building.

The costs for the depreciation of information systems and furniture are also allocated to a department per person. This seems reasonable because every person needs one set of furniture plus one computer. Besides, the costs for depreciation are so low compared to the costs for labour and expenses that it is not worth to do a thorough study. So, all the depreciation costs are calculated on the basis of number of associates (formula 5.4).

*Formula 5.4: Total depreciation per department per year*

$$\text{Depreciation department X} = \frac{\text{\# associates department X}}{\text{\# associates total office}} * \text{depreciation total office}$$

- *Energy*

The energy costs are assigned to the total office via the installed power in the office. These costs are again not known on department level. The number of associates per department again seems the most suitable way to assign the energy costs to a department. This means that the ratio between the number of associates in the department and the total number of associates indicated in formula 5.4 can also be used to calculate energy costs per department.

Reliable estimates concerning the maintenance costs for the office are not known.

All these costs for a certain department are assigned to activities via an hourly tariff (resource driver) based on the number of hours per year per Full Time Equivalent (FTE) which equals 1.808 for an office employee.

### 5.2.2 Calculate tariffs for activities in the supply chain

In this section the methods described in section 5.1 are applied to the activities in the supply chain. In appendix 5.3 an overview is given of the resources that are used per activity. For all the activities is again investigated what the total costs are and what these costs drives. This results in a tariff per activity.

#### Inbound logistics

In this section the calculations, resulting in tariffs for all the activities, with regard to inbound logistics are presented.

The following inbound logistics activities are executed at Hays:

- HANDLE IN PACKAGING MATERIAL
- STORE WRAPPERS/ SHOWBOXES
- STORE CASES
- HANDLE OUT PACKAGING MATERIAL

The activities concerning the handling in and out of pallets packaging material consist of several detail activities. These detail activities are charged to Masterfoods per pallet or per fixed tariff per year. To get one tariff for the aggregated activity per pallet, the detail activities that are charged with a fixed tariff have to be transformed to a tariff per pallet. How this is exactly done is described in appendix 5.4. The storage of packaging materials does not consist of detail activities and is calculated on the basis of m<sup>2</sup> per week. The tariff per week of wrappers and showboxes is higher than the tariff for cases since only the first two materials have to be stored in a conditioned warehouse. The final tariffs are indicated in table 5.2.

Table 5.2: Tariffs inbound logistics

| Activity                      | Tariff                   |
|-------------------------------|--------------------------|
| Handle in packaging material  | € **per pallet           |
| Store wrappers/showboxes      | € ** per pallet per week |
| Store cases                   | € ** per pallet per week |
| Handle out packaging material | € ** per pallet          |

- HANDLE PACKAGING MATERIAL FACTORY

In the factory several associates are concerned with the handling of packaging materials to and from the lines. In the total costs for this activity (table 5.3) only the labour costs of these associates are taken into account, because the depreciation of their equipment (some lift trucks) is not known. Besides, as we see in the other activities, the costs for labour form the largest part. The packaging material handlers are not only concerned with packaging material handling, but they also have other activities to do. On the basis of interviews is determined how much time they spend on the handling of pallets packaging material to and from the line (see appendix 5.5).

Table 5.3: Costs packaging material handling

| Packaging material handling (PMH) |                     |                    |                         |                           |                              |
|-----------------------------------|---------------------|--------------------|-------------------------|---------------------------|------------------------------|
| Resources                         | # associates / crew | Total # associates | % of time busy with PMH | Labour costs / period (€) | Total costs / yr (€ * 1.000) |
| <i>B. Personnel</i>               |                     |                    |                         |                           |                              |
| SWB material handlers             | **                  | **                 | **                      | **                        | **                           |



The activity driver should be the total number of pallets with packaging material handled in the factory (formula 5.5). Formula 5.6 shows how the final tariff to bring one pallet from hal A to the line or the other way around is calculated.

*Formula 5.5: Total number of packaging material pallet movements*

# pallet movements packaging material = # pallets transported to factory + # half pallets that return from factory  
= \*\*\*

*Formula 5.6: Total costs per pallet*

Total costs per pallet movement =  $\frac{\text{Total costs}}{\text{Total \# pallet movements}}$  = \*\*\*

## Operations

The following activities are executed at the line and in Hal A:

- PRODUCE BARS
- PACK BARS AUTOMATICALLY
- CHANGE OVER PACKAGING MACHINES
- TRANSITION PACKAGING MACHINES
- PACK BARS MANUALLY
- PALLETISE CASES
- MAKE PALLETS READY FOR TRANSPORT

The costs for the activity “pack bars manually” are not difficult to determine. One temporary associate to pack the products manually costs Masterfoods € \*\*\* per year if the associate would work full time. A full time job in the factory means 1.650 hours per year. Temporary associates are hired per hour, so this means that to hire a temporary associate for one hour, Masterfoods pays € \*\*\*.

For the other activities it is more complicated to determine the costs. First of all, the line is divided into two parts:

1. Process part: this is the part where the actual production of the bars takes place.
2. Packaging part: in this part three activities take place:
  - pack bars automatically,
  - change over packaging machines
  - transition packaging machines.

In case of line 3 this part consists of the pack room plus the two packaging machines that are located in hal A, but are reserved only for line 3.

Hal A is divided into three areas according to the activities that are executed in hal A:

1. Packaging machines: this area consists of five packaging machines which can pack showboxes in cases. These are an extension of the lines and are allocated to the packaging part of the lines. Two of these machines belong to line 3.
2. Palletising area: in this area several palletisers and robots take care of stacking up the pallets. The cases arrive via conveyors and are palletised in this area.
3. Despatch area: in this last part of hal A, the pallets are made ready for distribution; they are stretched, labelled and put on a conveyor belt which can push the pallets in the truck.

All the costs concerning hal A are divided in these three parts.

For all these areas on the line and in hal A the following costs need to be determined:

### B. Personnel

Permanent labour costs: based on the number of associates and their zones that are working in one area.

Temporary labour costs: based on the number of temporary associates in a certain area that are not busy with packing bars manually.

*C + E Machinery and equipment, and buildings*

- *Maintenance costs*

Maintenance labour: the labour costs for maintenance are based on the number of hours maintenance a certain activity uses per year.

Expenses: the expenses for e.g. spare parts are known per area or are estimated by the reliability manager.

- *Depreciation costs*: the total depreciation costs for Hal A and line 3 are distributed over the areas via the asset value of the different parts. The asset value is determined via specified lists of all the assets.

- *Energy costs*: the total energy costs are distributed on the basis of the installed power in the different parts.

The calculations (appendix 5.6) result in the table below which shows the total costs for the activities.

*Table 5.4: Total costs for line 3 (€ \* 1.000)*

| <b>Activity</b>                     | <b>Labour</b> | <b>Maintenance</b> | <b>Depreciation</b> | <b>Energy</b> | <b>Total costs</b> |
|-------------------------------------|---------------|--------------------|---------------------|---------------|--------------------|
| Produce bars                        | ***           | ***                | ***                 | ***           | ***                |
| Packaging part (3 activities)       | ***           | ***                | ***                 | ***           | ***                |
| Palletise cases                     | ***           | ***                | ***                 | ***           | ***                |
| Make pallets ready for distribution | ***           | ***                | ***                 | ***           | ***                |

- **PRODUCE BARS**

Activity driver: total number of hours the process part produces per year. This number is worked out in table 5.5.

*Table 5.5: Available hours per year processing part*

(Source: Logistics manager + reliability manager)

|                                  |     |
|----------------------------------|-----|
| Total shifts per year            | *** |
| # shifts holidays/recipe changes | *** |
| # shifts maintenance             | *** |
| Available shifts                 | *** |
| <b>Available hours</b>           | *** |

- **PACK BARS AUTOMATICALLY**

- **CHANGE OVER PACKAGING MACHINES**

- **TRANSITION PACKAGING MACHINES**

These activities are all executed in the pack room of line 3. For these activities the driver is also the number of hours, but this time not for the pack room as one entity, but for all the machines separately.

This is done because an item is often packed on only 1 to 3 machines. Formula 5.7 is used for calculating the total number of machine hours in the pack room.

*Formula 5.7: # activity drivers pack bars*

$$\text{Number of machine hours} = \# \text{ available shifts} * \# \text{ hours per shift} * \# \text{ packaging machines} = ***$$

The tariff that is calculated indicates how much one hour on one machine costs.

- **PALLETISE CASES**

The palletisers and robots handle one case at the time, so it would be logical to choose the number of cases as activity driver. However, the total time to palletise one case highly depends on the type of case and the specific robot or palletiser it is palletised on. That is why it is chosen to determine a tariff per hour to palletise cases (table 5.6). The speed of the specific palletisers is taken into account in the next chapter.

Table 5.6: Available hours per year to palletise cases

|                       |     |
|-----------------------|-----|
| Total shifts per year | *** |
| # shifts holidays     | *** |
| # shifts maintenance  | *** |
| Available shifts      | *** |
| # palletisers/robots  | *** |
| Available hours       | *** |

- MAKE PALLETS READY FOR DISTRIBUTION

The logical activity driver for this activity is the number of pallets finished product. This number equals (based on Business Review 4 2002) \*\*\*.

### Outbound logistics (Hays)

The category outbound logistics consists of the following activities:

- HANDLE IN FINISHED PRODUCT
- STORE FINISHED PRODUCT
- HANDLE OUT FINISHED PRODUCT

For the activities concerning the outbound logistics the same applies as for the inbound logistics activities. The detail activities and their tariffs can be found in appendix 5.4 again. This results in the tariffs indicated in the table below.

Table 5.7: Tariffs outbound logistics activities

| Activity                       |         | Tariff                   |
|--------------------------------|---------|--------------------------|
| Handling in finished product   |         | € ** per pallet          |
| Store pallets finished product | Storage | € ** per pallet per week |
|                                | Capital | € ** per euro per year   |
| Handling out finished product  |         | € ** per pallet          |

### Supporting activities in the supply chain

Three supporting activities can be distinguished in the supply chain:

- ORDER PACKAGING MATERIAL
- MAKE PRODUCTION PLANNING
- MAKE DISTRIBUTION PLANNING

The total costs are calculated in the same way as was done with the activities in the implementation process. However, in this situation the total costs for an activity can be calculated on the basis of the percentage of time the department is busy with the activity. The total costs per activity are indicated in table 5.8, the calculations are included in appendix 5.7. Every time the item is made, the item has to be planned and packaging materials have to be checked on availability and ordered if necessary. The activity driver for these two activities is the number of appearances of the item. Physical Distribution plans per freight, which can be easily translated to pallets since one freight consists of 30 pallets.

Table 5.8: Total costs for the supporting activities

|                            | Total costs activity<br>(€ * 1.000) | # activity drivers | Tariff per activity<br>driver (€) |
|----------------------------|-------------------------------------|--------------------|-----------------------------------|
| Order packaging material   | ***                                 | ***                | # appearances                     |
| Make production planning   | ***                                 | ***                | # appearances                     |
| Make distribution planning | ***                                 | ***                | # pallets finished product        |

### 5.3 Overview of tariffs

All the calculations outlined in the previous section lead to tariffs for all the activities. The results are given in the tables 5.9 and 5.10.

Table 5.9: Tariffs concerning activities in the implementation and update process

| Activities                             | Tariff (€)               |
|--|--------------------------|
| GRAPHICS PRODUCTION CENTER             |                          |
| Process artwork                        | *** per packaging change |
| GRAPHICS                               |                          |
| Give input in POR                      | *** per hour             |
| Coordinate packaging change            | *** per hour             |
| PACKAGING DEVELOPMENT                  |                          |
| Make specifications (+ do line trials) | *** per hour             |
| Give input in POR                      | *** per hour             |
| LEGAL                                  |                          |
| Make legal text                        | *** per hour             |
| BDA                                    |                          |
| Coordinate POR-process                 | *** per hour             |
| QUALITY ASSURANCE                      |                          |
| Give input in POR                      | *** per hour             |
| INDUSTRIAL ENGINEERING                 |                          |
| Give input in POR                      | *** per hour             |
| PACKAGING BUYING                       |                          |
| Give input in POR                      | *** per hour             |
| SUPPLY SERVICES PACKAGING              |                          |
| Give input in POR                      | *** per hour             |
| S&F SUPPLY                             |                          |
| Give input in POR                      | *** per hour             |
| PRODUCTION PLANNING                    |                          |
| Process change in planning system      | *** per hour             |

Table 5.10: Tariffs concerning activities in the supply chain

| Primary activities                | Tariff |  |
|-----------------------------------|--------|--|
| <i>Inbound logistics</i>          |        |  |
| Handle in packaging material      | ***    | per pallet packaging material in       |
| Store wrappers, showboxes         | ***    | per pallet / week                      |
| Store cases                       | ***    | per pallet / week                      |
| Handle out packaging material     | ***    | per pallet packaging material out      |
| Handle packaging material factory | ***    | per pallet packaging material in + out |
| <i>Operations</i>                 |        |  |
| Produce bars                      | ***    | per hour                               |
| Pack bars automatically           | ***    | per hour                               |
| Change over packaging machines    | ***    | per hour                               |
| Transition packaging machines     | ***    | per hour                               |
| Pack bars manually                | ***    | per hour                               |
| Palletise cases                   | ***    | per hour                               |
| Make pallets ready for transport  | ***    | per pallet finished product            |
| <i>Outbound logistics</i>         |        |  |
| Handle in finished products       | ***    | per pallet finished product in         |
| Store pallets finished product    | ***    | per pallet / week                      |
|                                   | ***    | per euro / year                        |
| Handle out finished product       | ***    | per pallet finished product out        |
| <b>Supporting activities</b>      |        |  |
| Order packaging material          | ***    | per appearance                         |
| Make production planning          | ***    | per appearance                         |
| Make distribution planning        | ***    | per pallet finished product            |

### Reliability of the tariffs

All the costs used to calculate the tariffs in the previous section are as accurate as possible. However, it is nonsense to claim that these tariffs indicate the exact costs for an activity. Some remarks can be made concerning the reliability of the calculated tariffs.

#### - *Implementation process*

The total costs for processing the artwork are set down in a contract and these costs are thus exact and complete for certain.

The total costs for the different departments consist of several components. The largest part of the costs is caused by the labour costs, which are known exactly per zone and are thus reliable. The expenses are charged to the departments via a debatable way. However, these costs were not known on a more detailed level.

#### - *Supply chain*

For the activities executed by Hays, the tariffs are almost exact since Hays charges Masterfoods per activity. The costs to pack bars manually are known at the Finance department exactly since they receive the invoices from the temporary employment agency.

The reliability for tariffs for the activities at the production line and in hal A cannot be checked precisely. Again the labour costs are the largest part and these costs could be calculated very precise, since the division of labour (numbers as well as zones) among the different parts of the line and in hal A is pretty much fixed. Costs for depreciation, maintenance and energy are calculated or estimated as precisely as possible, but are still debatable. The tariffs at the production line can be cross-checked. At the moment, Masterfoods charges € \*\*\* when the production line is down for one hour. With the tariffs from table 5.10 this would be € \*\*\* calculated according to formula 5.8. This calculation strengthens the belief that the tariffs for activities at the production line are reliable.

*Formula 5.8: Tariff when a production line is down for 1 hour*

$$\begin{aligned} \text{Tariff for 1 hour standstill} &= \text{tariff / hr process part} + \# \text{ machines packaging part} * \text{tariff / hr per packaging machine} \\ &= *** \end{aligned}$$

For the tariffs concerning the supporting activities in the supply chain the same accounts as for the tariffs per department in the implementation process.

## 5.4 Summary

In this chapter the ABC-method described in literature was slightly adapted to the practical situation, which resulted in three different methods that can be used for different activities. These methods are applied to the activities in the implementation and update process, and the supply chain. For every activity it has been investigated which resources it uses and what the costs of these resources are. The result of this chapter was an overview of the tariffs for all the activities. These tariffs are an important step in quantifying the cost impact of new item request. It could be concluded that the tariffs calculated are pretty reliable.

In the next chapter it is investigated which types of requests can be distinguished. Subsequently, the tariffs calculated in this chapter are assigned to cost objects and everything is included in a design.

## 6. Design Request Impact Charge

To be able to calculate the extra costs for a new item request several input data are necessary:

- the tariffs for the activities calculated in chapter 5
- the extra use made of activities for the specific item (figure 6.1)

The tariffs per activity are the same for every new item request. The extra use of resources however, depends for a large part on the characteristics of the item requests. So, before calculating the extra use of activities, the important characteristics are determined in section 6.1. After the calculation of extra use in section 6.2, section 6.3 pays attention to the design, which is called Request Impact Charge (RIC), its input fields and its functioning. Next, some results of line 3 and a sensitivity analysis are described. Section 6.4 pays attention to the other consequences and the last section contains a summary.

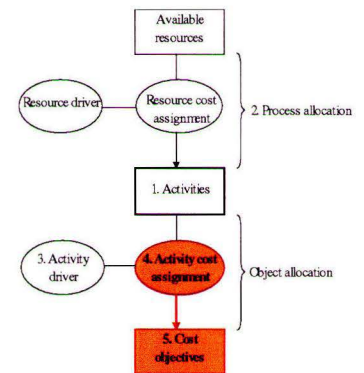


Figure 6.1: ABC-method

### 6.1 Characteristics of item introductions

Not all the requests for item introductions can be represented with one and the same amount, because some characteristics of a request influence the extra use made of activities. Different categories of requests are defined on the basis of interviews held with the associates from IE who are confronted with all the requests. The categories defined are based on four characteristics (A to D) described below, which result in table 6.1 with eight possibilities for every pack type.

Table 6.1: Categories of requests concerning pack changes per pack type (multi-pack, showbox, STO)

|                       | Replace? | Extra? |
|-----------------------|----------|--------|
| <b>Permanent item</b> |          |        |
| New pack size         | 1        | 2      |
| New pack variant      | 3        | 4      |
| <b>Temporary item</b> |          |        |
| New pack size         | 5        | 6      |
| New pack variant      | 7        | 8      |

#### A. Time span

The first characteristic is the duration of the production of the item (how many periods the item will be active).

- Request for implementation of a permanent item (categories 1 to 4). This item is implemented for an “indefinite” time span.
- Request for implementation of a temporary item (promotion) (categories 5 to 8). A promotion is done during a time span that is established before implementation.

The time span of the specific item is mainly important for the update process and several activities in the supply chain. The packaging material handling activities for example are dependent on the number of times the item is made, which depends on the number of periods the item is active. Furthermore, the update process is not of interest in case of a temporary item, because the item does not need updating in the limited time span it is produced.

#### B. Pack size versus pack variant

Besides the time span, other characteristics of a request result in more categories. In figure 2.2 can be seen that two levels of packaging can be distinguished: pack size and pack variant (one pack size consists of more pack variants). IE is also interested in a distinction between these two. So, this seems a logical classification within the categories permanent and temporary. The most

remarkable difference between these two packages is the changeover time in the factory, which is higher in case of a new pack size.

*C. Replacing item versus extra item*

A third characteristic, which distinguishes one request from the other, indicates if the execution of the request replaces an already existing item (categories 1, 3, 5, and 7) or if an *extra* item is implemented in the factory (categories 2, 4, 6 and 8). If an extra item is added, also extra activities in the factory and the update process are necessary. If an item replaces another item, in principle no extra complexity is added in the factory, but only in the supporting departments for the implementation process. It is important to understand that adding an extra item does not mean that the volume of the item is also extra. By far most of the requests do not result in extra production volume.

*D. Pack type*

Finally, a separate design (RIC) is made for each pack type (multi-pack, showboxes and STO's), because the department of IE also indicated that they want to gain insight into the differences – if there are - between activities concerning the different pack types.

After these categories were defined, it was checked on the basis of the data in the New Activity Database whether the specific types of request, that are listed there, can be placed in these eight categories (appendix 6.1) in order to check the completeness of the categories. This was possible, but it also turned out that some specific requests require significantly more or less extra activities than the average request in a category. This is for example the case when the weight of the package changes or if handpack is needed. So, the RIC has to be designed in such a way that these characteristics can be indicated.

## 6.2 Request Impact Charge

The design of the RIC for multi-packs is shown in figure 6.2. The RIC's for the other two pack types consist of exactly the same input fields. In this spreadsheet the last step of the ABC-analysis is executed; assign the activities to the cost objects. This RIC enables the department of IE to calculate the impact of new item requests, which was the research objective. All the calculated tariffs of the activities are included just as the characteristics defined in the previous section. It is chosen to use the program Microsoft Excel for the RIC, since this program offers all the necessary functions. But above all, it is easy to use and understand for the users, because they are already familiar with the program. The spreadsheet consists of several tables that will be explained in this section. In appendix 6.2 an extensive explanation of all the input fields is given.

### 6.2.1 User interface

#### REQUEST SPECIFIC DATA

All these green input fields *must* be filled in. These data are used to determine the characteristics of the request described in section 6.1. After the answers to the questions 1, 2, 3 and 5 are known, it is possible to indicate in which category the request can be placed (table 6.2). The answers to 6, 7 and 8 indicate other characteristics that influence the extra use of activities. Furthermore, the number of periods (4) and the expected volume (9) are key values to calculate several supply chain costs. Because the three recipes produced on line 3 all have a different bar weight, this has to be taken into account as well (10), since the speed of the packaging machines is expressed in bars per minute. These request specific data are all volume-independent. This means that these characteristics (except 9) have cost consequences that are independent of the volume filled in.

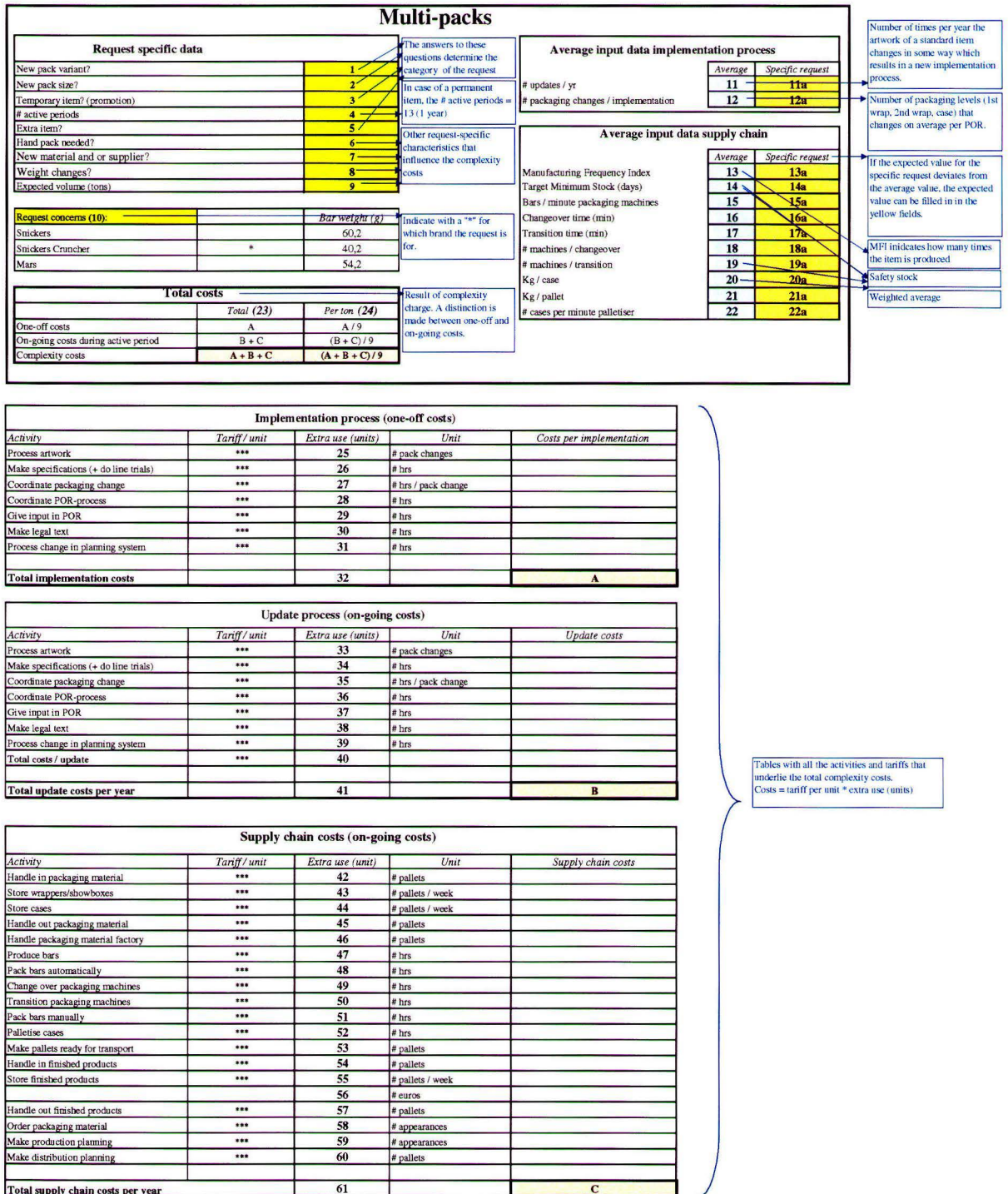


Figure 6.2: Request Impact Charge

#### AVERAGE INPUT DATA IMPLEMENTATION PROCESS & SUPPLY CHAIN

The average input data (blue fields, 11 to 22) indicate the average data - based on the current assortment - the spreadsheet uses in the calculations that underlie the RIC (section 6.2.2). They must not be changed for a specific request! In case a value for a specific request differs from the averages that are filled in, the specific data can be filled in in the corresponding yellow field (11a to 22a). These fields are optional, but if one is filled in, the RIC takes that value into account. The input data for the supply chain influence of course the activities in the supply chain, while the input data for the implementation process influence the activities in the implementation process and update process. The



underlying calculations and tables are explained in appendix 6.2. The input in the supply chain consists of some volume related inputs (15a, 20a, 21a, 22a).

