

# **Spare Parts Distribution at Gambro Renal Products**

- Evaluation of Alternative Distribution Structures for the European Market

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## Summary

**Title:** Spare Parts Distribution at Gambro Renal Products – Evaluation of Alternative Distribution Structures for the European Market

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**Issues:** Logistics can be argued to have the potential to assist the organization when seeking both a cost/productivity advantage and a value advantage. This argument is also held true at the Global Supply Division in Gambro. The supply chains of disposables and monitors have been restructured in order to achieve these advantages. The distribution of spare parts is however currently not performing on desired service levels and gives rise to high costs. Today the spare parts are delivered from a distribution centre, DC, in Lund to the European sales subsidiaries, which keep stocks for further distribution to customers and service technicians. To achieve improvements in the distribution of spare parts two alternative distribution structures have been suggested. The first alternative is to eliminate sales subsidiaries' stocks and deliver spare parts directly from Lund. The other alternative is to eliminate parts with a low turnover and only keep them at the DC.

There are few theories and methods directly applicable when companies wish to redesign their distribution structures. The main part of the research available is focused on changes that already have been made. Consequently, there is a lack of established tools and frames of reference concerned with how companies should act when ready to make changes in their distribution structures. The research that *has* been made, is often not conducted in an extensive manner, that is, it considers only aspects on costs *or* organization, when changing distribution structures. Further, the changes are rarely treated in a comprehensive manner for the supply chain as a whole.

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There are even further scarcities in theory concerning the distribution of spare parts. That is, even though spare parts are recognized as an important element of customer service, little research has been made considering distribution of spares in the logistics literature. The more general theories are not always valid since spare parts possess special characteristics, e.g. low and irregular demand, differentiating them from other kinds of goods.

The situation, described and explained above, incorporates issues on both a practical and a theoretical level. From a Gambro perspective a world-class distribution channel might be an important competitive weapon. From an academic standpoint there is a need for system perspective theories of supply chain redesign, especially when focusing on spare parts. We can thus conclude that the situation in Gambro is appropriate for further examination from both these views.

**Purpose:** Our purpose is to evaluate the two alternative distribution structures for the supply of Gambro spare parts described above, towards the aim of lower costs and increased customer service levels.

**Methodology:** The conducted research can best be described as case studies within the systems approach. Hence, largely affecting the outcomes of the study is the definition of the system, which has the *components*; suppliers, DC Lund, sales subsidiaries, service technicians and customers, and the *links* between these components; transportations and information flows.

The research procedure has been an iterative process including the three phases of pre-study, enlarged study and system analysis. Results from the pre-study were general understanding of the system and establishment of the theoretical frame of reference. Deeper knowledge and the formulation of new research questions were outcomes from the enlarged study. The system analysis included the creation of a framework for the analysis, evaluation of the current system and evaluation of the alternative distribution systems.

**Conclusion:** The distribution system must be designed to fulfil the intended purpose. The purpose in this case is to offer differentiating service to the customers. In order to do so the distribution

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system must provide a high availability of parts and deliveries, preferably within 24 hours.

In order to improve the distribution it will be relevant to implement more centralized control over the distribution activities. Moreover, it will be relevant trying to standardize the service offered.

To reach improvements in the chain, it will also be relevant to consider aspects that lie outside the scope of this thesis including monitor design, supplier performance and the distribution of Hospital branded parts.

The use of ABC-analysis for deciding on where to locate inventories has been found insufficient and contradictory to logistics theory. Hence other dimensions have to be used for deciding on positioning of stock. One proper dimension would be *demand*.

When deciding on which distribution structure that will be implemented, it will be relevant to consider the increases in transportation costs for the distribution to France and the small use of maintenance kits in Germany. Increasing the use of maintenance kits will facilitate forecasting of frequently demanded parts.

In a strict academic sense the direct distribution structure will be the most favourable. In reality it might be more suitable to implement this structure incrementally starting with increasing the visibility in the chain and to centralize inventory of parts characterized by low demand. When centralizing inventories it will also be relevant to reduce the risks that will follow when the diversification of risks is reduced. Such reductions might include investments such as new facilities for keeping inventory.

The study contributes to the academic field with several important aspects. First, direct distribution is not always the best solution even if lead times can be upheld. This is due to the large requirements on capabilities such as coordination and planning. This may be valid explicitly in organizations that need to coordinate distribution with service activities. Second, the administrative centre concept developed by Norrman has been found beneficial. However, it need to be refined for companies with a profit centre structure. Third, the impact on

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costs when centralizing has been found to differ significantly according to the specific conditions in individual markets.

Finally, the study points out the importance of taking a holistic perspective when redesigning distribution structures. Such a holistic perspective is provided by recent supply chain management theories and illuminates the difference between supply chain management and traditional logistics.

**Key words:** Supply chain management, Logistics, Distribution, Spare parts, Gambro, Cost, Customer service.

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## 1 Introduction

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*This chapter places the study in its theoretical context, to which the company specific situation is linked. A company background is provided illustrating the firm's structural evolvements. A more detailed description of the market area in focus is followed by an outline of recent initiatives taken in order to improve the distribution of spare parts at Gambro Renal Products. Some theoretical and practical issues are discussed which leads directly to the purpose of the study. To give a more detailed precision of this purpose, the scope and focus of the thesis are discussed.*

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### 1.1 Background

The industry life cycle is a traditional and well-known concept describing how market characteristics vary over time. Intimately related to the industry life cycle, stand theories concerned with how different types of innovations are more or less present as companies evolve. One basic assumption is that product innovation decreases over time, whereas process innovation becomes increasingly important. When the roles of both product and process innovation played their parts, companies shift their attention towards strategic innovation, i.e. new ways to compete. One possible way in which companies can pursue this strategic innovation, and which has been increasing its popularity during the last decade, lies in the concept of Supply Chain Management (SCM). Central to this concept is the idea that companies can increase their competitive advantage by reconfiguring the value chain, e.g. through cost advantages or increased customer service.<sup>1</sup>

Companies of today are placing greater emphasis on logistics for several reasons. Customer service and satisfaction have become cornerstones of marketing strategy, and distribution is regarded an important element of customer service. Logistics is also a major cost element for most companies. About 15 per cent of an average product's price is accounted for by shipping and transport alone. Increase in product variety has also created a need for improved logistics management. Finally, vast developments in information technology create opportunities for efficiency gains in distribution.<sup>2</sup>

The concept of distribution can be looked upon as a topic within the wider frame of Supply Chain Management. Distribution enables the company to link the supply chain to the customers. In recent years there has been an increasing trend towards direct distribution. Earlier on, a centralization of the distribution structure was supposed to lead to higher costs of transportation and deterioration of customer service. However, structural changes in the transportation industry, e.g. deregulations in the European market, in addition to more efficient systems of information

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<sup>1</sup> Grant (2001).

<sup>2</sup> Kotler et al. (1999), p. 925-926.

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technology, has led to the fact that centralization and direct distribution in many cases result in decreased costs of transportation and increased control.<sup>3</sup>

Gambro AB has during a long period of time been a major player within the dialysis industry. The company has achieved its strong position partly by supplying the market with high-quality and innovative products. Today, the company finds itself in a situation of increasing competition, with several competitors able to deliver products of similar quality. When offering high-quality products no longer is sufficient to reach sustainable competitive advantage, the company seeks new ways in which to compete. A world-class distribution channel, which enables Gambro to reduce costs and increase customer service levels, might be such an alternative.

For many companies, distribution is not all about the supply of the product originally purchased by the customer. Companies also supply their customers with complementary goods such as disposables and spare parts. For Gambro, the supply of disposables and finished products today functions in a satisfactory manner. However, the distribution of spare parts for the dialysis monitors still suffers from severe costs due to high stock levels and unsatisfying customer service levels. To fully experience the benefits of a highly efficient supply channel, the distribution of spare parts must be overseen in order to reach the performance levels of the other Gambro supplies, such as disposables and finished products.

