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Salesplan reliability project

Philips Consumer Electronics Accessories & Batteries Europe

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Salesplan Reliability Project

Philips Consumer Electronics
Accessories & Batteries Europe

Final thesis report

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Amsterdam, November 2001

Preface

This report describes the methods and results of a project that was carried out at Philips Accessories Europe. The assignment was used as a final thesis project in the Industrial Engineering and Management Science programme.

Philips Accessories Europe was facing problems with stock levels as well as customer service levels and suspected that these problems were among others caused by inaccurate salesplans. The project that is described in this report gives insight into the accuracy of the salesplans and investigates possibilities for improving this accuracy.

This report is written for two purposes. The first purpose is to inform Philips Accessories Europe about the results of the project and about the recommendations for solving the central problems of the project. The second purpose of the report is to inform the members of the committee about the methods used, the chosen solutions and the (suggested) implementation of these solutions.

Throughout the project two employees within Philips assisted me. Firstly Hans van Saaze who is a very experienced logistics manager, and secondly Erik Raphael, the senior marketing manager of Accessories Europe. Erik has been a great support in this project for several reasons. The main reason is that I was always allowed to use all of his scarce human resources, an offer I have used extensively. The list of persons who have been supportive for this project is too long to print in this preface. There is however one person who I should mention here and that is Jasper Hijink who helped me creating a structural way towards the project goal.

From the beginning of the project Mr. Schaart was involved with the project on behalf of the Eindhoven University of Technology. Mr. Schaart helped me to keep me on the right track and his frequent requests for an update were very motivating. In the second phase of the project Dr. Ir. Van Winkel joined the committee. He has a lot of experience in this field of study and I found my discussions with him very useful.

To avoid that confidential information is made public some figures show graphs of which the vertical axes are kept blank. In this instance, the vertical axis is equal to zero where it crosses the horizontal axis.

Casper Scheffer
Amsterdam, November 2001

Abstract

This report is the result of a project, in which the possibilities for improving the accuracy of the salesplans for Philips Accessories in Europe were investigated. The project was divided in two phases. In the first phase the current situation and the requirements for more accurate salesplans were defined. In the second phase a forecasting and measurement tool were designed and developed.

Summary

This report describes a project, in which the accuracy and the possibilities for improving the accuracy of the salesplans for Philips accessories and batteries in Europe were investigated.

Philips Accessories Europe is part of the Philips Business Creation Unit (BCU) Accessories and Recordable Media, which is a BCU of Philips Electronics. Accessories Europe is responsible for sales, marketing, logistics, loss and profitability of Philips accessories and batteries in Europe. The products are sold by National Sales Organisations (NSO's) to customers like hypermarkets, buying groups and wholesalers. The NSO's are responsible for sales, marketing, logistics and pricing for Philips accessories and batteries in a sub-region within Europe. This sub-region can contain one or more countries.

The products sold by Accessories Europe can be divided into four Main Article Groups (MAG's): Sound, Vision, Baby Care and Batteries. The products are produced by third parties that are situated in Europe and Asia. Production takes place in batches. The total of the ordering, production and supply lead-times differs from two weeks to five months. The lead-times can differ per product. Since these lead-times are longer than the period that customers are willing to wait for delivery, the products are made to stock.

How many products are produced depends on salesplans that are made by the NSO's. The NSO's are not automatically the stockowner of the goods they planned to sell. In most cases the products are delivered from the suppliers to the European distribution centre (EDC) where central stock is kept. The local distribution centres (LDC's) that are controlled by the NSO's are replenished by the EDC. As long as the goods are in the EDC, Accessories Europe is financially responsible for the stocks.

Due to several reasons Accessories Europe experiences problems with some logistical performances. In April 2001 an improvement project started that was used as a major thesis project in the Industrial Engineering and Management Science programme. The central problems in this project are lost sales and excess and obsolete stocks.

The size of the lost sales is very difficult to measure and there are no figures known about this size. In contradiction to the lost sales, the obsolete and excess stocks can be measured easily. Accessories Europe handles the following definitions for obsolete and excess stocks.

Stock of a certain product in the EDC is defined as obsolete in case:
1. for this product there are no salesplans anymore;
2. for this product there are salesplans, but there is already a successor product in the EDC available;
3. production of this product has been stopped.

The definition of excess stock per product is expressed in a formula:

Em = C-S-N

where

C = Current stock level expressed in months future sales
S = Supply lead-time expressed in months
N = Norm stock expressed in months of future sales
Em = Excess stock expressed in months future sales.

These definitions are made in September 2001 when the value of these stocks was almost twice as high as the target. This target fluctuates over the months since it is a percentage of the stock budget in the current month. This stock budget is based on the planned turnover in a month.

The project started with interviews with those whom the project involves. The main goals of these interviews were to make an inventory of the several opinions about possible causes to the central problems and to learn more about the current way of working. Soon it was clear that there are many causes for the central problems. In consultation with Accessories Europe the decision was made that this project would concentrate at the accuracy, or reliability as it is called within Philips, of the salesplans and the measurement of this reliability.

The goal of this project is defined as:

To improve salesplan reliability in order to improve customer service level and to reduce excess and obsolete stocks.

The deliverables are:

A measurement tool to understand the reliabilities of the salesplans, to recognise best practices and to use it as a basis for continuous improvement actions.

A forecasting tool that will be used by the NSO's in order to compose salesplans that will be a better reflection of actual future sales. This should result in a higher customer service level and less excess and obsolete stocks.

The choice for these deliverables is in line with the forecasting system suggested by Silver and Peterson (1985). When the project started two elements were missing in the forecasting system of Accessories Europe; a measurement tool and a forecasting tool.

There was decided to measure the salesplan reliability in two ways. The first way is to measure the mean percentage error (MPE). The goal of this measurement is to gain information about the structure of forecasting errors. This information can lead to indicating NSO's that are structurally planning to high or to low on certain products or product groups. The second way of measuring is the average absolute salesplan reliability in terms of percentage. This measurement gives information about the average salesplan reliability regardless of the question whether the plan was to high or to low. Both methods can be used on any aggregation level like per NSO or per MAG and will be used to measure the performances per month.

The measurements are done on a monthly basis now. The results confirm the assumption that the central problems are among others caused by the inaccuracy of the salesplans. In September 2001 a project group was formed. The goal of this group is to improve the sales planning process, resulting in higher salesplan reliability. The leader of this group has got the responsibility for performing the measurements and the distribution of the results. This distribution is necessary in order to get the maximum

support of the tool. The results can be used as management information as well as a support in decision making in the planning process.

The forecasting tool should propose salesplans that can be used to support the sales planning process. Several requirements are set to this tool. Some of these requirements are that it is cheap, simple and fast. Besides these requirements, the tool must also be able to handle the demand patterns of the products. After an inventory has been made of forecasting methods there has been chosen to use the Winters Exponential Smoothing Procedure for a Seasonal Model. This procedure extrapolates time series to predict future demand. The procedure is capable of handling trends as well as seasonal patterns.

The first results of the forecasting tool, which was developed in this project, confirm that the tool can add value to the planning process. The project group mentioned before has taken over the responsibility for the implementation of the tool. Plans for the implementation as well as guidelines for usage and maintenance of the tools are developed in this project and are handed over to the project group. Since the subject is found complex, a good explanation of the possibilities of the tools is a critical success factor. Another critical success factor is the motivation of the makers of the plans. As long as they are not held responsible for the problems caused by inaccurate plans, it will be very difficult to motivate them to do their utmost to create accurate plans.

Table of Contents

1 Introduction

In the world of consumer electronics, supply chain management plays a very important role. As the production is concentrated in a few plants located all over the world, lead-times to the (in this case European) markets can be substantial and unreliable. The relatively low margins cause the need to control the costs, by enlarging the production batches and reducing the inventory levels. On the other end, customer satisfaction might be even more important, as out-of-stock situations in the European markets have a direct impact on the sales. In situation like this, there is a clear need to havean accurate estimation of future demand.

The project that is described in this report was a step towards this accurate estimation. In the project the approach that is described by Kempen and Keizer (1996) has been followed. They state that the major thesis project of a student can be seen as an advice project where the company is considered as the client and the student as the advisor. The described approach consists of three phases:

- the orientation phase,
- the research and solution phase,
- and the implementation phase.

Orientation
The first phase is described in chapter 2, 3, 4 and 5. In chapter 2 the problem description is defined. In chapter 3 the organisation, the products, markets and demand patterns are described. In chapter 4 the production, business and planning processes are described. In chapter 5 the project description and the projects scope are defined. The project is defined through a project goal and two deliverables, which are two tools. This phase was rounded off by a presentation where the project definition was fixed.

Research and solution
The second phase started with a plan of approach for the rest of the project. This plan is described in chapter 6. Then the research phase started. In this phase, that is described in chapter 7 the requirements for the two deliverables were listed. The solution phase that is described in chapter 8 consisted of selecting methods that met the requirements best. The research and solution phase was rounded off by a presentation where the proposed methods were explained and fixed.

Implementation
Since the subjects of projects that are used as a major thesis project can differ a lot, Kempen and Keizer did not describe the implementation phase in great detail. In this project much effort was put in this phase. It started with collecting the available data. Then the architecture of the database was designed. After the database was filled the tools were tested. This process is described in chapter 9. After the tools were tested an implementation plan was made. Part of this plan was carried out in the project. The plan and the execution so far are described in chapter 10. The report is closed in chapter 11 where the conclusions and recommendations are discussed.

2 Problem Description

In this chapter the central problems of the project, which is described in this report, are defined.

Philips Accessories Europe experiences problems with some logistical performances. Central problems in this project are **lost sales and excess and obsolete stocks.**

The size of the lost sales is very difficult to measure and there are no figures known about this size. In contradiction to the lost sales, the obsolete and excess stocks can be measured easily. Accessories Europe handles the following definitions[1] for obsolete and excess stocks.

Stock of a certain product in the European Distribution Centre (EDC) is defined as obsolete in case:

1 for this product there are no salesplans anymore;
2 or for this product there are salesplans, but there is already a successor product in the EDC available;
3 or production of this product has been stopped.

The definition of excess stock per product is expressed in a formula:

Em = C-S-N

where

C = Current stock level expressed in months future sales
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Em = Excess stock expressed in months future sales.

These definitions are made in September 2001 when the value of these stocks was almost twice as high as the target. This target fluctuates over the months since it is a percentage of the stock budget in the current month. This stock budget is based on the planned turnover in a month.

[1] Source: Progress report of 'Control of Excess and Obsolete stock'-project.

3 Philips Accessories Europe Organisation

In this chapter the organisation where the project took place, is introduced to the reader. In the first part of this chapter the organisation of Royal Philips Electronics will be described. In the second part the products that Accessories Europe sells will be briefly discussed as well as the markets where the products are sold. The third part describes the demand patterns of the products.

3.1 Royal Philips Electronics

Royal Philips Electronics is one of the world's biggest electronics companies and the largest in Europe. It was established in 1891 as a factory for lamps and other electrical products and today has 200,000 employees active in more than 60 countries. The headquarters is located in Amsterdam, the Netherlands.

Philips consists of the following 6 product divisions:
- Philips Components
- Philips Domestic Appliances and Personal Care
- Philips Lighting
- Philips Medical Systems
- Philips Semiconductors
- Philips Consumer Electronics

Philips Accessories Europe is part of Philips Consumer Electronics (CE), which will be described briefly in the next section.

3.1.1 Philips Consumer Electronics

Philips CE is one of the world's top three consumer electronics companies, with a product portfolio designed to offer people the benefits of new digital technologies whether they are at home, at work or on the move[1].

The product division can be divided into the following 7 Business Creation Units (BCU's):
- BCU TV
- BCU Audio
- BCU Video
- BCU Monitors
- BCU Disc Systems
- BCU DVD and RW
- BCU Accessories and Recordable Media

3.1.2 Philips Accessories and Recordable Media

BCU Accessories and Recordable Media employs about 500 people and can be divided in a global BCU and four geographical regions. The BCU is situated in Eindhoven and Hong Kong. The BCU is responsible for product management, quality management, strategy, purchasing, logistics and finances. The products produced and sold by the BCU can by divided into five groups, which are called lines of business (LoB). These LoB's are: Sound, Vision, Baby Care, Batteries and Recordable Media. The last group has a different business model than the other groups and is not managed by

[1] Source: Philips Consumer Electronics Intranet

Accessories Europe anymore[1]. Therefore Recordable Media will not be handled in this report. Nor are these products included when Accessories Europe is mentioned in this report.

The four regions are Europe, Asian Pacific, Latin America and Northern America. Accessories Europe consists of marketing managers, logistics managers, a marketing communication manager and financial controllers. They are the contact persons for the National Sales Organisations (NSO's) in their region. Figure 3.1 shows the organisation chart of the BCU[2].