#### TOTAL COSTS

On the basis of all the characteristics filled in in the three tables, the total complexity costs are calculated. The light red fields indicate the results of all these calculations. One amount indicates the total costs for introducing and producing the item (23). The other field indicates how much this is per ton (24). The total costs are in that case divided by the expected number of tons that will be produced. The total costs are divided into one-off costs (implementation process) and on-going costs (update process and supply chain costs).

#### 6.2.2 Assign activities to cost objects

In this section is briefly explained how the extra use of activities is assigned to the cost objects – the items in this case. For the extensive description of all the activities is referred to appendix 6.2. The tables described in this section form the basis for the total costs. They only serve to see how the total costs are build up. In case of a specific request no changes ought to be made in these tables.

#### IMPLEMENTATION PROCESS (25 TO 32)

The costs for the implementation process are always included in the RIC irrespective of the category of request. Below is explained how the extra use in units of activity is calculated.

For processing the artwork an average per implementation is calculated on the basis of historical data (12). In this way an estimate of the average costs can be made. The other activities during the implementation process mainly consist of input given by several departments. For all these departments a tariff per hour was calculated in chapter 5, so the extra use is also indicated in hours. The time a department is busy with an activity is called a time standard, which is also the extra use of the activity. How these time standards are determined, is described in appendix 6.3. In some situations, such as in case of a weight change, extra time is needed to give input. Furthermore, in the implementation process no differences are seen between multi-packs, showboxes and STO's.

#### UPDATE PROCESS (33 TO 41)

In the RIC the implementation process and update process are separated. The specific request only causes extra costs for updating if it concerns a *permanent* and *extra* item (categories 2 and 4). Assumed is that a temporary item is not updated, because the duration is only limited. Furthermore, if an item replaces another item, no *extra* update costs are incurred, because the predecessor also needed updating. If a request meets these demands the extra usage of activities for the update process are passed on to the request as part of the on-going costs. The way the extra use of activities is calculated is the same as in the implementation process. The update process and its extra use are independent of the specific type of request or pack type.

The total update costs are calculated by multiplying the costs for one update process by the number of times a standard item is updated per year.

#### SUPPLY CHAIN (42 TO 61)

The supply chain costs are part of the on-going costs. Furthermore, in the supply chain activities differences between multi-packs, showboxes and STO's come to the fore (see appendix 6.2) as a result of differences in the average input data (blue fields).

*Inbound logistics*

The extra use concerning these activities is based on the fact that every time an item is made (every production run), the half pallets of packaging material that are left have to be transported from the line to hal A and then to Hays again. Next time the item is made, these half pallets are called of again. Besides extra handling, you should also expect that more storage space is necessary to stock the packaging material of an extra item. However, in practice no direct relationship could be found between extra items and the height of the packaging stock. Besides, it would be difficult to take this into account since the suppliers of the packaging material are responsible for the height of the packaging stock and Masterfoods only passes on their requirements.

*Operations*

- The extra use for Packing the bars automatically and Palletise cases, is based on an average speed or number of kilos per case for the current assortment. Deviations from these averages can be indicated in the table “average input data supply chain” and are taken into account in the RIC according to formula 6.1.

*Formula 6.1: Example Pack bars automatically*

$$\text{Extra use "Pack bars automatically" (hrs)} = \frac{\text{Expected volume new item (tons)}}{\text{Average speed current assortment (tons/hr)}} - \frac{\text{Expected volume new item (tons)}}{\text{Expected speed new item (tons/hr)}}$$

- In practice the speed of the process part often decreases when two or three machines are changed over at the same time. However, in theory the line speed should not decrease during changeovers, because there is enough extra capacity. So, this extra use to “ Produce bars” cannot be taken into account.
- For changeovers and transitions time standards are determined (see appendix 6.3). The total time needed is calculated according to formula 6.2.

*Formula 6.2: Example Change over machines*

$$\text{Extra use "Change over machines" (hrs)} = \text{Time standard} * \# \text{ machines per changeover} * (4 / \text{MFI})^1 * \# \text{ active periods}$$

<sup>1</sup> The MFI indicates every how many weeks the item is produced. The number of times the item is produced per period (4 weeks) equals thus: 4 / MFI

- Finally, the number of hours needed to “Pack bars manually” equals the number of production hours needed to produce the expected volume. However, this number of hours must be multiplied by 1,25 because one temporary associate cannot work 100% of the time. They need 2 hours per shift to take breaks and for personal care.

*Outbound logistics*

The extra use of handling activities regarding finished products consists of two parts.

1. Every time an item is made, one extra half pallet is produced.
2. If the expected number of kilos on a pallet differs from the average number of kilos on a pallet, the complexity costs are influenced according to formula 6.3.

*Formula 6.3: Finished product handling*

$$\text{Extra use "finished product handling"} = \frac{\text{Expected volume new item (tons)}}{\text{Average \# ton per pallet current assortment}} - \frac{\text{Expected volume new item (tons)}}{\text{Expected \# ton per pallet new item}}$$

The costs for storing the pallets finished product are influenced by the cycle length (MFI). In case of a longer cycle length the average cycle stock and the safety stock increase. This results in higher carrying costs for storage as well as capital.

#### *Supporting activities*

- Every time an item is produced, packaging material has to be ordered and the item has to be planned. This is the extra use for the activities “Order packaging material” and “Make production planning”.
- The planning activities from the Distribution Planning department depend on the number of freights they have to plan, which is influenced by the number of pallets again. So, the extra use of the Distribution Planning department depends on the extra use of pallets finished product.

The connection between all the tables can be seen in figure 6.3.

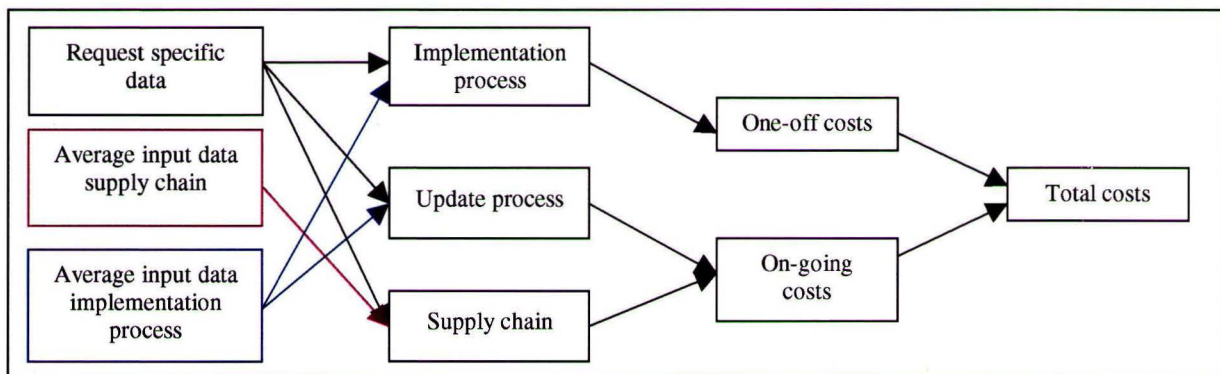


Figure 6.3: Connection between the tables in the RIC

### **6.3 Examples of outcomes of the charge for line 3**

In this research the method and developed design is applied to line 3. To get an idea about the order of magnitude of the results and the most important costs, some results of the RIC are shown in this section.

#### *6.3.1 Order of magnitude of results*

To get an idea about the order of magnitude of the outcomes of the RIC and the differences between the different categories defined in section 6.1, the calculations for some example requests are shown in this section. The numbers in table 6.2 are the results of implementing an item with the following characteristics:

- the item always includes 13 periods (also in case of a temporary item)
- all the calculated averages (blue fields) apply for the specific item

The volume and brand of the item do not have any influence on the numbers in the table. These characteristics are only important when some yellow volume and brand related fields are filled in as was indicated in section 6.3. In this example non of these yellow fields is filled in. Of course the expected volume influences the costs per ton. The link between the volume and the costs per ton is seen in figure 6.4.

From the table can be concluded that the implementation costs are not dependent on the pack type, but only differentiate between pack sizes (€ \*\*\*) and pack variants (€ \*\*\*). The update costs are also not influenced by the pack type. As was already explained these costs are only of interest when an extra permanent item is implemented. The total costs for the update process, which are included in the on-going costs, are almost equal to the costs for the implementation process.

Table 6.2: Examples of outcomes in absolute amounts (€)

|                       |                | Multi-pack |     | Showbox |     | STO     |     |
|-----------------------|----------------|------------|-----|---------|-----|---------|-----|
|                       |                | Replace    | Add | Replace | Add | Replace | Add |
| <b>Permanent item</b> |                |            |     |         |     |         |     |
| New pack size         | Implementation | ***        | *** | ***     | *** | ***     | *** |
|                       | Update         | ***        | *** | ***     | *** | ***     | *** |
|                       | Supply chain   | ***        | *** | ***     | *** | ***     | *** |
|                       | Total          | ***        | *** | ***     | *** | ***     | *** |
| New pack variant      | Implementation | ***        | *** | ***     | *** | ***     | *** |
|                       | Update         | ***        | *** | ***     | *** | ***     | *** |
|                       | Supply chain   | ***        | *** | ***     | *** | ***     | *** |
|                       | Total          | ***        | *** | ***     | *** | ***     | *** |
| <b>Temporary item</b> |                |            |     |         |     |         |     |
| New pack size         | Implementation | ***        | *** | ***     | *** | ***     | *** |
|                       | Update         | ***        | *** | ***     | *** | ***     | *** |
|                       | Supply chain   | ***        | *** | ***     | *** | ***     | *** |
|                       | Total          | ***        | *** | ***     | *** | ***     | *** |
| New pack variant      | Implementation | ***        | *** | ***     | *** | ***     | *** |
|                       | Update         | ***        | *** | ***     | *** | ***     | *** |
|                       | Supply chain   | ***        | *** | ***     | *** | ***     | *** |
|                       | Total          | ***        | *** | ***     | *** | ***     | *** |

The supply chain costs are dependent on the pack type. In case of replacement of an existing item by a new item, no supply chain costs are incurred in these example requests. This is only the case when the expected input for the replacing item deviates from the average input data (blue fields). When an extra item is implemented, the supply chain costs can be substantial. The amounts for multi-packs and showboxes lie in the same order of magnitude; ± € \*\*\* for a new pack size and ± € \*\*\* for a new pack variant. The supply chain costs for STO's however are lower than for the other two pack types; ± € \*\*\* for a new pack size and ± € \*\*\* for a new pack variant. This difference can be attributed to several factors:

- The number of packaging levels equals 2 in case of an STO instead of 3.
- The time needed to changeover a machine is lower than in the other two cases.

The largest part of the costs in the supply chain are caused by the packaging material handling (MP + SB: ± € \*\*\* and STO: ± € \*\*\*) and the change-overs (MP + SB: ± € \*\*\* and STO: ± € \*\*\*) .

Furthermore, the difference in supply chain costs between pack sizes and pack variants is mainly caused by the changeovers which are more expensive than the transitions.

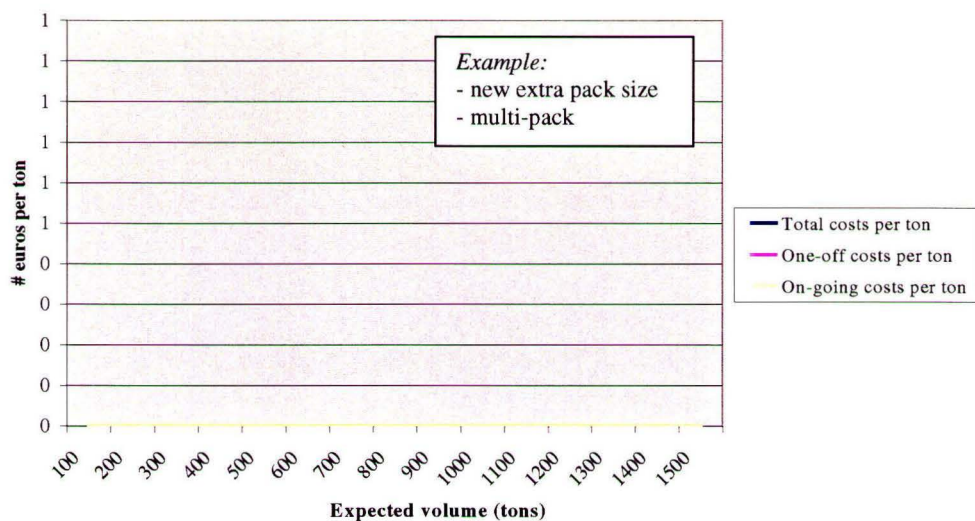


Figure 6.4: Relation between extra costs and volume

Figure 6.4 shows what the charge is for several values of the expected number of tons. It is based on one of the examples in table 6.2. However, the other requests show the same chart. This is easy to explain, since the costs for the examples in table 6.2 are volume independent. When you divide an amount by 100 ton, you get a higher charge per ton than when you divide the same amount by 500 ton. In the current situation these differences between large and small volume items are not so clear. It was not possible to draw such a charge for the current situation. An example in section 6.3.3, however, will show that the difference in cost price between two similar Snickers® items with very diverse volumes is almost negligible. From figure 6.4 can also be concluded that the on-going part forms the largest portion of the costs. This also explains why adding an item costs much more than when an existing item is replaced.

### 6.3.2 Multi-packs, Showboxes and STO's compared

The examples in this subsection are based on different assumptions than the examples in the previous subsection. In this subsection the yellow volume and brand related input fields are filled in contrary to the example in section 6.3.1. The following characteristics apply for this example:

- new pack size for Snickers®
- expected production volume of 500 tons
- (yellow) volume and brand specific fields are filled in

The costs from the RIC are based on the average input data for a certain pack type. The RIC investigates what the extra costs are compared to an average pack type item. However, there are also differences between the different pack types. To see which pack type is the most expensive or cheapest, the average input data (values in the blue fields) from the multi-packs and STO's are filled in in the yellow fields of the RIC from the showboxes. The results of this exercise are seen in table 6.3.

Table 6.3: Multi-packs, Showboxes and STO's compared

|                                      | Multi-pack | Showbox | STO |
|--------------------------------------|------------|---------|-----|
| Total extra supply chain costs       | ***        | ***     | *** |
| Deviation in comparison to Showboxes | ***        | ***     | *** |

\* The supply chain costs for STO's are corrected for the number of packaging levels. An STO has only 2 packaging levels while a multi-pack or showbox consists of three packaging levels.

The conclusion from this table is that an average Multi-pack and STO are both more expensive to make than the average Showbox. This should be taken into account in the decision making process and the future transfer price calculation. The extra supply chain costs for STO's compared to showboxes are mainly caused (€ \*\*\*) by the lower pallet weight which results in more pallet handling for finished products. Besides, also the low case weight accounts for a substantial part of the difference (€ \*\*\*). The difference between the costs for multi-packs and showboxes is mainly caused (€ \*\*\*) by the lower packaging speed for multi-packs (\*\*\*) versus (\*\*\*) bars/min). The implementation costs are not taken into account since this exercise compares pack types that already exist. The update costs are also not taken into account since these are the same for all pack types.

### 6.3.3 Cost differences between transfer prices

Two items that are currently produced were investigated to see what the difference between their transfer prices currently is and what it should be if the transfer prices of these items would be calculated on the basis of the RIC. In this case the implementation costs are not taken into account since the items are already introduced some time ago. For this test two similar Snickers® items were taken. The only difference, besides the language on the packaging, is their volume as can be seen in table 6.4. In the current situation, the difference in the transfer prices is only € \*\*\*per ton, while this

difference would be € \*\*\* if the RIC is taken into account. So, for this situation the RIC leads to more differentiated transfer prices. Of course one test is not enough to draw the general conclusion that the RIC leads to more differentiated transfer prices.

*Table 6.4; Difference between current transfer prices and new transfer prices*

In the RIC, the following assumptions were made: new pack variant, extra item, permanent item.

|                  | casecount | Item code | Volume (tons) | Current TPexw / ton (€) | Total on-going costs with CC (€) | Extra costs / ton (€) |
|------------------|-----------|-----------|---------------|-------------------------|----------------------------------|-----------------------|
| 1 Snickers std   | 8X36      | T7796     | 268           | ***                     | ***                              | ***                   |
| 2 Snickers std   | 8X36      | FF900     | 5900          | ***                     | ***                              | ***                   |
| Difference in TP |           |           |               | ***                     |                                  | ***                   |

As was described in chapter 4 the costs for engraving the cylinders, plates and clichés, and the set-up costs are not taken into account in the RIC. They are already included in the current transfer price-calculation via a standard per ton per pack size for the update process. For the implementation the extra costs are exactly calculated. To get an idea of the order of magnitude of these costs and thus the importance of these costs in comparison to the RIC, the standards for the examples in table 6.4 are shown.

- Standard cylinder/plate/clichés costs Snickers® 8X36: € 5,20 per ton
- Standard set-up costs Snickers® 8X36: € 6,34 per ton.

These figures are quite high compared to the outcomes of the RIC and can thus not be ignored. So, the department of IE should work together with the Standard Packs and Transfer Price Analyst in the Activity Recommendation process in order to get a complete outline of the costs.

### 6.3.4 Sensitivity analysis

To identify the influential variables, a sensitivity analysis can be used. The sensitivity analysis technique that is used in this section is the “one-way” sensitivity analysis, which determines a variable’s influence by the degree to which the objective function changes as that variable is varied while all the other variables are held fixed [Reilly and Schweih, 2000]. Most important for the users of the spreadsheet is the sensitivity of the input variables. They want to know how precisely they have to fill in the RIC. So, for all the average input data in the supply chain, a sensitivity analysis is done including the number of active periods in the request specific data. For all these input fields, the total costs and supply chain costs are calculated for the average input and for the average input plus and minus 25%. The costs are also expressed in percentages compared to the average number. The results of all these tests can be seen in appendix 6.4. From these results can be concluded that the number of bars per minute is the most influential variable. For this variable the results from the sensitivity analysis are shown below.

*Table 6.5; Sensitivity analysis for # bars per minute*

The sensitivity analysis is done for a new permanent and extra pack size for the pack type multi-pack with an expected production volume of 500 tons.

| # bars/minute | Total costs | %   | SC costs | %   |
|---------------|-------------|-----|----------|-----|
| ***           | ***         | *** | ***      | *** |
| ***           | ***         | *** | ***      | *** |
| ***           | ***         | *** | ***      | *** |

In table 6.5 can be seen that a decrease or increase of 25% in the number of bars per minute leads to a more than proportional decrease or increase of the total costs. When only the supply chain costs are taken into account, the costs are almost doubled or halved.

Next to the input data, the influence of deviations in the tariffs for the activities was also investigated. It is examined what the influence on the total costs is when the tariff would increase with 25%. It turned

out that changes in the tariffs hardly influence the outcome of the RIC. This information can be taken into account when the tariffs have to be updated in the future.

## 6.4 Other consequences

The RIC tries to quantify the consequences of item introductions. However, not all the consequences are directly visible or quantifiable. In this section attention is paid to a few of these consequences of item introductions. These consequences are certainly important, but their costs cannot be directly related with one item or the consequence cannot be quantified at all.

- **MORE OBSOLETES**

When an item changes, there is always some packaging material left at the warehouse. This cannot be used anymore and is thus obsolete. The packaging material that is left (€ \*\*\* for Veghel in 2001) has to be destroyed.

- **RISE IN CLEARANCE COSTS**

Clearance costs are costs that are made when Masterfoods has to dump their products on the market for a lower price than normally to prevent that the best before date is exceeded. A consequence is that not all the costs made to produce the item are recovered. The clearance costs rise when the number of items increases. Clearance costs are mainly incurred when completely new items are introduced.

- **MORE MISTAKES**

An extra item in the factory means that the chance for mistakes rises. The Supply department has to order extra packaging material, which also accounts for the factory. Furthermore, more different packaging materials can result in more trouble in the pack room, as a result of small differences in packaging material between several variants. These slight differences can cause major problems at the packaging machines.

## 6.5 Summary

In this chapter the important characteristics of a request were identified: time span, pack size or pack variant, replacing or extra item and pack type. These characteristics are included in the design of the Request Impact Charge (RIC) which is described in the second section. The RIC consists of different input tables that form the basis for the calculation for the one-off and on-going costs. It is difficult to draw general conclusions concerning the results of the RIC because numerous combinations of input data are possible. However, some examples were shown to get an idea of the order of magnitude and a sensitivity analysis was done. From this analysis was concluded that the speed of the packaging machines is the most influential input variable. The tariffs for the activities do not have a large influence on the total costs. Finally, it was concluded that there are also other consequences that are important, but could not be represented in the RIC.

In the next chapter will be described how this RIC has to be implemented and how this design has to be maintained.

## 7. Implementation issues

*The last part of the assignment is the implementation process for the design. In this chapter several important aspects that influence the implementation and a time plan are presented. In the first section the changes in the organisation as a result of implementing the RIC are named after which the maintenance process is described. In the third section the time plan is the subject of discussion. The chapter is concluded with a summary.*

### 7.1 Organisational changes

In this section is described which associates experience changes in their activities due to the RIC and what their attitudes towards the charge are. Attention is also paid to the possible resistance within the organisation concerning the implementation of the RIC and training that is necessary. The information in this section is based on interviews and meetings with the associates involved.

#### 7.1.1 Associates concerned

##### LOCAL INDUSTRIAL ENGINEER (USER)

The RIC will be used during the AR-process by the Local Industrial Engineers. They give input in the AR concerning the feasibility and the costs of a certain item-request. In the current situation they can only indicate the most obvious extra costs that are incurred by implementing the item such as an extra hand packer. This input is replaced by the costs that are the output of the RIC. The Local Industrial Engineer has to fill in the specific characteristics of the request which results in the extra costs. This procedure will not take more time than giving input in the current situation.

##### SUPPLY FINANCE ANALYST (PROCESSOR)

The input given by the Local Industrial Engineer goes to the Supply Finance Analyst who calculates the expected transfer price. In the current situation this associate takes the limited input from IE into account. However, in the new situation the whole RIC needs to be taken into account, which implies an extra aspect in calculating the transfer price. How this is exactly done, is not part of this project anymore.

The persons described above are directly involved in the implementation process. Other associates should also experience some consequences on the longer term from implementation, but do not have to change their activities. For example if less items are introduced on the longer term, the department of Graphics will experience a lower workload.

#### 7.1.2 Possible resistance

The Local Industrial Engineers are involved during the whole process of designing the charge. The question for this research came from them, so they have a positive attitude towards implementing the RIC. In a meeting, with the Local Industrial Engineers, the Supply Finance Analyst and the Supply Finance Manager, the final RIC was presented and the goal was explained. After this meeting it was clear that the attitude of the department of Finance towards the RIC was very positive since they want to put the costs where they belong. They are favourable of introducing the RIC and already proposed to attract a trainee to investigate how this RIC should be taken into account in the transfer price. However, a contradiction is noticed within the Finance department. The RIC makes the calculation of the transfer price slightly more complicated while the general policy within Masterfoods is to make it simpler.

A risk might be the attitude of the markets. They will challenge the RIC, because they are triggered by new item introductions. However, the climate within Masterfoods is now probably ready for this RIC, because the number of items increased in a short time frame. Besides, they also cooperated closely with a project concerning the reduction of the number of items.



### 7.1.2 Training

Because the Local Industrial Engineers have to use the RIC, an extensive explanation of the design was given to them. At the same time they could “play” with the design to see what the consequences were of certain inputs and to get an idea of the order of magnitude of the amounts. Because they followed the whole process from the beginning (they provided a lot of information needed) and the RIC is easy to use, more training was not necessary. An explanation was also given to a couple of persons from the Finance department, so that they understand how the RIC works and what input they will receive from the Local Industrial Engineers.