The requirements for planning the logistics of spare parts differ from those of other materials in several ways. First, service requirements are higher as the effects of stock-outs may be financially remarkable. Second, the demand for parts may be extremely sporadic and difficult to forecast, and the prices of individual parts may be very high. At the same time, material and time buffers in production systems and supply chains are decreasing. These characteristics set pressures for streamlining the logistics system of spare parts.<sup>4</sup>

## 1.2 Company Background

Gambro AB was founded in Lund in 1964 by the inventor Nils Alwall and the businessman Holger Crafoord. Today, Gambro has grown to a multinational corporation with 20,900 employees in 40 countries, generating a turnover of 27 billion SEK in the year 2002.<sup>5</sup>

Since the start in 1964, Gambro has evolved through a number of structural changes, of which the acquisition of French-Italian Hospal in 1987 is one of the most important. The acquisition opened the gates to the south European dialysis market. In

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<sup>3</sup> Abrahamsson (1992).

<sup>4</sup> Huiskonen (2001), p. 125.

<sup>5</sup> [www.gambro.com](http://www.gambro.com). 030502

1990, Gambro became a significant player in the U.S. through the acquisition of the American company Cobe.<sup>6</sup>

Earlier on, the units representing the three brands, Cobe, Hospal and Gambro, largely operated independently. During the year of 2001, it is however reported that the main activities managed by the three different units have been coordinated. In addition, in the same year the company reaches its objectives, reducing the number of European warehouses from 56 to six large distribution centres.<sup>7</sup> Gambro Corporation has ceased to manufacture Cobe branded products; however, there are still products obtainable, especially for the American market.

### 1.3 Gambro Renal Products

Today, Gambro consists of three different market areas, Gambro Renal Products (GRP), Gambro Healthcare and Gambro Blood Component Technologies (BCT). Gambro Renal Products manages development, manufacturing and marketing of dialysis machines, dialysers, bloodlines and dialysate concentrates for brand names Hospal and Gambro. Manufacturing is located in 11 different countries and sales activities in 90 countries. Gambro Healthcare owns and operates clinics suited for care of dialysis patients, while Gambro BCT is directed towards blood component technology. In 2002, GRP was responsible for 32 per cent of Gambro total revenues.<sup>8</sup>

GRP acts in a market divided in three different product segments, hemodialysis (HD), peritoneal dialysis (PD), and renal intensive care (RIC). In hemodialysis, blood is purified through an artificial kidney outside the patient's body. Besides purifying blood, the dialysis machine also can be used for supervising and improving the patient's blood quality. Peritoneal dialysis is mainly conducted in the patient's home and implies that a cleaning liquid is introduced into the patient's abdominal cavity. Intensive care means hemodialysis for patients in urgent need for treatment.

The three dominant players in the market for blood renal care products are Gambro, German Fresenius Medical Care and the American company Baxter. In addition to these three major players, there are also several minor competitors who certainly are focused on smaller segments, but who possess a significant share on an aggregate level. Market shares for the HD, PD and RIC segments, and for all the segments together are shown in figure 1.

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<sup>6</sup> Larsson, Ed. (1998).

<sup>7</sup> Gambro Annual Report 2001.

<sup>8</sup> Gambro Annual Report 2002.

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There is a vast amount of spare parts to be supplied by GRP for numerous reasons. The acquisitions of Hospal and Cobe implied an expansion in the already extensive mix of products. Besides, introducing new products often has resulted in shifts in suppliers and components between generations. At the same time, Gambro promises the customers a continuous supply of spare parts ten years after the manufacturing of the product has ceased. Furthermore, another factor contributing to the extensive product mix to be supplied, is the fact that older products have shown such high quality that customers have them in use long after the machines are taken out of production. Hence, a large part of the installed machine fleet consists of non-modern products.

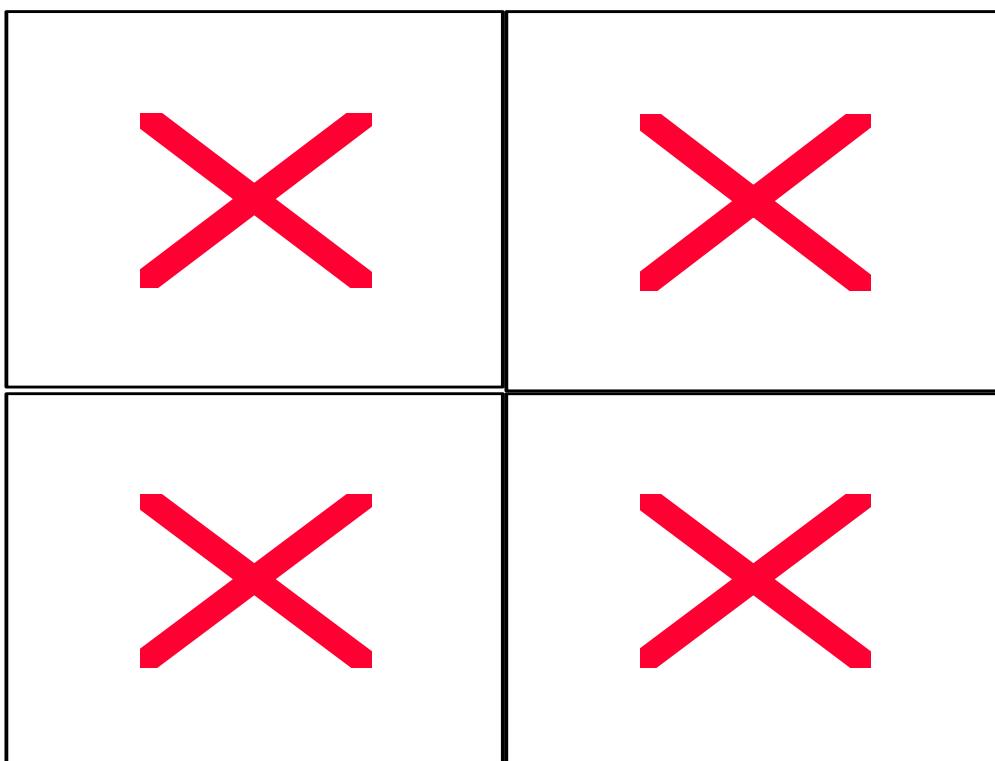


Figure 1.1. Market Shares. Source: Gambro Annual Report 2002.

#### 1.4 Spare Parts Distribution at GRP

In 1998, a project was launched aiming at improving the management of the Gambro logistical flows. The project was broken down into three different subprojects, of which one considered the management of spare parts. The other two subprojects concerned the flows of monitors and disposables. The spare parts project failed for

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several reasons, but was resumed in 2001. The reasons creating a need for improvement were numerous, and this led to the initiation of the project:

- Increased demand on service levels
- Lack of homogeneous spares handling processes
- Very low rate of stock turnover
- Low prediction accuracy on spare parts demand
- High demand on short delivery lead times
- Long process lead time
- No forecasts on spares in local sales subsidiaries
- High ratio of obsolete stock

The spare parts project was in its turn made up of two subprojects, called Spare Parts Logistics and Spare Parts as a Business. The subprojects objectives were, respectively:

Spare Parts Logistics:

- Define and implement an organization capable of handling spare parts globally within Gambro Renal Products
- Increase customer service levels
- Reduce cost

Spare Parts as a Business:

- Decrease the number of spare parts
- Get the parts from suppliers directly ready to send out
- A reasonable price level
- Create an interactive manual

The benefits the two subprojects were supposed to generate were shorter lead times, 24 hours on an average for the European market, together with increased service levels, averaging 98 per cent, and decreased total logistic costs.

A decision made within the frames of the project was transferring all logistical functions concerning the handling of spares (planning, order handling, warehousing and shipping) from the Monitor Division<sup>9</sup> to Global Supply<sup>10</sup>. A second decision was the integration of the processes planning and forecasting into the prevailing processes of Global Supply. Further, a centralization of the European warehouse structure was proposed, with direct distribution from two distribution centres in Lund and Mirandola, Italy. The only inventory to be held by local sales subsidiaries should be the one kept in service technicians' cars. The centralization proposal has not yet become realized.

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<sup>9</sup> Monitor Division is a division subordinated Gambro Renal Products, responsible for manufacturing of Gambro branded monitors and spare parts.