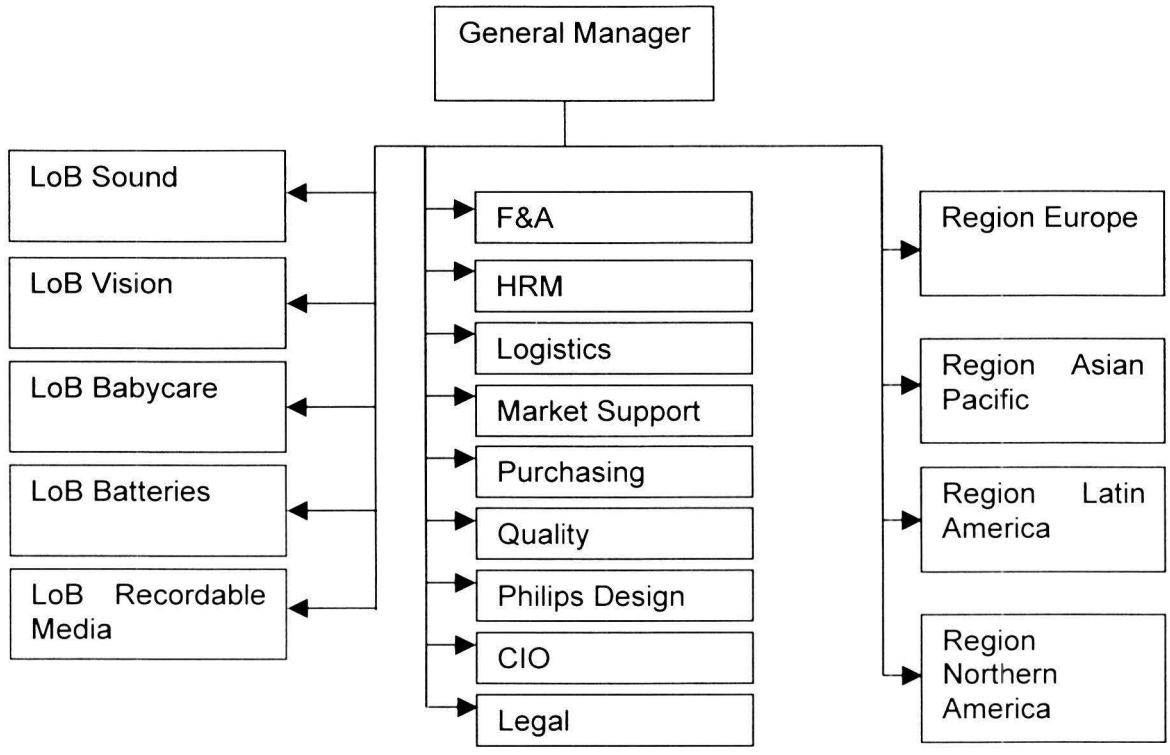


Figure 3.1 Organisation chart of Philips Accessories and Recordable Media

This project was carried out in Region Europe, which in this report is also referred to as the Region.

3.1.3 National Sales Organisations

Each region consists of several NSO's. A NSO is responsible for sales, marketing, logistics and pricing for all consumer electronics in a geographical sub-region. This sub-region can contain one or more countries. In some NSO's there are employees who are only dedicated to Accessories. In the others they are also dedicated to one or more other BCU's.

3.2 Products and Market

As mentioned above, the products made by Accessories that are handled in this report can be divided into four groups: Sound, Vision, Baby Care and Batteries. These groups

[1] Source: Interview with Mr. Patti, Logistics Manager Accessories Europe
[2] Source: Presentation by Mr. Bosscher, Marketing Manager Batteries Europe

are called Main Article Groups (MAG's). Each MAG can be divided into several Article Groups (AG's) that contain several products. In this section these MAG's will be described.

3.2.1 Sound

Sound products represent 32% of the total planned turnover for 2002[1]. Headphones, microphones and mini loudspeakers fall under this product range. There are three AG's for headphones. These are cordless headphones, hi-fi headphones and small headphones like in-ear and sports headphones. The microphones can be used for karaoke or studio recording for example. The loudspeakers are small speakers and some of them are cordless.

3.2.2 Vision

Vision products represent 22% of the total planned turnover for 2002. The products can be divided in (universal) remote controls (URC's), cleaning products, TV/video supports, cordless links and small antennas. The remote controls can either operate only Philips products or almost every brand. Also in functionality a split up can be made. Some only operate a television, others are also capable to operate other electronically products from VCR to sunblinds. Cordless links transfer video and audio signals from any video device, for example a DVD player, to any TV.

3.2.3 Baby Care

Baby care products represent 15% of the total planned turnover for 2002. The products consider baby monitors, baby lights and baby personal care products. Baby monitors enable communication between young children and the child's parents when they are in another room for example. Baby personal care products are bottle warmers, thermometers, and bottle sterilisers for example.

3.2.4 Batteries

In June 2001 batteries became part of the product range of Accessories Europe. Batteries represent 31% of the planned turnover for 2002. Before June 2001, BU Batteries was an independent BU within Philips Lighting. The products can be divided in displays, minicells, torches and alkaline, zinc carbon and re-chargeable batteries. Minicells are small flat batteries that are among others used in cameras and watches. Zinc carbon batteries can be used for low energy consumption like remote controls and radios. Alkaline batteries can be used for high energy consumption like remote controlled cars. These four types of batteries are sold in different sizes (like AA or AAA), voltages and quantities per package. The torches can be divided in several types like pocket sized torches and lanterns. The displays that are sold differ in size and material. The displays are used in stores to promote batteries' sales. The displays are sold either empty or filled with batteries.

3.2.5 Market

Philips Accessories is making most of their turnover in Europe. Market shares differ per group and per NSO. Figure 3.2 shows market shares on value for URC's in France.

[1] Source: Ms. Moog, Financial Controller Accessories Europe

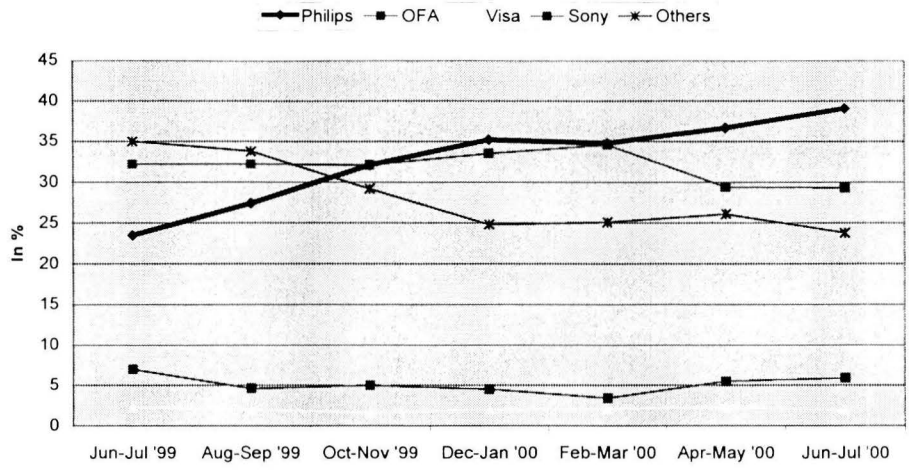


Figure 3.2 Market shares of URC's on value in Germany (Source: GfK Marketing Services)

The Consumer Electronics market can be described as deal driven and highly price competitive. Large players in this market are competing through low prices, product developments and customer services. Many deals that are made in this market consider a lead-time that is shorter than the production lead-time. The products are sold in the following outlets: high street chains, buying groups, independent retailers, wholesalers, distributors, department stores, Do It Yourself shops and hypermarkets. This is different for each NSO and product group. For example products like babymonitors are mainly sold in specialised stores (e.g. Prenatal).

Not all products are sold by all NSO's. This can be a result of marketing decisions or for technological reasons like country specific plugs or the allowed bandwidth of frequencies used for cordless data transfer. Another reason for not selling a product in a certain sub-region are profitability reasons.

3.3 Demand Patterns

The NSO's only have limited information about real selling out. The Region considers sales to the NSO's customers as real demand. When products are returned the amounts of returned goods are subtracted from the actual sales.

3.3.1 Seasonal Effects

Seasonal effects describe the phenomenon that the demand is not equally spread over the year but concentrates more on certain periods. A requirement is that this pattern repeats itself in several years (Van Winkel, 1970).

Seasonal effects also influence demand patterns of accessories. The impact and pattern differ per product and per NSO. Figure 3.2a gives an impression of how sales are divided over the year. The totals are measured on turnover and consider sales of sound, vision and baby care products[1]. Sales are products sold to the customers mentioned in section 3.2.5. The figures are not corrected for inflation.

[1] Sources: results 2000 and EPT act2000 blocked

In figure 3.3a three sharp peaks can be seen in the total sales for 1999, which take place in March, June and September. Two causes can be found for these peaks:

- Bonuses are given on a quarterly basis so sales people are pushing sales more in these months.
- These months consist of 5 weeks according to the Philips calendar.

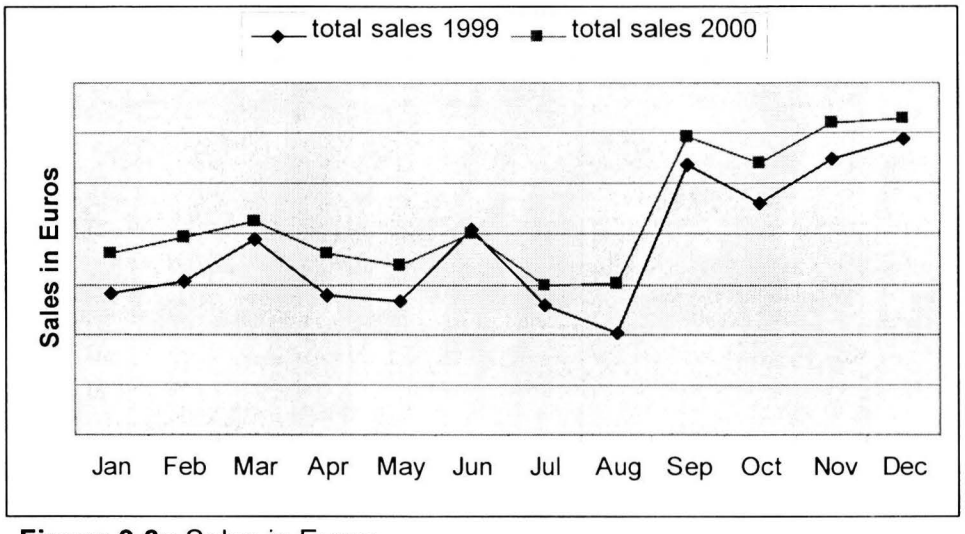


Figure 3.3a Sales in Euros

When sales for all 5-week months are divided by 1.25, they can be considered as a normal month. Figure 3.3b reflects this corrected situation. As can be seen a much less freakish pattern appears. In this project, this correction shall not take place for two reasons. First reason is that the bonus system is not about to change and therefore there is no reason to expect the effect will change. The second reason for not correcting the sales is that normally every year the same months will contain a week more than the others. From January 2003 onwards the weekly rhythm in a quarter will be adjusted from 4-4-5 to 5-4-4. This adjustment is made only once[1].

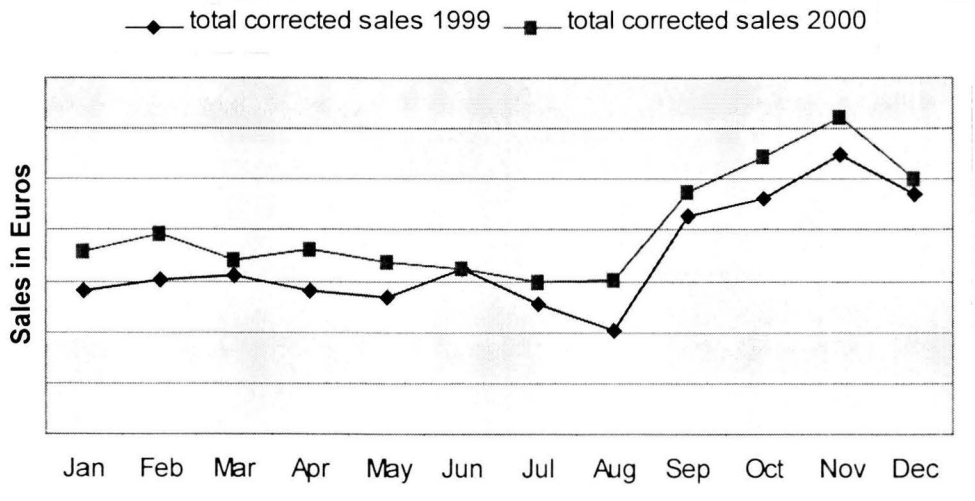


Figure 3.3b Corrected sales in Euros

[1] Source: http://pww.center.corp.philips.com/corpctrl.home.nsf

3.3.2 Trends and Cycles

Trends differ per NSO and per product. Two types of trends can be distinguished, the ones that are the result of an increasing or decreasing market and the ones that are the result of changes in market shares. In forecasting future trends both can play a role. Economic cycles also can have influence on sales. Fluctuations in the market for consumer electronics (like accessories, ed.) are highly dependent on macro-economic cycles[1].

3.3.3 Promotions and Deals

Many products that are sold by Accessories Europe are used in deals and promotions. These events can have an enormous impact on sales as can be seen in figure 3.4. The figure represents the sales of a full size headphone by the Swiss NSO in the year 2000.

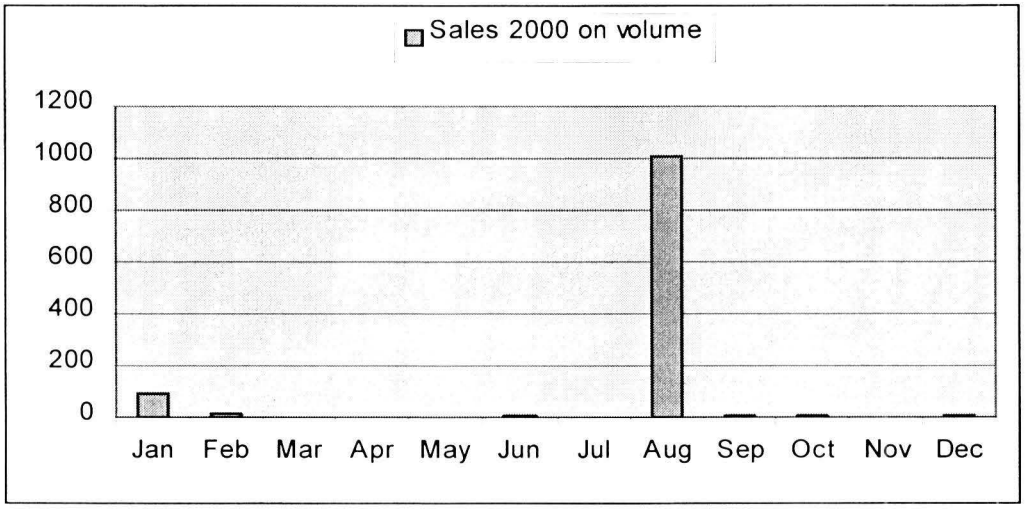


Figure 3.4 Impact of deals

The frequency and impact of the deals and promotions differ per product and per NSO. Many deals are made within the fixed period of the products. This influences salesplan reliability in various ways. For example, unexpected deals will result in under planning. The possibility exists that there are not enough safety stocks to arrange such deals. In order to avoid these lost deals, NSO's may anticipate on deals and order more products. When a anticipated deal does not take place, too many products are ordered.