At the same time a small manual was written for IE as well as Finance to serve as reference work and support in case things are unclear during the use of the RIC.

## 7.2 Maintenance

Regardless of the uses for or level of detail within the Activity Based Costing system, the data will have to be updated periodically. The transfer prices for the existing items are updated once per year by the department of Finance. It is logical to update the RIC just before the transfer prices are updated since the planning is to use the RIC in this update process. This would mean that the update of the charge must be ready every year in August. The Local Industrial Engineer is responsible for this maintenance, because he uses the RIC and knows a lot of input data for the charge. The first update should be made in August 2003 (see also figure 7.1).

The RIC consists of three sorts of data that need to be updated:

#### 1. *Average input data*

Some of these numbers are gained via extensive measurement. A new measurement every year would take too much time, so these input data should be checked with several key operators to see whether they are still up-to-date. Other input data can be updated easily because the numbers needed are known within Masterfoods. This will not take more than a couple of hours, because this is information within the field of Industrial Engineering.

#### 2. *Tariffs per unit of activity*

These tariffs have to be recalculated once per year so that they represent the actual costs. How these tariffs are calculated is thoroughly explained in the appendices 5.1 to 5.7. Because all the information needed has to be gathered at different departments and interpreted in the right way by IE, this will take some days. The tariffs are important to update, but small deviations do not have substantial effects on the total costs as was seen in section 6.3.

#### 3. *Extra use made of activity*

The formulas and assumptions that underlie this extra use need to be checked every year.

Furthermore, the time standards used need to be discussed with the departments involved.

In appendix 7.1 it is exactly indicated for every input field where the Local Industrial Engineers can get the information needed and how the specific field should be updated.

## 7.3 Extension of RIC for other lines

At this moment, the RIC is only available for line 3. The costs and characteristics of the other lines should also be investigated to be able to challenge all the requests received. In this section is explained which fields in the RIC are line specific. After checking all the fields in the RIC, it turned out that the largest part of the RIC is generally applicable for all the production lines, which is a big advantage. All the input fields regarding the implementation and update process are the same for all the lines. The same accounts for all the inbound and outbound logistics activities. The only fields that have to be

made line specific are the characteristics in the table with average input data for the supply chain and the tariffs for the activities that are executed at the line (table 7.1).

Table 7.1: Production line specific tariffs

| Activities that need a line specific tariff |   |
|---|---|
| Produce bars                                | } Activities are included in one tariff |
| Pack bars automatically                     |   |
| Change over packaging machines              |   |
| Transition packaging machines               |   |

For the other lines the labour, depreciation, maintenance and energy costs have to be found out. In appendix 7.1 is shown where the information concerning these costs, but also with regard to the average input data for the supply chain can be found.

### 7.4 Time plan

It is recommended to use the RIC during the Activity Recommendation process, since it is easy to fill in and it gives a quick and more detailed overview than can be gained in the current situation. Besides, from the examples given in chapter 6 can be concluded that the extra costs per ton can be substantial. A disadvantage is that more research is necessary to take the RIC into account in the transfer price.

The RIC, which is finished for line 3, can be used immediately to challenge requests from the markets. As was seen in the previous section, the costs for the other lines should also be investigated. Another aspect is the revision of the transfer prices for the standard items that are already in production. These transfer prices are updated once per year in September so that they reflect the actual costs. It has to be investigated whether the RIC can serve as a supporting design in September 2003 and can be integrated in the update process in September 2004. S&F wants to use the RIC in this process since it is a good design to indicate the differences between the transfer prices for the different items. All these planned activities are put in a time plan (figure 7.1).

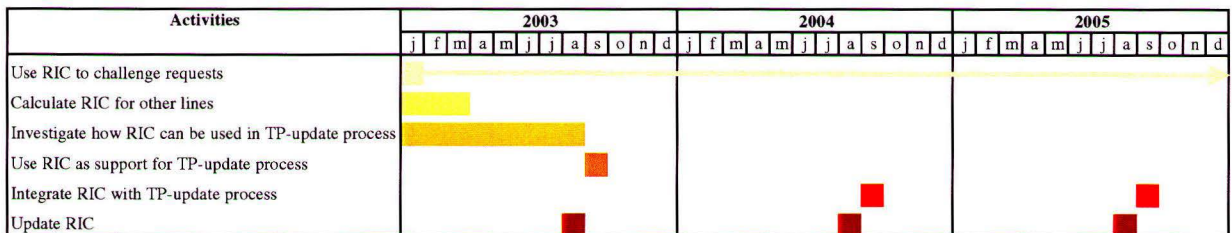


Figure 7.1: Time plan for implementing the RIC

### 7.5 Summary

The RIC directly influences the activities from the Local Industrial Engineers and the Supply Finance Analyst. They are all positive about the introduction of the RIC and are trained so that they understand how it works and are able to use it. A risk, however, might be the attitudes of the markets, because they are challenged more in the new situation. The RIC needs to be updated once per year just before the transfer prices are updated. The RIC can be used to challenge requests from the markets. However, the costs for the other lines have to be investigated too just as how the charge can be taken into account in the yearly TP-update process. After this has been done, the RIC can be used as a support in this update process and can eventually be integrated with it.

In the next chapter general conclusions and recommendations that result from this research will be described.

## 8. Conclusions and recommendations

*This final chapter begins with a description of the conclusions. The second section pays attention to the recommendations followed by a section with a reflection on the whole project and the design.*

### 8.1 Conclusions

The problem defined at the beginning of this research was: the department of IE is unable to challenge requests from the markets, because they do not know how to quantify the cost impact of introducing and producing an extra item. The total costs for the factory are thus not known and decisions are made based on incomplete information. During this project a suitable method had to be determined, which can be used to calculate the cost impact of new item requests. This method should be used as the basis for a design that can help the department of IE when they are confronted with new item requests. Some attention had to be paid to the implementation process as well. The conclusions of this research can be summarised in the six points described below.

- The Activity Based Costing (ABC) method seemed to be the most suitable method found in literature to allocate costs more realistically. However, after investigating the available information it was concluded that the ABC-method described in literature needed adjustments to make it ready for use in practice. This resulted in three methods based on the ABC-principles.  
The ABC-method is suitable to allocate costs more realistically, but cannot be used as a decision making tool. With ABC the factory raises a hurdle for the markets in the form of a more realistic cost price. The markets get this new transfer price and they decide on the basis of this price whether they still want to introduce the item.
- During the activity analysis is decided that only the costs for the activities in the implementation process and supply chain that are directly influenced by the number of items are taken into account. Furthermore, the activities executed or paid by the markets, such as making the artwork, are not included, since the scope included only the factory costs. Furthermore, costs for engraving the cylinders, plates and clichés, and the set-up costs for the printer are outside the scope. This decision was made, because these costs are already calculated very realistically and thoroughly by the Standard Packs & Transfer Price Analyst. For the activities included in this research a tariff was calculated which represents the costs to execute one unit of the activity.
- The following four main characteristics were identified that determine the costs of a request: time span, pack size or pack variant, replacing or extra item and pack type. From these characteristics especially the differences in cost consequences between an extra or replacing item are substantial. This is mainly caused by a difference in on-going supply chain costs.
- The design made, the Request Impact Charge, contains the tariffs determined with the ABC-method plus the extra use made of the defined activities. This leads to an amount for the extra costs for the item. Part of these extra costs applies for all items, but it is also possible to indicate request specific characteristics concerning parameters in the supply chain part as well as the implementation part. It can be concluded that a part of the activities and extra use investigated is volume related, but most of this extra use is item or batch related. The absolute differences in extra costs between large and small volume items are not striking, but if this amount is divided by the number of tons produced, the differences in costs per ton between large and small volume items are substantial.  
The advantage of this Request Impact Charge is that it is easy to use; there is hardly any training necessary. Besides, it gives a more accurate total outline of the costs than can be achieved in the current situation. The RIC is designed to raise a hurdle for the markets when they want to introduce

an item and should thus only be used for this goal. It is not a decision making tool nor a design with which the current assortment can be cleared.

- It is not possible to draw general well-founded conclusions about the height of the extra costs, since numerous options and combinations are possible. Besides, only line 3 has been investigated. So, the conclusions about the RIC are restricted to some striking issues found in the examples.
  - Supply chain costs form the largest part of the total extra costs calculated by the RIC.
  - From these supply chain costs, the costs for packaging material handling are substantial followed by the costs for changing over the packaging machines in case of a new pack size.
  - The implementation costs and update costs are independent of the type of item that is introduced.
  - The speed of the packaging machines is the most influential input variable.
- In principle, the RIC can be used directly to challenge requests from the markets and does not ask for a lot of effort for implementation. However, to integrate the design with the transfer price calculations extra research is necessary.

## 8.2 Recommendations

In this report, the RIC is applied to line 3. It is, however, important to investigate the costs of the other production lines as well, because otherwise it is not possible to calculate the impact of all the new item requests. Attention has to be paid to the specific characteristics and cost structure of each line. The advantage of the RIC is that a large part of the RIC is generally applicable to all the production lines. This investigation is thus not a lot of work.

One disadvantage of the RIC is that it cannot be integrated with the cost price calculations directly. So, more research has to be done regarding the way the RIC can be taken into account in the transfer prices calculations and the yearly TP-update process. In this way the RIC will be more embedded in the procedures and activities in the whole organisation. Besides, the TP's of all the items will be based on more realistic costs.

Taking the advantages and disadvantages into account, it is recommended to use the RIC during the Activity Recommendation process, because it does not take a lot of time to fill it in and it gives a quick and realistic overview of the extra costs. Besides, from the examples worked out, it turned out that the extra costs per ton can be substantial and it is thus not wise to ignore these costs.

If the RIC is used in the Activity Recommendation process, the department of Industrial Engineering and Finance should work closely together since they both calculate part of the extra costs. In case of a new item request, IE has to discuss the total extra costs from the RIC with the Standard Packs & Transfer Price Analyst, who delivers input concerning the fixed and variable packaging material costs that are excluded from the RIC. In this way a complete overview of the extra costs for the specific request is obtained and decisions are made on the basis of realistic total costs.

Further investigation is necessary to find out what the reaction of the markets is on the RIC. Are the markets willing to pay more for an exclusive item or are they triggered to choose a more standard and cheap item?

### 8.3 Reflection

The usefulness of this investigation can be measured by the added value for the persons concerned. The RIC designed is certainly a design that gives IE insight in the extra costs for an item. Furthermore, it can be used easily in the Activity Recommendation process to challenge the requests from the markets. However, it is important to notice that the RIC can never be the only decision-making criterion in the item request process. There are always other criteria that have to be taken into account. Besides, Masterfoods should always look at the output with a critical view. A lot of specific characteristics can be indicated and taken into account in the RIC, but it remains a general model. The output has to be interpreted in the right way.

It was tried to be as objective and quantitative as possible to get an optimal representation of reality. However, complete objectivity could not always be reached. For pragmatic reasons, in some cases the tariffs and extra use of activities have been based on interviews with and estimations of experts in which some subjectivity could not be avoided. So, the variables in the RIC closely resemble reality, but small deviations compared to this actual situation can occur.

With the RIC, insight can be gained in the extra costs for certain item requests. So, decisions concerning new item requests can be made based on complete information and the department of IE is able to challenge requests from the markets. However, an important question is whether the RIC will really influence the attitudes of the markets. This question remains unanswered in this research, since the RIC is not yet applied in practice. Nevertheless, some predictions can be made when you compare the outcome of the RIC for the examples in section 6.3 to the profit margin of the markets. The extra costs per ton for the small volume Snickers<sup>®</sup> item were around € \*\*\*. If you assume that the extra costs directly influence the profit of the markets which is around € \*\*\* per ton for Snickers<sup>®</sup>, the profit margin on the item is reduced with \*\*\*%. It is expected that this should influence the markets' reaction, especially if you know that the margin for a Snickers<sup>®</sup> is high compared to e.g. Snickers Cruncher<sup>®</sup>.

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# The impact of new item requests

Development of an item-specific charge on the basis of  
Activity Based Costing

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## Appendices

**NIET  
UITLEENBAAR**

December 2002  
Eefje Meulepas



## Appendix 1 Glossary

### *Activity*

1. Within the ABC-analysis: a set of actions to execute a certain function [Theeuwes and Adriaansen, 1994]
2. The development of a new product or items and changes to current ones are called activities at Masterfoods.

### *AR - Activity Recommendation*

Document made by an Activity Task group to check operational feasibility and financial health of an activity, and to prepare for implementation.

### *ATG - Activity Task Group*

A team with representatives from different departments that delivers an activity through agreed business process from concept approval to implementation supported by a Feasibility Assessment.

### *BDA – Business Data Administration*

Departments that facilitates the POR-process.

### *BBT - Brand Business Team*

A team which investigates the strategic direction for one specific brand throughout Europe.

### *Business Review*

Periodic report made within Masterfoods to evaluate the business.

### *CBS - Concept Board Session (CBT day 1)*

Meeting meant to lead the Innovation process flow, prioritising ideas and approve Innovation Briefs and Concept Recommendation (decide to stop, rework, continue concepts).

### *CBT – Category Business Team*

This team makes the final decision about a new activity.

### *Consumer*

The people who buy and consume the bars.

### *CR - Concept recommendation*

A document made for A, and B-activities to quantify consumer appeal and decide, based on strategic rationale and consumer insight, which concepts are worth developing further.

### *Customer*

The customers of Masterfoods Veghel are the various markets (market depots) and sometimes retail trade (for large orders).

### *EAM - European Activity Manager*

A person who manages the activities for a couple of brands throughout Europe.

### *EBL - European Brand Leader*

A person who is responsible for one brand throughout Europe.

### *FMAC - Factory Margin After Conversion*

Transfer price factory – Factory Gate costs (see appendix 2.2).

### *FTE – Full Time Equivalent*

A measure that indicates one associate working full time (100%).

### *GMAC - Group Margin After Conversion*

Factory Margin After Conversion + Market Margin After Conversion (see appendix 2.2).

### *GPC – Graphics Production Center*

An external agency that takes care of the compilation of the artwork and the colour separation for Masterfoods.

*Hal A*

The area within Masterfoods where the finished products from the lines go to be palletised and made ready for transportation. Showboxes from the lines 1, 3 and 5 also need to be packed in cases in hal A.

*IB - Innovation Brief*

A document made by the Brand Business Team to explore strategic directions; decide which innovation gaps/creation areas will be digged into.

*Item*

A complete product - a bar with first wrap, second wrap or showbox (if needed), and case – that is ready for transport to the customer.

*LBM - Local Brand Manager*

A person who is responsible for one brand in one market.

*Line 3*

One of the production lines of Masterfoods Veghel that produces Mars<sup>®</sup>, Snickers<sup>®</sup>, and Snickers Cruncher<sup>®</sup>.

*MAPP – MAsterfood Production Planning*

Program that is used by the production department to make a detailed line schedule.

*NSV - Net Sales Value*

Transfer price markets \* quantity of sold product.

*Pack size*

The dimensions of a package and the pack type that is used (showbox, multi-pack, bulk etc.).

*Pack variant*

Packaging with the same dimensions as an existing item, but different artwork.

*Period*

4 weeks, so there are 13 periods per year.

*POR – Packaging Origination Request*

Implementation document to confirm timings for production and delivery of packaging material.

*RIC - Request Impact Charge*

A design that can be used to calculate the extra costs for item requests on the basis of the characteristics of the specific item request.

*S&OP - Sales & Operational Planning (CBT day 2)*

The role of this meeting in the introduction process is to approve Activity recommendations.

*STO - Single Traded Outer*

Strong showbox that can be used as a transportation unit; an outer case is not necessary.

*TP – Transfer Price*

The price the factory charges to the market which is based on the cost price within Masterfoods.

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## **Appendix 2.1 Introduction criteria**

This appendix describes the two criteria for item introductions. The first one is used for all introductions, while the second one is only used when investments are necessary.

## Appendix 2.2 Line characteristics

Table 2.2.1: Line characteristics of different production lines in Veghel

| Line         | Products per line  | Actual production 2001 (in tons * 1000) | # produced pack sizes in 2001 | # pack variants/ period | MFI* | Utilisation** |
|--------------|--|---|-------------------------------|-------------------------|------|---------------|
| Line 1       | Bounty® Milk standard<br>Bounty® Dark standard   |   |                               |                         |      |               |
| Line 3       | Mars® standard and kingsize<br>Snickers® standard, snacksize and kingsize<br>Snickers Cruncher® standard     |   |                               |                         |      |               |
| Line 4       | Mars® mini<br>Milky Way® mini<br>Snickers® mini  |   |                               |                         |      |               |
| Line 5       | Twix® standard   |   |                               |                         |      |               |
| Line 6       | Mars® miniature<br>Topic® miniature<br>Milky Way® miniature<br>Snickers® miniature<br>Bounty Milk® miniature |   |                               |                         |      |               |
| Line 7       | Twix® miniature  |   |                               |                         |      |               |
| Line 8       | Maltesers®   |   |                               |                         |      |               |
| Line 9       | Celebrations®  |   |                               |                         |      |               |
| <b>Total</b> |  |   |                               |                         |      |               |

\* The MFI (Manufacturing Frequency Index) measures the number of appearances of the items in a certain period and is used by Masterfoods to indicate the responsiveness or the ability to respond to market variance. The formula Masterfoods uses, is:

$$MFI = \frac{\# \text{ items} * \# \text{ weeks}}{\# \text{ appearances}}$$

where, *number of items* : number of different items produced in a period

*number of weeks*: number of weeks in the period

*number of appearances*: total number of item runs in that period

A low MFI indicates short production cycles. The MFI is the indicator of the item run time.

(MFI period 1 + MFI period 2 + .....+ MFI period 13) / 13 = mean MFI 2001 [Tijssen, 2002]

\*\* In this utilisation percentage the time for changeovers, maintenance etc. is already included.

## Appendix 3.1 Cost allocation methods

### Absorption cost method

This method is the simplest one and distinguishes between direct and indirect costs. The direct costs are defined with the help of standard amounts and standard prices. The indirect costs are taken into account in the cost price by means of a percentage of the total costs or direct costs. The method is based on the assumption that the indirect costs have a linear, causal relation with the direct costs [Van Damme, 2000].

### Cost allocation table method

With this method costs can be allocated to cost objects more differentiated than with the absorption cost method. The direct costs are again directly allocated to cost objects; most of the times the products. The indirect costs however, are first assigned to cost tables that can be distinguished in main cost tables and help cost tables. The costs of the help cost tables are passed on to the main cost tables. The costs that are allocated to main cost tables can then be, with the help of a number of distributive codes, allocated to cost objects (figure 3.1.1). The distributive codes are volume related [Van Damme, 2000].

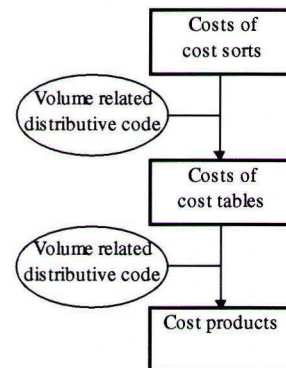


Figure 3.1.1: Cost allocation table method [Van Damme and Van der Zon, 1999]

This method is, as was already mentioned, more differentiated than the absorption cost method because the allocation takes place on the basis of more than one distributive code

### Activity Based Costing method (ABC)

Zimmerman [1997] defines ABC as follows: “a process of identifying activities that cause indirect costs and choosing cost drivers to apply those indirect costs to different products and services.”

ABC is based on the assumption that not the products, but the activities use resources. The activities have to be related to cost objects [Van Damme, 2000].

Within ABC three sorts of costs can be recognized. The direct costs can be traced directly to a product (item in the case of Masterfoods) and have a volume related relation with production. The attention within ABC is focused on the indirect costs -connected with the supporting activities- and the influence of complexity on those costs [Boons et al., 1991]. These indirect costs are assigned to the products via a causal relationship. The costs that are not direct and do not have a causal relationship with the products are allocated to products in some arbitrary manner (figure 3.1.2).

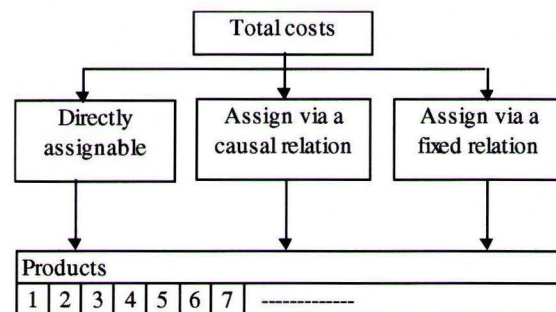


Figure 3.1.2: Basic concept of the ABC-method [Theunisse, 1992]

## Appendix 4.1 Development process

An idea for a new activity arises somewhere in the business e.g. at the European Brand Leader, R&D or the supply side. Dependent on the type of activity, an introduction process is started. In this appendix only the different steps in the development process are described (figure 4.1.1).

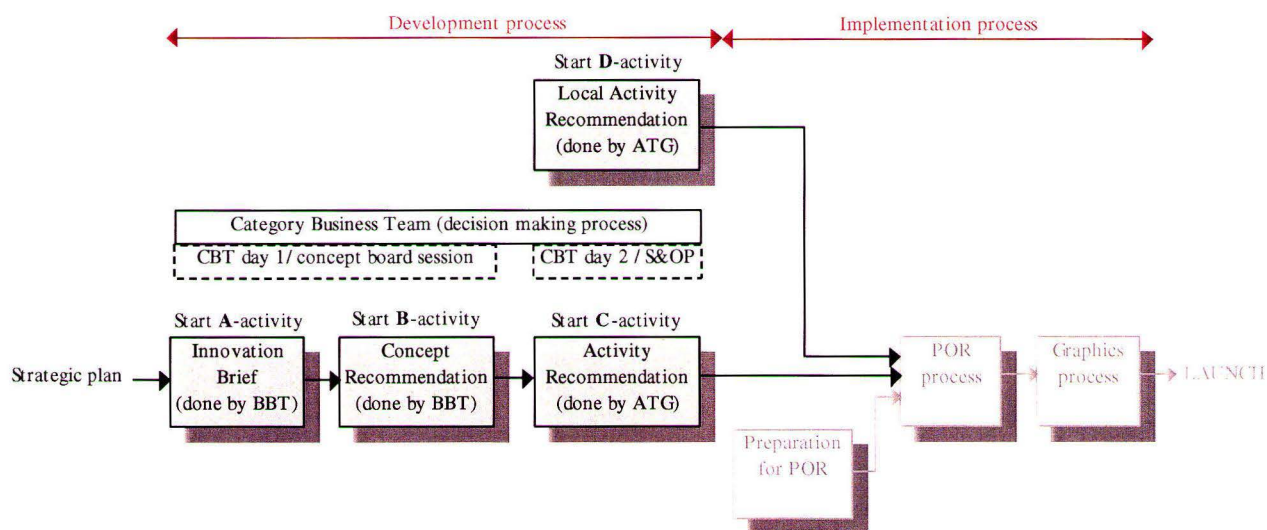


Figure 4.1.1: The steps in the development part of the introduction process

### Innovation brief

In case of an A-activity Masterfoods starts - under the leadership of the European Brand Leader (EBL) - with the identification of innovation areas within the strategy of the brand. For this activity, the Brand Business Team (BBT) is responsible, with the EBL as chairman. The BBT writes an innovation brief. The purpose of this innovation brief is to explore strategic directions and decide which innovation gaps or creation areas will be digged into. If this brief is checked and approved by the Concept Board Session (or CBT day 1) and - after pre-screening - by the Category Business Team meeting, money is released for the project. A Concept Board Session is held 4 times per year.

### Concept recommendation

For an A- or B-activity, a concept recommendation (CR) must be written. This CR is also made by the Brand Business Team under the leadership of a European Brand Leader and must be approved in the Concept Board Session and - after a pre-screening - by the Category Business Team. In a CR, one positions the activity in the strategy and make sure that capacity will be available (marketing concept). It is more or less an innovation brief that is worked out in more detail. The purpose is to quantify consumer appeal and decide, based on strategic rationale and consumer insight which concepts are worth developing further. After approval of the CR, the activity is delegated to the Activity Task Group (ATG), which is facilitated by the European Activity Manager. However, the BBT keeps following the activities of an ATG.