<sup>10</sup> Global Supply is the global sales organization within Gambro Renal Products.

The objective when transferring the logistical flows associated with spare parts to Global Supply, was concentrating the competence into one organizational unit, thereby obtaining coordination, transferring of knowledge, and more standardized processes. A centralization of the distribution structure was supposed to yield a reduction of costs in the supply chain along with gains in efficiency, together enabling Gambro to achieve an increase in customer satisfaction as well as a higher profitability. Locating central warehouses in Lund and Mirandola for Gambro and Hospal products, respectively, was a natural choice as it places the spare parts warehouses in close connection to the development, manufacturing and technical support departments.

## 1.5 Issues

Commercial success derives either from a productivity advantage or a value advantage or, ideally, both. The productivity advantage gives a lower cost profile and the value advantage gives the product or offering a differential premium over competitor offerings. Traditionally the source to cost reductions has been increased sales volume, the relation between relative market share and relative cost having great importance. However, it must be recognized that logistics can provide several ways to increase efficiency and productivity, thereby significantly contributing to reduced unit costs.<sup>11</sup>

It has long been an axiom in marketing that ‘customers don’t buy products, they buy benefits’. However, put in another way the product is purchased not for itself but for the promise of what it will ‘deliver’. These benefits may be intangible, i.e. they do not relate to specific product features but rather to such things as image or reputation. Unless the product or service offered can be differentiated from its competitors there is a strong likelihood that the marketplace will view it as a ‘commodity’, and so the sale will tend to go to the cheapest supplier. Hence the importance to seek to include additional values to the offering in order to distinguish it from competition. A powerful means of adding value is service. Increasingly it is the case that markets are becoming more service sensitive and this poses particular challenges for logistics.<sup>12</sup>

Logistics can be argued to have the potential to assist the organization when seeking both a cost/productivity advantage and a value advantage. Value advantage can be achieved by leverage in such logistics opportunities as e.g. tailored services, reliability, responsiveness, etc. Productivity or cost advantage can be realized by leveraging logistics opportunities by capacity utilization, asset turn, etc. The goal of logistics management can even be seen as the achievement of competitive advantage through both cost reductions and service enhancement.<sup>13</sup>

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<sup>11</sup> Christopher (1998), pp. 5-7.

<sup>12</sup> Christopher (1998), pp. 7-8.

<sup>13</sup> Christopher (1998), pp. 12-13.

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The importance of seeking customer satisfaction and cost reductions is also recognized by Gambro Global Supply, which becomes evident in the Global Supply mission statement:

*“To achieve the best customer service level in our industry, by having a world-class supply chain information and planning, storing and distribution of Gambro’s products while streamlining our total supply chain costs.”<sup>14</sup>*

Best-practice companies have in similarity recognized the importance of logistics cost and service and have in recent years shifted their focus from individual cost parameters and local units to total costs and global setups. The rationalization of existing structures by using mechanization and automation, with the potential improvement being 5 to 10 per cent, has been replaced by projects where logistics systems have been totally restructured. The result has been quantum-leap improvements where logistics costs have been decreased by 25-30 per cent. At the same time customer service, in terms of shorter lead times and increased order fill rate, has been improved similarly. Traditional trade-offs between customer service and cost are not applicable to quantum leaps. Efficiency can be increased by lowering costs at the same time as lead times decrease and delivery service increases.<sup>15</sup>

The efforts undertaken at Gambro in order to improve the distribution of spare parts within the existing structure have in several cases proven successful. Transferring the responsibilities for the handling of spare parts from Monitor Division to Global Supply has resulted in improved coordination and efficiency gains. More distinct areas of responsibility, clearer procedures and more accurate planning, have yielded increases in customer service levels and reductions in tied up capital. However, efforts can still be made to further improve service levels and reduce costs. In order to bring about these improvements, the following two alternative distribution structures have been identified:

1. Daily deliveries to local sales subsidiaries directly from DC Lund. The stock kept today at sales subsidiaries is reduced to comprise only A-articles<sup>16</sup>, and B-articles to some extent. There will be no C-articles in stock at sales organizations; these will exclusively be held at DC Lund.
2. Direct distribution from DC Lund to service technicians, alternatively to hospitals. This means a total elimination of the stocks held today at local sales subsidiaries. The only inventory held in stock, DC Lund excluded, will be located in service technicians’ cars and only consist of a selection of A-articles.

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<sup>14</sup> Gambro company internal material.

<sup>15</sup> Abrahamsson & Aronsson (1999), p. 263

<sup>16</sup> A, B, C-articles are defined in section 6.5.2.

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Today, Gambro branded spare parts are distributed from a distribution centre in Lund out to the European sales subsidiaries. The sales subsidiaries are then responsible for the supply of spare parts to the end users.

The two alternative distribution structures described above are the results of investigations made by the Global Supply Division in Gambro. The direct distribution concept was the original proposal for bringing about improvements in the flow. The other approach was later launched as an alternative to the direct distribution concept, since the positive outcomes from direct distribution were dubious in relation to the efforts that had to be made. Hence the first alternative above is seen as a more modest approach to achieve performance increases in the distribution, easier to implement than the direct distribution concept.

There are few theories and methods directly applicable when companies wish to redesign their distribution structures. The main part of the research available is focused on changes that have already been made. Consequently, there is a lack of established tools and frames of reference concerning how companies should act when ready to make changes in their distribution structures. The research, that *has* been made, is often not conducted in an extensive manner, that is, it considers only aspects on costs *or* organization, when changing distribution structures. Further, the changes are rarely treated in a comprehensive manner for the supply chain as a whole.

There are even further scarcities in theory concerning the distribution of spare parts. That is, even though spare parts are recognized as an important element of customer service, little research has been made considering distribution of spares in the logistics literature. The more general theories are not always valid since spare parts possess special characteristics, e.g. low and irregular demand, differentiating them from other kinds of goods.

In practice, spare parts inventories are often managed by applying general inventory management principles, if any, and not enough attention is paid to control characteristics specific to spare parts only. Furthermore, the control is usually focused on local inventories and not so much on the supply chain as a whole.<sup>17</sup>

The situation, described and explained above, incorporates issues on both a practical and a theoretical level. From a Gambro perspective, a world-class distribution channel might be an important competitive weapon. From an academic standpoint there is a need for system perspective theories of supply chain redesign, especially when focusing on spare parts. We can thus conclude that the situation in Gambro is appropriate for further examination from both these points of view.

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<sup>17</sup> Huiskonen (2001). p. 125

## 1.6 Purpose

Our purpose is to evaluate the two alternative distribution structures for the supply of Gambro spare parts described above, towards the aim of lower costs and increased customer service levels.

## 1.7 Scope and Focus of the Study

The scope of the study is the distribution of Gambro branded spare parts from the Distribution Centre in Lund to customers in Sweden, Germany and France. Hence, the flow of other Gambro products and spare parts branded Hospital are not included. This means that the distribution of spare parts from the DC in Italy is not included in the study. The term “spare parts” is thus used as a synonym for Gambro branded spare parts in the following chapters – should any other spare parts be referred to, this will specifically be pointed out. Further, the flow concerned with repair of spare parts is not taken into consideration.

The study focuses on the distribution of spare parts between the DC in Lund and the German and French customers. The domestic deliveries in Sweden mainly serve as a contrasting example to the French and German distribution structures and are not to be evaluated in a distribution-redesign perspective.

Since the focus is on distribution, other supply chain considerations such as supplier management, product development, and manufacturing are not discussed in the analysis. Such considerations are however illustrated in the presentation of empirical data with the purpose of illuminating the complexity and external forces that act upon the distribution.

A great obstacle to surmount, when changing organizational structures, is the implementation process itself. However, although an interesting issue, this study leaves no recommendation how implementation of new distribution structures can be facilitated.

During this study, Gambro has realized some organizational changes. In cases when reorganizations have had no significant impact on the study, these changes have been neglected.