3.3.4 Phasing-in / -out

The average life cycle of the products sold by Accessories Europe is no longer than 2 or 3 years. Usually the products are replaced by an upgraded version. This may be done for technological reasons or on a customer's demand. Technological reasons can be the allowed radio frequencies in a country or the plug that should be used. In some cases this new version is commercially considered as the same product as the old version. This implies that the salesplans for the old version can be used for the new version. Figure 3.5 represents the sales on volume of the BP010, a set of loudspeakers and its redesigned upgrade, the BP015 in Iberia in 2000.
The policy with phasing-in upgrades is that first all of the old products should be sold out before phasing-in of the upgrades can start.

[1] Source: De Financiële Telegraaf, 07/18/'01

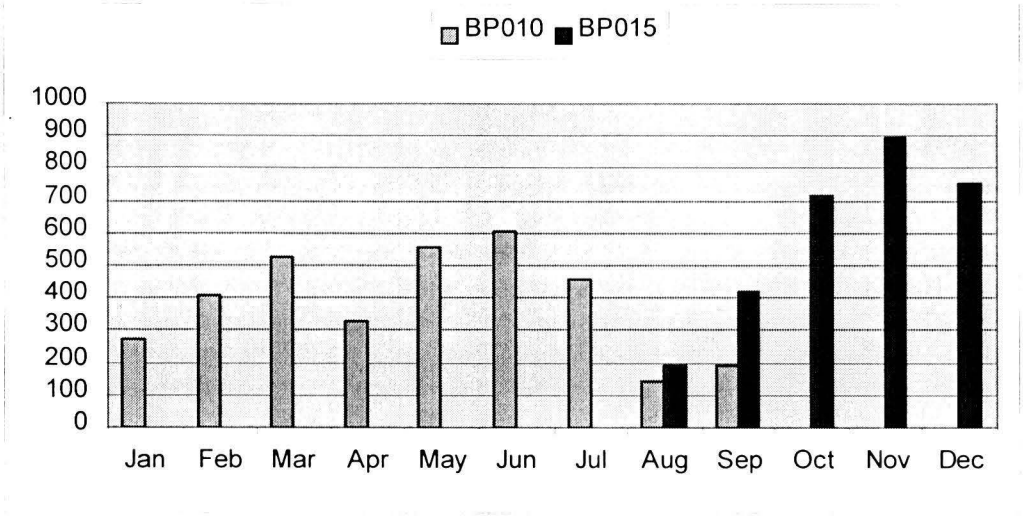


Figure 3.5 Phasing-in / -out

4 Processes

In this chapter the production process, the business model and the planning process are described.

4.1 Production Process

The high-end remote controls are produced in Belgium. The other remote controls are produced in Portugal and Singapore. A Philips BU, called BU Remote Control Systems owns the plants. Suppliers in Europe and Asia produce the rest of the products. Overall could be stated that sound products are produced in Asia, vision products are produced in Europe and baby care and batteries products are produced in both continents. Production takes place in batches. These batch sizes differ per product. Production lead-times vary from 12 to 90 days.

4.2 Business Process

The outlets mentioned in section 3.2.5 are considered as the customers of the NSO's. These customers place orders with the NSO. Then the NSO's order with the Region. The Regions place orders with the BCU, which handles the ordering with the supplier's side. The suppliers deliver to the EDC or to the local distribution centres (LDC's). The LDC's are normally replenished from the EDC or very rarely directly from the supplier. The Business Model in figure 4.1 is representative for most products. Sometimes one of the two stock keeping points, the EDC or the LDC is bypassed.

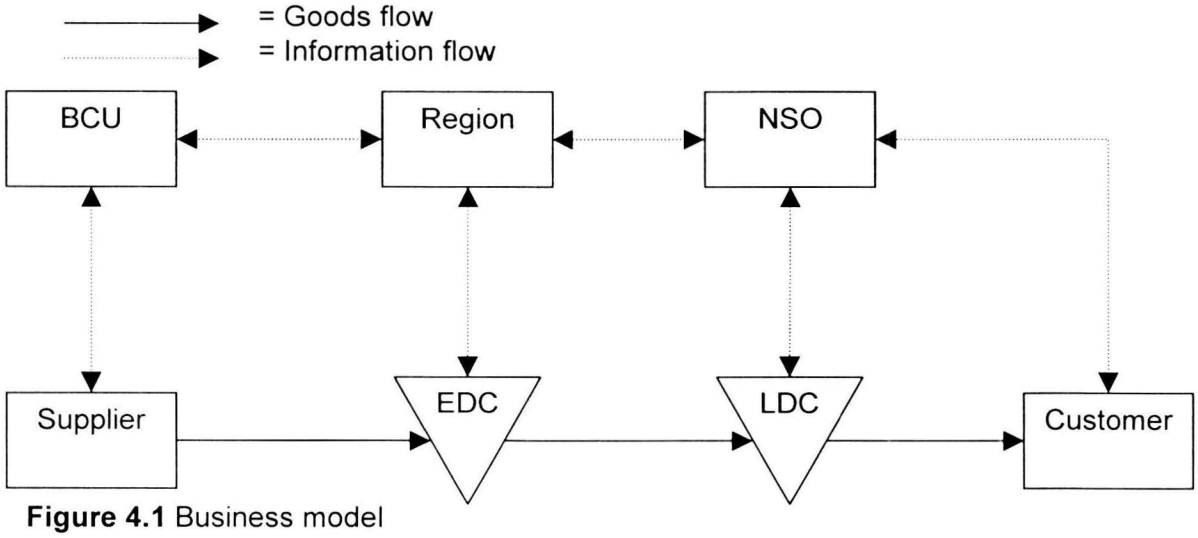


Figure 4.1 Business model

4.3 Planning Process

The products that are sold by Accessories Europe are made to stock. Production orders are generated from the NSO's salesplans and norm stock levels. The NSO's are not obliged to order the products that they forecasted. This means end products are kept on stock at the distribution centre. For the products from Asia a shipping time of 30 days exists. Many products have a life cycle that is no longer than 2 or 3 years, which may lead to problems in forecasting demand and to obsolescence risks. This means accurate salesplans are necessary since production is based on these forecasts of future demand. Within Accessories Europe 4 types of salesplans can be distinguished:

Long term (5 years)

Which considers strategic plans for the next 5 years, based on birth rates, market shares, technological developments, consumer and retail panels or environmental changes. These plans are called strategic value agreements. The marketing department of the Region makes these plans. The plans are made at AG level and they are updated once a year.

Medium term (1 year)

Which considers yearly budgets and rolling annual forecasting (RoFo) of the financial results. It is produced every quarter and focuses on sales, margins, and Income From the Operations (IFO) for the next 12 months. These plans are made by the marketing departments of the NSO's and are checked by the regional financial controllers and the regional marketing managers. The plans are made at product (12NC) level. At this term, suppliers are informed about estimated future demand.

Short term (1-5 months)

Which considers plans, which are being used for production schedules. The plans are automatically generated from the annual plans. Changes can be made, based on the result of a monthly meeting of the logistics, sales and marketing departments of the NSO's (PSI meeting). The logistics department of the Region checks these changes. Exceptionally the regional marketing department has got influence on these plans. The time-span considered depends on the lead-times of the products.

Immediate term (0-5 months)

Which considers plans at 12NC level after the production order has been send out. These plans are said to be within the fixed period. Changes in these plans consider a re-allocation of goods between NSO's and using safety stocks (e.g. France increases a salesplan for month N while Germany decreases their salesplan). The changes can also result in excess or obsolete stocks. The change requests are done by the NSO's and if the changes are feasible they are converted in salesplans by the Regional planners.

As mentioned above yearly salesplans per product are made. These plans are spread over the months through seasonal indices. These indices are fixed by the NSO's and it is their responsibility to keep them up to date. When sales of a product in a month are lower then the plans in the sales planning system at month end; the difference between the planned and the actual sales is subtracted from the yearly salesplan. When actual sales are higher then expected, the yearly salesplan increases.

The PSI meeting, that takes place once a month, most often results in some requests for salesplan changes. The proposed salesplan changes (or salesplan change requests) are sent to the Region at the beginning of each month. Then the Logistics department of the Region reviews those plans and checks if the increases are possible. It is also possible for a NSO to request for salesplan changes within the month, although the Region does not prefer this. Most changes consider the changes in yearly salesplan. This means plans within the so-called fixed period as well as plans for the unfixed period are changed. It is not unusual that plans for one product for one NSO changes several times in a year.

After all changes are in the system the salesplans are brought to an aggregated European level and are checked if they meet the regional targets. Halfway through the third week of each month a supply request is sent by the BCU to the suppliers. Halfway the fourth week of each month a confirmation is returned and the production lead-time starts.

NSO's may order more products towards the end of a quarter in order to reach their targets. When the NSO's fail to sell these stocks the result is excess or obsolete stocks and/or lost opportunities to sell them in other NSO's.

NSO's are not penalised when their salesplans are not reliable. As long as products are stored in the EDC the Region has the responsibility for the stock level of the products. For the NSO's it may be attractive to fill the EDC completely with products in order to increase product availability. Even when a product can only be sold in one region, like it is often the case with products for the UK because of specific plugs, and consequently is produced only for that NSO, they are not financially responsible for the goods as long as they are in the EDC. The advantage for the Region to work this way is that the stocks can be reallocated between NSO's easily.

Although there are some arguments for making plans on a European level, the Region wants to maintain the structure that the NSO's make the plans on which production orders are based. An argument to make the plans on a European level can be that on the whole it is easier to plan on a higher aggregation level since the total European demand is more stable than the demand in a single NSO. Another argument can be that since the Region is the stockowner, it is probably more motivated to keep the stock levels within the margins than the NSO's are. The reason why the Region wants to maintain the current structure is that the knowledge about the market lies in the countries. Therefore the NSO's are supposed to be ones who are most capable of foreseeing future demand[1].

[1] Source: Interview with Mr. Raphael

5 Project Description

In this chapter the essence of the project will be described. More specifically this implies the causes of the central problems as well as the project's scope will be highlighted. At the end of this chapter the final project definition can be found.

5.1 Problem Causes

In the chain from salesplan to actual sales, many factors can be found that can cause the central problems; lost sales and excess and obsolete stocks. The factors can influence three parts of the chain. These parts are the planning process, the actual sales and the business processes in supply chain. The factors that may influence the actual sales part (like seasonality) are discussed in section 3.3. Therefore only the other two parts will be described in this section. In section 5.2 the causes that will be in the scope of this project will be handled.

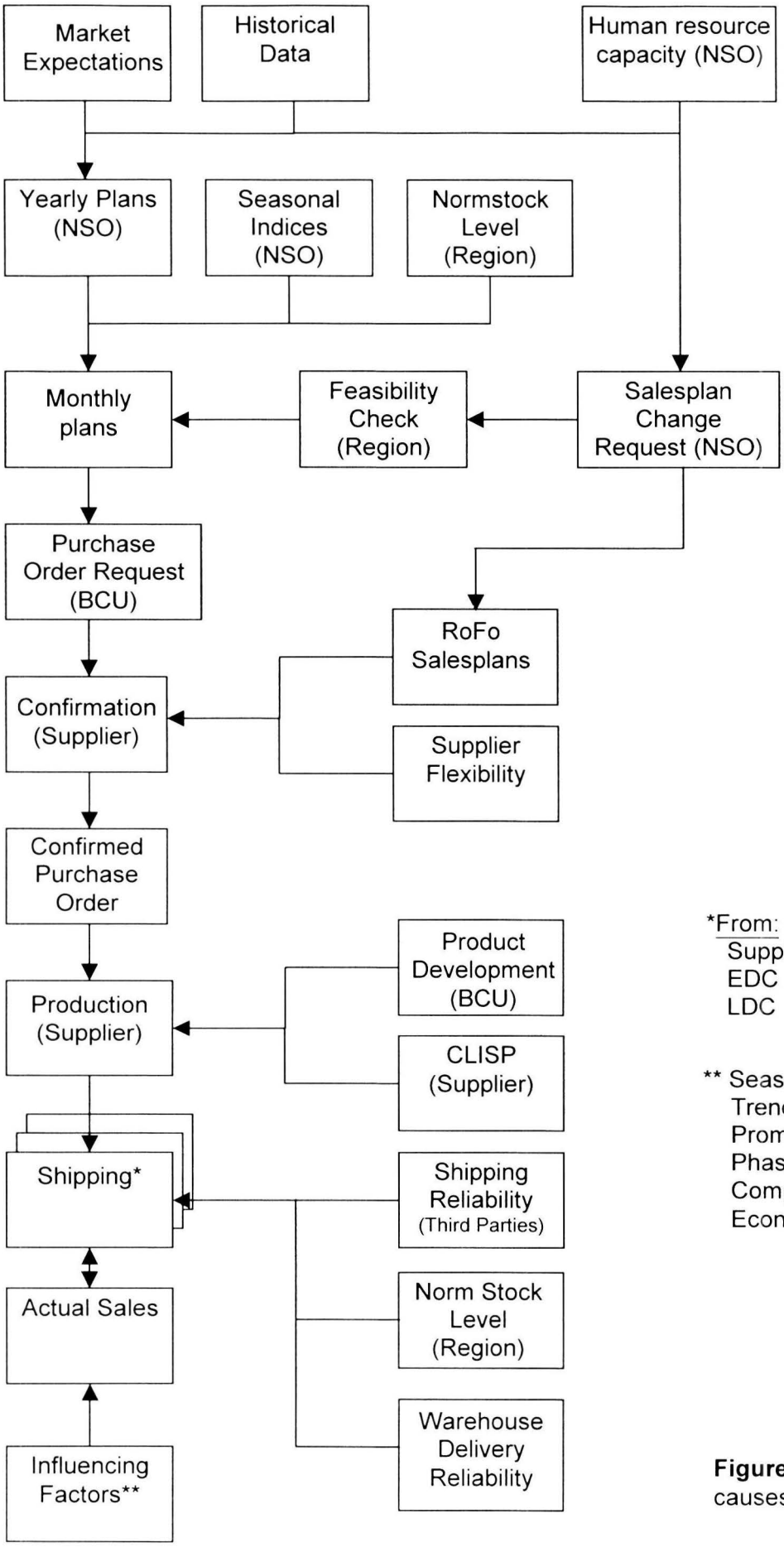
5.1.1 Problem Causes in the Planning Process