---

### **Activity recommendation**

The next step is to make an Activity Recommendation (AR), done by an Activity Task Group (ATG). An AR has to be made to gain insight in the detailed operational and financial implementation of an activity. In theory an AR has to be made for every activity and consists of a number of fixed steps. In practice however, the AR-steps are not fully followed for every activity (mainly C single market and D-activities)

#### *AR process steps*

1. Raise draft AR / develop the business case
2. Make detailed project plan available (incl. time plan and scope of activity)
3. Confirm route to market
4. Agree on consumer proposition
5. Identify market investment required
6. Finalise the product and packaging specification
7. Investigate the production feasibility and identify supply solutions
8. Confirm the volumes by market
9. Make a full Profit & Loss by market

If these steps are completed, the AR can be submitted. The result of an AR is that one knows exactly where, when and how Masterfoods is going to make the item and how the financial part looks. After the AR is approved, the actual spending of money for e.g. equipment can be started. These AR process steps are the same for all activity levels, but some differences are seen in the route an AR follows, and the people that participate in and lead the ATG. In general, the divisions that participate in an ATG are: Operational Supply Division, Research & Development, Supplier Development, Service & Finance and the Markets. A distinction is made between local AR's for D-activities and AR's for A, B, and C activities. The first category does not have to be approved by the CBT day 2 meeting. The last category on the other hand has to be submitted for CBT day 2 approval.

After the go/no go decision the actual implementation of the item is started. This part is described in chapter 4.

## Appendix 4.2 Line 3 in Veghel

### Line characteristics

Production at Masterfoods can be characterized as flow production. The process of line 3 transforms ingredients into the products Mars<sup>®</sup>, Snickers<sup>®</sup>, and Snickers Cruncher<sup>®</sup>. Within these recipes, different product groups are produced (table 2.3.1). Snickers Cruncher<sup>®</sup> is produced once per two weeks, while Mars<sup>®</sup> and Snickers<sup>®</sup> are produced almost every week.

Table 2.3.1 Production volumes on line 3 ( in tons \* 1.000)

| Product group                                  | Actual production 2001 | Forecasted production 2002 |
|--|------------------------|----------------------------|
| Mars <sup>®</sup> standard (54 g)              |                        |                            |
| Mars <sup>®</sup> kingsize (74 g)              |                        |                            |
| Snickers <sup>®</sup> standard (60 g)          |                        |                            |
| Snickers <sup>®</sup> kingsize (85 g)          |                        |                            |
| Snickers <sup>®</sup> snacksize (40 g)         |                        |                            |
| Snickers Cruncher <sup>®</sup> standard (42 g) |                        |                            |
| <b>Total volume</b>                            |                        |                            |

Line 3 is the line in Veghel with the largest output of about 60.000 ton. There is some spare capacity on line 3. Approximately \*\*% of the capacity is used during the year. In this percentage, the time for changeovers, maintenance etc. is already included.

### Process and packaging

Line 3 can be divided into a process part and a packaging part. The process part produces the naked bars. The packaging part provides the customer specific element. Figure 2.3.1 gives an overview of the complete production process of line 3.

#### PROCESS PART

Line 3 has a “base” and a “caramel” component that are both produced in the “base tower”. The composition of the base component can be modified for the different product groups. For Snickers, peanuts are added to the caramel and the base, and Snickers Cruncher<sup>®</sup> contains rice crispies. At the beginning of the line (figure 2.3.1), the base component is spread, and the caramel component is layered on top of this base component. The semi-finished product, “slab”, is transported via a conveyor belt system through a cooling tunnel. Only when the slab is sufficiently cooled down, it can be properly cut. As the slab has a width of approximately one metre, it first has to be slit into 40 endless lanes by a number of blades. Then the uncoated product is led through the guillotine, which cuts the slab to its proper length. On line 3, concurrent running is possible. This means that the guillotine is able to cut bars with different lengths at the same time, for example six rows of standard Mars bars are alternated with a row of kingsize Mars bars. The product is then transported on a conveyor and coated with chocolate by two enrobers. The coated product is further cooled down before arriving in the wrapping and case filling area of line 3.

#### PACKAGING PART

The packaging part of line 3 consists of nine packaging units, of which 8 are able to pack showboxes and 5 units can pack multi-packs (figure 2.3.1). All the bars have to be first wrapped; after which they are called ‘singles’. Dependent on the type of unit, the bars can be second-wrapped in a multi-pack or put in a showbox. The multi-packs are either stacked into cases automatically or by hand.



The packaging part of line 3 also has three buffers. Two carousel buffers on machine 7 and 9, and one end-belt buffer. The products on the end-belt-buffer are carried back to machines 14 and 15 as soon as the line speed allows this.

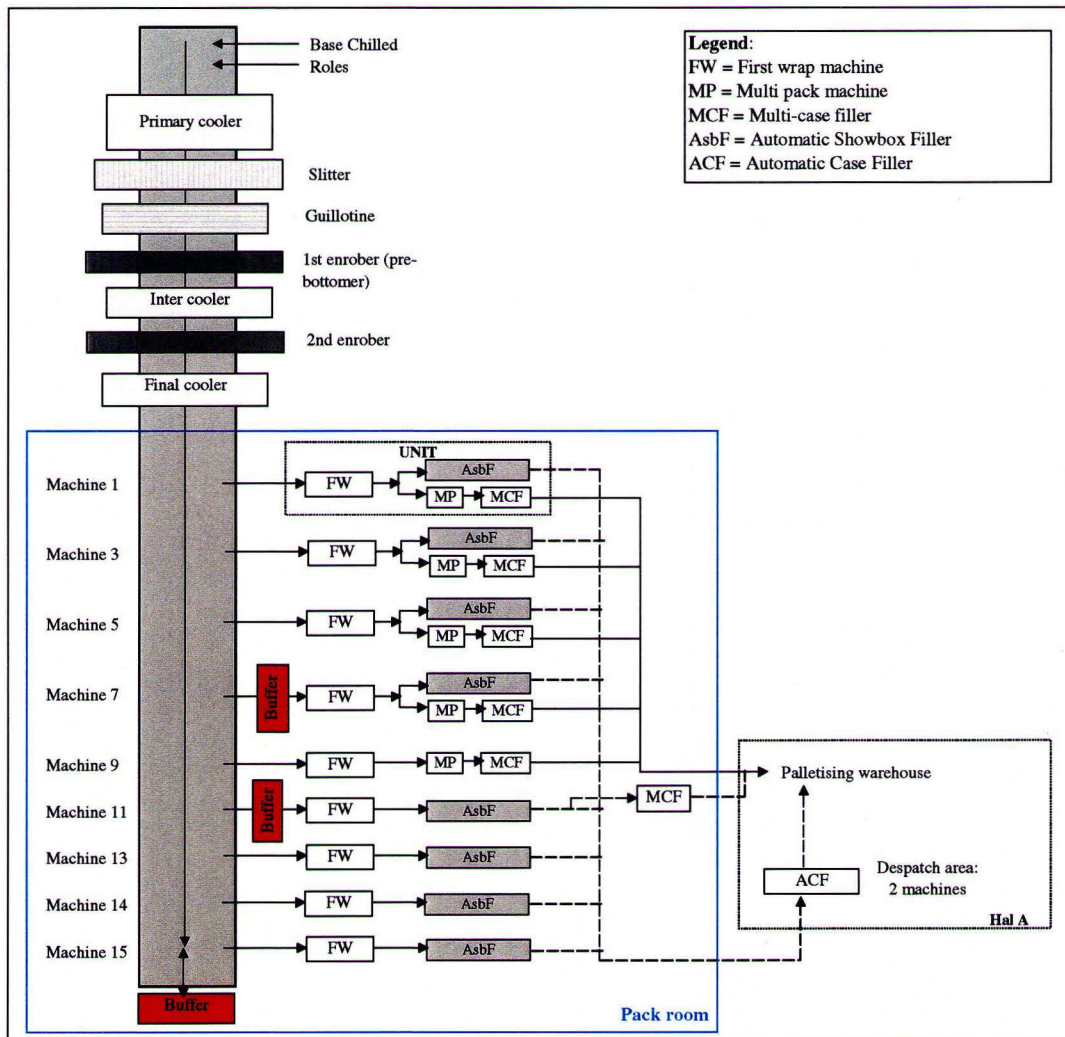
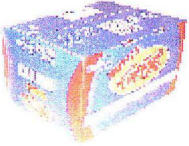





Figure 2.3.1; Configuration of line 3

After the packaging process, the products are transported to the despatch area, called Hal A. In hal A, two case-filling machines are reserved for line 3 to pack showboxes. Multi-packs are already packed in cases at the line. When the cases have been palletised, they leave Masterfoods Veghel and are transported to the central warehouse.

## Appendix 4.3 Packaging possibilities

Table 4.3.1: Packaging possibilities

| Transport unit with display properties  | Transport unit with consumer sales units   |
|---|--|
| 1. Perforated transport resistant showbox (1 <sup>st</sup> wrap, transport resistant showbox)<br>2. Display case (1 <sup>st</sup> wrap, display case) <div style="text-align: center; margin-top: 20px;">  </div>  | American case* with: <ul style="list-style-type: none"> <li>- multi-packs (1<sup>st</sup> wrap, 2<sup>nd</sup> wrap, case)</li> <li>- bags (1<sup>st</sup> wrap, 2<sup>nd</sup> wrap, case)</li> <li>- Loose mini's (1<sup>st</sup> wrap, case)</li> <li>- Loose miniatures (1<sup>st</sup> wrap, case)</li> </ul> <div style="text-align: center; margin-top: 20px;">  </div> |
| Transport unit; content displayable   | Transport unit; content non-displayable  |
| American case with perforated** showbox (1 <sup>st</sup> wrap, showbox, case) <div style="text-align: center; margin-top: 20px;">  <span style="font-size: 2em; margin: 0 10px;">+</span>  </div> | American case with non-perforated** showboxes (1 <sup>st</sup> wrap, showbox, case)  |

\* An American case is a brown case only meant for transportation.

\*\* A perforated showbox can be opened (along the perforated lines) and displayed. In England non-perforated showboxes are used. These showboxes also contain single bars, but they are taken out by the retailer and the box is thrown away.

## Appendix 4.4 Overview of activities in the implementation process

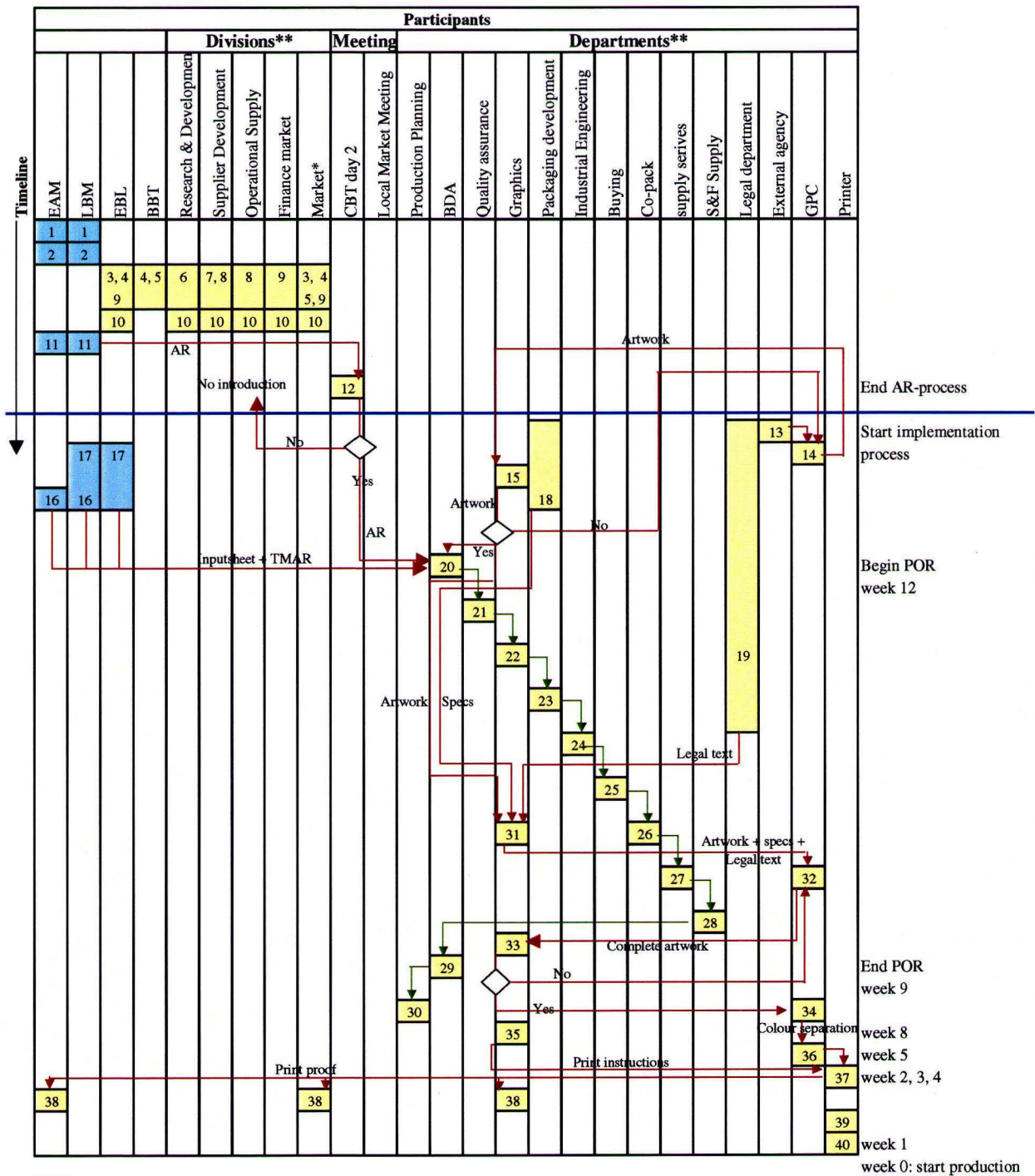


Figure 4.4.1: Activities and timings in the implementation process

Table 4.4.1: Activities AR, POR, and Graphics process

|                         | <b>Activity</b>   | <b>Division/person</b>   |
|-------------------------|---|--|
|                         | 1. Raise draft European AR<br>2. Make project plan available<br>3. Confirm route to market<br>4. Agree on consumer proposition<br>5. Identify market investments required<br>6. Finalise technical specifications product/process<br>7. Finalise packaging specification<br>8. Investigate production feasibility and identify supply solutions<br>9. Confirm the volumes by market<br>10. Make a full P&L by market<br>11. Submit AR<br>12. Approve AR   | EAM/LBM<br>EAM/LBM<br>EBL/Market<br>EBL/Market/BBT<br>Market/BBT<br>Research & Development (R&D)<br>Supplier Development Division (SDD)<br>Supplier Development Division<br>EBL/Finance/Market<br>EBL/R&D/SDD/OSD/S&F/Market<br>EAM/LBM<br>CBT day 2 |
| <b>Preparations</b>     | 13. Make artwork and send it to origination<br>14. Check artwork<br>15. Check and approve artwork<br>16. Fill in POR-inputsheet<br>17. Make TMAR<br>18. Make packaging specification<br>19. Make legal text   | External Agency<br>GPC<br>Graphics<br>Market<br>Market<br>Packaging development<br>Legal department  |
| <b>POR-process</b>      | 20. Collect inputs, put in system, make codes available, determine route<br>21. Input POR: check working & declared weight<br>22. Input POR: give # colours<br>23. Input POR: fill out pallet stacking<br>24. Input POR: calculate investments<br>25. Input POR: define supplier<br>26. Input POR: define co-packer<br>27. Input POR: number of calls<br>28. Input POR: calculate packaging costs and transfer price<br>29. Check info on completeness and confirm when everything is complete<br>30. Process change in planning system | BDA<br>Quality assurance<br>Graphics<br>Packaging development<br>Industrial Engineering<br>Buying<br>Co-pack department<br>Supply services<br>S&F supply<br>BDA<br>Production Planning   |
| <b>Graphics process</b> | 31. Collect everything and send to graphics production centre<br>32. Compile artwork<br>33. Approve artwork compilation<br>34. Make colour separations<br>35. Make print instructions<br>36. Engrave cylinders/ plate/ clichés<br>37. Make print proof<br>38. Approve print proof<br>39. Set up machines<br>40. Print + supply material   | Graphics<br>GPC<br>Graphics<br>GPC<br>Graphics<br>Printer<br>Printer<br>EAM/Market/Graphics<br>Printer<br>Printer  |

## Appendix 4.5 Aggregation of activities

Table 4.5.1: Aggregated activities during the implementation and update process

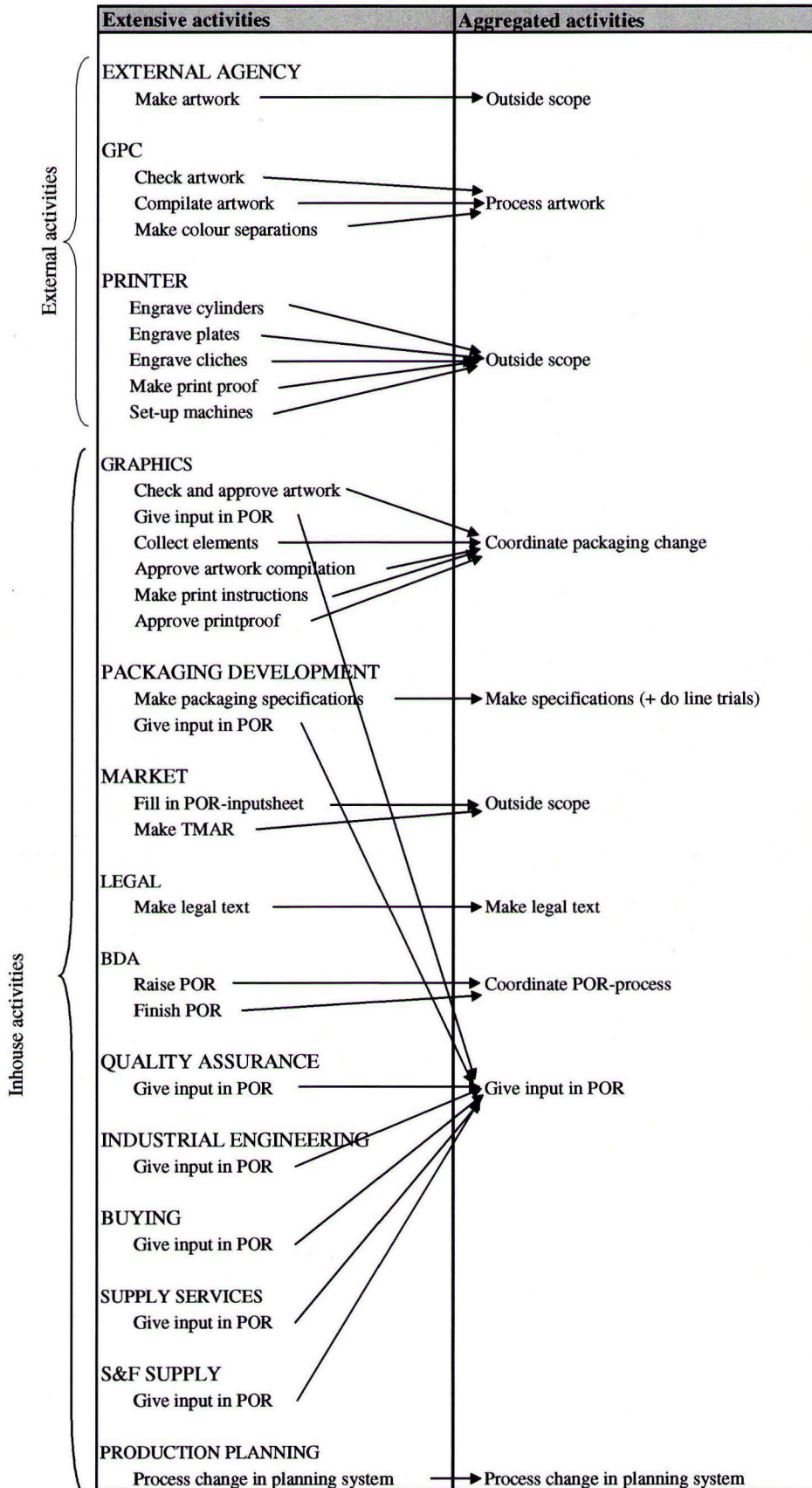


Table 4.5.2: Aggregated activities in the supply chain

|                          | Detail activities                                       | Aggregated activities  |
|--------------------------|---|--|
|                          | <i>Primary activities</i>                               |  |
| <b>Inbound logistics</b> | <b>Packaging material (Supply &amp; handling)</b>       | <p><i>Inbound packaging</i></p> <p>Handle in from suppliers/factory/others → 1 → Handle in packaging material</p> <p><i>Storage</i></p> <p>Store wrappers, showboxes → Store wrappers, showboxes</p> <p>Store cases → Store cases</p> <p><i>Outbound packaging</i></p> <p>Handle out to factory/others → 1 → Handle out packaging material</p> <p>Shuttle to factory/others →</p> <p>Shuttle from factory/others →</p> <p>Bring packaging material to line → Handle packaging material factory</p> <p>Bring material to hal A (after production) → 2 →</p> |
|                          | <b>Factory</b>  | <p>Produce bars → Produce bars</p> <p>Pack bars automatically → Pack bars automatically</p> <p>Changeover packaging machines → Change over packaging machines</p> <p>Transition packaging machines → Transition packaging machines</p> <p>Pack bars manually → Pack bars manually</p>  |
| <b>Operations</b>        | <b>Despatch</b>   | <p>Palletise cases → Palletise cases</p> <p>Stretch pallets →</p> <p>Label pallets → Make pallets ready for transport</p> <p>Set the pallets ready for loading →</p>   |
|                          | <b>Warehousing</b>                                      | <p>Shuttle factory - warehouse →</p> <p>Unloading system →</p> <p><i>Handling in pallets</i></p> <p>Pre-advices → Handle in finished products</p> <p>Print label →</p> <p>Handling in → 3 →</p> <p>Store pallets → Store pallets</p>   |
| <b>Outbound</b>          | <b>Distribution</b>                                     | <p><i>Handling out</i></p> <p>Handling out → Handle out finished products</p> <p>Loading trucks →</p>  |
|                          | <i>Supporting activities</i>                            |  |
| <b>Inbound</b>           | <b>Packaging material (supply &amp; handling)</b>       | <p>Order packaging material → Order packaging material</p> <p>Administration packaging (Hays) → 1 →</p>  |
|                          | <b>Factory</b>  | <p>Make production planning → Make production planning</p> <p>Administration factory → Administration factory*</p> <p>Make schedule →</p> <p>Call of material →</p>  |
| <b>Operations</b>        | <b>Despatch</b>   | Send pre-advise → 2 →  |
|                          | <b>Warehousing</b>                                      | <p><i>Administration</i></p> <p>Handled in → 3 →</p> <p>Stock transfer → 3 →</p>   |
| <b>Distribution</b>      | Make distribution planning → Make distribution planning |  |

\* These activities only take little time per week from the key operators in the factory. The time for these activities is included in the activities executed in the pack room

## Appendix 5.1 Resource consumption implementation process

Table 5.1.1: Resource consumption implementation process

| Costs resources                               | Resource driver              | Process artwork | Coordinate packaging changes | Make packaging specification | Make legal text | Coordinate POR-process | Give input in POR | Process change in planning system |
|---|------------------------------|-----------------|------------------------------|------------------------------|-----------------|------------------------|-------------------|-----------------------------------|
| <b>A. Packaging material fixed (invoices)</b> |                              |                 |                              |                              |                 |                        |                   |                                   |
| Costs GPC                                     | Fixed tariff                 | *               |                              |                              |                 |                        |                   |                                   |
| <b>B. Personnel (SWB + Expenses)</b>          |                              |                 |                              |                              |                 |                        |                   |                                   |
| Personnel Legal Department                    | # man hours                  |                 |                              |                              | *               |                        |                   |                                   |
| Personnel Business Data Administration        | # man hours                  |                 |                              |                              |                 | *                      |                   |                                   |
| Personnel Quality Assurance                   | # man hours                  |                 |                              |                              |                 |                        | *                 |                                   |
| Personnel Graphics                            | # man hours                  |                 | *                            |                              |                 |                        | *                 |                                   |
| Personnel Packaging Development               | # man hours                  |                 |                              | *                            |                 |                        | *                 |                                   |
| Personnel Industrial engineering              | # man hours                  |                 |                              |                              |                 |                        | *                 |                                   |
| Personnel Buying                              | # man hours                  |                 |                              |                              |                 |                        | *                 |                                   |
| Personnel Supply Services                     | # man hours                  |                 |                              |                              |                 |                        | *                 |                                   |
| Personnel Service & Finance Supply            | # man hours                  |                 |                              |                              |                 |                        | *                 |                                   |
| Personnel Production Planning                 | # man hours                  |                 |                              |                              |                 |                        |                   | *                                 |
| <b>C. Equipment + E. Building</b>             |                              |                 |                              |                              |                 |                        |                   |                                   |
| Depreciation building                         | # m2, # man hours            |                 | *                            | *                            | *               | *                      | *                 | *                                 |
| Other depreciation                            | asset value, # man hours     |                 |                              |                              |                 |                        |                   |                                   |
| Energy costs office                           | installed power, # man hours |                 | *                            | *                            | *               | *                      | *                 | *                                 |
| <b>D. Information systems</b>                 |                              |                 |                              |                              |                 |                        |                   |                                   |
| EDP hardware depreciation                     | asset value, # man hours     |                 | *                            | *                            | *               | *                      | *                 | *                                 |

## Appendix 5.2 Tariff for departments

The costs indicated in red are the costs known from the Profit & Loss or experts within Masterfoods. The other amounts are calculated on the basis of the formulas given in chapter 5.