## 2 Methodology

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*The procedure used when working with the thesis is here described and explained. The authors' interpretation of the empirical context is also accounted for. These considerations are further interpreted and classified in a methodological context. Finally, the procedure and the research instruments are evaluated with regard to their impact on the results and the quality of the thesis.*

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### 2.1 Basic Assumptions

The purpose of this report is to evaluate two alternative future distribution systems for Gambro spare parts. The first step, in order to fulfil this purpose, has been to describe the existing distribution system, identify its components and their functions, and the external factors that affect it. The next step of the study has been to determine what parts of the distribution system that has to be changed, in order to meet the future demands. Finally a new system has been constructed. This way of conducting research is usually referred to as the system approach. See figure 2.1.<sup>18</sup> As shown in figure 2.1 the research procedure according to the system approach also includes a fourth step: the application of the concepts from the analysis. In this thesis, however, that step has been left out since the implementation of the proposed distribution system falls out of the scope of the thesis.

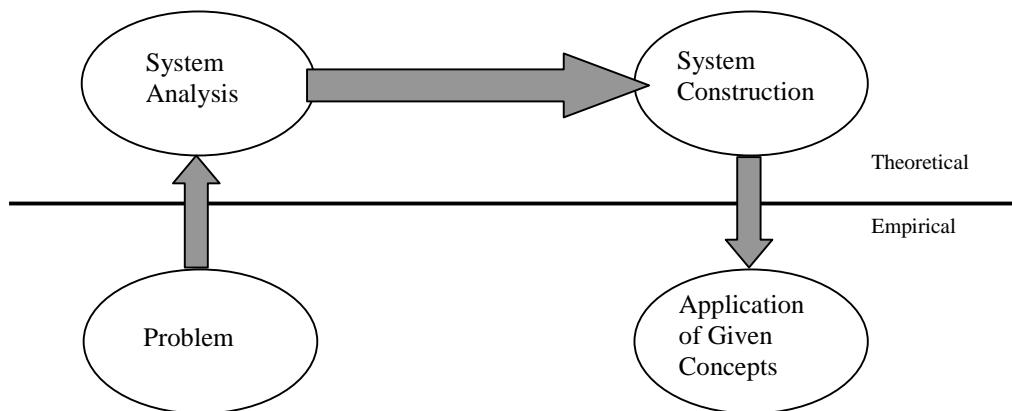


Figure 2.1. The system approach research process.  
Source: Arbnor & Bjerke (1998).

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<sup>18</sup> Arbnor & Bjerke (1998). p. 322

## 2.2 Research Approach

Reality, according to the systems approach, is arranged in such a way that the sum of the parts is always less than the total sum. The key issue here is the relations between the parts. Systems can be defined as open or closed. An open system contains parts that are not included in the analysis, but still affect the parts within the assumed system boundary. Considering a system as closed, on the other hand, means that all of its components are taken into account.

Gambro is in this report considered to be an open system. The company consists of internal parts and is connected to components in its environment, such as suppliers, customers and competitors. Gambro is part of this system and contains subsystems, such as marketing, supply and manufacturing.

The system that is in focus in this thesis, the spare parts distribution system, is shown in figure 2.2. The system includes DC Lund, service technicians and the links, i.e. information, financial and physical flow, between them. Outside the system boundary are placed the sales companies, the suppliers and the customers. These last subsystems have only been studied in regard to their part in the spares distribution system, meaning that much information about them has been left out. Inevitably this raises the question whether important information has not been left out. There is, of course, no clear answer to this. However, it can be said that there must always be a limit to what to include in the thesis, and either this limit can be a product of a

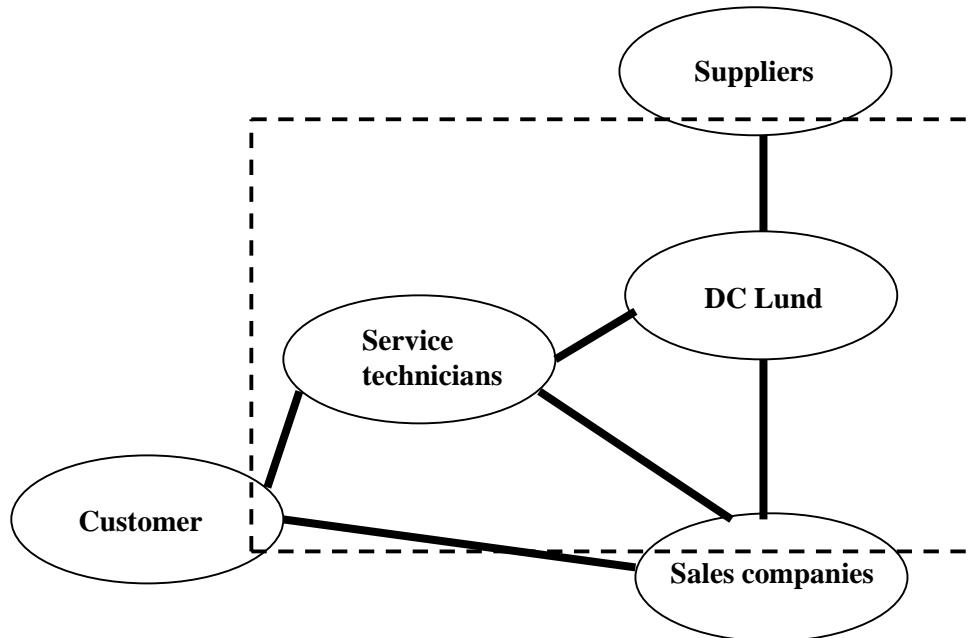


Figure 2.2. The system of interest, including boundaries, in the thesis.

conscious choice or it can be a product of other actions, not primarily aimed at academic quality. Consciously choosing, making this matter clear to both the author and the reader, is without doubt the better option. It must also be said that defining the system has not been a one time decision as much as a process, which has, more or less, continued throughout the whole research process.

### **2.2.1 Components in the System**

*Suppliers* – Suppliers refer to all suppliers of spares for the Gambro brand of dialysis machines. In cases where the parts are bought from the Monitor Division, that division is considered to be a supplier.

*DC Lund* – DC Lund is, as mentioned above, responsible for the distribution of spare parts for dialysis machines under the Gambro brand. The activities associated with this flow are studied; other logistic issues dealt with in DC Lund are left out.

*The sales companies* – Sales companies refer to the three studied sales companies, in Sweden, Germany and France. These are currently responsible for ordering and, in the case of France and Germany, warehousing of the spare parts. These processes have been studied, while the other activities of the sales companies' have been left out.

*Links* – Transports are supplied from external sources. This is always the case for transports between DC Lund and the sales companies and sometimes the case for transports from sales companies to customers. Transports from suppliers to DC Lund will not be dealt with. Logistical information and economic data are transferred between and within the subsystems within their respective information systems.

*Service technicians* – The service technicians are in several cases the final link between Gambro and the customer. In the service cars a small supply of the most commonly used parts are stored.

*Customers* – Customers include hospitals and specialised dialysis clinics. These are of interest in the thesis regarding those of their demands that concern the distribution system.

## **2.3 Research Procedure and Structure**

The study on which this thesis is based has been performed between January and June 2003. The authors have been based at Gambro's Distribution Centre in Lund, but other parts of the company have also been studied. The procedure used when working with the study can be divided into three phases, here described and explained. See figure 2.3.

### 2.3.1 Pre-Study

At the earliest stage of the study there was some uncertainty concerning both precisely what was the issue and which theoretical framework was appropriate to use. To reduce this uncertainty a series of interviews were conducted in order to establish how the distribution system worked. A second purpose with these interviews was to clarify the different perspectives on spares distribution held by the different departments and divisions.

The basis for the latter purpose was the assumption that the spares distribution, even if the company logic did not clearly state that, was an integrated part of the Gambro value chain. A consequence of this was that a complete understanding of the logic governing the spares distribution only could be reached when regarding it as a link in that chain. According to this view the thesis has come to include material about functions and parts that are not included in a strict definition of the distribution system. This material is only included to gain a better understanding of the distribution system and shall thus not be regarded as attempts to a comprehensive understanding or analysis of these other functions.

The base of the theoretical framework was also established during this phase. In the very beginning of the study the framework consisted mainly of the logistics literature that the authors were already familiar with. Progressively this base was widened through extensive searches among scientific journals and in the university library.