The yearly plans are based on historical data, market expectations and product information. Based on historical data and market expectations a NSO might expect to sell the same amounts as the last year plus or minus a percentage, depending on the expected growth. These market expectations also include some forecasts made by customers. In general, the customers are not committed to these forecasts.
Product information considers among others introduction and end dates. When a product is a successor of another product, the old plan can be continued for the new product. Wrong yearly plans can cause excess and obsolete stocks and lost sales.
Within the NSO's capacity shortages exist. Since not all NSO's are dedicated to Accessories only, planning of Accessories does not always get a high priority. Especially plans for relative unimportant products might suffer from this. The salesplans are therefore not as reliable as they could be.
The amounts in the yearly plans are distributed over the months through seasonal indices. These indices are manually fixed by the NSO's and can differ per product. Some NSO's (e.g. Germany) use the same seasonal indices for all accessories. Incorrect seasonal indices can cause lost sales in one month and excess and obsolete stocks in another.
When an NSO wants to change its salesplans, they can send a salesplan change request to the Region. These changes can involve plans for separate months or yearly plans. The Region checks whether the changes are feasible. The requested changes might be a better forecast of actual sales.
Based on the salesplans of the NSO's, the BCU places purchase orders with the supplier. These orders also included normstocks. These normstock levels will influence stocks and sales. The suppliers check if they can deliver the orders and if so, they send a confirmation to the BCU.
Every supplier needs to know six months in advance, how many products the BCU thinks it will order. This information is gathered from the plans as they are in the planning system. Certain agreements are made with suppliers about bandwidths between which the changes may fluctuate. These bandwidths decrease when the supply date comes closer as can be seen in appendix II. The conformation of changed plans is therefore dependent on the size and timing of these changes. Sometimes the suppliers are capable and willing to handle bigger changes than agreed. Therefore, also supplier flexibility has an influence on sales.

5.1.2 Problem Causes in the Supply Chain

The BCU has approximately 20 suppliers. These suppliers are not always able to deliver all the order lines that they have confirmed which may lead to lost sales. The supply performances of these suppliers are measured through the Confirmed Line Item Supply Performance (CLISP). The performances are ex works, this means they are measured at the supplier's gate. An order line is considered to be supplied correctly if the products leave the supplier in time and between 95% to 105% of the agreed volume. The CLISP is measured on a monthly basis per supplier. An example of such a measurement can be found in appendix III.
Problems with supplies can also be caused by problems in the product development. These problems can cause delayed or phased introduction and can influence sales of predecessors as well.
After products have been supplied, they have to be shipped. Problems with shipping can influence excess and obsolete stocks and lost sales. For example late delivery, can blow a deal off, resulting in excess and obsolete stocks. Delivery performances off third parties as well as warehouse delivery performances are measured.
Replenishment from the EDC to the LDC is triggered by the normstock level of the LDC. Once products are supplied to a NSO, reallocation is expensive and therefore avoided. This means flexibility reduces once products are in LDC's. This may result in excess and obsolete stocks and lost sales at the same time.

Figure 5.1 gives an overview of the possible problem causes in the chain.



PHILIPS

*From: To:
Supplier EDC
EDC LDC
LDC Customer

** Season
Trend
Promotions / Deals
Phasing-in / -out
Competitors Actions
Economic Cycle

Figure 5.1 Problem causes in the chain

5.2 Project's Scope

Although there are many possible sources of improvements that can decrease the impact of the central problems, this project concentrates at the reliability of the salesplans. Better insight in historical data in combination with a proposed salesplan should be part of a forecasting system (S&P, page 88). Selecting and initialisation of a tool that generates proposals for salesplans will be the main part of this project.

Measuring forecast errors and salesplan reliability can highlight best and worst cases. This can help recognising best practices and can be used as a basis for continues improvement. It can also help to notice big errors early so one can intervene rapidly. Part of my project is designing appropriate measurement tools as well as designing a format for the feedback process.

Measuring forecasting errors and salesplan reliability can help in decision-making about safety stock levels. More appropriate safety stock levels can in it's turn increase flexibility in reallocating products within the fixed period.

Some causes can be avoided through more reliable salesplans. For example when salesplans are more accurate far in advance, supplier flexibility will be less important.

A number of causes are already handled in other projects. Those projects are led either by the BCU Accessories and Recordable Media (e.g. product development), by Accessories Europe (e.g. norm stock levels) or centrally by Philips Consumer Electronics (e.g. warehouse delivery reliability). These problem causes are not handled in this project although the problems that are caused by them should be taken into account when measuring salesplan reliability.

Some other causes are assumed to be given, like competitors actions and fluctuations of the economical cycle.

5.3 Project Definition

The agreed final project definition exists of a goal and two deliverables.

The goal is:
To improve salesplan reliability in order to improve customer service level and to reduce excess and obsolete stocks.

The deliverables are:
An objective measurement tool to understand the reliabilities of the salesplans, to recognise best practices and to use it as a basis for continuous improvement actions.

A forecasting tool that will be used by the NSO's in order to compose salesplans, which will be a better reflection of actual future sales. This should result in a higher customer service level and less excess and obsolete stocks.

The justification for choosing these two deliverables will be done in chapter 7. Since it is very hard to measure lost sales and there are several ways to reduce the level of the obsolete and excess stocks, there has been decided to choose another performance indicator than these lost sales and stock levels. This performance indicator is the average salesplan reliability per NSO per month.

6 Plan of Approach

Now the project is defined, the scope is clear and the deliverables are known it is possible to make a plan for the research and solution phase. In this chapter this plan shall be described.

The first step is investigating the requirements of the two tools. These requirements are both technical as well as organisational. Technical requirements can be the accuracy of the data used. Organisational requirements can be the complexity and costs of the tools.

The second step in this phase is investigating which methods can be used for measuring reliability and for forecasting future sales.

In the third step a measuring and forecasting method will be selected. This selection will probably be based on a trade of between the several requirements. Accessories Europe will make the decision about which methods will be selected.

Once an agreement is reached about the methods that should be used, the fourth step can be taken. This step is the development and testing of the tools.

Once the tools are tested and approved, an implementation plan must be made and carried out. The last step of the project is handing over the tools and the user manuals.

The steps mentioned above are applicable both tools. The steps should be taken one at the time for both tools. It is not necessary to carry out the steps parallel for both tools. All steps, with exception of the implementation, are to be taken by the undersigned.

7 Requirements

In this chapter the requirements to reach the goal of this project are described. In the first section a framework is presented that suggests how a forecasting system should be built up. The same section described how the elements of the framework are and should be filled in within Accessories Europe. The other two sections discuss the organisational and technical requirements.

7.1 Object Model

In the literature (Silver & Peterson, 1985) a framework is used that suggests how a forecasting system should be built up. This framework is used as the object model in this project. Figure 7.1 shows this framework.

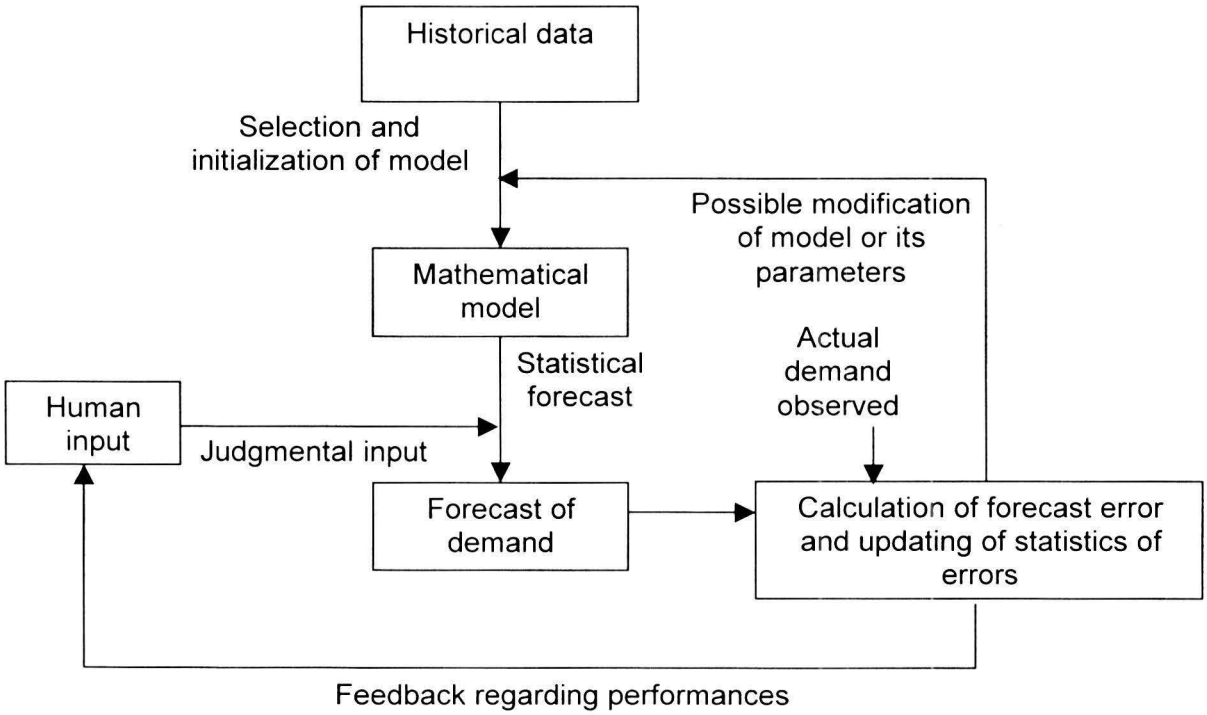


Figure 7.1 A suggested forecasting system (Silver & Peterson, 1985)

Historical Data

In the past, only limited information was collected. According to Silver and Peterson, from a statistical point of view, a minimum of four years of historical data should be available in order to define seasonal indices. They also mention a risk of this long period, being that the possibility exists that the indices have changed during the years. In the case of accessories, the products as well as the distribution channels changed during the past years. This means that even if more historical data was saved, it may be doubted how useful it would be. Actual sales per NSO, per month have been collected on CTV level since January 2000. Salesplans have been collected since May 2001. These plans are needed to measure salesplan reliability.

Mathematical Model

When the project began no mathematical model was used in the forecasting system. Section 7.2 and 7.3 describe the requirements of the mathematical model that will be used. The purpose of the model is to give a proposal for salesplans.

Human input
It will be necessary to provide the ability to overrule the proposed plans since the planners have information about future events. This can be fixed orders by customers for example. Another reason why the ability must exist to overrule the plans is that the NSO's can influence the sales, by promotions for example. Also when new products are introduced, human input is required. A NSO may choose to use the history of another product, a predecessor for example, as historical data. Items with different priorities can be treated differently. For important products, more attention can be given to the human input while for less important products the proposed salesplan can be used more often. This classification can be based on IFO, turnover or strategic reasons for example. Although it is necessary that there is room for human input, it should be handled with care since one of the strengths of a mathematical forecasting tool is that is does not suffer from overconfidence like humans do (Blattberg, 1990).

Forecast of demand
These forecasts are necessary since production and shipment lead-times are longer than customer order lead-times. The forecasts shall be the salesplans that the NSO's communicate to the Region. These plans should be finalised in the beginning of the first week of each month so production and reallocation decisions can be made. These salesplans shall be saved so afterwards forecasting errors can be measured. Within the month, salesplan changes can also be made in order to use the reallocation possibility optimally.

Calculation of forecast error and salesplan reliability and updating of statistics of errors
After month closing, actual demand can be observed and compared with planned sales. Now the forecast error and the salesplan reliability of both the mathematical model as the human judgement can be measured. Besides measuring the salesplan reliability, the statistics of the forecasting errors should be measured for two purposes. The first goal of measuring forecasting errors is to check whether the model's parameters should be changed or not. The second goal is to be able to provide feedback on the performances of the subjective input component of the forecasts. After a while it might be possible to use the forecasting errors to base safety stock levels on.

7.2 Organisational Requirements

The forecasting tool as well as the measurement tool should meet several requirements from an organisational point of view. These requirements will be described in this section.

Simple
The prospective users of the forecasting tool are not selected on their statistical background, nor is the Region intended to train them on this subject. Therefore their knowledge on statistics is assumed to be low. Consequently usage of the tool should not require these competencies.

Measurable
In order to show the value of the forecasting tool and the quality of the planners, a measurement of the salesplan reliability of the tool as well as the salesplan reliability of the planners is required. This measurement can be used to convince users of the value of the tools.

Achievable
In the Region and in the NSO's, capacity problems exist. Since for 20 NSO's, for dozens of products and for several months plans should be made, the tools should not contain time-consuming processes. Otherwise the chance that the tools will be used on a continuous basis will be low. There should be someone within the Region who supports the tools.

Reliable
The results of the tool must be reliable. This reliability depends on the system used for measuring actual sales. At this moment returned goods are subtracted from the actual sales. The possibility to undo these decreases should exist when the numbers of returned goods are substantial. Also exceptional deals should be distracted from the actual sales.

Timed
Each month several processes take place in the different parts of the chain. In order to get the optimal support from the tool, the tool should be timed well. This implies the forecasts should be available at the NSO's when they start making the salesplan change requests. The forecasts should at least contain plans for the coming six months in order to inform suppliers about expected demand. More accurate should the plans be that should be fixed in the current month. The most recent information available should be used for the forecasts.

Inexpensive
Three kinds of costs of the tools can be recognised (Makridakis, 1982). The first kind is the develop, purchase and start up costs. Since within Consumer Electronics a cost reduction process is in progress, there is no budget for buying the tools. Therefore, the tools have to be developed within Accessories Europe. The start up costs are the costs that are needed to train the users to use the tools. The second kind of costs is the costs for data storage. The third kind is the maintenance and usage costs. These costs consider the costs for the systems used by the tools, as well as the cost of the human resources needed for using and maintaining the tools.