### B. Personnel

In table 5.2.2 is investigated which zones execute the defined activities in a certain department. On the basis of these zones and their labour costs (table 5.2.1) an average amount for SWB is calculated. In these costs only the direct associates are included.

Table 5.2.1: SWB per period (€) per zone

| Zone | Labour costs / period / FTE (€) |
|------|---------------------------------|
| 11E  | ***                             |
| 10E  | ***                             |
| 10   | ***                             |
| 9F   | ***                             |
| 9    | ***                             |
| 8F   | ***                             |
| 8    | ***                             |
| 7    | ***                             |

Table 5.2.2: Average labour costs from persons in a department who execute the defined activities

| Department            | Zone (# FTE's * zone)     | Average labour costs/period (€) |
|-----------------------|---------------------------|---------------------------------|
| Packaging development | <b>1*10 + 2*8</b>         | ***                             |
| Graphics              | <b>9</b>                  | ***                             |
| BDA                   | <b>9F</b>                 | ***                             |
| Supply services       | <b>10E</b>                | ***                             |
| IE                    | <b>7</b>                  | ***                             |
| Planning              | <b>1*8F + 1*9 + 1*10E</b> | ***                             |
| S&F                   | <b>11E</b>                | ***                             |
| Quality assurance     | <b>8</b>                  | ***                             |
| Buying                | <b>8F</b>                 | ***                             |
| Legal                 | <b>8</b>                  | ***                             |
| Physical distribution | <b>10E</b>                | ***                             |

Table 5.2.3: Calculation of the costs for expenses

|                        | Total SWB P&L (€ * 1.000) | Total expenses P&L (€ * 1.000) | % expenses van SWB |
|------------------------|---------------------------|--------------------------------|--------------------|
| Logistics              | ***                       | ***                            | ***                |
| Engineering            | ***                       | ***                            | ***                |
| Supplier development   | ***                       | ***                            | ***                |
| Service & Finance      | ***                       | ***                            | ***                |
| Research & Development | ***                       | ***                            | ***                |

### C, D, E Machinery & equipment, Information systems and Buildings

In the table below the total depreciation and energy costs are shown. Knowing that \*\*\* FTE's (Personnel & Organisation) work in the office, the costs per person per year can be calculated.

Table 5.2.4: Total costs for depreciation and energy per year

|                                   | Total (€ * 1.000) | Per FTE (€) |
|-----------------------------------|-------------------|-------------|
| Depreciation furniture & building | ***               | ***         |
| Depreciation buildings            | ***               | ***         |
| Hardware depreciation             | ***               | ***         |
| Energy costs                      | ***               | ***         |



One FTE works **1.808 hours per year** (Personnel & Organisation). This number is used to calculate the costs per hour indicated in table 5.2.5

Table 5.2.5: Costs per hour per department

|                                      | SWB/hr (€) | Expenses/hr (€) | Depr furniture/hr (€) | Depr hardware/hr (€) | Depr buildings/hr (€) | Energy costs/hr (€) | Total costs/hr (€) |
|--------------------------------------|------------|-----------------|-----------------------|----------------------|-----------------------|---------------------|--------------------|
| <b>Logistics</b>                     |            |                 |                       |                      |                       |                     |                    |
| Supply Service Packaging             | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Production planning                  | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Physical distribution                | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Business Data Administration         | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| <b>Engineering</b>                   |            |                 |                       |                      |                       |                     |                    |
| Industrial engineering               | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| <b>Supplier development division</b> | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Graphics                             | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Packaging development                | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Packaging buying                     | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| <b>Service &amp; Finance</b>         | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Supply analyst                       | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| <b>Research &amp; Development</b>    | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Legal department                     | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |
| Quality assurance                    | ***        | ***             | ***                   | ***                  | ***                   | ***                 | ***                |

Sources:

- SWB: Financial Account Manager
- Expenses: P&L Business Review 2002
- Depreciation: Project Control & Asset Analyst
- Energy costs: Milieu Coordinator
- # persons + hours per year: Personnel & Organisation

## Appendix 5.3 Resource use supply chain

Figure 5.3.1: Resource consumption supply chain

| Resources                            | Resource driver              | Handle in packaging material | Store wrappers/showboxes | Store cases | Handle out packaging material | Handle packaging material factory | Produce bars | Pack bars automatically | Change over packaging machines | Transition packaging machines | Pack bars manually | Palletise cases | Make pallets ready for transportation | Handle in finished product | Store pallets | Handle out finished products | Order packaging material | Make production planning | Make distribution planning |   |
|--------------------------------------|------------------------------|------------------------------|--------------------------|-------------|-------------------------------|-----------------------------------|--------------|-------------------------|--------------------------------|-------------------------------|--------------------|-----------------|---------------------------------------|----------------------------|---------------|------------------------------|--------------------------|--------------------------|----------------------------|---|
| <b>B. Personnel (SWB + Expenses)</b> |                              |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Personnel Supply Services Packaging  | # man hours                  |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          | *                        |                            |   |
| Personnel Production Planning        | # man hours                  |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          | *                          |   |
| Personnel Physical Distribution      | # man hours                  |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          |                            | * |
| Direct labour permanent lines        | # associates                 |                              |                          |             | *                             | *                                 | *            | *                       | *                              | *                             |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Direct labour permanent hal A        | # associates                 |                              |                          |             | *                             | *                                 | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| Direct labour temporary              | # associates                 |                              |                          |             |                               |                                   | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| <b>C. Machinery &amp; Equipment</b>  |                              |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Depreciation equipment line 3        | asset value, m2              |                              |                          |             | *                             | *                                 | *            | *                       | *                              | *                             |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Depreciation equipment hal A         | asset value, m2              |                              |                          |             | *                             | *                                 | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| Other depreciation office            | asset value, # man hours     |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              | *                        | *                        | *                          |   |
| Maintenance personnel                | # man hours                  |                              |                          |             |                               | *                                 | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| Maintenance expenses                 | # man hours, costs of parts  |                              |                          |             | *                             | *                                 | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| Energy costs line 3                  | installed power              |                              |                          |             |                               | *                                 | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| Energy costs hal A                   | installed power              |                              |                          |             |                               |                                   | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| Energy costs office                  | installed power, # man hours |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              | *                        | *                        | *                          |   |
| <b>D. Information systems</b>        |                              |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| EDP hardware depreciation            | # man hours                  |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          | *                        | *                          | * |
| <b>E. Buildings</b>                  |                              |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Depreciation buildings line 3        | m2                           |                              |                          |             |                               | *                                 | *            | *                       | *                              | *                             |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Depreciation buildings hal A         | m2                           |                              |                          |             |                               |                                   | *            | *                       | *                              | *                             | *                  | *               | *                                     |                            |               |                              |                          |                          |                            |   |
| Depreciation buildings office        | m2, # man hours              |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              | *                        | *                        | *                          |   |
| <b>Invoices Hays Logistics</b>       |                              |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Tariff per pallet                    | Not necessary                | *                            |                          |             | *                             |                                   |              |                         |                                |                               |                    |                 |                                       | *                          |               | *                            |                          |                          |                            |   |
| Tariff per m2                        | Not necessary                |                              | *                        | *           |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            |               |                              |                          |                          |                            |   |
| Tariff per shuttle                   | Not necessary                |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       | *                          |               |                              |                          |                          |                            |   |
| Tariff per pallet slot               | Not necessary                |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            | *             |                              | *                        |                          |                            |   |
| Fixed tariff per year                | Not necessary                | *                            |                          |             | *                             |                                   |              |                         |                                |                               |                    |                 |                                       | *                          |               | *                            |                          |                          |                            |   |
| Capital costs                        |                              |                              |                          |             |                               |                                   |              |                         |                                |                               |                    |                 |                                       |                            | *             |                              |                          |                          |                            |   |

## Appendix 5.4 Tariffs for inbound and outbound logistics Hays

### Inbound logistics

Table 5.4.1: Tariff handle in packaging material

| Activities                            | Charged per:     | Tariff / yr (€) | Total # packaging pallet movements 2001 | Tariff / pallet (€) |
|---------------------------------------|------------------|-----------------|---|---------------------|
| Handing in from factory               | Pallet           |                 |   | ***                 |
| Shuttle from factory                  | Pallet           |                 |   | ***                 |
| Administration packaging              | Fixed            | ***             | ***                                     | ***                 |
| <b>Handling in packaging material</b> | <b>Pallet in</b> |                 |   | <b>***</b>          |

Store pallets packaging material is charge to Masterfoods via a tariff per pallet per week. No further calculation are necessary.

Table 5.4.2: Tariff handle out packaging material

| Activities                             | Charged per:      | Tariff / yr (€) | Total # packaging pallet movements 2001 | Tariff / pallet (€) |
|--|-------------------|-----------------|---|---------------------|
| Handing out to factory                 | Pallet            |                 |   | ***                 |
| Shuttle to factory                     | Pallet            |                 |   | ***                 |
| Administration packaging               | Fixed             | ***             | ***                                     | ***                 |
| <b>Handling out packaging material</b> | <b>Pallet out</b> |                 |   | <b>***</b>          |

### Outbound logistics

The tariff for finished products is based on several detail activities. One of these detail activities is the unloading system. This is the system Hays bought for the handling of finished products from Masterfoods.

Table 5.4.3: Tariff handle in finished product

| Activities                          | Charged per:     | Tariff / yr (€) | Total # finished product pallets handled in 2001 | Tariff / pallet (€) |
|-------------------------------------|------------------|-----------------|--|---------------------|
| Shuttle factory –warehouse          | Fixed            | ***             | ***  | ***                 |
| Unloading system                    | Fixed            | ***             | ***  | ***                 |
| Pre-advice                          | Shuttle          | ***             | ***  | ***                 |
| Print label                         | Pallet           |                 |  | ***                 |
| Handling in                         | Pallet           |                 |  | ***                 |
| Administration finished product     | Pallet           |                 |  | ***                 |
| <b>Handling in finished product</b> | <b>Pallet in</b> |                 |  | <b>***</b>          |

Table 5.4.5: Tariff handle out finished product

| Activities                           | Charged per:      | Tariff / pallet (€) |
|--------------------------------------|-------------------|---------------------|
| Handling out                         | Pallet            | ***                 |
| Loading trucks                       | Pallet            | ***                 |
| <b>Handling out finished product</b> | <b>Pallet out</b> | <b>***</b>          |

### STORE FINISHED PRODUCTS

The direct costs for carrying inventory exist of two components [Silver and Peterson, 1985]:

- *Capital cost:* Costs directly related to inventory investment. Capital can be expressed in Return On Total Assets (ROTA). Resources tied up in the business can be seen as opportunity costs. It is assumed that if this money is invested elsewhere in the business a rate of return equal to the ROTA would be accrued. ROTA costs of stock calculation is based on the value of the product to be stored [Tijssen, 2002]. This year, Masterfoods has defined a ROTA target for the factories of \*\*\* %. The tariff for capital cost equals € \*\*\* for one euro for one year.
- *Storage costs:* Include the costs to store finished product in the conditions meeting the agreed specifications. These are the costs that Hays charges to us for their services. The costs are shown in table 5.4.4.

Table 5.4.4: Tariff for storage of pallets finished product

| Activities                            | Charged per:         | Tariff / yr (€) | Average # pallets / m <sup>2</sup> | Tariff / pallet / week (€) |
|---------------------------------------|----------------------|-----------------|------------------------------------|----------------------------|
| Floor space                           | Fixed                | ***             | ***                                | ***                        |
| Pallet slots                          | Pallet/week          |                 |                                    | ***                        |
| <b>Store pallets finished product</b> | <b>Pallet / week</b> |                 |                                    | <b>***</b>                 |

\* Tariff is based on \*\*\* m<sup>2</sup> space. On those \*\*\* m<sup>2</sup> on average \*\*\* pallets are stored.

## Appendix 5.5 Time spend on packaging material handling

All the packaging material handlers from the green crew were asked about the time they spend on the activity packaging material handling which includes:

- ordering the packaging materials
- bring the materials from hal A to the line
- bring the materials from the line to hal A again

The associates could indicate the time spend in the number of hours or a percentage. The results are shown in figure 5.5.1. Formula 5.5.1 is used to transform number of hours per shift to percentage of time.

*Table 5.5.1: Time spend on packaging material handling*

| Line          | # hrs / shift | % of time per shift |
|---------------|---------------|---------------------|
| 1             |               | ***                 |
| 3             |               | ***                 |
| 4             |               | ***                 |
| 2+5+7         | ***           | ***                 |
| 6             | ***           | ***                 |
| 8             | ***           | ***                 |
| 9             | ***           | ***                 |
| <b>Totaal</b> |               | ***                 |

*Formula 5.5.1: % of time per shift*

$$\% \text{ of time per shift} = \frac{\# \text{ hrs per shift}}{6,5^*} * 100$$

\* One shift equals eight hours. However, the times and percentages indicated by the material handlers were based on the time they work during a shift. If the time for breaks and personal care are deducted from the 8 hours, 6,5 hours are left.

## Appendix 5.6 Tariffs for activities in the factory

The costs are determined in two parts; first line 3 is described after which hal A will be explained. The numbers indicated in red are the ones that are known or estimated by experts. The other figures are calculated with the help of the “red” figures.

### Line 3

All the different resources are discussed successively.

#### B. Personnel

##### Permanent labour

The number of associates in the process and packaging part of the line is determined on the basis of crew pictures made by the department of IE (table 5.6.1). The ratio between associates at the process and packaging part according to these pictures is used as a basis to divide the real total number of FTE’s (table 5.6.2) among the two parts. This total number of FTE’s per zone is found in the finance system. Because the finance system also reports e.g. zone 8 people at line 3 and the crew pictures do not, the salaries for some zones are taken together. Table 5.6.1 is the planned division while the number of FTE’s in table 5.6.2 indicates what the real numbers are.

Table 5.6.1: # associates per crew according to crew pictures line 3

| Manpower / crew    | Process | Pack |
|--------------------|---------|------|
| F4                 | ***     | ***  |
| F5                 | ***     | ***  |
| F7                 | ***     | ***  |
| F9                 | ***     | ***  |
| Total # associates | ***     | ***  |

Table 5.6.2: Permanent labour costs line 3

| Zones        | # FTE total line 3 | Avg labour costs / period (€) | Total costs/yr (€ * 1.000) | #FTE process | # FTE pack | Costs process (€ * 1.000) | Costs pack (€ * 1.000) |
|--------------|--------------------|-------------------------------|----------------------------|--------------|------------|---------------------------|------------------------|
| F4           | 7                  | ***                           | ***                        | ***          | ***        | ***                       | ***                    |
| F5           | 9                  | ***                           | ***                        | ***          | ***        | ***                       | ***                    |
| F6           | 3                  | ***                           | ***                        | ***          | ***        | ***                       | ***                    |
| F7           | 41                 | ***                           | ***                        | ***          | ***        | ***                       | ***                    |
| F8           | 1                  | ***                           | ***                        | ***          | ***        | ***                       | ***                    |
| F9           | 13                 | ***                           | ***                        | ***          | ***        | ***                       | ***                    |
| F9afw1       | 1                  | ***                           | ***                        | ***          | ***        | ***                       | ***                    |
| <b>Total</b> | <b>75</b>          |                               | ***                        | ***          | ***        | ***                       | ***                    |

##### Temporary labour

The total number of temporary associates on line 3 in all the crews is **24** (Source: Supply Finance Analyst), who are all active at the packaging part of the line. After inquiries were made at the key operators of line 3 about the division in pool associates and hand packers, it turned out that 2 out of 5 temps are pool associates, while the other 3 are hand packers. This distinction is necessary because hand packers have to be assigned to the activity “pack products manually”, while the pool associates can be included in the total labour costs for line 3. Pool associates execute the activities that are also done by the permanent section operators on line 3 (table 5.6.3).

Table 5.6.3: Temporary labour costs line 3

|                 | # FTE's | Costs/ temp FTE /yr | Total costs<br>(€ *1.000) |
|-----------------|---------|---------------------|---------------------------|
| Line 3          | ***     |                     |                           |
| Pool associates | ***     | ***                 | ***                       |
| Hand pack       | ***     |                     |                           |

### C + E Machinery & Equipment and buildings

#### Maintenance costs

Maintenance costs consists of costs for labour and expenses. The labour part of the maintenance costs is estimated on the basis of the number of hours of planned maintenance on line 3. This number of hours is built up out of:

- Annual shut downs during e.g. Christmas or Easter
- Planned maintenance during a whole shift (once in the 6 weeks)
- Running planned maintenance

The expenses are estimated by the Reliability Manager, who controls the maintenance budget. He also indicated that the process part takes \*\*\*% of the maintenance costs, while the packaging part consumes \*\*\*%.

Table 5.6.4: Maintenance costs line 3 (€ \* 1.000)

| Parts in Maintenance costs                 | Costs      |
|--|------------|
| Expenses -Stored parts                     | ***        |
| Expenses - Other (contractors,repairs etc) | ***        |
| Masterfoods labour (days)*                 | ***        |
| Masterfoods labour (shifts)**              | ***        |
| <b>Total costs line 3</b>                  | <b>***</b> |

\* costs of Masterfoods day technicians who work directly on the line

\*\* costs of proportion of shift technicians allocated to the line

Table 5.6.5: Maintenance costs per part of line 3 (€ \* 1.000)

|                       | % of costs | Total costs |
|-----------------------|------------|-------------|
| Total costs process   | ***        | ***         |
| Total costs packaging | ***        | ***         |

#### Depreciation

The depreciation costs for line 3 consist of three parts: process, packaging and general. These general costs are distributed over the process and packaging part in the same ratio as the specific depreciation costs.

Table 5.6.6: Depreciation costs line 3 (Source: Project Control & Asset Analyst)

|                | Depreciation / yr<br>(€ *1.000) | %   | Total costs<br>(€ *1.000) |
|----------------|---------------------------------|-----|---------------------------|
| Process part   | ***                             | *** | ***                       |
| Packaging part | ***                             | *** | ***                       |
| General        | ***                             |     |                           |
|                | ***                             |     | ***                       |

#### Energy costs

The percentage of the energy costs that is assigned to line 3 is based on the installed power on that line (table 5.6.7). The same accounts for the percentages given in table 5.6.7.

Table 5.6.7: Total energy costs line 3

|  |            |
|--|------------|
| Total energy costs Masterfoods Veghel (€ *1.000)   | ***        |
| % line 3 installed power compared to total factory | ***        |
| <b>Energy costs line 3 (€ *1.000)</b>              | <b>***</b> |

Table 5.6.7: Energy costs per part of line 3

|           | Installed power (%) | Energy costs (€ *1.000) |
|-----------|---------------------|-------------------------|
| Process   | ***                 | ***                     |
| Packaging | ***                 | ***                     |
| Line 3    | ***                 | ***                     |

All the categories are grouped in table 5.6.8, which results in the total costs of the process and packaging part of line 3. The two packaging machines located in hal A are not included yet.

Table 5.6.8: Total costs line 3 (€ \* 1.000)

|                       | B. Personnel |             | C, E Machinery & equipment and buildings |        |     | Total |
|-----------------------|--------------|-------------|--|--------|-----|-------|
|                       | Labour       | Maintenance | Depreciation                             | Energy |     |       |
| <b>Process part</b>   | ***          | ***         | ***                                      | ***    | *** |       |
| <b>Packaging part</b> | ***          | ***         | ***                                      | ***    | *** |       |
| <b>Total</b>          | ***          | ***         | ***                                      | ***    | *** |       |
| %                     | ***          | ***         | ***                                      | ***    | *** |       |

## Hal A

All the costs concerning hal A are divided in the three parts described in section 5.3.2.

### B. Personnel

#### Permanent labour

Table 5.6.9 is again the result of the crew picture made by IE, which is used to distribute the total number of FTE's (from finance) among the three areas. This results in the total costs for permanent labour per area.

5.6.9: # associates according to crew pictures hal A

| Manpower / crew           | Total hal A | Pack machines | Palletising | Despatch |
|---------------------------|-------------|---------------|-------------|----------|
| F5                        | ***         | ***           | ***         | ***      |
| F7                        | ***         | ***           | ***         | ***      |
| F9                        | ***         | ***           | ***         | ***      |
| <b>Total # associates</b> |             | ***           | ***         | ***      |

5.6.10: Total permanent labour costs hal A

| Zones        | # FTE total hal A | Avg labour costs / period (€) | Total costs/yr (€ *1.000) | # FTE pack machines | # FTE palletising | # FTE despatch | Costs pack mach (€ *1.000) | Costs palletising (€ *1.000) | Costs despatch (€ *1.000) |
|--------------|-------------------|-------------------------------|---------------------------|---------------------|-------------------|----------------|----------------------------|------------------------------|---------------------------|
| F11          | 1                 | ***                           | ***                       | ***                 | ***               | ***            | ***                        | ***                          | ***                       |
| F5           | 8                 | ***                           |                           |                     |                   |                |                            |                              |                           |
| F6           | 6                 | ***                           |                           |                     |                   |                |                            |                              |                           |
| F6afw1       | 8                 | ***                           |                           |                     |                   |                |                            |                              |                           |
| F7           | 11                | ***                           | ***                       | ***                 | ***               | ***            | ***                        | ***                          | ***                       |
| F7afw2       | 1                 | ***                           | ***                       | ***                 | ***               | ***            | ***                        | ***                          | ***                       |
| F9           | 5                 | ***                           |                           |                     |                   |                |                            |                              |                           |
| <b>Total</b> | <b>40</b>         |                               | ***                       | ***                 | ***               | ***            | ***                        | ***                          | ***                       |



### Temporary labour

Per crew almost 4 temporary associates are active in hal A. According to the key operators of hal A, 1 of those temps is working at the packaging machines, and the other three work in the palletising area. This results in the figures in table 5.6.11.

5.6.11: Temporary labour costs hal A.

|               | # FTE all crews | Costs / temp FTE/yr | Total costs (€ *1.000) |
|---------------|-----------------|---------------------|------------------------|
| Hal A         | ***             | ***                 | ***                    |
| Pack machines | ***             | ***                 | ***                    |
| Palletising   | ***             | ***                 | ***                    |
| Despatch      | ***             | ***                 | ***                    |

### C + E Machinery & Equipment and buildings

#### Maintenance costs

For the maintenance costs of hal A an estimation is made on the basis of the number of associates that are working in that area (table 5.6.12). For the labour costs of the expenses, the same is done, while the costs for the parts is estimated by the reliability manager who also made the distribution for the maintenance cost for the three areas (tables 5.6.13 + 5.6.14).

Table 5.6.12: Labour costs for maintenance hal A

| # associates              | Zone    | Costs / period (€) | Costs / yr (€ *1.000) |
|---------------------------|---------|--------------------|-----------------------|
| 1/3 technician            | F12     | ***                | ***                   |
| 3/5 rayon technician      | F10     | ***                | ***                   |
| 1 1/2 trouble-service     | F10/F11 | ***                | ***                   |
| <b>Total labour costs</b> |         |                    | ***                   |

Table 5.6.13: Expenses for maintenance hal A

|                       | Costs / hr (€) | # hrs | Total costs (€ *1.000) |
|-----------------------|----------------|-------|------------------------|
| Parts                 |                |       | ***                    |
| 1 contractor/yr       | ***            | ***   | ***                    |
| <b>Total expenses</b> |                |       | ***                    |

Table 5.6.14: Maintenance costs per area

|                                | Distribution maintenance costs (%) | Total costs /part (€ *1.000) |
|--------------------------------|------------------------------------|------------------------------|
| Total costs packaging machines | ***                                | ***                          |
| Total costs palletising        | ***                                | ***                          |
| Total costs despatch           | ***                                | ***                          |
| Total costs hal A              | 100                                | ***                          |

#### Depreciation

The total costs for depreciation are known at the department of Finance. For the distribution between the areas, the asset value for the three parts is determined. The distribution made in table 5.6.15 is the result of investigating all the available assets in hal A.