### 2.3.2 Enlarged Study

The outcome of the first phase was an understanding of the problems related to distribution in general as well as a deeper knowledge concerning the various complications in Gambro's spare parts distribution process. This new knowledge was used to formulate a series of new research questions.

In order to gather information to answer the new research questions further interviews were conducted. The respondents selected for these interviews were people with key roles in the different aspects of the spare parts distribution at Gambro.

Interviews were also conducted with researchers in the areas of engineering logistics and production management. The purpose of these interviews was to further adjust the search for adequate theories and to gain a better understanding for the theories regarding the critical areas of the study.



Figure 2.3. Illustration of the major elements in the research procedure. The feedback arrows symbolize the iterative nature of the process.

At this stage it was clear that the distribution structure in Sweden bore a great deal of resemblance with the possible future structures in question, while the structures in France and Germany had no such resemblance. Key personnel in the Swedish sales company were also easy of access compared to their counterparts in France and Germany. As a result of this the Swedish sales company was the first to be studied in depth together with the shared logistics functions at the Global Supply Division.

The European market for Gambro products is not uniform since customer demands differ considerably between countries and since the local sales companies operate in different ways. Thus it was not considered useful to try to regard the market as one single market. Instead, two economically important and demanding markets, France and Germany, were selected as a base for further studies. This rendered two immediate advantages. First, the scope of the study decreased, which made it possible to research into the ingoing objects in greater detail. Second, it implied that the solution reached in the study would satisfy the highest demands posed on the distribution system in Europe. This also increased the probability that the solution could be used in a country that had not been included in the study.

### **2.3.3 System Analysis**

This phase of the study essentially consisted of three activities, the construction of a framework for the analysis, the evaluation of the current distribution system and the evaluation of a possible future distribution system.

The analytical framework for dealing with the qualitative aspects was developed very much as an aggregate of the theories. Primarily this aggregation was made by using the broad ideas of Huiskonen<sup>19</sup> as general guidelines and refining these with the more specific theories. A further description of the theoretical foundations of the thesis is found in chapter 4.

A clearly stated demand from Gambro was the inclusion of an economical comparison of the future scenarios for spare parts distribution. In order to meet this demand the distribution system has to be modelled by mathematical means. This proved to be a problem since strict mathematical models for this particular type of distribution system did not exist. Prediction of the economic performance could, however, be made through the use of earlier empirical studies.<sup>20</sup> By creating intervals using this method and evaluating these intervals in qualitative terms, an acceptable degree of certainty could be reached.

Using this framework, the current distribution system was analysed. The result of that analysis then became the foundation for the evaluation of the possibilities and limitations of the future distribution system.

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<sup>19</sup> Huiskonen (2001).

<sup>20</sup> Abrahamsson & Aronsson (1999).

### **2.3.4 Comments on the Research Procedure**

The description above suggests that the research underlying the thesis has followed a sequential pattern. The authors wish to underline the fact that this description is merely a model and, as all such constructions, sacrifices detail for clarity. In reality the research has resembled a coherent process more than a series of steps. The process has also been of an iterative nature, meaning that earlier steps constantly have been controlled and changed in accordance with new findings. The logical frame holding the process together has been the ambition to create the best system model possible with given limits in time and resources.

## **2.4 Research Instruments**

The most important way of collecting empirical data for this thesis has been through interviews. The interviews can be divided into two groups based on their research purpose. The first group consists of the interviews conducted with the purpose of building an empirical base of understanding, the majority of these were held during the first half of the study. During the latter part of the study the interviews usually were aimed at more specific understanding of individual activities, these belong to the second group. The data collected during the interviews was mostly of a qualitative type and the common objective was to gain a better understanding of the links between the sub systems and the function of the systems themselves. Quantitative data was also, to some extent, gathered during the interviews but the main source for this data were Gambro's databases over logistic and economic data. The latter data was collected in order to calculate the cost relations in the present and future systems. For the prediction of future costs a mathematical model was used.

### **2.4.1 Sources of Data**

Data can be classified as either primary or secondary, depending on whether it is collected specifically for the study or if it already has been collected and processed.<sup>21</sup> The main sources of these types of data in this report are listed below.

#### *Primary data*

Main sources were:

- Interviews and discussions with Gambro personnel
- Searches in Gambro databases

#### *Secondary data*

The following sources were mainly used:

- Gambro material: annual reports, intranet, presentation material
- Academic reports and literature

These types of data are all commonly used within the systems approach.<sup>22</sup>

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<sup>21</sup> Arbnor & Bjerke (1998). p. 241

### **2.4.2 Interviews and Discussions**

The interviews have each been based on a set of questions related to the study, but varying depending on the respondent. The prepared questionnaire has, however, not always been followed. In those cases the answers given by the respondent have shown new issues or new angles, which were considered more important than the ones known at the start of the interview. Formally this type of interview is referred to as semistructured and the questions as open.<sup>23</sup> The interviews have been conducted as personal interviews or, in a few cases, via e-mail. During the interviews both authors were present, asking questions and writing down answers, in order to decrease the risk of losing or misinterpreting information. The average interview lasted for one hour.

In general the respondents have been highly motivated to participate in the interviews. This depended on good preliminary information in a letter of introduction and, possibly, on the fact that the authors were not employees of Gambro. It could be argued that the latter cause might have made it easier for the respondent to discuss issues in conflict with company policy or otherwise controversial.

### **2.4.3 Choosing Respondents**

The main guideline when choosing respondents for the interviews has been the system described in section 2.2. Together with organization charts of Gambro this system has given the first line of respondents on each subject. Other main influences on the choice have been advice from the supervisors at Gambro. Those have, as individuals in the organization with their detailed knowledge of the functions, provided vital information, not otherwise accessible.

In choosing the second line of respondents much of the same method has been used. However it has been complemented with recommendations issued by the respondents. Parts of the system that seemed to be associated with problems or frictions were also identified and further examined.

The basis for selection might be considered to have been recommendations,<sup>24</sup> either from respondents or from supervisors. This method of selection carries the obvious disadvantage that it potentially gives a great deal of influence on the results to those issuing the recommendations. On the other hand it gives the researcher access to information and views of the issue held within the studied organisation, which can prove instrumental in gaining an understanding of the system.

In order to counter the drawbacks of the recommendation based selection the authors have also sought to use other methods of selection. Mainly this has been done by matching the recommendations with knowledge and understanding of the system and

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<sup>22</sup> Arbnor & Bjerke (1998). p. 244

<sup>23</sup> Arbnor & Bjerke (1998). p. 243

<sup>24</sup> Arbnor & Bjerke (1998). p. 240

with knowledge of identified sources of problems within the system. In this way the probability of impact from deception or ignorance on behalf of the respondents has been considerably reduced, if not eliminated.

The selection has thus been based on recommendation, system understanding and problems in the system. These methods are commonly used simultaneously in social sciences.<sup>25</sup>

#### **2.4.4 Gambro Material**

Secondary data collected from different sources within Gambro has been used. Material of this kind has an advantage when company policies and strategy are sought after, because it gives an insight in the internal life of the organisation. Using it for other purposes requires some caution though, since it can be assumed that the company will tend to communicate information that will support its own actions. Gambro material has therefore predominantly been used to gather historic facts and data about market shares etc, i.e. information that easily could be controlled against other sources.

#### **2.4.5 Academic Literature and Reports**

A substantial volume of printed material has been studied in order to gain a deeper understanding of the concept of distribution and of its dependencies to other areas of research. The material included books, reports and articles. The search for this material has been undertaken in the University Library in Lund and in its data base, LOVISA, and in the data base of The Royal Library in Stockholm, LIBRIS. To complete and refine the search three interviews have also been conducted. Respondents in the interviews were Professor Mats Abrahamsson, Department of Logistics Management, LiTH, Adjunct Professor Stig-Arne Mattsson, Department of Engineering Logistics, LTH, Ph.D. Andreas Norrman, Department of Engineering Logistics, LTH and Ph.D. Student Fredrik Olsson, Department of Production Management, LTH. Through these interviews further appropriate literature could be found. Moreover, they were also used to gain insight in specific problems of both quantitative and qualitative kind.