7.3 Technical Requirements

In this section an overview is given of the technical requirements to the tools. In the first part there is defined which data are used as input to the tools.

7.3.1 Data

Until now, each NSO has received on a monthly base, a report containing their salesplan reliability performances for the most recent month. The salesplans used for this report are the latest salesplans as they were in the planning system, called Gipsy. These plans are not the ones that should be used for measuring salesplan reliability. The plans that can avoid lost sales and excess and obsolete stocks are the plans on which production orders are based. Which plan this is depends on the lead-time of the product. These lead-times include production lead-time, shipping lead-time to Acht and the ordering lead-time as described in section 4.3. This will be explained in the following example.

Salesplans of Antennas that have a lead-time of two months, for the month May (month N) should be correct after the Region handled the salesplan changes. This means at the beginning of the second week of March (month N-2).

Salesplans of Small Headphones that have a lead-time of three months, for the month May (month N) should be correct after the Region handled the salesplan changes. This means at the beginning of the second week of February (month N-3).

Salesplans of FM Microphones that have a lead-time of four months, for the month May (month N) should be correct after the Region handled the salesplan changes. This means at the beginning of the second week of January (month N-4).

Salesplans of MD190's that have a lead-time of five months, for the month May (month N) should be correct after the Region handled the salesplan changes. This means at the beginning of the second week of December (month N-5).

Figure 7.1 represents the process for products from the Far East with a production lead-time of 30 days like Small Headphones.

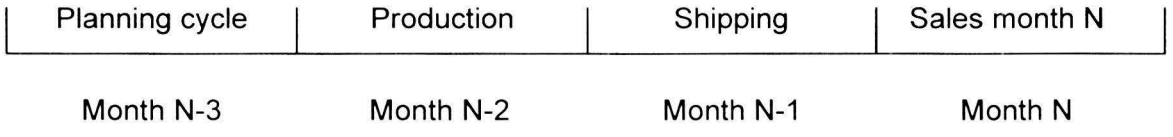


Figure 7.1 Lead-time

Similar figures can be made for products with other production or shipping lead-times.

In order to measure salesplan reliability of the plans on which production orders are based, at the beginning of the second week of each month (according to the Philips production calendar) salesplans should be saved. This date has been chosen because production orders that are sent to the suppliers are based on these plans. Before May 2001 these plans were not saved on the date mentioned above, but at the beginning of each month. In order to be able to start measuring salesplan reliability these plans were used.

7.3.2 Requirements to Forecasting Tool

In order to make good forecasts of future demand, the tool must be able to handle the characteristics of the data patterns.

7.3.2.1 Seasonal Effects

As mentioned in previous sections, a strong seasonal influence can be found when analysing historical data. The model used for the statistical forecast must therefore be able to handle these influences. One season will have the length of one year and will be built up from 12 pieces that correspond to the months according to the Philips calendar. Reason for this is that all systems within Philips are organised like this. Another reason for this is the relatively big differences between consecutive months. In order to let the tool to be able to handle this seasonality, seasonal indices should be calculated. In consultation with the Regional marketing managers was decided to calculate these indices per NSO on AG level. Advantages of this aggregation level are:

- it is system supported,
- the products within each AG are not assumed to have different seasonal indices,
- the AG's are assumed to have different seasonal indices,
- the number of groups is manageable (±15),
- it removes some noise because several product are taken into account (±15 products per AG),
- it can handle new products easily since they all fit in an AG and therefore automatically have seasonal indices as well.

In appendix IV the patterns of sales of two AG's in Europe are shown.

7.3.2.2 Trend

Silver & Peterson (1985) state that a model should handle trends only if significant trends are involved. The significance of a trend in my opinion depends on three factors. These are the impact/size of the trend, the number of months used in the analysis and the determination coefficient, R^2. This coefficient is a measurement of how well the data fits to the trend[1]. Unlike with the seasonal indices, with trends it is not appropriate to use the trend of an AG when forecasting an individual product since the products are not assumed to show equal trends. Since it will take a lot of work to check if each product/NSO combination meets the three requirements mentioned above, there was proposed to leave the trend out of the standard model. An option of entering a trend manually can be added if found necessary.

7.3.2.3 Level

A common way to calculate the level of time series is simple exponential smoothing (Silver & Peterson, 1985). This method gives more weight to recent values then to older values. There are two arguments to do this. The first argument is that recent information is more important for the forecast than older information. The second argument is that there is no reason to set the weight of information of a certain age to zero like methods as the moving average do (van Winkel, 70). Simple exponential smoothing method uses a parameter, α ($0 \leq \alpha \leq 1$). The more this parameter tends towards 1, the more weight is given to the most recent value. For example if α is equal to 0.3, the level will be determined for (0.3*100%=) 30% by the most recent value and for (0.3*70%=) 21% by the most recent but one value and so on. A big advantage of this method is that only two values have to be saved. This makes it easy to copy historical data if new products are introduced. A disadvantage is that a value for the parameter α must be determined.

[1] $R^2=1-(SS_E/S_{yy})$ Source: D.C. Douglas, 1994. *Applied Statistics and Probability for Engineers.*

8 Selection of Methods

In this chapter the selected measurement and forecasting methods are presented and explained.

8.1 Selection of Measurement Methods

There has been decided to select two measurement methods. The first method measures the average salesplan reliability (SPR). This method is also used by the other BCU's of CE. The second method measures the mean percentage error (MPE). This method gives insight in the structure of the errors as will be made clear in section 8.1.2. The methods will be discussed in the next two sections.

8.1.1 Measuring Salesplan Reliability

SPR per CTV is defined as follows:

$$SPR_i = 100\% - \frac{|ActualSales_i - PlannedSales_i|}{PlannedSales_i} * 100\%$$

and if *Salesplan = 0* and *ActualSales > 0* then *reliability = 0%*
and if *2*Salesplan < ActualSales* then *reliability = 0%*

where $ActualSales_i$ refers to realised sales in month i; $1 \leq i \leq I$.
The vertical lines indicate that the absolute value of the difference is taken.

This definition will be explained in the following examples.

When a NSO planned to sell 100 pieces of product X in month i and the NSO actually sold 120 pieces, the error is 20% of the salesplan. Therefore the SPR for month i for product X is 100%-20% = 80%.

When a NSO planned to sell 100 pieces of product Y in month i and the NSO actually sold 80 pieces, the error is 20% of the salesplan. Therefore the SPR for month i for product Y is 100%-20% = 80%.

When a NSO planned to sell 100 pieces of product Z in month i and the NSO actually sold 0 pieces, the error is 100% of the salesplan. Therefore the SPR for month i for product Z is 100%-100% = 0%.

When a NSO planned to sell 100 pieces of product Q in month i and the NSO actually sold 201 pieces, the error is over 100% of the salesplan. Therefore the SPR for month i for product Q is 0%.

This definition has been chosen for several reasons:

- The absolute difference between planned and actual sales is used. This is done in order to avoid a positive and a negative difference to cancel each other out when reliabilities are aggregated.
- The absolute difference is divided by the planned sales. By doing this, a percentage error can be calculated. This is done in order to give more insight in the forecast error.

- Within Philips the term salesplan reliability is used more often than forecasting error. Therefore the percentage is subtracted from 100%. Now not the error but the reliability is calculated.

SPR can also be measured on any aggregated level. In this project the key performance indicator (KPI) will be the average SPR per NSO. If necessary, different aggregation levels can be selected. The definition of average SPR on any aggregation level will be:

$$SPR_{aggr.level} = \frac{1}{n}\sum_{i=1}^{n}(SPR_i).$$

In this definition n represents the number of CTV's and i refers to a month; $1 \leq i \leq I$.

When one is using this measurement one should keep in mind that there are restrictions to the availability of products and consequently to the maximum sales level. This can lead to a high SPR although there actually are lost sales due to too low salesplans.

8.1.2 Measuring Mean Percentage Error

When one wants to make judgements about the tools parameters and the performances of the human judgements, the MPE can be used. The MPE is defined as follows:

$$MPE = \frac{1}{n}\sum_{i=1}^{n}\frac{(ActualSales_i - PlannedSales_i)}{PlannedSales_i} * 100\%$$

and if *Salesplan = 0* and *ActualSales > 0* then *MPE=100%*
and if *2*Salesplan < ActualSales* then *MPE=100%*.

Where n is the number of plans used in the measurement and where $ActualSales_i$ refers to realised sales in month i; $1 \leq i \leq I$.

If the mean value of the errors fluctuates round zero, the MPE shall be close to zero. A positive MPE means overall plans are to low. A negative MPE means overall plans are too high. When plans of a NSO are overall higher or lower then actual sales the planner can be informed about this. When the MPE of the tools' forecast is positive or negative for several months in a row the level used by the tool can be incorrect. A MPE that in- or decreases structurally over the months can indicate a trend that is not calculated by the forecasting tool.

When using the MPE one should keep in mind that it is possible to sell zero percent of the forecasted sales. But due to the limited product availability there are limits to exceeding your planned sales. This can lead to a positive MPE although the actual MPE is zero. One should also keep in mind that when there are problems in for example the supply chain, the chance on a negative percentage error will increase.

8.2 Selection of Forecasting Method

The methods that have been developed to make forecasts fall into two major categories: quantitative methods and qualitative methods. Qualitative methods require inputs like intuitive thinking, judgement, and accumulated knowledge (Makridakis, 1978). These inputs can be said to be time consuming. Since the output of the forecasting tool should be proposals for a lot of products without investing a lot of time, the method used in the

tool should be quantitative instead of qualitative. Makridakis (1978) uses three conditions that should be met before quantitative methods can be used. These conditions are:

- Information from the past should be available.
- This information can be quantified as data.
- The pattern in the data is assumed to continue in the future.

As mentioned before, at the moment there is limited historical information available. The amount of information available is increasing in time since it is collected on a monthly base. The information that is available can be quantified as data and the underlying patterns are assumed to continue within the period for which the forecasts are done. Although the first condition is not met completely, a quantitative method will be used.

Quantitative methods can be divided in two kinds: causal methods and time series. Causal methods try to find relations between one or more independent variables like prices and incomes. The methods can especially be supportive for decision-making (e.g. about price increases). Time series on the other hand base their forecast on historical values and/or errors. Time series can especially be supportive for forecasting. Since forecasting will be the main objective of the tool it will use time series.

Considering the organisational requirements and the characteristics and amount of the available historical data, it is a logical step to choose for Winters Exponential Smoothing Procedure for a Seasonal Model. The procedure can handle trends and seasonality and is easy to understand and to learn.

Makridakis and Wheelwright (1982) consider this method appropriate when:

- There are many items to be forecasted.
- Only a small proportion of the items is critical, but planning is necessary for all.
- Only *short-term* forecasts are required.
- Reasonable, but not precise, accuracy is acceptable.
- The past is an acceptable guide to the future for a high proportion of items.
- More sophisticated procedures are not cost/benefit justified.
- Forecasts are required for *independent* demand situations.
- For production environments, if production is to stock as opposed to order.

Looking at the situation of Philips Accessories Europe, the author considers the choice for this method justified. The underlying model of for Winters Exponential Smoothing Procedure for a Seasonal Model is:

$$x_t = (a + bt)F_t + \varepsilon_t$$

where

x_t = the actual sales
a = the level,
b = the linear trend,
F_t = a seasonal index appropriate for month t,
ε_t = independent random variable with mean 0 and constant variance σ^2.

The model assumes that the sales pattern can be explained by a level, a linear trend, seasonal factors and random noise.

The Winters exponential smoothing procedure implies that when on moment t, a forecast is to be made for period t+τ, one adds τ times the estimated trend to the estimated level. Figure 8.1 shows this graphically.

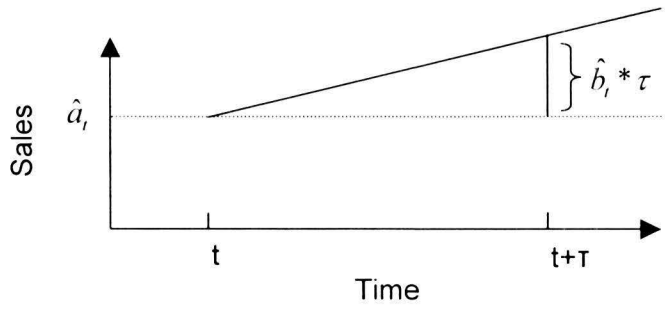


Figure 8.1

Hereafter this amount is multiplied by the estimated seasonal index belonging to period t+τ-P, where P is the length of seasonality (e.g., number of months in a year). At the end of period t, the forecast for period t+τ is:

$$\hat{x}_{t,t+\tau} = (\hat{a}_t + \hat{b}_t \tau)\hat{F}_{t+\tau-P}$$

Where a hat on a symbol implies it considers an estimated or forecasted value. In the case that is described in this report, the season has a length of 12 periods and the seasonal indices are normalised so that, at any point, the sum of the indices over a full season is exactly equal to 12. As mentioned in section 7.3.2.2 the trend is left out of the standard model. This implies the standard value for the estimated trend will be zero. To repetitively use the model, the parameters should be updated on a monthly base. This can be done with the three following equations:

$$\hat{a}_t = \alpha_{HW} * (x_t / \hat{F}_{t-P}) + (1 - \alpha_{HW}) * (\hat{a}_{t-1} + \hat{b}_{t-1})$$

$$\hat{b}_t = \beta_{HW} * (\hat{a}_t - \hat{a}_{t-1}) + (1 - \beta_{HW}) * \hat{b}_{t-1}$$

$$\hat{F}_t = \gamma_{HW} * (x_t / \hat{a}_t) + (1 - \gamma_{HW}) * \hat{F}_{t-P}$$

These equations will be explained below.