Table 5.6.15: Depreciation hal A

|                    | % asset value | Costs (€ * 1.000) |
|--------------------|---------------|-------------------|
| Pack machines      | ***           | ***               |
| Palletising        | ***           | ***               |
| Despatch           | ***           | ***               |
| <b>Total costs</b> |               | ***               |

### Energy costs

The energy costs for hal A are calculated in the same way as the energy costs for line 3.

*Table 5.6.16: Total energy costs hal A*

|   |            |
|---|------------|
| Total energy costs Masterfoods Veghel (€ *1.000)  | ***        |
| % hal A installed power compared to total factory | ***        |
| <b>Energy costs hal A (€ *1.000)</b>              | <b>***</b> |

*Table 5.6.17: Energy costs per part of hal A*

|               | <b>Installed power (%)</b> | <b>Energy costs (€ *1.000)</b> |
|---------------|----------------------------|--------------------------------|
| Pack machines | ***                        | ***                            |
| Palletising   | ***                        | ***                            |
| Despatch      | ***                        | ***                            |
| Hal A         | ***                        | ***                            |

### TOTAL COSTS

All the categories are grouped in table 5.6.18 which results in the total costs of the different areas in hal A.

*5.6.18: Total costs hal A*

|                      | <i>B. Personnel</i> | <i>C, E Machinery &amp; equipment and buildings</i> |                     |                     |                    |
|----------------------|---------------------|---|---------------------|---------------------|--------------------|
|                      | <b>Labour costs</b> | <b>Maintenance</b>                                  | <b>Depreciation</b> | <b>Energy costs</b> | <b>Total costs</b> |
| <b>Pack machines</b> | ***                 | ***   | ***                 | ***                 | ***                |
| <b>Palletising</b>   | ***                 | ***   | ***                 | ***                 | ***                |
| <b>Despatch</b>      | ***                 | ***   | ***                 | ***                 | ***                |
| <b>Total hal A</b>   | ***                 | ***   | ***                 | ***                 | ***                |
| <b>% of total</b>    | ***                 | ***   | ***                 | ***                 | ***                |

The total costs for the packaging part of line 3 consists of the total costs named in table 5.6.8 and part of the costs mentioned in table 5.6.18. Two of the five packaging machines in hal A belong to line 3, which means that 2/5 of the costs of the packaging machines in hal A have to be allocated to the packaging part of line 3. This results in the costs for the packaging part described in table 5.6.19.

*Table 5.6.19: Total costs packaging part (€ \* 1.000)*

|                       | <b>Costs table 5.6.8</b> | <b>2/5 * costs table 5.6.18</b> | <b>Total costs</b> |
|-----------------------|--------------------------|---------------------------------|--------------------|
| Packaging part line 3 | ***                      | ***                             | ***                |

## Appendix 5.7 Costs supporting activities

The tariff per hour used in table 5.7.1. is calculated in appendix 5.2. The timings in table 5.7.2 are based on interviews with all the associates from the departments.

*Table 5.7.1: Total costs departments*

|                           | Tariff per hour | # FTE | Total costs / yr (€ * 1.000) |
|---------------------------|-----------------|-------|------------------------------|
| Supply Services Packaging | ***             | ***   | ***                          |
| Physical Distribution     | ***             | ***   | ***                          |
| Production Planning       | ***             | ***   | ***                          |

*Table 5.7.2: Total costs for supporting activities*

| Activity                  |                            | Total costs / yr (€ * 1.000) | % of time busy with activity | Costs specific activity (€ * 1.000) |
|---------------------------|----------------------------|------------------------------|------------------------------|-------------------------------------|
| Supply Services Packaging | Order packaging material   | ***                          | ***                          | ***                                 |
| Production Planning       | Make production planning   | ***                          | ***                          | ***                                 |
| Physical Distribution     | Make distribution planning | ***                          | ***                          | ***                                 |

## Appendix 6.1 Types of requests or update activities

In this appendix an overview is given of the different types of activities that can be found in the New Activity Database. Only the activities which concern a new packaging are included in this overview. Besides, the projects that include an investment in the factory are also not included. Together with the help of the associates concerned the list of types of requests from the database is made complete.

### A-ACTIVITIES

A-activities are all large projects. For these projects no general judgement can be made. Each activity is a project on itself.

### B-ACTIVITIES

B-activities are all large projects. For these projects no general judgement can be made. Each activity is a project on itself.

These A- and B-activities are outside the scope of this project.

### C-ACTIVITIES

- **Change of an existing pack type** (pack count, pack-size or weight) to a format already familiar to the factory
- **(Repeated) limited edition done within the last 3 years.** Limited edition is for the markets concerned often a new pack size, but most of the times this pack size is already produced in the factory. So, for the factory such a request is a new pack variant. A limited edition can also be a new recipe like the Twix with caramel and cocoa in the biscuit.
- **European Promotion / sponsorship:** for these requests the same applies as for the limited edition. Sometimes such a request results in a new pack size, but most of the time only a new pack variant.
- **Change of sourcing factory / new co-manufacturer / new licensing partner** Masterfoods Europe has not worked with. In this case another address has to be reported on the packaging materials, and in some cases new packaging specifications and (elaborate) line trials are necessary.
- **A request with a significant impact on spare line capacity and/or efficiency** (e.g. change in volume, materials used). This is only a reason why a D-activity can turn out to be a C-activity. Can belong to all the categories of table 6.1.1.
- **European brandflag packaging re-design.**
- **Rollout of an existing brand/product to a new market.** In general this means that a new pack variant is introduced.

### D-ACTIVITIES

- **Locally driven promotion with regard to:**
  - Value: e.g. price flash
  - Volume: e.g. + 10% promotion, 5+1 promotion. This promotion can result in a new pack size
  - Price: e.g. instant win, inserts, inside print.
  - Theme: e.g. Efteling promotion
- **Legal text change**

In table 6.1.1 an overview is given of the categories in which the types of requests or update activities can be placed.

Table 6.1.1: Types of requests

|                                      | Replace? | Extra? |
|--------------------------------------|----------|--------|
| <b>Permanent item</b>                |          |        |
| New pack size                        |          |        |
| Change of existing pack type         | *        | *      |
| New pack variant                     |          |        |
| Re-sourcing                          | *        |        |
| Brandflag change                     | *        |        |
| Legal text change                    | *        |        |
| Roll out                             | *        |        |
| <b>Temporary item</b>                |          |        |
| New pack size                        |          |        |
| Limited edition                      | *        | *      |
| European promotion                   | *        | *      |
| Volume promotion local market (+10%) | *        | *      |
| New pack variant                     |          |        |
| Limited edition                      | *        | *      |
| European/ multi-brand promotion      | *        | *      |
| Volume promotion local market (5+1)  | *        | *      |
| Value promotion local market         | *        | *      |
| Price promotion local market         | *        | *      |
| Theme promotion local market         | *        | *      |

Is possible but very unlikely

For all these specific requests it is investigated whether significantly more or less resources are necessary by asking all the involved departments. The results of this investigation are taken into account in the calculations mentioned in appendix 6.2.

## Appendix 6.2 Explanation of all the fields

Three Request Impact Charges are made: one for every pack type (multi-pack, showboxes and STO's). Each charge consists of the same fields. This appendix explains all the input fields in the RIC. The main lines are also told in the report. In the figure below, the bold numbers refer to the numbers in the explanations. All the numbers will be discussed in increasing order. Goal is to explain all the underlying formulas and consequences of certain characteristics of the specific request.

| Request specific data               |            |                 | The answers to these questions determine the category of the request<br>In case of a permanent item, the # active periods = 13 (1 year) | Average input data implementation process |                  |
|-------------------------------------|------------|-----------------|---|---|------------------|
|                                     |            |                 |   | Average                                   | Specific request |
| New pack variant?                   | 1          |                 | 11  | 11a                                       |                  |
| New pack size?                      | 2          |                 | 12  | 12a                                       |                  |
| Temporary item? (promotion)         | 3          |                 |   |   |                  |
| # active periods                    | 4          |                 |   |   |                  |
| Extra item?                         | 5          |                 |   |   |                  |
| Hand pack needed?                   | 6          |                 |   |   |                  |
| New material and/or supplier?       | 7          |                 |   |   |                  |
| Weight changes?                     | 8          |                 |   |   |                  |
| Expected volume (tons)              | 9          |                 |   |   |                  |
| <b>Request concerns (10):</b>       |            |                 | <b>Bar weight (g)</b>   |   |                  |
| Snickers                            |            | 60,2            |   |   |                  |
| Snickers Cruncher                   | *          | 40,2            |   |   |                  |
| Mars                                |            | 54,2            |   |   |                  |
| <b>Total costs</b>                  |            |                 |   |   |                  |
|                                     | Total (23) | Per ton (24)    |   |   |                  |
| One-off costs                       | A          | A / 9           |   |   |                  |
| On-going costs during active period | B + C      | (B + C) / 9     |   |   |                  |
| Complexity costs                    | A + B + C  | (A + B + C) / 9 |   |   |                  |

| Average input data supply chain  |         |                  |
|----------------------------------|---------|------------------|
|                                  | Average | Specific request |
| Manufacturing Frequency Index    | 13      | 13a              |
| Target Minimum Stock (days)      | 14      | 14a              |
| Bars / minute packaging machines | 15      | 15a              |
| Changeover time (min)            | 16      | 16a              |
| Transition time (min)            | 17      | 17a              |
| # machines / changeover          | 18      | 18a              |
| # machines / transition          | 19      | 19a              |
| Kg / case                        | 20      | 20a              |
| Kg / pallet                      | 21      | 21a              |
| # cases per minute palletiser    | 22      | 22a              |

| Implementation process (one-off costs) |              |                   |                     |                          |
|--|--------------|-------------------|---------------------|--------------------------|
| Activity                               | Tariff/ unit | Extra use (units) | Unit                | Costs per implementation |
| Process artwork                        | ***          | 25                | # pack changes      |                          |
| Make specifications (+ do line trials) | ***          | 26                | # hrs               |                          |
| Coordinate packaging change            | ***          | 27                | # hrs / pack change |                          |
| Coordinate POR-process                 | ***          | 28                | # hrs               |                          |
| Give input in POR                      | ***          | 29                | # hrs               |                          |
| Make legal text                        | ***          | 30                | # hrs               |                          |
| Process change in planning system      | ***          | 31                | # hrs               |                          |
| <b>Total implementation costs</b>      |              | <b>32</b>         |                     | <b>A</b>                 |

| Update process (on-going costs)        |              |                   |                     |              |
|--|--------------|-------------------|---------------------|--------------|
| Activity                               | Tariff/ unit | Extra use (units) | Unit                | Update costs |
| Process artwork                        | ***          | 33                | # pack changes      |              |
| Make specifications (+ do line trials) | ***          | 34                | # hrs               |              |
| Coordinate packaging change            | ***          | 35                | # hrs / pack change |              |
| Coordinate POR-process                 | ***          | 36                | # hrs               |              |
| Give input in POR                      | ***          | 37                | # hrs               |              |
| Make legal text                        | ***          | 38                | # hrs               |              |
| Process change in planning system      | ***          | 39                | # hrs               |              |
| <b>Total costs / update</b>            | ***          | <b>40</b>         |                     |              |
| <b>Total update costs per year</b>     |              | <b>41</b>         |                     | <b>B</b>     |

| Supply chain costs (on-going costs)      |              |                   |                  |                    |
|--|--------------|-------------------|------------------|--------------------|
| Activity                                 | Tariff/ unit | Extra use (units) | Unit             | Supply chain costs |
| Handle in packaging material             | ***          | 42                | # pallets        |                    |
| Store wrappers/showboxes                 | ***          | 43                | # pallets / week |                    |
| Store cases                              | ***          | 44                | # pallets / week |                    |
| Handle out packaging material            | ***          | 45                | # pallets        |                    |
| Handle packaging material factory        | ***          | 46                | # pallets        |                    |
| Produce bars                             | ***          | 47                | # hrs            |                    |
| Pack bars automatically                  | ***          | 48                | # hrs            |                    |
| Change over packaging machines           | ***          | 49                | # hrs            |                    |
| Transition packaging machines            | ***          | 50                | # hrs            |                    |
| Pack bars manually                       | ***          | 51                | # hrs            |                    |
| Palletise cases                          | ***          | 52                | # hrs            |                    |
| Make pallets ready for transport         | ***          | 53                | # pallets        |                    |
| Handle in finished products              | ***          | 54                | # pallets        |                    |
| Store finished products                  | ***          | 55                | # pallets / week |                    |
|  |              | 56                | # euros          |                    |
| Handle out finished products             | ***          | 57                | # pallets        |                    |
| Order packaging material                 | ***          | 58                | # appearances    |                    |
| Make production planning                 | ***          | 59                | # appearances    |                    |
| Make distribution planning               | ***          | 60                | # pallets        |                    |
| <b>Total supply chain costs per year</b> |              | <b>61</b>         |                  | <b>C</b>           |

Number of times per year the artwork of a standard item changes in some way which results in a new implementation process.

Number of packaging levels (1st wrap, 2nd wrap, case) that changes on average per POR.

If the expected value for the specific request deviates from the average value, the expected value can be filled in the yellow fields.

MFI indicates how many times the item is produced

Safety stock

Weighted average

Indicate with a "\*" for which brand the request is for.

Result of complexity charge. A distinction is made between one-off and on-going costs.

Tables with all the activities and tariffs that underlie the total complexity costs.  
Costs = tariff per unit \* extra use (units)

Figure 6.2.1: Request Impact Charge

## Request specific data

The green input fields *must be filled in* to get the total costs. These fields are all connected with important characteristics of the request, which have been described in section 6.1. For all the request specific data is indicated where the influence in extra use is noticeable in the activities. If possible, it is also indicated what the influence is.

### 1. NEW PACK VARIANT?

A request for an item introduction contains in principle always a new pack variant. However, it is included to make the picture complete regarding the characteristics described in section 6.1. If a new pack variant is introduced, an extra transition is necessary every time an item is made.

However, when the new pack variant is also a new pack size, the changeover time is taken into account instead of the transition time, because in the changeover time, the change of packaging material is already included (figure 6.2.2).

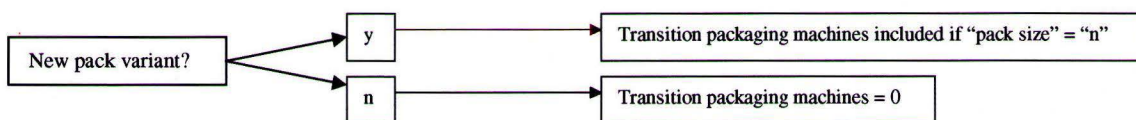


Figure 6.2.2: Influences new pack variant

### 2. NEW PACK SIZE?

If a new pack size is introduced, extra changeovers are necessary in case of an extra pack size.

Furthermore, new packaging specifications have to be made and line trials have to be done. In case of a new pack variant, new specifications are not necessary (figure 6.2.3) if the weight, material or supplier does not change.

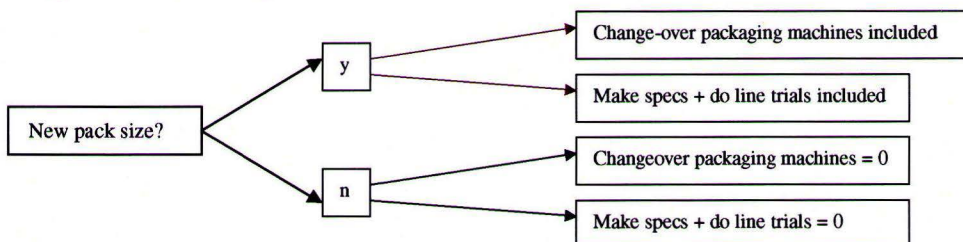


Figure 6.2.3: Influences new pack size

### 3. TEMPORARY ITEM (PROMOTION)?

Assumed is that a temporary item does not need updating. It is already taken out of production, when an update is necessary. The influences are described in figure 6.2.4.

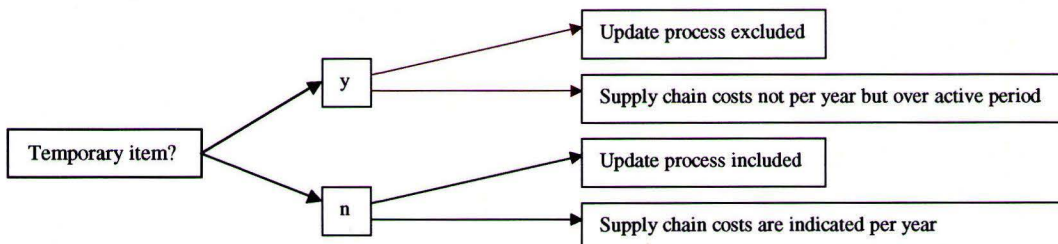


Figure 6.2.4: Influences temporary item

### 4. # ACTIVE PERIODS?

The number of active periods is mainly important for the promotional items. The RIC charges the on-going costs for the time the item is active. If the request concerns a permanent item the number

of active periods should equal one year (= 13 periods), so that the on-going costs can be calculated per year. This is done, because the time span of a non-temporary item is unknown. The number of active periods has a lot of influence on the extra use of activities in the supply chain.

The number of active periods influences the following activities:

- Handle in packaging material (42)
- Handle out packaging material (45)
- Handle packaging material factory (46)
- Change over packaging machines (49)
- Transition packaging machines (50)
- Make pallets ready for transport (53)
- Handle in finished products (54)
- Store finished product (55)
- Handle out finished product (57)
- Order packaging material (58)
- Make production planning (59)

#### 5. EXTRA ITEM?

The answer to this question should be “n” if the new item replaces an old item and “y” if the new item is an (temporary) extra item in the Masterfoods assortment. If an existing item is replaced, no extra update costs are included. Furthermore, this input field influences the extra use of a lot of supply chain activities (figure 6.2.5).

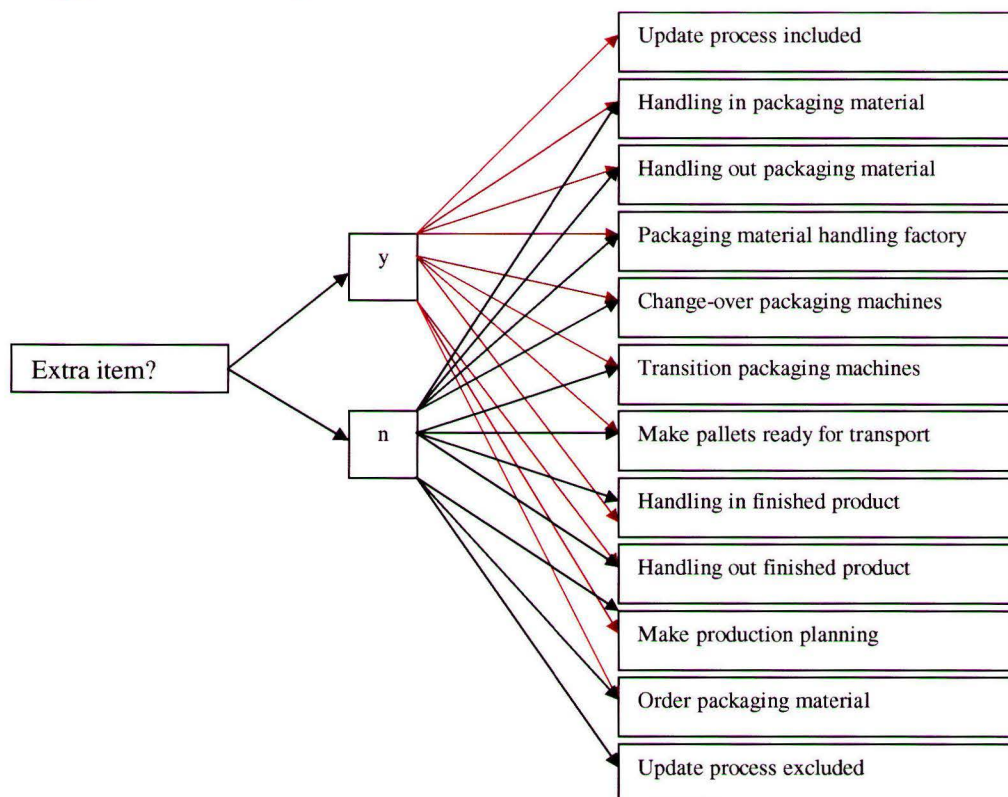


Figure 6.2.5: Influences extra item



#### 6. HAND PACK NEEDED?

If you answer this question with “y”, the item makes use of an extra hand-packer during all the production hours (figure 6.2.6).

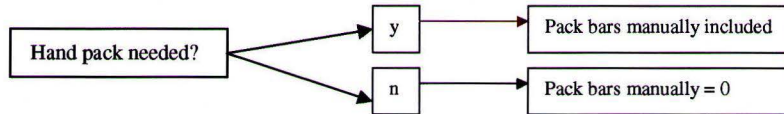


Figure 6.2.6: Influences hand pack needed

#### 7. NEW MATERIAL OR SUPPLIER?

The answer to this question has great influence on the extra use of the activity “make specs and do line trials (24)” in the implementation process. The 40 hours indicated in figure 6.2.7, are determined in appendix 6.3.

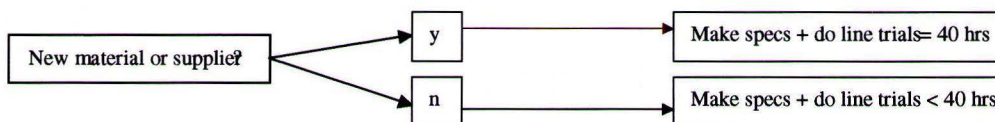


Figure 6.2.7: Influences new material or supplier

#### 8. WEIGHT CHANGES?

With weight change is meant: the weight of the package the consumer buys and not the weight of an individual bar. In case of a weight change, the department of Packaging Development needs 12 hours to make specifications and do line trials during the implementation process (appendix 6.3). Furthermore, Quality Assurance that gives input in the POR, needs 2 extra hours (figure 6.2.8).

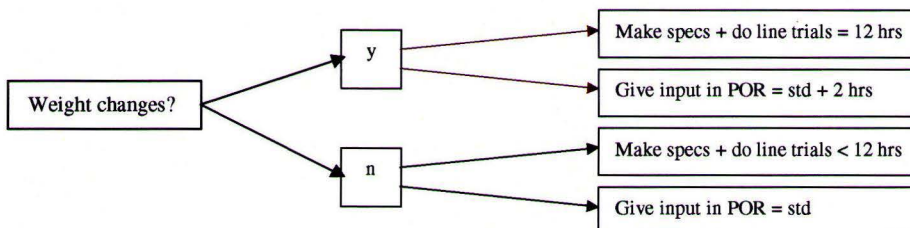


Figure 6.2.8: Influences weight changes

#### 9. EXPECTED VOLUME (TONS)

The expected volume is used in the formulas for calculating:

- Pack bars automatically (48)
- Pack bars manually (51)
- Palletise cases (52)
- Make pallets ready for transport (53)
- Handle in finished products (54)
- Store finished products (55)
- Handle out finished products (56)

Of course this number is also used to calculate the complexity costs per ton (24).

#### 10. REQUEST CONCERNS

You have to indicate for which brand the request is for, because the different brands have different bar weights. This influences the following data:

- # kg per case (brand specific average) (20)
- # kg per pallet (brand specific average) (21)

- the activities: “Pack bars automatically (48)” and “Pack bars manually (51)”. For calculating the extra use of these activities the number of bars per minute (15) is used. To convert bars per minute to tons per minute, the bar weights are necessary.

### Average input data implementation process

#### 11. # UPDATES/YR

Included in: Total update costs per year (41)

This total number of updates per year on Masterfoods fixed assortment is calculated via formula 6.2.1. The results are shown in table 6.2.1. So, a standard item needs an update approximately once a year. It is important that the number of updates per year is known, because the supply chain costs for permanent items are also expressed in that time unit.

*Formula 6.2.1: # updates per year*

$$\text{\# updates per year} = \frac{\text{Total \# POR's (per year)} - \text{\# promotional POR's (per year)}}{\text{Total \# items produced (per year)} - \text{total \# promotion produced (per year)}}$$

Sources:

|                           |  |
|---------------------------|--|
| Total # POR's             | POR-database   |
| Total # promotional POR's | In POR-database is indicated how many POR's are promotional. The total # promotional POR's in one year = # promotions produced in one year |
| Total # items produced    | Based on: RPXX Jeroen 2000 1 2.xls   |

*Table 6.2.1: Average # updates per year*

| Year                     | 2000 | 2001 |
|--------------------------|------|------|
| Total # POR's in Europe  | ***  | ***  |
| # promotional POR's      | ***  | ***  |
| Total # items produced   | ***  | ***  |
| # updates / year         | ***  | ***  |
| Average # updates / year | ***  |      |

#### 12. # PACKAGING CHANGES PER IMPLEMENTATION:

Included in: Process artwork (25 + 33)  
Coordinate packaging change (27 + 35)

The timings Graphics works with are indicated per packaging change. Since an item has two or three packaging levels, more packaging changes per implementation or update are possible. To connect the activities from Graphics with the other activities that are calculated per POR, you have to know how many packaging changes there are per POR. The same applies for processing the artwork. The tariff given is for processing one artwork, which is one packaging change.