#### **2.4.6 The Cost Model**

The study includes one significant quantitative part – the evaluation of financial consequences of changes in the distribution structure. This evaluation presented somewhat of a problem due to the lack of logistics research in the area. In many empirical studies the subject of cost in relation to distribution structure is covered. However these studies are mainly concerned with the analysis and comparison of systems already in place. Further cost is very seldom treated as an explicit quantitative parameter. The issue in question in this thesis concerns the prediction of the total cost for a system where only the starting point and not the end state is given

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<sup>25</sup> Arbnor & Bjerke (1998). p.240

and there is a need for calculating the difference in cost as absolute number. Thus the majority of the empirical studies available were not found to be of any use for the quantitative part of the thesis.

In one case, however, an aggregate of empirical studies had been used to model a mathematical link between the outlines of the distribution system and the total cost. This was made by Abrahamsson and Aronsson<sup>26</sup> who argue that a prediction of the total cost can be made with reasonable accuracy, given that qualitative parameters of the system also are known. The model was found to be in accordance with the system approach used in this study. During the study it was found that the empirical context in Gambro was not in full correspondence with the theory behind the model in details concerning the physical flow. However Abrahamsson and Aronsson's model was used as a basis for the calculation of future distribution costs. The cost model is further explained in section 4.4.5.

#### **2.4.7 The Qualitative Analysis**

The analysis of the distribution system is based upon the theoretical frame of reference presented in chapter 4. The structure of the frame of reference is based on the theories of Huiskonen.<sup>27</sup> Its original content has been modified to fit in with the circumstances of this particular study. The modifications have been done both with regard to the empirical data and with regard to other theories found relevant.

### **2.5 Criticism of the Used Methods**

#### **2.5.1 Validity**

The most important verification of validity within the systems approach is the effects obtained when the results of the study are used as guidance.<sup>28</sup> Such use of the results of this particular study has not been made during the study itself. However, if Gambro, or any other company in a similar situation, would put the analytical results to use in redesign of their distribution structure that would be the final test of validity.

During the study the authors have sought to investigate every issue from as many angles as possible. This has been achieved by interviewing several respondents, representing as many functions as possible, on every subject and by studying secondary data. Diversity has also been sought by the use of a broad array of theories for the analysis in order to catch the complexity of the problem at hand.

In order to increase the credibility of the results from the interviews the interview guides and the interview technique have been continuously refined. The authors have been aware of the risk of their own bias and therefore conducted the interviews as semistructured, thus continuously taking the respondents' views into account.

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<sup>26</sup> Abrahamsson & Aronsson (1999)

<sup>27</sup> Huiskonen (2001).

<sup>28</sup> Arbnor & Bjerke, (1998), s. 251

Finally, the empirical and analytical findings have been discussed throughout the study, both with the project hosts at Gambro and with the supervisors at the University of Lund.

### **2.5.2 The Use of Interviews**

Interview as a way of acquiring information can be said to contain certain risks. First there is the risk of misinterpretations. These can come about as an effect of misunderstandings during the interview, both on behalf of the respondent and the interviewer. The result is that the interpretation of the responses becomes incorrect and thus that the analysis is based on facts not corresponding with the real situation. Second the interviewer himself can affect the respondent's way of answering, causing him to withhold or exaggerate information.<sup>29</sup>

In order to avoid these effects both authors have attended the interviews, taking turns asking questions and taking notes. Questions concerning critical facts have routinely been asked to several respondents from different departments. The purpose of this procedure was to eliminate the risk that one respondents' answer alone or one departmental view should be too influential.

### **2.5.3 The Validity of the Cost Model**

In order to evaluate the economic consequences of the two alternative future distribution strategies a model based on aggregated empirical data has been used.<sup>30</sup> The use of this model, as well as the model itself can be questioned. The model is based on observed and approximate relations and not, in a strict sense, on mathematical evidence of cause and effect relations. Furthermore the results produced by the model are not precise and have the form of intervals rather than precise numbers.

This kind of criticism is, however, based on the belief that cause and effect relations in distribution can be mathematically modelled. One should here bear in mind that the mathematical models for distribution systems of today incorporate extensive simplifications of reality and are to a great extent focused on satisfying academic needs and demands.<sup>31</sup> The simplifications include discarding of parameters such as company bargaining power, irregular demand patterns and complexity in distribution structure. Furthermore the models are based on basic assumptions such as single product manufacturing, single customer relationships and intercompany synchronized production cycles. This makes the mathematical models, however relevant they are in the theoretical aspect, inappropriate as tools to describe and explain reality in order to achieve practical results.<sup>32</sup>

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<sup>29</sup> Eriksson & Wiedersheim-Paul (1997). p. 87

<sup>30</sup> Abrahamsson & Aronsson (1999)

<sup>31</sup> New & Payne (1995). p. 61

<sup>32</sup> New & Payne (1995). p. 63

This deficiency in the theoretical framework makes it necessary to find a balance between the need for precise numbers and the will to accept the complexity of the system. The emphasis of this report is on the latter of these aspects. The study as a whole is based on a perception of reality that links to the systems approach, which has a basic view that directly opposes the base of the mathematical models.<sup>33</sup> Furthermore, the purpose of this report is very much related to future need for redesign of Gambro's spare parts distribution system. This being a practical result it follows that a research method that gives the most relevant result from a practical perspective should be used. From both practical and theoretical point of view it is thus reasonable to use a method that takes into account the full complexity of the distribution system. The loss of precision, concerning the numbers that hereby occurs is, according to the authors, primarily imaginary.

#### **2.5.4 The Quality of the Research**

All the methodological choices made during the course of work with this thesis have, in their respective way, affected the final quality and character of the thesis. The use of different methods would possibly have resulted in a different quality and other conclusions. With given time and resources the authors are convinced that the methods used were the most appropriate. This conviction does however by no means make the discussion of choice of methods less interesting. Thus some of the major decisions and their consequences are here discussed.

The system could have been defined otherwise. From a supply chain perspective it is by no means obvious where the system boundaries should be set. System components before DC Lund in the chain, e.g. production and product development, might be included. Since the performance of such components affect the performance downstream a system expansion would have the potential to improve the total quality of the study. Changing the system in this way had however also given a great increase in scope making the task not manageable within the given limits. Instead the system has been considered as open and the effects of components outside of the system have been accounted for but their causes have not been examined.

The assumption that the studied objects can be described as a system has also to a great extent affected the results. Had the assumption been that the subcomponents were independent units merely arranged in a certain pattern much effort could have been spared since the connections between these does not have to be taken in account. A more analytical<sup>34</sup> procedure would thus have given time for other research activities; it would also have made it possible to use other methods. This approach was however rejected at an early stage simply because the connections between the components proved too complex and entangled for them to be described as independent. Such a description would have meant that important features would

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<sup>33</sup> Arbnor & Bjerke, (1998)

<sup>34</sup> Arbnor & Bjerke (1998). pp. 96

have been left out and the simplifications would have made the result of little practical use.

The use of interviews as the main way of collecting data and the theories included in the theoretical framework are two other factors that have affected the quality of the thesis. The heavy reliance on interviews for gathering empirical data is connected to the perception of the issue and to the system definition. If the studied object is defined as a system it follows that personal interviews rather than surveys is the most appropriate technique to gain the necessary understanding of the system<sup>35</sup>. The effect of the use of personal interviews is that a deeper knowledge of a few cases is gained. If surveys were used instead, it would have been possible to gather information about more subsystems, for example all the sales companies in Europe could have been included. Since a survey is a more formalized way of communicating than a semistructured interview and the framework within which the communication is to take place is shaped to a great extent by the designers of the survey the knowledge gathered would then to a greater extent have been influenced by the authors' views of the distribution system. Thus the use of surveys would have brought the risk of information being lost due to lack of comprehension of the system on behalf of the authors'. The selection of theories has been based on the authors' understanding of the specific issue and the system approach for examining it. The theoretical framework has thus further enhanced the prevailing system view in the thesis.

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<sup>35</sup> Arbnor & Bjerke (1998).