The first equation estimates the level at the end of period t. This estimation is based on the weighted average of two other estimations of the level. The first estimation uses the actual sales in period t after these sales are corrected for seasonality. This estimation can be found between the first set of brackets in the first equation. The second estimation of the new level is equal to the estimated level at the beginning of period t plus one time the estimated linear trend at the beginning of period t. This estimation can be found between the second set of brackets in the first equation. The weight of the first

estimation is equal to the parameter α_{HW}[1], the weight of the second estimation is equal to (1- α_{HW}).

The second equation estimates the linear trend at the end of period t. This estimation is based on the weighted average of to other estimations of the linear trend. The first estimation is equal to the difference between the estimated level at the end of period t and the estimated level at the end of period t-1. The second estimation is equal to the estimated linear trend at the end of period t-1. The weighting works the same as for the first equation except that it uses a different parameter, which is β_{HW}.

The third equation estimates the seasonal index for period t at the end of period t. This estimation is based on the weighted average between two other estimations of this index. The first estimation is equal to the actual sales in period t divided by the estimated sales level at the end of period t. The second estimation is equal to the most recent estimation of the seasonal index of this period. The weighting works the same as for the first equation except that it uses a different parameter, which is γ_{HW}.

The equations use three parameters that handle historical data in the same way as α in section 7.3.2.3 did. The values of the parameters (α_{HW}, β_{HW}, γ_{HW}) lie between 0 and 1 and should be determined manually. Which values should be used for the parameters depend on the system on which the model is based. If there is a lot of random noise in the pattern, low values are wanted because these smaller values will smooth out more of this noise. Higher values are wanted when the pattern in the data is assumed to change in time. Higher values will correspond faster to these changes. Since both occasions will occur simultaneous and it won't always be possible to tell what was the cause of the forecast error, a compromise has to be made.

[1] Subscripts HW represents Holt-Winters

9 Development and First Results

Before the tools can be used they have to be developed and initialised. After the initialisation the tools must be tested. This process is described in this chapter.

9.1 Development of the Tools

As mentioned before there was no budget for buying the tools. Therefore the tools were developed in this project. The tools were developed in Microsoft Excel and Microsoft Access, both currently available for employees of Accessories Europe.

9.2 Initialisation of the Measurement Tools

As mentioned before, the required information for the measurements was not available. The first step of the initialisation was therefore collecting historical data. After the tools are introduced, new data will be collected on a monthly basis. How this can be done is described in the guidelines of the measurement tool. These guidelines can be found in appendix V.

The second step was determining which products should be included in the measurement. This had to be done because there was a lot of noise in the planning system. This noise consisted of plans created by the planning system. These plans are automatically created when, according to the system stock is kept for which no plans are made. This happens often with obsolete products. To avoid these plans having an influence on the measurement they had to be removed from the data. Therefore a column was added to the table with all the CTV's that is used by the tool. In this column the CTV's for which the measurements should be done, can be selected. In another column in the CTV table, there is a list of the lead-times for all CTV's, as described in section 7.3.1. The lead-time of the CTV determines which plan is used in the measurement.

9.3 Initialisation of the Forecasting Tool

The original Winters Exponential Smoothing Procedure for a Seasonal Model as described in chapter 8, calculates seasonal indices on CTV level. Since there it was decided to estimate the seasonal indices on the AG level, the model had to be adjusted. The equation in which the seasonal indices are updated should not consider x_t and a_t on product level but on AG level. To enable this, an extra equation for the level on the AG level was needed as well as an adoption of the equation that updates the seasonal indices (Hijink, 1996). Since the trend is left out of the standard model, the equation that estimates the trend is left out of the model. The following four equations are now used for updating the model and for making the forecasts.

$$\hat{x}_{t,t+\tau} = \hat{a}_t * \hat{F}_{t+\tau-P}$$

$$\hat{a}_t = \alpha_{HW} * (x_t / \hat{F}_{t-P}) + (1-\alpha_{HW}) * \hat{a}_{t-1}$$

$$\hat{a}'_t = \alpha'_{HW} * (x'_t / \hat{F}_{t-P}) + (1-\alpha'_{HW}) * \hat{a}'_{t-1}$$

$$\hat{F}_t = \gamma_{HW} * (x'_t / \hat{a}'_t) + (1-\gamma_{HW}) * \hat{F}_{t-P}$$

In these equations an apostrophe indicates the AG level instead of a single product. For the rest, the equations work the same as in described in chapter 8.

When the model has been updated the sum of the seasonal indices might have changed. If this is the case the indices must be adjusted in such a way that the sum equals 12 again. This is done by multiplying each seasonal index with 12 divided by the sum of the seasonal indices.

Before the tool can be used there are three things that should be determined. These are γ_{HW}, α_{HW} and the seasonal indices.

To be able to determine which value must be used for γ_{HW}, several years of information are needed. Since this is not the case, the value that is defined as reasonable by Silver and Peterson (1985) is used. This value is 0,10. This value should be tested when more information is available. If found necessary the value should be changed.

For α_{HW} Silver and Peterson suggest a reasonable range of values that lies between 0,02 and 0,51. Which value of α_{HW} is appropriate in this case was determined by testing the tool using eight α_{HW}'s that were selected by cutting the suggested range in seven equal pieces. In this test, forecasts were done for the first nine months of 2001. The starting level was the average saleslevel per month in 2000. An average lead-time of three months was used. The results of the tests can be found in appendix VI. The result was that in 35% of the tests, an α_{HW} of 0,02 showed the highest average SPR. Based on this result in combination with the idea that not much attention will be given to removing big deals from the data, there was decided to use the value 0,02 for α_{HW}. If found necessary this value can be changed easily.

Silver and Peterson (1985) state that the seasonal indices should be determined by using the average of centered moving averages of each period. Since there was not enough information available to follow this procedure a more simple method was followed. For batteries the seasonal indices were recently determined per AG per NSO by a former logistics manager of batteries. These seasonal indices were used for the model since no historical information was available. To determine the seasonal indices for the other products the indices were based on the sales in 2000. Large fluctuations that were not expected to occur in the future were damped.

9.4 First Results Of Measurement Tool

Since the original salesplans were not saved in the past, it was not possible to measure SPR or MPE properly before October 2001. For this period the most accurate information on plans available was used. In the measurements for August and September batteries were not included. Measurements for August to October show average SPR's of between 10% to 51% per NSO. Figure 9.1 displays the average SPR and the MPE per NSO for August to October 2001.

The results of the tool correspond to manual measurements. Therefore the tool is considered to perform as it should.

NSO name	SPR Aug 01	SPR Sep 01	SPR Oct 01	MPE Aug 01	MPE Sep 01	MPE Oct 01
Austria	41	43	46	5	19	-1
Belgium	40	45	44	11	2	13
BSGE	10	20	14	-1	-22	4
Czechia	34	42	41	-1	5	-14
France	31	33	37	-23	14	3
Germany	35	34	44	15	-19	-2
Greece	30	36	37	-3	3	-25
Hungary	22	27	27	-11	-25	-34
Iberia	27	38	41	11	20	9
Ireland	25	39	25	-32	-6	-8
Italy	21	32	36	-27	-22	-18
Netherlands	29	38	43	-1	5	6
Nordic	31	38	43	19	22	7
Pila			45			-20
Poland	51	45	42	-18	-13	2
RSO	23	30	21	-32	-25	37
Russia	16	14	21	-36	-16	-20
Slovakia	27	45	40	-11	-10	-24
Switzerland	26	27	27	-6	-23	-43
Turkey	30	22	20	-11	-25	-51
UK	24	32	29	-5	-7	-11

Figure 9.1 Average SPR (%) and MPE per NSO

As mentioned before, the measurements can be done on several aggregation levels. Two examples of possible ways of reporting the results of the measurements can be found in appendix VII.

9.5 First Results Of Forecasting Tool

To be able to test the performances of the forecasting tool, for 4 NSO's a forecast for October was done. This forecast used levels that were generated based on actual sales information till September 2001. The performance of the tool was compared with the salesplans of the 4 NSO's as they were in the salesplanning tool in the second week of October. The results are shown in figure 9.2.

NSO Name	SPR NSO's	SPR Tool	MPE NSO's	MPE Tool
Italy	53	48	-31	-8
Netherlands	49	47	-2	4
Nordic	59	55	-21	10
UK	46	40	-16	5

Figure 9.2 Average SPR (%) and MPE per NSO of NSO's and Tool

The differences between the results of the NSO's in figure 9.1 and 9.2 can be explained by the fact that the figures are based on salesplans with different dates. Another explanation is that the tool was not tested for new products that did not have a predecessor. It is not possible to draw a conclusion from one single measurement. Another reason why it is not possible to draw a conclusion is that the lead-times of the products were not considered. Although no conclusion can be drawn, the results can be an indication that on NSO level the NSO's are performing several percents better on SPR than the tool is. When one looks to the MPE it seems that the plans of the NSO's are higher than the forecasts of the tool.

A different way of aggregating the results of the measurements mentioned above, is aggregating them on AG level. The results are shown in figure 9.3. Appendix VIII shows a part of the details of the measurement results of the tool compared with the results of the NSO's.

AG name	SPR NSO	SPR Tool	MPE NSO	MPE Tool
Antennas & Supp.	32	57	-68	-33
Baby Care	62	60	-30	-20
Cleaning	55	91	35	-2
Cordl. Headph.	47	45	-22	-22
HiFi Headph.	47	35	-6	22
Microph.	39	27	-34	-28
Mini Loudsp.	53	44	-11	17
Philips RC	55	38	-1	-23
Small Headph.	50	50	-1	12
Universal RC	60	49	-23	10
Wireless Link	37	79	63	21

Figure 9.3 Average SPR (%) and MPE per AG of NSO's and Tool

Again this is no solid basis for conclusions. However, it looks like there are large differences between the scores on SPR of the tool between the several AG's. To be able to make judgements about the tool more measurements have to be done.

10 Implementation

This section describes both the implementation carried out so far as the implementation plan for the two tools.

10.1 Implementation of the measurement tool

The measurement tool and the forecastong tool make use of the same Microsoft Access database. This database is on a drive that is shared with all employees of Accessories Europe. In the beginning of the second week of each month, the most recent information that is in the sales planning system is added to the database. The database manager who is responsible for the maintenance of the database makes sure this happens. All employees mentioned above have been informed about how they can find the information they are looking for.

It appeared that many prospective users were not familiar with Microsoft Access. That is why several switchboards were composed that can lead the user to the information he is looking for. In appendix IX and appendix X examples of these switchboards can be found.

Guidelines for usage and maintenance of the tools were made and handed over to the database manager. The guidelines for the measurement tools were tested when the measurement for September was done. After some remarks were taken into account, the database manager was capable to perform the measurement. In the mean time the database manager has carried out the measurement on her own.

Next to the guidelines an overview of all tables used by the tools was made. This overview can be used when adaptations have to be made to the database. A part of the overview is displayed in appendix XI.

10.2 Implementation plan of the measurement tool

In September 2001 a project group was formed. This project group consists of employees of Accessories Europe, a Logistics Manager from a NSO and temporary the undersigned. The group has the goal to improve the sales planning process resulting in higher salesplan reliability. The team members are discussing about when, what information should be sent and to who the information should be send. Some results of these discussions are described below.

The results are gathered in the second week of each month. In the same week they can be send to all users. When the results are send before the fourth week of each month, they can be used as input in the PSI meeting.

What information should be send depends on what the receiver can and will do with the information. The rolling measurement on NSO level can be used as an indication of how NSO's are performing. This kind of reporting can be used as management information by NSO managers and by the management of the Region. The AG level can highlight AG's for which the NSO is structurally planning not well, to high or to low. Corrective actions

can be taken after the MPE on CTV level is analysed. These corrective actions can be taken by the NSO's themselves or on request of the Region.

The discussions mentioned above shall result in a policy for distributing the measurement results. A simple explanation of the way the results are gathered shall be enclosed. Also instructions of how the results can be used during the planning process shall be enclosed. This should enable that the results are not only used as reporting but also as a support for decision making.

Since the subject of SPR is found very complex[1], there should be checked if the explanation and instructions are understood by the receivers. If this is not the case, better guidelines are needed. After the implementation of the tool the results should be evaluated. As agreed in project definition, the SPR per NSO should be used as KPI.

10.3 Implementation plan of forecasting tool

The following questions have to be answered before the forecasting tool can be implemented.

How well does the tool perform when it handles the correct lead-times? The measurement as presented in chapter 9 did not take the complete lead-times of the products into account. The goal of the tool is to support the process in which the plans on which production orders are based. Therefore the tool should consider the lead-times.

How well does the tool perform compared with the NSO's? In order to bring added value, the tool should be able to generate salesplans that perform at least as good as the NSO's. Before the NSO's are willing to use the tool, they probably want to see some results that can convince them about the added value of the tool.

Do the results show differences between NSO's and/or between products and product groups? It is possible that the results of the tool show differences between NSO's and/or between products and product groups. For example in a NSO where a large percentage of the sales is a result of deals, the added value of a forecast tool can be lower than the added value for a NSO where more sales are done by listings. These differences can support decisions about for which products the forecasting tool can be used for example.

Do the results show a not wanted trend? It is possible that the results show a trend. These trends can indicate that the model is not following the changes of the reality. Corrective actions might be wanted. These actions can be changing the levels, the seasonal indices or one of the parameters. If these actions are not satisfying, it might be necessary to check if the chosen method is the most appropriate one.

The answers on these questions can only be found if more measurement results are available. That is why the first step in the implementation plan is to continue forecasting and measuring the performances.

[1] Source: Interviews with Ms. Rosen and Ms. Dunbar who are both prospective users.

If the results of the tool appear to be good enough to be supportive in the sales planning process, the forecasts of the tool will be communicated to one or more NSO's. Depending on the results of the measurements there has to be decided for which NSO and/or for which article (group) the forecasts are communicated.

11 Conclusions and recommendations

This final chapter starts with a copy of the project definition. Then the conclusions and recommendations are discussed.

11.1 Project definition

The goal is:
To improve salesplan reliability in order to improve customer service level and to reduce excess and obsolete stocks.

The deliverables are:
An objective measurement tool to understand the reliabilities of the salesplans, to recognise best practices and to use it as a basis for continuous improvement actions.