*Formula 6.2.2: # pack changes per POR*

$$\text{Average \# packaging changes / POR} = \frac{\text{Total \# pack changes 2001}}{\text{Total \# POR's 2001}} = \frac{***}{***} = ***$$

Source:

|                           |                                     |
|---------------------------|-------------------------------------|
| Total # pack changes 2001 | File from European Graphics Manager |
| Total # POR's             | POR-database                        |

### Average input data supply chain

The numbers in the blue input fields are the average numbers based on the current assortment. The formulas concerning the extra use in the supply chain use these numbers except when the

the yellow fields are filled in. In the yellow fields IE can indicate if a parameter differs for the specific request. If this is the case, the RIC will take the number in the yellow field into account. For all the parameters is indicated which activities the parameter influences.

### 13. MANUFACTURING FREQUENCY INDEX

The number of active periods influences the following activities:

- Handle in packaging material (42)
- Handle out packaging material (45)
- Handle packaging material factory (46)
- Change over packaging machines (49)
- Transition packaging machines (50)
- Make pallets ready for transport (53)
- Handle in finished products (54)
- Store finished product (55)
- Handle out finished product (57)
- Order packaging material (58)
- Make production planning (59)

This parameter is used within Masterfoods to indicate how many weeks there are between two production runs of an item. With this MFI the number of runs per period can be calculated. The average MFI for line 3 during the periods 5 to 8 included in 2002 equalled 1,9.

### 14. TARGET MINIMUM STOCK

The TMS is the minimum stock level (physical stock) for a certain item in the total pipeline (from factory up to and including market depot). For every product/market combination, a TMS is assigned. This TMS should ensure the required customer service levels and is measured in weeks of sales cover. For the current situation on line 3, the TMS is \*\*\* days. This TMS is explained more thoroughly at the points 55 and 56.

### 15. BARS / MINUTE PACKAGING MACHINES

Included in: Pack bars automatically (48)  
Pack bars manually (51)

This is a pack type specific parameter and is calculated via a file with packaging machine speed from IE. Per pack size has been indicated how many bars could be packed per minute. A weighted average has been calculated via formula 6.2.3 This resulted in the average packaging speed indicated in table 6.2.2.

*Formula 6.2.3: Average # bars / minute*

$$\text{Weighted average pack type} = \frac{(\# \text{ tons ps 1} * \text{bars per minute ps 1}) + (\# \text{ tons ps 2} * \text{bars per minute ps 2}) + \text{etc.}}{\text{Total volume produced from pack type (tons)}}$$

ps = pack size

*Table 6.2.2: Speed packaging machines*

| Pack type   | Average # bars /minute |
|-------------|------------------------|
| Multi-packs | ***                    |
| Showboxes   | ***                    |
| STO's       | ***                    |

### 16. CHANGEOVER TIME (MINUTES)

Included in: Change over packaging machines (51)

This is also a pack type specific time standard, which is determined via the way described in appendix 6.3. The results of this calculation are the timings indicated in table 6.2.3.

Table 6.2.3 Average change-over times

| Pack type   | Average change-over time (min) |
|-------------|--------------------------------|
| Multi-packs | ***                            |
| Showboxes   | ***                            |
| STO's       | ***                            |

17. TRANSITION TIME

Included in: Transition packaging machines (50)

These timings turned out to be the same for the different pack types: \*\*\* minutes.

18. # MACHINES PER CHANGEVER

Included in: Change over packaging machines (49)

This number is acquired after analysing 10 recent weeks of the MAPP production planning (P4W4 to P7W1 2002). All the changeovers and transitions between items were counted just as the number of machines that was changed over per time. This resulted in an average number of machines per changeover for the different pack types (table 6.2.4).

Table 6.2.4: Number of machines per changeover

| Pack type   | # machines per changeover |
|-------------|---------------------------|
| Multi-packs | ***                       |
| Showboxes   | ***                       |
| STO's       | ***                       |

19. # MACHINES PER TRANSITION

Included in: Transition packaging machines (50)

After analysing the production planning as indicated above the average number of machines per transition was determined per pack type (table 6.2.5).

Table 6.2.5: Number of machines per transition

| Pack type   | # machines per transition |
|-------------|---------------------------|
| Multi-packs | ***                       |
| Showboxes   | ***                       |
| STO's       | ***                       |

20. KG/CASE

Included in: Palletise cases (52)

The average number of kilograms per case differs not only per pack type, but also per brand. So, for every combination a weighted average is calculated based on Business Review 6 2002.

Table 6.2.6: Number of kilograms per case

| Pack type   | Snickers®<br>(# kg / case) | Snickers Cruncher®<br>(# kg / case) | Mars®<br>(# kg / case) |
|-------------|----------------------------|-------------------------------------|------------------------|
| Multi-packs | ***                        | ***                                 | ***                    |
| Showboxes   | ***                        | ***                                 | ***                    |
| STO's       | ***                        | ***                                 | ***                    |

21. KG/PALLET

Included in: Make pallets ready for distribution (53)

Handle in finished product (54)

### Handle out finished product (57)

The average number of kilograms per pallet differs not only per pack type, but also per brand. So, for every combination a weighted average is calculated based on Business Review 6 2002.

*Table 6.2.7: Number of kilograms per pallet*

| Pack type   | Snickers®<br>(# kg / pallet) | Snickers Cruncher®<br>(# kg / pallet) | Mars®<br>(# kg / pallet) |
|-------------|------------------------------|---------------------------------------|--------------------------|
| Multi-packs | ***                          | ***                                   | ***                      |
| Showboxes   | ***                          | ***                                   | ***                      |
| STO's       | ***                          | ***                                   | ***                      |

#### 22. # CASES PER MINUTE PALLETISER

Included in: Palletise cases (52)

The palletisers that the STO's make use of palletises more cases per minute than the multi-packs and showboxes (table 6.2.8). Since the tariff is indicated per hour, this has to be corrected for the differences in speed.

*Table 6.2.8: Speed of the palletisers (Source: Local IE)*

| Pack type  | # cases per minute palletisers |
|------------|--------------------------------|
| Multi-pack | ***                            |
| Showbox    | ***                            |
| STO        | ***                            |

### Total costs

#### 23. TOTAL COSTS

These total costs are the result of the RIC. This amount is calculated as indicated in formula 6.2.4. It also shows that the basis for this amount are the three tables with activities: implementation process, update process and supply chain activities.

*Formula 6.2.4: Total costs RIC*

#### One-off costs

- Total costs implementation process (32)

#### On-going costs

- Total costs update process (41)
- Total supply chain costs (60) +

---

**Total complexity costs (23)**

#### 24. TOTAL COSTS PER TON

Because the department of finance uses for its calculations an amount per ton, the impact costs are also expressed in an amount per ton. In this way it is possible to gain insight in the differences between costs per ton for a large and small volume item with the same characteristics.

*Formula 6.2.5: Costs per ton RIC*

$$\text{Total costs per ton} = \frac{\text{Total complexity costs}}{\text{Expected volume (tons)}}$$

### Extra use per activity

In the rest of this appendix it is explained how the extra use of an activity for a specific request is determined. The total extra costs for these activities are calculated via formula 6.2.6.

*Formula 6.2.6: extra costs per activity*

Total extra costs activity = Tariff per unit of activity (ch 5) \* # units extra use of activity (calculated in this section)

All the time standards that are named in this section are calculated and explained in appendix 6.3.

### Implementation process (one-off costs)

#### 25. PROCESS ARTWORK

The extra use of “process artwork” is the number of packaging changes per implementation (12).  
Per implementation on average \*\* artworks have to be processed.

#### 26. MAKE SPECIFICATIONS (+ DO LINE TRIALS)

The time required for this activity depends on the specific request (see appendix 6.3).

The following reasoning forms the basis for the extra use:

IF “New material or supplier (7)” = yes,

THEN extra use is 40 hrs,

ELSE: IF: “weight changes? (8)” = yes,

THEN extra use is \*\*\* hrs,

ELSE: IF: “new pack size? (2)” = yes,

THEN: extra use = \*\*8 hrs,

ELSE extra use = \*\*\* hrs

This reasoning goes from the largest number of hours of extra use (\*\*\*) hrs) to the lowest number of hours of extra use (\*\*\*) hrs). It checks some characteristics of the request.

Coordinate packaging changes\*\*\* hours. No distinction is made between different introductions since this would be very complicated. Besides, the categories Graphics distinguishes are not completely clear and do not match the categories IE distinguishes.

The extra use of this activity is calculated via formula 6.2.7.

*Formula 6.2.7: Extra use coordinate packaging change*

Total extra use activity = # hrs needed for packaging change \* # packaging changes per implementation

#### 27. COORDINATE POR-PROCESS

The average time BDA is busy with co-ordinating one POR is \*\*\* minutes. This average time is taken to keep the RIC simple.

#### 28. GIVE INPUT IN POR

To give input in the POR an average time is taken. However, in case of a weight change, the POR takes extra time. So the following logic underlies the extra use of activity:

IF “weight changes (8)” = yes,

THEN extra use is \*\*\* minutes,

ELSE: extra use is \*\*\* minutes

#### 29. MAKE LEGAL TEXT

The extra use is \*\*\* minutes = \*\*\* hrs.

#### 30. PROCESS CHANGE IN PLANNING SYSTEM

The average extra use is independent of the characteristics of the request and equals \*\*\* hrs per implementation.

#### 31. TOTAL IMPLEMENTATION COSTS

Add up the total costs of the activities 23 to 29.

---

### Update process (on-going costs)

Only small differences are seen between the extra use in the implementation process and update process. Only these differences are described in this section.

32. PROCESS ARTWORK

See: Process artwork (25)

33. MAKE SPECIFICATIONS (+ DO LINE TRIALS)

The time spend on making specs and doing line trials is represented in an average time consumption. If it concerns a legal text change, packaging development does not have any activities, but in case of a brandflag change, they have to do a lot of work. So, an average seems to be reasonable. The average number of hours packaging development is busy with an implementation or update is 6 hours.

34. COORDINATE PACKAGING CHANGES

See: coordinate packaging changes (27)

35. COORDINATE POR-PROCESS

See: coordinate POR-process (28)

36. GIVE INPUT IN POR

For the time consumption needed to give input in a POR, the average timing of \*\*\* minutes is used. In the update process, you have nothing to do with weight changes.

37. MAKE LEGAL TEXT

See: make legal text (30)

38. PROCESS CHANGE IN PLANNING SYSTEM

See: process change in planning system (31)

39. TOTAL COSTS PER UPDATE

Add up the total costs of the activities 33 to 39.

40. TOTAL UPDATE COSTS PER YEAR

To calculate the total update costs per year, the total costs per update (40) have to be multiplied by the number of updates per year (11).

*Formula 6.2.8: Total update costs per year*

Total costs = Total costs per update \* # updates per year

### Supply chain costs (on-going costs)

41. HANDLE IN PACKAGING MATERIAL

Every time an item is made – every production run – extra pallets packaging material are transported. At the end of a run, half pallets of packaging material need to be transported back to the warehouse. Next time, these pallets need to be called of again (figure 6.2.9). So, if there are three packaging levels, every time an item is produced, 3 extra pallets have to be transported from Hays to the factory. At the end of the run, there are – almost - always three half pallets left, which have to be transported back to the Hays warehouse and have to be handled in again.

Formula 6.2.9 represents this, but is only applied when the introduced item is an *extra* item. Furthermore, the pack type STO only has two packaging levels.

*Formula 6.2.9: Packaging material handling*

Extra use packaging material handling = # runs per period (14) \* # active periods (4) \* # packaging levels

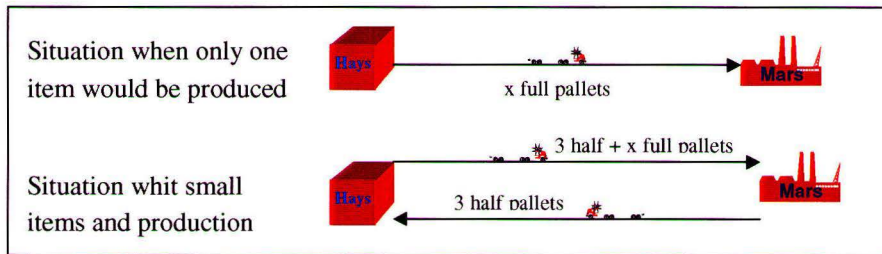


Figure 6.2.9: Packaging material handling

42. STORE WRAPPERS/SHOWBOXES

It was investigated if a relation could be seen in practice between the number of items and the height of the packaging stock. On the basis of the figures in table 6.2.9 is concluded that no direct relationship can be seen. You should expect a relation, but probably there are other factors that overrule the factor “extra item”.

Table 6.2.9: Relation # packaging items vs stock of packaging material

| Year | # active packaging items | Stock in pallets |
|------|--------------------------|------------------|
| 1998 | ***                      | ***              |
| 1999 | ***                      | ***              |
| 2000 | ***                      | ***              |
| 2001 | ***                      | ***              |
| 2002 | ***                      | ***              |

43. STORE CASES

See: 43. Store wrappers and showboxes.

44. HANDLE OUT PACKAGING MATERIAL

For handle out packaging material, the same applies as handling in the pallets (43). So, the same formula with the same condition can be used.

45. HANDLE PACKAGING MATERIAL FACTORY

These same extra pallet handling can also be seen within the packaging material handling in the factory. Since handle packaging material factory includes both bring pallets to the line and back to hal A again, the formula has to be adapted slightly. Formula 6.2.10 is however also only applicable if an *extra* item is introduced.

*Formula 6.2.10: Handle packaging material factory*

Extra use packaging material handling = # runs per period (14) \* # active periods (4) \* # packaging levels \* 2

46. PRODUCE BARS

It is very difficult to say what the effect is of a lower packaging speed on the process part. In general one can assume that the pack mix is planned in such a way that the process part does not have to reduce line speed as a result of a lower speed in packaging part. The planning does never contain a situation were e.g. all the 3-packs are made at the same time. This is not a realistic situation, also on the longer term.

During machine changeover it can happen that the process speed decreases. However, no unambiguous conclusions can be drawn with regard to this consequence. Some key operators indicate that if one machine has to be changed over, the process speed decreases already with 5



cuts per minute. Other key operators indicate that changing over one machine does not have any influence on the process speed, because machines 14 and 15 can take over this machine. However, if two or more machines are changed over at the same time, the process speed decreases. This is only the case with showboxes, because a multi-pack or STO item is often packed on one machine. Some further investigation is necessary concerning the decrease in line speed.

#### 47. PACK BARS AUTOMATICALLY

The extra use of resources is based on an average packaging speed (15). If the expected packaging speed differs from this average, extra costs have to be added or subtracted according to formula 6.2.11.

*Formula 6.2.11: Extra use pack bars automatically*

$$\text{Extra use of packaging machines} = \frac{\text{Expected volume (9) (tons)}}{\text{Average speed (15) (tons/hr)}} - \frac{\text{Expected volume (9) (tons)}}{\text{Expected speed (15a) (tons/hr)}}$$

Condition:

IF: 15a does not contain a value

THEN: extra use = 0

ELSE: extra use = formula 6.2.11

#### 48. CHANGE OVER PACKAGING MACHINES

Machine changeovers are only present, when an extra pack size is introduced. This is represented in the formulas below.

IF: New pack size (2) = yes

THEN: IF: Extra item (5) = yes

THEN: IF: 15a does not contain a value

THEN: formula 6.2.12, using 16

ELSE: formula 6.2.12, using 16a

ELSE: extra use = 0

ELSE: extra use = 0

*Formula 6.2.12: Change over time needed*

$$\text{Extra change-overs} = 4 / \text{MFI (13)} * \# \text{ active periods (4)} * \text{time per changeover (hrs) (15 or 15a)} * \# \text{ machines per changeover (17)}$$

#### 49. TRANSITION PACKAGING MACHINES

IF: New pack variant (1) = yes

THEN: IF: New pack size (2) = no

THEN: IF: Extra item (5) = yes

THEN: formula 6.2.13

ELSE: extra use = 0

ELSE: extra use = 0

ELSE: extra use = 0

*Formula 6.2.13: Extra transition time needed*

$$\text{Extra transitions} = 4 / \text{MFI (13)} * \# \text{ active periods (4)} * \text{time per transition (hrs) (17)} * \# \text{ machines per transition (19)}$$

50. PACK BARS MANUALLY

This is only applicable for certain items, like the king-size products. During all the production hours, an extra hand-packer is needed. The extra costs are calculated via formula 6.2.14. This number of hours is multiplied by 1,25 because one temporary associate cannot work 100% of the time. The associate needs 2 hours per shift to take breaks and personal care.

*Formula 6.2.14: # hrs needed to pack bars manually*

$$\text{Extra use packing bars manually} = \frac{\text{Expected volume (9) (tons)}}{\text{Expected speed (15) (tons/hr)}} * 1,25$$

51. PALLETISE CASES

For this activity extra costs are incurred when the number of tons per case is lower than the average number of tons per case for the pack group concerned, because in that case more cases have to be palletised which leads to a longer palletising time.

For MP's and SB's \*\*\* cases per minute can be palletised, while the STO palletiser has an average speed of \*\*\* cases per minute.

*Formula 6.2.15: Extra hours needed palletising area*

$$\text{Extra use of palletisers (hrs)} = \left( \frac{\text{Expected volume new item (9)}}{\text{Average tons per case (20)}} - \frac{\text{Expected volume new item (9)}}{\text{Expected tons per case new item (20a)}} \right) \cdot \text{Speed palletiser (22 or 22a)}$$

52. MAKE PALLETS READY FOR TRANSPORT

For this activity the same applies as for the packaging material handling. Every time an item is made, an extra half pallet of finished products is produced. So, the number of extra pallets as a result of small production runs is calculated via formula 6.2.16.

*Formula 6.2.16: Extra pallets finished product due to production runs*

$$\text{Extra use finished product handling} = ((4 / \text{MFI (13)}) * \# \text{ active periods (4)}) / 2$$

Another consequence of a new item can be that the number of kilos on a pallet is different than average. In that case formula 6.2.17 applies.

*Formula 6.2.17: Extra pallets finished product due to different average*

$$\text{Extra use of pallet handling} = \frac{\text{Expected volume (9) (tons)}}{\text{Average tons per pallet (21)}} - \frac{\text{Expected volume (9) (tons)}}{\text{Expected tons per pallet (21a)}}$$

Condition:

IF: 20a does not contain a value

THEN: IF: extra item = yes

THEN: extra use = formula 6.2.16

ELSE: extra use = 0

ELSE: IF: extra item = yes

THEN: extra use = formula 6.2.16 + formula 6.2.17

ELSE: extra use = formula 6.2.17

53. HANDLE IN FINISHED PRODUCT

For handling in the pallets finished product at the Hays warehouse, the same extra use applies as for handling out the pallets at the factory (53).

---

 STORE PALLETS FINISHED PRODUCT

## 54. STORAGE

## 55. CAPITAL

Two characteristics of the new request can have an influence on the finished products stock. It is investigated what the consequences of changing these characteristics are in practice.

1. In case of implementing an **extra item**, the forecast error is expected to increase according to theory. In practice, however, this effect is not visible. The production planning department at Masterfoods determines one forecast error per market and per product group. So, adding only one extra item in a product group will not have any effect on the stock of finished product in practice.

2. When the **MFI** and thus the cycle length deviates from the average filled in, some effects in the stock of finished products are seen.

- *Cycle stock*

This stock results from producing in production runs instead of one unit at a time. The amount of inventory on hand, at any point, that results from such production runs is called cycle stock. The amount of cycle stock on hand at any time depends directly on how frequently orders are placed [Silver, 1998]. The cycle stock is directly influenced by the cycle length. The average cycle stock is half of the cycle length as is seen in formula 6.2.18.

*Formula 6.2.18: Height of cycle stock [Silver, 1998]*

$$I_{\text{average}} = Q / 2 = (\text{MFI} * D_{\text{per week}}) / 2$$

Where:  $I_{\text{average}}$  = average stock height (in units)

$Q$  = replenishment order quantity

$\text{MFI}$  = Manufacturing Frequency Index (expresses in weeks)

$D_{\text{per week}}$  = expected demand (in units) per week

The difference in stock level compared to the stock level with the average MFI is indicated in formula 6.2.19.

*Formula 6.2.19: Expected cycle stock compared to average cycle stock*

$$\text{Difference in cycle stock as a result of deviation in MFI (in units)} = \frac{(\text{MFI}_{\text{expected}} - \text{MFI}_{\text{average}}) * D_{\text{per week}}}{2}$$

- *Safety stock*

Safety stock is the amount of stock kept on hand, on average, to allow for the uncertainty of demand and the uncertainty of supply in a certain period. The safety stock is influenced indirectly by the cycle length. The cycle time is the time between two successive production moments of the same product. When cycle time increases, the lead-time of the products gets longer and so the forecast horizon. In general, a longer forecast horizon gives a higher demand uncertainty and a higher process uncertainty. This has to be covered with a higher safety stock [Tijssen, 2002]. The safety stock is calculated within Masterfoods by the Target Minimum Stock (TMS) model. One of the variables that influences this TMS, is the cycle length. If there is no cycle, the part of the TMS that is caused by the cycle is negligible and the “base TMS” remains. If you keep all the other input variables constant, you can see in figure 8.2.10 what the influence of the cycle length is, In consultation with the production planning department the other variables are determined.

*Formula 6.2.20: Expected safety stock compared to average safety stock*

$$\text{Difference in safety stock as a result of deviation in MFI (in units)} = \frac{(\text{SS}_{\text{new item}} - \text{SS}_{\text{average}})}{5} * D_{\text{per week}}$$

\*The SS is expressed in days of demand. One week has 5 days in the TMS model. So the SS is transformed to weeks by dividing it by 5.

The total extra stock is the sum of the formulas 6.2.19 and 6.2.20.

#### STORAGE

The storage costs are expressed in a tariff per pallet per week. So, it has to be calculated how many pallets per week are stored extra or less.

*Formula 6.2.21: Storage space*

$$\text{Storage space needed} = \frac{\# \text{ extra units in stock (6.2.19 + 6.2.20)}}{\# \text{ units on one pallet}} * \# \text{ periods active} * 4$$

#### CAPITAL

The value of the products in stock has to be calculated and expressed in value per year, since the tariff is expressed in years.

*Formula 6.2.22: Capital in stock*

$$\text{Capital in stock} = \# \text{ extra units in stock (6.2.19 + 6.2.20)} * \text{factory gate costs per unit} * \frac{\# \text{ active periods}}{13}$$

For the factory gate costs an average for the products of the whole factory is taken within Masterfoods. This amount is € 2.200,- per ton finished product.

#### 56. HANDLE OUT PALLETS

See: 54. Handle in finished product

#### 57. ORDER PACKAGING MATERIAL

Every time an item is made, the department of supply services is involved. So, the extra use of the activity “order packaging material” equals formula 6.2.23.

*Formula 6.2.23: Order packaging material*

$$\text{Extra use order packaging material} = 4 / \text{MFI (13)} * \# \text{ active periods (4)}$$

#### 58. MAKE PRODUCTION PLANNING

See: order packaging material (58).

“Make production planning” has the same activity driver as “order packaging material”.

#### 59. MAKE DISTRIBUTION PLANNING

The activity “make distribution planning” depends on the number of freights they have to plan. A full freight contains 30 pallets. So, if you know the number of extra pallets, the extra use for this activity can be calculated. The extra use equals formula 6.2.17, the extra pallets as a result of less kilos on one pallet than average. The half pallets as a result of the production runs are not taken into account since distribution planning plans full pallets and Hays makes one full pallet out of two half pallets without interruption of the distribution planning department.

---

60. TOTAL SUPPLY CHAIN COSTS

The total supply chain costs are the sum of the activities 40 to 57 inclusive. For a permanent item these costs are indicated per year, while for a temporary item, they are indicated for the whole active period.

## Appendix 6.3 Determine time standards

For several activities in the supply chain and supporting departments, time spend on an activity is necessary to determine the costs of the activity. To determine these time standards a time study has to be done [Meyers and Stephens, 2000]. Only one time standard can be used for each job, even though individual differences of operators/associates cause different results. According to Meyers and Stephens [2000] a time standard can certainly be used to determine manufacturing costs and selling prices.