## 3 Pre-Study

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*This chapter presents the firm's general distribution structure for spare parts in Europe. The units contained in the structure, the intermediaries in the flow, are described. This presentation facilitates the common understanding of the system studied, which can be useful to bear in mind for the coming chapters. The pre-study serves as an opportunity for readers not familiar with the spare parts distribution in Gambro to achieve a general understanding of the spare parts distribution. Findings presented in this chapter are not exposed to analysis, as is the case for findings presented in the in-depth study. The pre-study is also used for presenting important aspects related to the distribution structure but not focused on in this thesis.*

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### 3.1 European Distribution Structure in Brief

All Gambro branded spare parts flow through the Monitor Division located in Lund, either because of the fact that the manufacturing of the part is located here, or, if sourced externally, because of quality controls. The spare parts are then shipped to a *distribution centre* located in Lund (DC Lund). From the distribution centre, spare parts are distributed out to the European sales subsidiaries. The spare parts are then further supplied to either customers or service technicians. The service technicians carry small stocks of spare parts in their cars. In some countries inventories are also carried at local branch offices. Figure 3.1 describes the general flow. For the Swedish market, the flow described above is slightly different, as no spare parts are kept in stock by the Swedish sales subsidiary; instead the distribution centre in Lund keeps them.

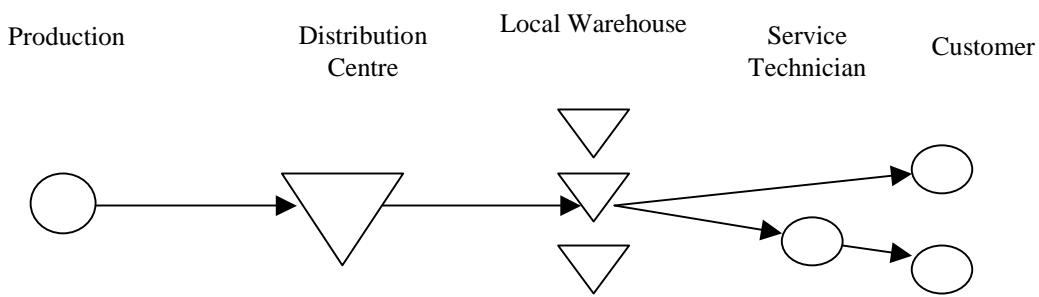


Figure 3.1. Gambro's general spare part distribution structure.

If a part is available at the production plant or the distribution centre, the lead time from order placement to delivery is between 24 hours and two weeks, depending on the customers location and types of transportation used. In the case when a spare part isn't readily available and must be sourced from an external supplier lead time may be up to four weeks from the time DC Lund places the order to the time that part is in the hands of the DC.

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Main supplier to the sales subsidiaries besides DC Lund is also the distribution centre in Mirandola, Italy, which distributes all Hospital branded spare parts. The distribution from the DC in Lund produces significantly higher service levels to the sales subsidiaries than the DC in Mirandola.

The units involved in the physical flow of spare parts are briefly described below in sections 3.1.1 - 3.1.5.

### **3.1.1 Production**

Lund is a so-called centre of excellence, which implies that the Monitor Division in Lund has the main responsibilities for sourcing, development and production of dialysis machines. Monitor Division in Lund produces all spare parts not sourced externally. However, all spare parts pass through the hands of the Monitor Division since externally sourced parts pass a quality control. The spare parts handled by the Monitor Division can be grouped in four categories. The first category consists of *spare parts sourced externally* and quality controlled by the Monitor Division as described above. The following two categories are *parts used in production* and *parts not used in production*. The fourth group consists of repaired material; this category is however excluded from the study.

The sourcing of external parts is currently struggling with certain issues. Small volumes give rise to conflicts with suppliers. Lead times for some suppliers are lengthy and a minority of suppliers contribute to a large share of back orders.

The main responsibilities for externally sourced parts lie upon the Monitor Division as supplies of spare parts are agreed on with suppliers in relation to contracts made for parts used in the production.

### **3.1.2 Distribution Centre**

DC Lund is one of four Distribution Centres subordinated Global Supply. DC Lund manages inventory and distribution of Gambro products for the Nordic Region, the Baltic States and the markets where Gambro does not have located any sales subsidiaries, a total of 90 countries. Further, the global distribution responsibilities for the dialysis machines and Dry-Cart products manufactured in Lund lie on the DC.<sup>36</sup> DC Lund also distributes all Gambro branded spare parts to the European sales subsidiaries. DC Lund consists of three different physical entities, separated geographically. The administrative functions are separated from the physical handling of the products and located together with other corporate functions. The two other entities are the central warehouses for spare parts and finished products that are located next to each other. The physical inflow of spare parts to the distribution centre is described in figure 3.2. The flow of repaired spare parts is not shown since it lies outside the scope of the study.

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<sup>36</sup> www.gambro.com. 030522

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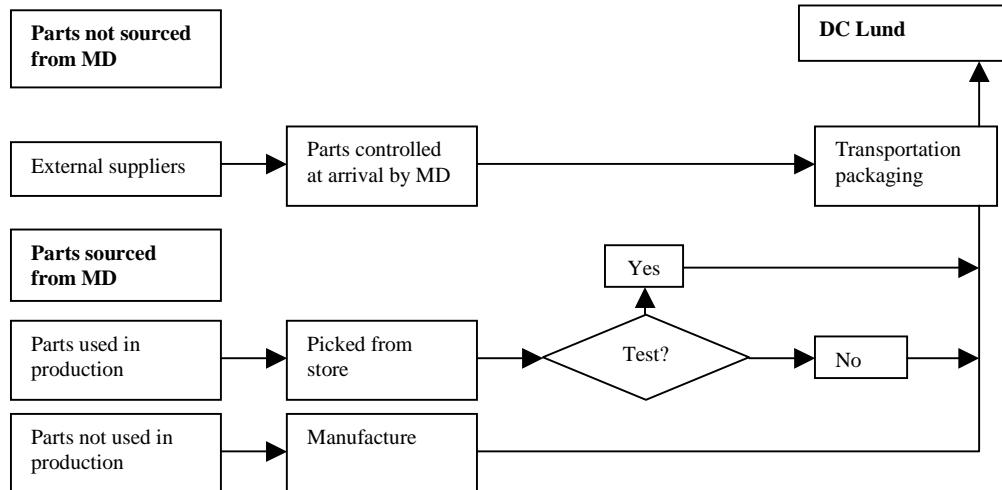


Figure 3.2. Spare parts inflow to DC Lund.

### 3.1.3 Local Warehouse

Local warehouses are in most cases located at the European sales subsidiaries, typically one sales subsidiary for each European country. The sales subsidiaries are responsible for sales and for supplying spare parts to service technicians and customers.

### 3.1.4 Service Technician

A service technician is responsible for maintenance and repair of Gambro products. Maintenance is typically carried out twice per annum or yearly after e.g. 2400 machine hours. One service technician is responsible for his own machine fleet. The service technician carries a mobile stock of spare parts in his car.

### 3.1.5 Customer

As Gambro both owns and manages clinics, the customer can be either internal or external. The customers also differ from each other with regard to the services purchased; this is reflected in the different types of contracts associated with purchase of spare parts and maintenance of dialysis machines.

Three different groups of end users can be identified:

1. *Home patients*; consists of stable chronics using PD dialysis. Typically this type of care requires 1500 machine hours yearly.

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2. *Clinics*; nursing stable and instable chronics and patients in need of intensive care. Normally a dialysis patient receives treatment four to five hours three times a week. The clinics manage between 12 and 50 dialysis machines each operating approximately 3000 machine hours per year.
3. *Satellites*; units managed by the clinics nursing stable chronics. The machines operated by the satellites are typically more extensively used compared with the machines operated by the clinics. This is due to a more continuous use being allowed since the patients have more stable medical conditions. The machines used by the satellites run about 4000 - 5000 hours a year. Satellites usually operate six days a week, often in two shifts a day.