A forecasting tool that will be used by the NSO's in order to compose salesplans, which will be a better reflection of actual future sales. This should result in a higher customer service level and less excess and obsolete stocks.

11.2 Conclusions

1. In the current salesplanning system two elements are missing; a mathematical model that composes statistical forecasts and a measurement tool that is able to measure forecasting errors. In this project these two elements were developed.
2. The results of the measurement of the salesplan reliability confirm the assumption that the central problems are among others caused by the inaccuracy of the salesplans. Although for example supply problems or delayed product introductions caused a part of this inaccuracy, for the majority of the differences no such causes can be found.
3. The developed measurement tool is capable to generate useful information in a quick and structural way on any aggregation level. The results can support the process of indicating best and worst practices and are able to support operational decision-making. Since the owner of the plan is not held financially responsible for the stocks, a lack of motivation to decrease plans can exist. Measuring mean percentage errors can help indicating those NSO's whose plans are too high or too low. It can also timely indicate products for which plans are too high or too low. Corrective actions can be taken accordingly in order to decrease the central problems.
4. Although there is limited evidence, the results of the first measurement of the accuracy of the forecasting tool confirm that using the forecasting tool can add value to the planning process. The development of the tool should only be seen as a first step towards giving support in the planning process.

11.3 Recommendations

1. To optimise the possibilities of the measurement tool and the forecasting tool, the tools have to be implemented. An important critical success factor for this implementation is understanding of the possibilities of the usage of the tools by all those involved. Therefore a lot of attention should be given to creation awareness of the possibilities of the tool.

2. Since the makers of the plans are not held financially responsible for the stocks that they are causing, it will be very hard to motivate them to decrease their plans as soon as there is an indication that it is necessary. Therefore the Region, which is financially responsible, should keep creating awareness in the NSO's of the importance of accurate salesplans. Therefore an incentive plan could be set up that awards those who are planning accurate.
3. Correspond any free available stocks rapidly to the sales force. For example when a deal is blown of this should be communicated in order to optimise sales opportunities and to decrease unwanted stocks.
4. Since yearly salesplans are divided over the months through seasonal indices, the indices have a great influence on production orders. Therefore much attention should be given to the seasonal indices. The fact that Germany, who is based on turnover one of the most important NSO's, has got the same indices for all accessories indicates opportunities for improvement. When the weekly rhythm in a quarter changes, it will probably be necessary to change all indices. This process should be managed carefully.
5. A lot of information about future demand can be available at the customers of the NSO's. More insight in this information can help in the salesplanning process as it is currently organised. Therefore possibilities about collecting this information should be investigated.

Literature and references

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Appendix I List of Abbreviations

12NC	12 Numbered Code
AG	Article Group
BCU	Business Creation Unit
CE	Consumer Electronics
CLISP	Confirmed Line Item Supply Performance
EDC	European Distribution Centre
IFO	Income from Operations
KPI	Key Performance Indicator
LDC	Local Distribution Centre
LoB	Line of Business
MAG	Main Article Group
MPE	Mean Percentage Error
NSO	National Sales Organisation
PSI	Purchase, Sales, Inventory
RoFo	Rolling annual Forecasting
SPR	Salesplan Reliability
URC	Universal Remote Control

Appendix II Flexibility margins

The figure below shows an example of flexibility margins as agreed with suppliers. This example is an agreement with a supplier in Hong Kong about products with an order lead-time of 30 days. Since the products have to be shipped one month should be added to M.

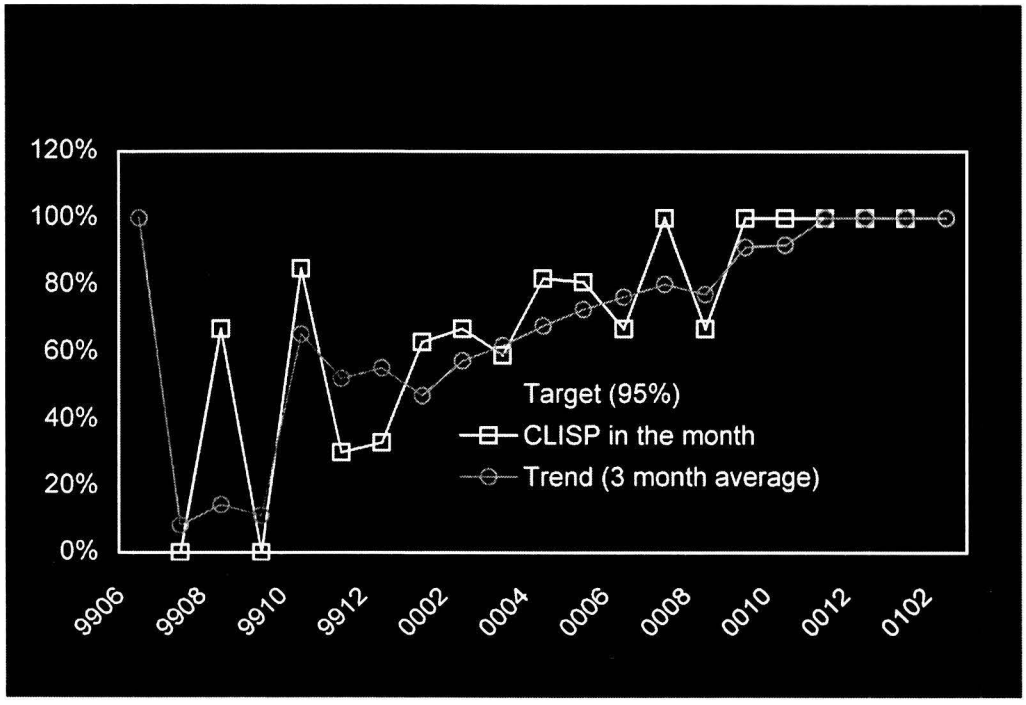
Month	Flexibility
M	Frozen
M+1	Frozen
M+2	Forecast +/- 25%
M+3	Forecast +/- 50%
M+4	Forecast +/- 100%

Flexibility margins of a supplier.

Source: Mr. Van Saaze

Appendix III CLISP measurement

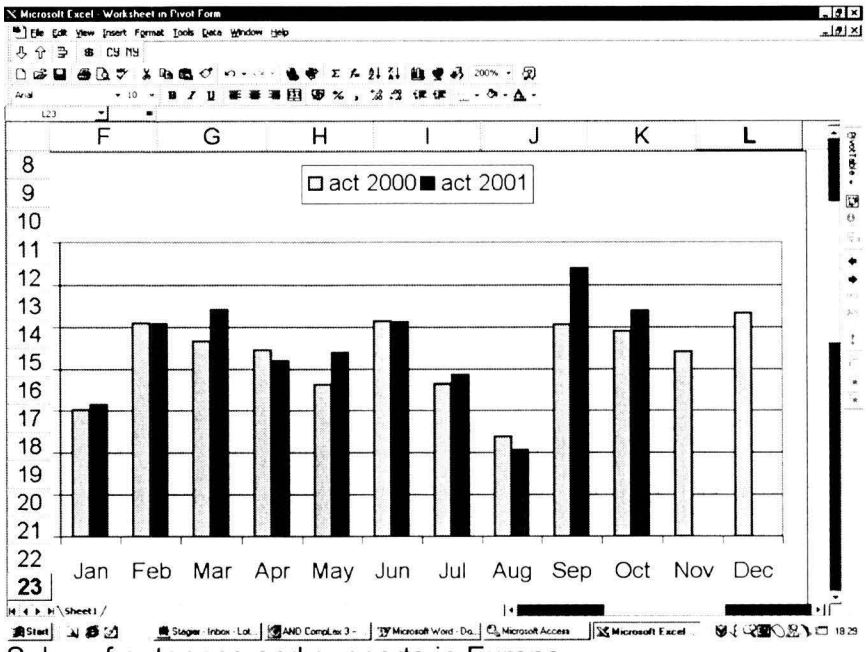
The figure below shows an example of the measurement of the CLISP of a supplier. The supplier in the example is UNI-ART, which is a supplier of cordless headphones.



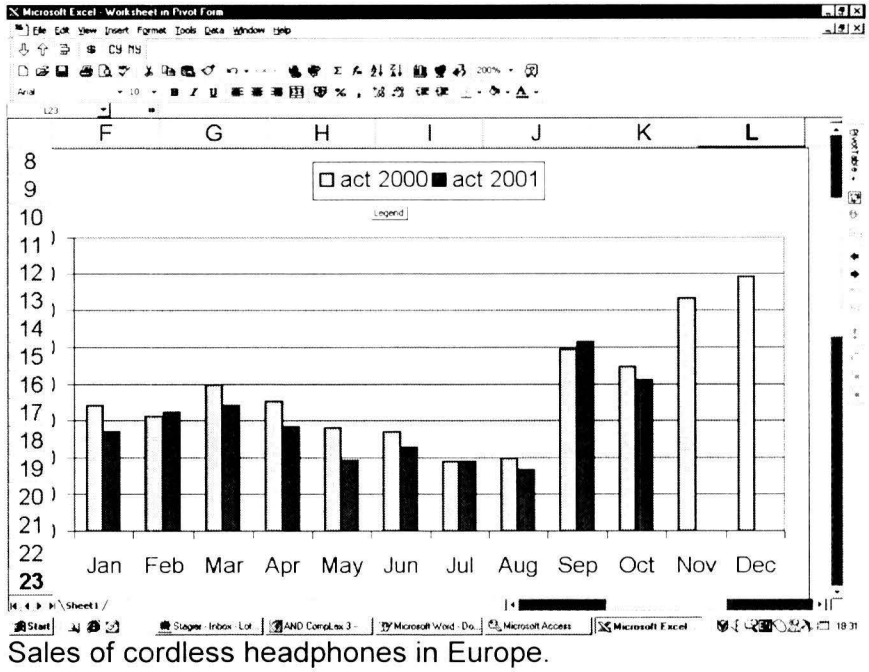
Source: Mr. Van Saaze

Appendix IV Pattern of Sales per AG

The two figures below show the sales of two AG's in 2000 and 2001. The sales are measured on volume in Europe.



Sales of antennas and supports in Europe.



Sales of cordless headphones in Europe.

Appendix V Guidelines of measurement tool

Measuring salesplan reliability for month N takes place in month N+1. These steps should be followed only once a month!

Step 1) Who: Database Manager
When: Beginning week 2 of month N+1 (=after salesplan change requests were handled).
What: Check if Atos Origin has send the latest download from Gipsy. This download can be found in the file: k:\europe\common\SPR Data Acc<Date>. This excel file contains two worksheets: one with the plans for month N+1 till month N+17 (qryAccAct) and one with the actual sales of month N (qryAccPlan). If they were not send, call Atos Origin (77606).

Step 2) Check if the column heads are correct.

Actual sales:

BU	MAG	AG	CTV	PlanType	CountryCode	BrandCode	FirstMonth	M01

Planned sales:

BU	MAG	AG	CTV	PlanType	CountryCode	BrandCode	FirstMonth	M01	Etc

If they are not correct, change them!
Close the file.

Step 3) Open the database. (k:/europe/europe t&a/shared documents/logistics/salesplan reliability measurement.mdb) Choose the button: Perform measurement. Open the CTV table. This table can be found in the table tab and shows all CTV's and their lead-times. This table should be up to date. This means the right products are ticked off. For the ticked off products, the measurement will be done. Close the file.

Step 4) Run macro "delete actuals last month (step 1)" in the database. This macro can be found in the macro tab and cleans some tables in order to make space for the new data.

Step 5) Import* the actual sales worksheet to the Access database in the file "import actual sales". Import the plan file to the Access database in the file "import planned sales". In the import plan/actual tables in the database, you can check if the files were imported correct.

*Importing files.

- In the Access database press Alt f (File)
- Press d (get external data)
- Press I (import)
- In Files of Type: select Microsoft Excel and browse to the file that should be imported.
- Press import
- Select the worksheet that should be imported and press next
- Choose first row containing column headings and press next

- Choose: in an existing file, and select the target file from the drop down menu.
- Next and finish.

Step 6) Run macro's called step 2 (Rename plan tables), 3(Run append queries) and 4(Perform measurement) in this order. The macro's can be found in tab Macro. They will update the names of the plans (e.g. month N-3 becomes month N-4) and calculate salesplan reliabilities.

Step 7) Open query "Add month to Rolling Actual Sales" in the **design view**. In the fifth column in the top cell select the appropriate month (= month N) from the drop down menu and run the query (by pressing the exclamation mark) to add the new actual sales to the file that contains the actual sales of the past months from January 2000 onwards.

Step 8) Open query "Add measurement results to Rolling Measurement" in the **design view**. In column 8 and 9, in the top cells select the appropriate month (in column this is SPR <month N>, in column 9 MPE <month N>) from the drop down menu. Than run the query to add the new measurement results sales to the file that contains the rolling measurement results of the past months from August 2001 onwards.

What if a new NSO, AG or MAG is defined?

Open the NSO, AG or MAG table and add the name and code.

What if a new product is introduced?

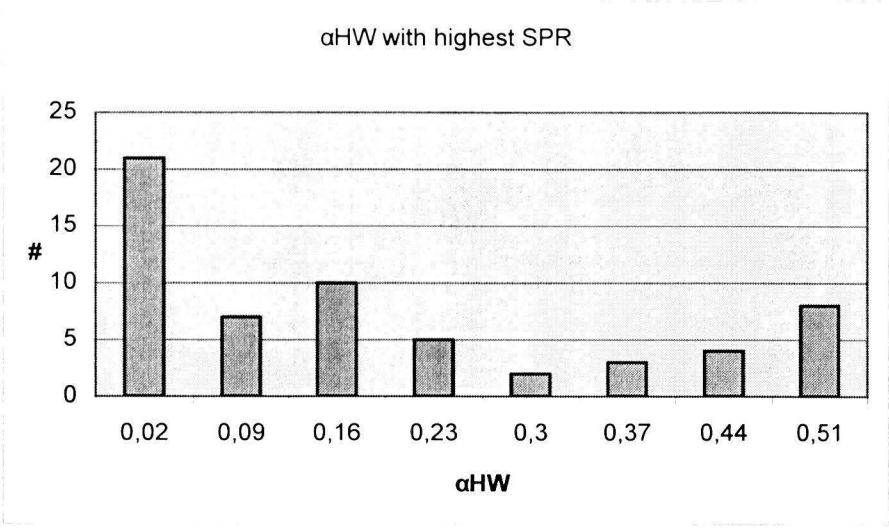
Open the CTV list and add the code, MAG, AG, lead-time and if it should be handled in the salesplan reliability measurement, tick it off.