Meyers and Stephens distinguish five techniques for time standard development:

1. *Predetermined time standard systems.* This technique is only useful for highly repetitive tasks, which the activities that have to be investigated are not. Besides, using this technique requires special training, are time consuming to execute and costly to maintain according to Maberley [1998].
2. *Stopwatch time study.* This technique requires thorough preparations and the time must be measured several times. Besides the fact that this technique is culturally unacceptable in many instances, it is also not feasible for this situation. A lot of times the activity is not done at once but in several parts, because one has to wait e.g. for input from another party. Besides, it is difficult to see when the person is busy with the activity and when it ends.
3. *Work sampling.* This is a direct observation method. With this technique only the proportion of time spent on an activity in an organisation can be measured and not the time standard to execute one unit of activity [Maberley, 1998].
4. *Standard data.* These standard data are not available, so the technique cannot be used.
5. *Expert opinion standard and historical data.* An expert opinion time standard is an estimation of the time required to do a specific job. The disadvantage of expert opinion, however, is that it is not as accurate as statistical methods and you have to realize that the outcome may be affected by what the interviewee believes the interview should achieve. Because this is the most feasible method in this situation, the expert opinion on the basis of interviews is used for all the times named in this report, together with the historical data available concerning production planning.

### Time standards concerning the implementation process.

Every department involved in the implementation process, has been asked to give estimates for the time they spend on an activity. The following questions were asked:

- What is the time you spend on average on one unit of the activity (different for every department)?  
Or: how many hours (or percentage) are you busy with this activity per week?
- What is the time you spend on the activity dependent of?
- Are there differences in time needed between categories? If the answer is yes, indicate the differences.

When only one person from a department is busy with the implementation process, the timings this associate indicated, were used. Because “soft” interview data was used for determining costs, estimates were cross-checked to minimise errors wherever possible. So, if more persons execute the activity, a second or even third opinion was asked. It turned out that associates found it rather difficult to estimate a time standard. That is why sometimes the activities are more aggregated than planned. The detailed activity time standards would otherwise become unreliable.

The time standards are ordered per department, but the activities within these departments are also indicated.

### BUSINESS DATA ADMINISTRATION (BDA)

The department of BDA coordinates all the packaging changes. During an interview with the two associates, the timings in table 6.3.1 were estimated for different categories of introductions. For the

update process it was chosen to take an average timing, because some update activities requires \*\*\* and other \*\*\* minutes. It turned out, however, that the RIC would become very complicated, if a distinction had to be made between all the different activities in the implementation process. Then the department of IE had to fill in many fields more. So, it was decided to take an average for the implementation as well as the update process. This has been calculated via formula 6.3.1.

Table 6.3.1: Coordinate POR-process

| *** minutes (55%)                  | *** minutes (45%)             |
|------------------------------------|-------------------------------|
| - Legal text change                | - Instant win promotion       |
| - On-pack promotion                | - Brandflag change            |
| - Repeat promotion                 | - Multi-brand promotion       |
| - Roll-out to new market           | - New pack format             |
| - Re-sourcing existing pack format | - Re-sourcing new pack format |

Formula 6.3.1: Average time BDA

$$\text{Average time to coordinate POR-process} = 55\% * *** + 45\% * *** = *** \text{ minutes}$$

Time standard to “coordinate POR-process (28 + 36)” = \*\*\* minutes

#### QUALITY ASSURANCE

The department of Quality Assurance is an optional department in the POR-process and only has to give input in two situations:

- the weight of the package changes
- the best before date changes

The time spend in these two cases is given in table 6.3.2.

Table 6.3.2: Give input POR, Quality Assurance

|                         | Time needed (minutes) |
|-------------------------|-----------------------|
| Weight change           | ***                   |
| Best before date change | ***                   |

A best before date change is an update activity that only occasionally happens. The 30 minutes needed for this change could be taken into account in the time standard for giving input in the POR during the update process, but this would hardly have any influence. This time standard is thus not used anymore in this report.

#### GRAPHICS

The timings from Graphics are based on a lean project that has been done 2 years ago. Then, they exactly investigated how much time Graphics was busy with a packaging change. The precise split is not known anymore, but a file with the mean timings has been kept. The data from two years ago have been revised by different originators again. They added some complexity compared to two years ago and also took the late tracks into account. The following mean timings are the result:

Table 6.3.3: Coordinate packaging change

|                                     | Time (hrs) |
|-------------------------------------|------------|
| Text change                         | ***        |
| Simple change                       | ***        |
| Complex promotion                   | ***        |
| Complex promotion with inside print | ***        |
| Brandflag change                    | ***        |

The differences in timings are mainly caused by the differences in time needed to sort out things like judging the artwork, asking the converter for advice, giving advice to market, etc. The average timings for a pack change has been estimated by Graphics: \*\*\* hours.

The input Graphics has to give in the POR, takes only \*\*\* minutes and does not depend on the type of activity. Since the categories that Graphics uses for the different timings are not defined very well and IE experiences other introductions as complex as Graphics, the average timings are taken. IE cannot judge for Graphics whether the packaging change is complex or not, because IE is factory focussed. Besides for the update process the average time is a right estimate anyway because this contains text changes (\*\*\* hrs) as well as brandflag changes (\*\*\* hrs).

Time standard to “coordinate packaging change (27 + 35)” = \*\*\* hours  
 Time standard to “give input in POR (29 + 37)” = \*\*\* minutes

**PACKAGING DEVELOPMENT**

To give input in a POR, Packaging Development needs \*\*\* minutes to check the Bill of Material and change codes in some computer systems. Only in the following cases extra implementation time is needed to make the packaging specifications and do line trials if necessary:

*Table 6.3.4: Make specs and do line trials*

|  | <b>Time needed</b> | <b>Remarks</b>  |
|--|--------------------|---|
| Change of existing pack type           | ***                | Make specs, do line trials etc.   |
| Re-sourcing (new material or supplier) | ***                | A lot of unknown variables. The packages have to be extensively tested. |
| Brandflag change                       | ***                | Depends very much on the specific situation                             |
| Weight of the package changes          | ***                |   |

For the implementation process, the specific situations in table 6.3.4 can be included. For the update process, however, an average time needs to be estimated. Since a legal text change does not ask extra time from the department of Packaging Development and a brandflag change or re-sourcing asks a lot of time, an average timing is estimated on the basis of formula 6.3.2.

The formula is based on the following estimates:

Packaging development is \*\*\*% of the time busy with factory related activities.

From this \*\*\* %, \*\*\* % concerns item implementations.

Three persons are working full time at the department of Packaging Development, which means 47 weeks of 40 hours per year.

There are on average \*\*\* POR's per yea for the Veghel factory.

*Formula 6.3.2: Timing fill in POR Packaging Development*

$$\text{Average time /POR Packaging Development} = \frac{\text{\# hours available (per yr)}}{\text{\# POR's (per yr)}} = \text{*** hrs}$$

Time standard to “make specifications (+ do line trials) (26)” depends on specific situation  
 Time standard to “make specifications (+ do line trials) (3)” = \*\*\* hrs  
 Time standard to “give input in POR (29 + 37)” = \*\*\* minutes

**INDUSTRIAL ENGINEERING**

Industrial Engineering is mainly active during the development phase of item introductions. They have to give input in the Activity Recommendation. To fill in a normal POR takes only \*\*\* minutes.



Time standard to “give input in POR (29 + 37)” = \*\*\* minutes

#### BUYING

If all the information is available, which should be the case, a POR takes around \*\*\* minutes. In some cases, however, things have to be checked by the person concerned. In that case, filling in the POR costs around \*\*\* minutes. An estimation is that \*\*\* % of the POR’s is “difficult”, which means that the mean time for filling in a POR is calculated via formula 6.3.3.

*Formula 6.3.3: Timing fill in POR buying*

Average time to fill in POR Buying = \*\*\* minutes

No differences have been seen between categories. The chance that some things have to be checked is the same with a multi-brand promotion than for example with a new pack size.

Time standard to “give input in POR (29 + 37)” = \*\*\* minutes

#### SUPPLY SERVICES PACKAGING

The two associates from Supply Services Packaging indicated that an average POR takes around \*\*\* minutes. The only differences in POR timings result from the sort of suppliers that are going to deliver the new package. If it concerns integrated suppliers, it takes \*\*\* minutes more to fill in the POR, than with non-integrated suppliers. These differences are not taken into account, because they are so small.

Time standard to “give input in POR (29 + 37)” = \*\*\* minutes

#### SERVICE & FINANCE

Within Service & Finance two persons are involved in each POR. One person calculates the packaging costs and the other one processes the POR in the system and makes a complete cost price. This last activity takes around 15 minutes independent of the type of POR.

In the calculations of the packaging costs some differences have been seen.

Successors (updates): \*\*\* minutes

Completely new item (implementation): \*\*\* hours

Promotion (implementation): \*\*\* hours

This means that for the activity “Give input in POR (35)” in the update process, \*\*\* minutes are needed while this activity during the implementation process takes \*\*\* hours.

Time standard to “give input in POR (29)” = \*\*\* minutes

Time standard to “give input in POR (37)” = \*\*\* hours

#### LEGAL

During the first interview, the two associates from the Legal department indicated that 20% of their time they are busy with POR related things. The average time they are busy with one POR can then be calculated via formula 6.3.4.

*Formula 6.3.4: Timing make legal text*

Average time per POR =  $\frac{\text{\# hours available (per yr)}}{\text{\# POR's (per yr)}}$  = \*\*\* minutes

This time was checked again by asking them the average time they are busy with one POR. They indicated between \*\*\* and \*\*\* minutes with \*\*\* minutes for a simple POR and \*\*\* minutes for a new recipe or when Arabian languages have to be on the package. So, the \*\*\* minutes are a good estimate.

This average is used, because it is difficult to indicate exactly in which situation more time is needed. Besides, the differences are not so large (between \*\*\* and \*\*\* minutes. Furthermore, the \*\*\* POR's per year are an average based on the years 1999, 2000 and 2001.

Time standard to "Make legal text (30 + 38)" = \*\*\* minutes

**PRODUCTION PLANNING**

This department needs to process the POR in its system so that the codes can be planned. This takes around \*\*\* minutes and is independent of the type of change.

Time standard to "Process change in planning system (37 + 48)" = \*\*\* minutes

**TIMINGS TO "GIVE INPUT IN POR (29 + 37)"**

Because the RIC would become very complicated when all the departments that give input in the POR (activities 29 + 37) are included separately it is chosen to combine the timings from all the departments and take a weighted average for the costs. The results are seen in table 6.3.5.

*Table 6.3.5: Average times to give input in POR*

| Department             | Tariff / hr (euro's) | Timings implementation (minutes) | Tariff implementation (euro's) | Timings update process (minutes) | Tariff update process (euro's) |
|------------------------|----------------------|----------------------------------|--------------------------------|----------------------------------|--------------------------------|
| Quality assurance      | ***                  | ***                              | ***                            | ***                              | ***                            |
| Graphics               | ***                  | ***                              | ***                            | ***                              | ***                            |
| Packaging development  | ***                  | ***                              | ***                            | ***                              | ***                            |
| Industrial engineering | ***                  | ***                              | ***                            | ***                              | ***                            |
| Buying                 | ***                  | ***                              | ***                            | ***                              | ***                            |
| Supply services        | ***                  | ***                              | ***                            | ***                              | ***                            |
| Service & Finance      | ***                  | ***                              | ***                            | ***                              | ***                            |
| <b>Total</b>           |                      | ***                              | ***                            | ***                              | ***                            |

**Time standards supply chain**

Concerning the activities in the supply chain, only for changing over the packaging machines and the transition of packaging machines a time standard needs to be developed. Extra items in the factory means that extra changeover or transition time is needed every time the item is made.

A distinction has to be made between changeover and transition time.

- Changeover time: extra changeover time is only generated when a new pack size is introduced in the factory.
- Transition time: an extra pack variant results only in extra transition time. A transition means that the packaging material from the old item has to get out of the packaging machines and new materials have to be put into the machines. The case count of the items is the same.

Within these two categories a distinction is made between the real change-over or transition time and start-up time. This last time standard indicates how much time is needed after the changeover before the machine works on full speed again. During the start-up time, the machine has an average speed of 50% of the full speed. This estimation is discussed with the machine minders (associates that execute the actual changeover) involved. So, the total time is calculated according to formula 6.3.5.

*Formula 6.3.5: Total changeover time*

Total change-over time = real changeover time + 0,50 \* start-up time

The figures in this appendix are obtained by asking numerous key operators (managers of the line) and machine minders on line 3. After combining all this information, a document is generated with the changeover and transition times, that is cross-checked again by another key operator.

The changeover times between different bar sizes are not included in the research. Furthermore, the changeover times apply for Snickers®, Mars® and Snickers Cruncher®. The interviewees indicated that it often takes slightly more time to do a changeover in case of a Snickers Cruncher®, but this cannot be quantified. Besides, Snickers Cruncher is a relatively new product which means that they are still in a learning curve.

### Multi-packs

Table 6.3.6: Changeover times for multi-packs

| Change-over / transition                                      | First wrap | Second wrap | Second wrap (size) | Case | Case (size) | Change over time | Start-up time | Total time |
|---|------------|-------------|--------------------|------|-------------|------------------|---------------|------------|
| Other item, same casecount (transition)<br>(17X5 -> 17X5)     |            |             |                    |      |             | ***              | ***           | ***        |
| Other item, with other case size<br>(17X5 -> 24X5)            |            |             |                    |      |             | ***              | ***           | ***        |
| Other item with totally different casecount<br>(17X5 -> 24X6) |            |             |                    |      |             | ***              | ***           | ***        |

### Showboxes

Table 6.3.7: Changeover times for showboxes

| Change-over / transition                                       | First wrap | Showbox | Showbox (size) | Case | Case (size) | Change-over time | Start-up time | Total time |
|--|------------|---------|----------------|------|-------------|------------------|---------------|------------|
| Other item, same casecount (transition)<br>(8X36 -> 8X36)      |            |         |                |      |             | ***              | ***           | ***        |
| Other item with other case size<br>(8X36 -> 6X36)              |            |         |                |      |             | ***              | ***           | ***        |
| Other item with totally different casecount<br>(8X36 -> 12X24) |            |         |                |      |             | ***              | ***           | ***        |

### Single Traded Outer (STO)

Table 6.3.8: Changeover times for STO's

| Chang-over / transition                                   | First wrap | Case | Case (size) | Change-over time                      | Start-up time | Total time |
|---|------------|------|-------------|---------------------------------------|---------------|------------|
| Other item, same casecount (transition)<br>(1X36 -> 1X36) |            |      |             | ***                                   | ***           | ***        |
| Other item with other case size<br>(1X36 -> 1X24)         |            |      |             | Only exists between different recipes |               |            |

TRANSITION PACKAGING MACHINES

The transition time is the same for all the pack types. So, no distinction has to be made.

Time standard for the activity “Transition packaging machines (48)” = \*\*\*minutes

CHANGE OVER PACKAGING MACHINES

**Multi-packs**

The timings for a changeover depend on the type of changeover. To calculate an average time needed for changeovers, it is measured how many times the different types of changeovers occur.

From the \*\*\* changeovers measured in the weeks P4W4 – P7W1, \*\*\* were change overs to another case size. The other \*\*\* changeovers concerned an item with a totally different case count.

The weighted average time needed for a changeover equals formula 6.3.6.

*Formula 6.3.6: Average time per changeover MP's*

Average time per changeover = \*\*\* minutes

**Showboxes**

For the showboxes, the case-packer which is located in hal A is always the bottle-neck (see table 6.3.7).

This change over always takes more time than the change over of the showbox fill machines on line 3.

For every change over the case fillers in hal A have to be changed over, which takes around \*\*\* minutes (\*\* hours).

**STO**

At this moment no different pack sizes from the STO's exist within one recipe. If an extra pack size will be introduced, the key operators and machine minders expect that this will take as much time as changing over the showbox fill machine on line 3. This takes around \*\*\* minutes.

Time standard to “change-over packaging machines (multi-pack)” = \*\*\* minutes

Time standard to “change-over packaging machines (showboxes)” = \*\*\* minutes

Time standard to “change-over packaging machines (STO)” = \*\*\* minutes

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## Appendix 6.4 Sensitivity analysis

For all the input data and tariffs in the RIC a sensitivity analysis has been done. This appendix contained the results for the sensitivity analysis with the following assumptions.

Assumptions:

- Multi-pack
- New pack size (For the sensitivity analysis of “transition time” and “# machines per transition” this variable is changed to “new pack variant”)
- Permanent item
- Extra Snickers item
- Expected volume: 500 tons

The most influential tariffs are those that are high or where the extra use made of the corresponding activity is high. The activity “pack bars manually” for example has a very high amount of extra use made of the activity and is the corresponding tariff is thus influential. Furthermore, the tariff for pack bars automatically, change over packaging machines and transition of the packaging machines is influential because this tariff is used for several activities.

## Appendix 7.1 Maintenance process

Table 7.1: Update process

| Field in RIC                                     | Data source (associates / file) <sup>1</sup>   |  | Maintenance <sup>2</sup>  |
|--|--|--|---|
| <b>Average input data supply chain</b>           |  |  |   |
| Manufacturing Frequency Index                    | Sales & OP info coordinator<br><i>MFI datafile</i>   |  | Fill in actual MFI  |
| Bars / minute packaging machines                 | Local Industrial Engineer<br><i>SOC per machine per item</i>                                 |  | Calculate weighted average  |
| Changeover time                                  | Key operators packaging / machine minders  |  | Verify if timings are still up-to-date                              |
| Transition time                                  | Key operators packaging / machine minders  |  | Verify if timings are still up-to-date                              |
| # machines per changeover                        | Key operators packaging<br><i>MAPP production schedule</i>                                   |  | Verify if number of machines is still up-to-date.                   |
| # machines per transition                        | Key operators packaging<br><i>MAPP production schedule</i>                                   |  | Verify if number of machines is still up-to-date.                   |
| Kg / case  | Local IE<br><i>BR plans in cases</i>   |  | Calculate weighted average  |
| Kg / pallet                                      | Local IE<br><i>BR plans in pallets</i>   |  | Calculate weighted average  |
| <b>Average input data implementation process</b> |  |  |   |
| # updates per year                               | # STD POR's: <i>POR-database</i><br># STD items: <i>BR plans</i> (Local Industrial Engineer) |  | Verify if number is still up-to-date with European Graphics Manager |
| # packaging changes per implementation           | European Graphics Manager (# pack changes)<br><i>POR-database (# POR's)</i>                  |  | Calculate # pack changes per implementation                         |
| <b>Implementation process + update process</b>   |  |  |   |
| Process artwork                                  | Tariff <sup>3</sup>  | Packaging Graphics Coordinator   | Calculate tariff  |
|  | Use  | See: # pack changes per implementation   |   |
| Make specs + do line trials                      | Tariff   | Labour: Financial Account Manager<br>Expenses: <i>Profit &amp; Loss</i><br>Energy: Milieu Coordinator<br>Depreciation: Project Control & Asset Analyst   | Calculate tariff  |
|  | Use  | Packaging Development Technologist   | Verify if time standards are still up-to-date                       |
| Coordinate packaging change                      | Tariff   | See: make specs + do line trials   | Calculate tariff  |
|  | Use  | Packaging Graphics Originator<br>Packaging Graphics Technician   | Verify if time standards are still up-to-date                       |
| Coordinate POR-process                           | Tariff   | See: make specs + do line trials   | Calculate tariff  |
|  | Use  | POR-coordinator  | Verify if time standards are still up-to-date                       |
| Give input in POR                                | Tariff   | See: make specs + do line trials   | Calculate tariff  |
|  | Use  | Quality Assurance Technician (R&D)<br>Packaging Graphics Coordinator (SDD)<br>Packaging development Technologist (SDD)<br>Local Industrial Engineer (IE)<br>Packaging activity Coordinator (SDD) | Verify if time standards are still up-to-date                       |

|                                   |        |   |   |
|-----------------------------------|--------|---|---|
|                                   |        | Supply Services Coordinator (LOG)<br>Standard packs & TP analyst (S&F)<br>Supply finance analyst (S&F)  |   |
| Make legal text                   | Tariff | See: make specs + do line trials  | Calculate tariff                              |
|                                   | Use    | Legal Text Coordinator (R&D)  | Verify if time standards are still up-to-date |
| Process change in planning system | Tariff | See: make specs + do line trials  | Calculate tariff                              |
|                                   | Use    | Production Planning Coordinator (LOG)   | Verify if time standards are still up-to-date |
| <b>Supply chain</b>               |        |   |   |
| Handle in packaging material      | Tariff | <i>Invoices Hays Logistics</i>  | Fill in up-to-date tariff                     |
|                                   | Use    | Local Industrial Engineer   | Check assumptions & formula                   |
| Storage wrappers                  | Tariff | <i>Invoices Hays Logistics</i>  | Fill in up-to-date tariff                     |
|                                   | Use    | Local Application Support Analyst   | Check assumptions & formula                   |
| Storage cases                     | Tariff | <i>Invoices Hays Logistics</i>  | Fill in up-to-date tariff                     |
|                                   | Use    | Local Application Support Analyst   | Check assumptions & formula                   |
| Handle out packaging material     | Tariff | <i>Invoices Hays Logistics</i>  | Fill in up-to-date tariff                     |
|                                   | Use    | Local Industrial Engineer   | Check assumptions & formula                   |
| Handle packaging material factory | Tariff | Labour costs: Supply Finance Analyst  | Calculate tariff                              |
|                                   | Use    | Material suppliers from all the lines   | Verify if time standards are still up-to-date |
| Produce bars                      | Tariff | Labour costs: Supply Finance Analyst<br>Depreciation: Project Control & Asset Analyst, System Designer<br>Engineering Services.<br>Energy: Milieu coordinator<br>Maintenance: Reliability Manager | Calculate tariff                              |
|                                   | Use    | Key operators<br>Local Industrial Engineer  | Verify if assumption are still up-to-date     |
| Pack bars automatically           | Tariff | See: produce bars   | Calculate tariff                              |
|                                   | Use    | Depends on input data   | Check assumptions & formula                   |
| Change-over packaging machines    | Tariff | Tariff is the same as “pack bars automatically”   | Fill in tariff                                |
|                                   | Use    |   |   |
| Transition packaging machines     | Tariff | Tariff is the same as “pack bars automatically”   | Fill in tariff                                |
|                                   | Use    | Depends on input data   | Check assumptions & formula                   |
| Pack bars manually                | Tariff | Labour costs: Supply Finance Analyst  | Calculate tariff                              |
|                                   | Use    | Depends on input data   | Check assumptions & formula                   |
| Palletise cases                   | Tariff | See: produce bars   | Calculate tariff                              |
|                                   | Use    | Depends on input data   | Check assumptions & formula                   |
| Make pallets ready for transport  | Tariff | See: produce bars   | Calculate tariff                              |
|                                   | Use    | Depends on input data   | Check assumptions & formula                   |

|                             |        |   |                  |
|-----------------------------|--------|---|------------------|
| Handle in finished products | Tariff | <i>Invoices Hays Logistics</i>  | Fill in tariff   |
|                             | Use    | Depends on input data   | Check formula    |
| Store pallets               | Tariff | <i>Invoices Hays Logistics</i>  | Fill in tariff   |
|                             | Use    | Depends on input data<br><i>Target Minimum Stock formula</i>  | Check formula    |
| Handling out pallets        | Tariff | <i>Invoices Hays Logistics</i>  | Fill in tariff   |
|                             | Use    | Depends on input data   | Check formula    |
| Order packaging material    | Tariff | # appearances: <i>MFI-datafile</i><br>Time standard: Supply Services<br>Coordinator<br>Costs: “make specs + do line trials”   | Calculate tariff |
|                             | Use    | Depends on input data   | Check formula    |
| Make production planning    | Tariff | # appearances: <i>MFI-datafile</i><br>Time standard: Production Planning<br>Coordinator<br>Costs: “make specs + do line trials”                                     | Calculate tariff |
|                             | Use    | Depends on input data   | Check formula    |
| Make distribution planning  | Tariff | # pallets: <i>BR plans in pallets</i> (Local<br>Industrial Engineer)<br>Time standard: Physical Distribution<br>Coordinator<br>Costs: “make specs + do line trials” | Calculate tariff |
|                             | Use    | Depends on input data   | Check formula    |

- 1 “Data source” indicates where the local Industrial Engineers can get the information. A distinction is made between associates and files that can be used.
- 2 “Maintenance” indicates what has to be done with the input field.
- 3 “Tariff” does not indicate how the tariff should be calculated, but where the information to calculate the tariff can be collected.