What if there is no more space in the 'Rolling Actual Sales' or 'Rolling Measurement' tables for new months?

Open the appropriate table in the design view and insert new rows and there names.

Appendix VI Selection of appropriate α_{HW}

The figure below shows the results of a test for the most appropriate α_{HW}. The frequency of the α_{HW} that showed the highest average SPR during the first 9 months of 2001 was measured. The test was done for 60 CTV's on NSO level.



Appendix VIIa Rolling MPE on AG Level

Below an example of a way of reporting the results of the measurements can be found. A part of the details behind the figures can be found in appendix Vb.

Rolling MPE per NSO on AG level (%)

A negative MPE means plans were to high.

NSO	AG	Aug 01	Sep 01	Oct 01	Nov 01	Dec 01
Austria	Adapters	7	-34	29		
	Antennas & S	-10	-17	-35		
	Baby Care	-29	10	-3		
	Cleaning	-63	-44	27		
	Cordl. Headph	-6	-2	-14	0	0
	HiFi Headph.	37	62	35		
	Microph.	67	88	-44	0	0
	Mini Loudsp.	12	-17	20		
	Philips RC	-18	54	100		
	Power Control	25	-100	-100		
	Small Headph.	42	32	1	0	0
	Universal RC	-51	19	1	0	0
Summary for 'NSO' = Austria (12 detail records)						
Avg		1	4	1	0	0

NSO	AG	Aug 01	Sep 01	Oct 01	Nov 01	Dec 01
Belgium	Adapters	-25	-20	43		
	Antennas & S	10	13	3		
	Baby Care	-28	-50	13		
	Batteries	12	5	-2		
	Cleaning	26	32	10		
	Combo		100	100		
	Cordl. Headph	41	26	-49	0	0
	HiFi Headph.	16	-5	12		
	Microph.	75	76	-3	0	0
	Mini Loudsp.	17	1	94		
	Minicells	15	-37	-3		
	Philips RC	-3	38	8		
	Power Control	27	-6	-12		
	Small Headph.	10	25	43	0	0
	Torches	-24	-7	-43		
	Universal RC	11	4	62	0	0
Summary for 'NSO' = Belgium (16 detail records)						
Avg		12	12	17	0	0

Appendix VIIb Rolling MPE on CTV level

Below an example of a way of reporting the results of the measurements can be found.

Rolling MPE per NSO on CTV level (%)

A negative MPE means plans were to high.

NSO	AG	CTV	Aug 01	Sep 01	Oct 01	Nov 01	Dec 01	Jan 02
Austria	Adapters	SBCCU070/00	100	-45	-2			
		SBCCU120/00	-74	-70	-45			
		SBCCU220/00	100	-41	63			
		SBCCU320/00S	-100	20	100			
	Summary for 'AG' = Adapters (4 detail records)							
	Avg		7	-34	29			

NSO	AG	CTV	Aug 01	Sep 01	Oct 01	Nov 01	Dec 01	Jan 02
Austria	Antennas & S	SBC8803/00	-100	-87	-54			
		SBCTT200/00	60	-1	20			
		SBCTT300/00U	-6	36	48			
		SBCTT600/00U	13	11	-67			
		SBCTT700/00U	16	22	57			
		SBCTT900/00U	100	80	-50			
		SBCVS005/00	0	-40	-25			
		SBCVS010/00R	43	-33	-100			
		SBCVS100/00	-100	-100	-100			
		SBCVS300/00R	-89	-47	-73			
		SBCVS400/00R	-44	-25	-39			
	Summary for 'AG' = Antennas & Supp. (11 detail records)							
	Avg		-10	-17	-35			

NSO	AG	CTV	Aug 01	Sep 01	Oct 01	Nov 01	Dec 01	Jan 02
Austria	Baby Care	SBCSC105/00	-100	-59	-7			
		SBCSC110/00	-95	-37	-50			
		SBCSC115/00	-100	-52	-61			
		SBCSC150/86		-29	-81			
		SBCSC205/86	100	100	100			
		SBCSC215/86		100				
		SBCSC215/86U	-100	4	52			
		SBCSC225/86	100	100	100			
		SBCSC225/86U	-100	-63	-62			
		SBCSC363/86U	10	29	17			
		SBCSC365/86U	15	23	22			
		SBCSC367/86U	-32	49	-44			
		SBCSC368/86U	-16	28	7			
		SBCSC475/86		-58	-32			
	Summary for 'AG' = Baby Care (14 detail records)							
	Avg		-29	10	-3			

Appendix VIII Comparison of SPR of Italy and tool

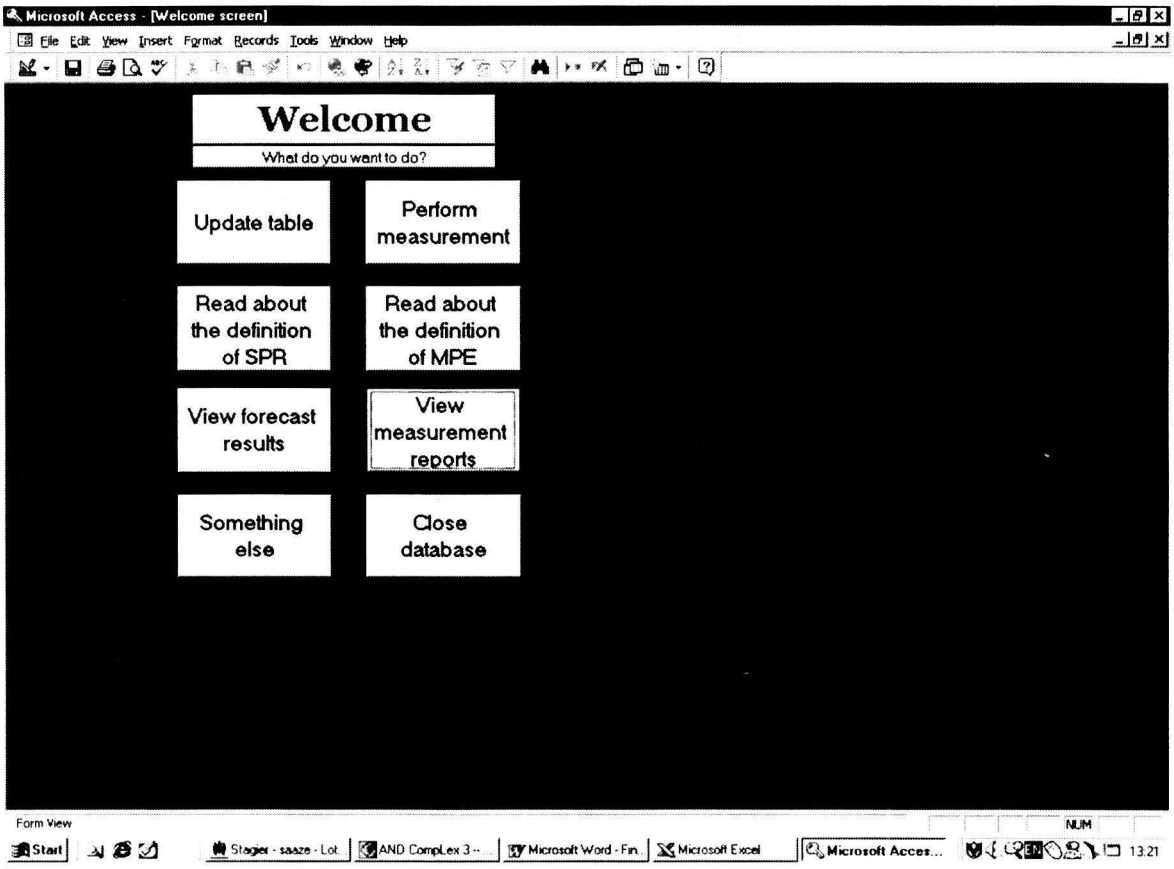
The figure below shows the SPR of the forecasting tool compared to the SPR of Italy. In the third column the salesplan of Italy for October is displayed. In the fourth column the salesplan generated by the tool is displayed. In the fifth column the actual sales in October can be found. In the last two columns, the SPR's of Italy and the tool are displayed.

comp oct 2

NSO Name	AG	CTV	NSO plan	Plan tool	Actual	SPR NSO	SPR Tool
Italy	1930	SB CHE205/00	12662	13062	10718	85	82
		SB CHE215/00	6803	6878	4014	59	58
		SB CHE216/00	107	142	54	50	38
		SB CHE219/00	123	17	0	0	0
		SB CHE225/00	4202	4101	3114	74	76
		SB CHE245/00	866	1098	732	85	67
		SB CHE510/00	42	20	6	14	30
		SB CHE555/00	358	192	288	80	50
		SB CHE565/00	785	48	66	8	61
		SB CHL120/00	5878	5847	3860	66	66
		SB CHL125/00	1028	754	582	57	77
		SB CHL135/00	6365	5661	4551	72	80
		SB CHM300/00	738	608	792	93	70
		SB CHR150/00	1295	496	144	11	29
		SB CHS300/00	2256	2222	1695	75	76
		SB CHS302/00	901	807	846	94	95
		SB CHS303/00	1425	1534	1553	91	99
		SB CHS400/00	78	90	0	0	0
		SB CHS500/00	63	79	66	95	83
		SB CHS501/00	203	225	213	95	95
		SB CHS710/00	86	29	0	0	0
		SB CHS800/00	63	20	6	10	30
	Summary for 'AG' = 1930 (22 detail records)						
	Sum		46327	43930	33300		
	Avg					55	57
Italy	1931	SB CHP090/00	171	48	96	56	0
		SB CHP140/00	3000	2736	2094	70	77
		SB CHP150/00	2001	1568	1206	60	77
		SB CHP160/00	2246	1675	1717	76	98
		SB CHP550/00	420	224	150	36	67
		SB CHP800/00	78	80	264	0	0
		SB CHP820/00	120	90	123	98	63
		SB CHP840/00	81	48	42	52	88
		SB CHP910/00U	54	13	24	44	18
	Summary for 'AG' = 1931 (9 detail records)						
	Sum		8171	6484	5716		
	Avg					55	54

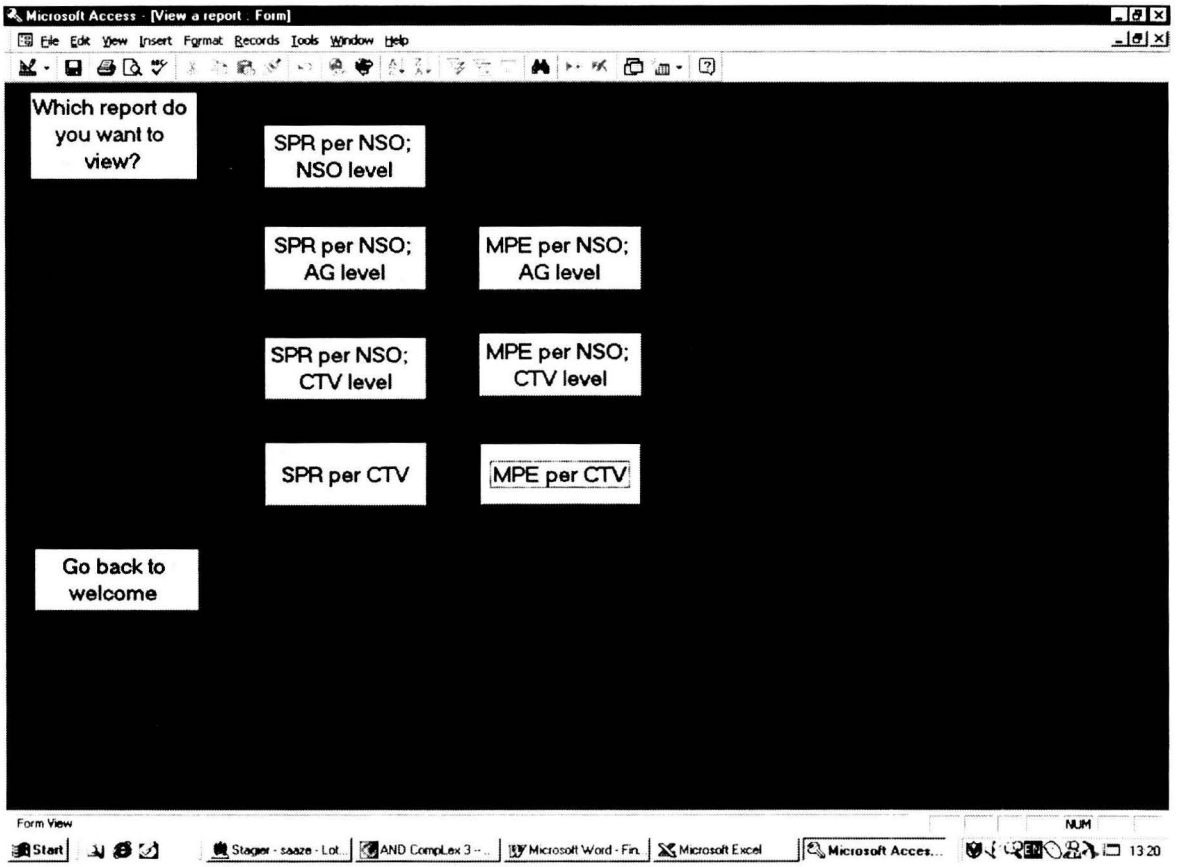
Appendix IX Welcome screen

The welcome screen is the first screen one sees when the database is opened. By clicking the buttons users can search for the information he is looking for.



Appendix X Report selection screen

By clicking the buttons on the report selection screen the results of the measurements can be viewed.



Appendix XI Overview of tables in database

In the overview of tables information about the tables used by the tools can be found.