## 4 Theoretical Frame of Reference

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*Prior to the presentation of the theoretical frame of reference that supports the analysis in this study, a brief discussion of the concepts logistics, supply chain management and distribution is conducted. The purpose of this discussion is to illuminate our perspective on logistics and distribution theories. This perspective is significant to bear in mind as it influences the analytical conclusions drawn later on.*

*The chapter proceeds with a presentation of a theoretical frame of reference based upon four constituting elements that are considered relevant to examine when striving to fulfil the purpose of this study. The four elements, strategy & policies, distribution structure, organizational structure, and coordination & control are thoroughly examined.*

*Finally, the chapter ends with a summary of the theoretical frame of reference and some illuminating examples of the linkages between the four elements contained.*

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### 4.1 Theoretical Introduction

The concept of *Supply Chain Management* was introduced during the first half of the 1980's, pointing out that discussing logistics for one company solely no longer was sufficient. Supply chain management states that a system no longer can be defined as one company with its suppliers and customers, but includes all activities from handling of raw materials to the point where the product lies in the hands of the customer.<sup>37</sup>

According to Copacino<sup>38</sup> Supply Chain Management can't be considered appreciably different from the understanding of integrated logistics. Supply chain management can be defined as:

*“Supply chain management is the integration of business processes from end user through original suppliers that provide products, services and information that add value for customers.”*<sup>39</sup>

One further definition, frequently found in the literature, is offered by Cooper & Ellram<sup>40</sup>:

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<sup>37</sup> Aronsson (2000), p. 6

<sup>38</sup> As referred to in Aronsson (2000).

<sup>39</sup> The International Centre for Competitive Excellence (1994) as referred to in Aronsson (2000), p. 24

<sup>40</sup> As referred to in Schary & Skjött-Larsen (2001)

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*“An integrative approach to manage the total flow of a distribution channel from the supplier to the ultimate user.”*

The Council of Logistics Management defines the concept of *logistics* as:

*“Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers’ requirements.”<sup>41</sup>*

The definition of modern logistics can thus be considered more detailed than the definition of SCM, whereas the scope of the process in study can be regarded as the same. However, there exists a difference in the meaning of the word process. In the definition of SCM a process is synonymous with a business process, strongly stressing the importance of integration. The need for integration clearly goes beyond logistics. An illuminating example is new product development, which is an important element of a business process but which traditionally is outside the scope of modern logistics. The scope of SCM can consequently be considered wider in its scope than that of modern logistics.<sup>42</sup>

We find, in accordance with Aronsson<sup>43</sup>, that most authors use the two concepts of SCM and modern logistics without making a clear distinction. Therefore, we will continuously use the two concepts interchangeably without making any clear difference between them.

*Distribution* can be separated from physical distribution where the former is a wider concept, including both physical distribution and promotion activities such as commercials, sales and exposition of the product<sup>44</sup>. It is possible to divide distribution in three different aspects<sup>45</sup>:

1. As synonymous to marketing.
2. As one of several ways to compete.
3. As the strict physical distribution.

As a definition of distribution, we use the following:

*“The tasks involved in planning, implementing and controlling the physical flow of materials and final goods from points of origin to points of use to meet the need of customers at a profit.”<sup>46</sup>*

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<sup>41</sup> www.clm1.org, 030429

<sup>42</sup> Abrahamsson (1992). p. 18

<sup>43</sup> Aronsson (2000).

<sup>44</sup> Abrahamsson (1992). p. 18

<sup>45</sup> Gadde (1980). p. 6-8

<sup>46</sup> Kotler et al. (1999). p. 925

To the definition standing above, we would also like to add the aspect mentioned earlier, that distribution could be considered as one of several ways to compete. We look upon distribution as a partial area inside the main areas of logistics and supply chain management.

Two concepts frequently referred to in this study are *distribution structure* and *distribution system*. The concepts can be described as follows:

*“Distribution structure, describes the physical structure of nodes (production, warehouses, place of consumption) and linkages (transportation) representing the physical distribution of a logistics chain.”<sup>47</sup>*

*“A system consists of a number of parts that are coordinated in order to achieve a set of goals. Thus a system is a number of objects and activities, such as items, facilities and people, and the relations and configurations of these.”<sup>48</sup>*

## 4.2 Theoretical Frame of Reference

The interdependencies between strategy, structure and control systems are widely recognized<sup>49</sup>. Some researchers argue that strategic choices determine structure<sup>50</sup>. The general concept is that changes in market strategy and/or product and service offerings will necessitate organization structure modification to accommodate new operational requirements<sup>51</sup>. Other researchers suggest a reverse relationship, that strategy is dependent upon structure<sup>52</sup>. The general premise is that committing to a specific organizational structure limits the applicable range of future strategies. Supporters of the resource-based view (RBV) take a more integrated approach, and recognize strategy as the matchmaking between organizational capabilities and resources, and opportunities that arise in the external environment<sup>53</sup>.

The relationship between strategy and structure may in fact be situational. In other words, one may proceed or follow the other.<sup>54</sup> The theoretical frame of reference used in this thesis also recognizes the relations among strategy, structure and control systems, in a distributional context. That is, a reconfiguration of the distribution structure is recognized to clearly affect which strategies that are possible to pursue. Simultaneously, the overall structure of the distribution system and the systems that

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<sup>47</sup> Norrman (1995). p. 16

<sup>48</sup> Norrman (1995). p. 12

<sup>49</sup> See e.g. Bowersox & Daugherty (1995) and Grant (2001).

<sup>50</sup> Chandler (1962). p. 14

<sup>51</sup> Bowersox & Daugherty (1995). p. 65

<sup>52</sup> Hall & Saias (1980).

<sup>53</sup> See e.g. Barney (1991) and Prahalad & Hamel (1990).

<sup>54</sup> Bowersox & Daugherty (1995). p. 66

control it should be designed in accordance to the purpose it is to fulfil, that is, the strategic objectives of the distribution system.

A distribution system design process can be described in numerous ways depending on the scope and purpose of the study. Although large efforts have been made in order to find a suitable frame of reference in the academic literature and reports, no completely satisfying framework has been found that recognizes the aspects that drive both cost and service in a spare parts distribution system. The most suitable frame of reference has been found to be a general approach to logistics system design based on Huiskonen<sup>55</sup>. The approach presented by Huiskonen is illustrated in figure 4.1 and describes what can be considered as the basic constituting elements of any logistics system study.

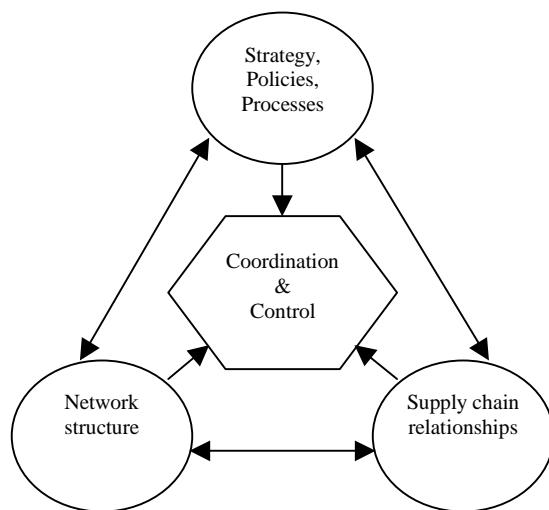


Figure 4.1. The constituting elements of a logistics system design. Source: Huiskonen (2001).

The framework suggested by Huiskonen is constructed as a general approach for the design of logistics systems, made to be used for the analysis of both the supplier's and the customer's requirements on the system.<sup>56</sup> This thesis has a much more specific aim, hence the approach in its original form was found too general. The focus of this thesis is distribution that, as discussed above, is only a part of the term logistics. The approach presented by Huiskonen is thus defining a broader area than necessary. Most importantly it assumes a situation where customer and supplier were two different firms, which is not directly applicable in this thesis. The distribution issue presented here has primarily an intra-company focus and the relations between Gambro and the final customers are of lesser interest in a logistic context.

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<sup>55</sup> Huiskonen (2001).

<sup>56</sup> Huiskonen (2001). p. 127

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Consequently the element associated with *supply chain relationships* has been substituted with an organizational perspective, focusing on the intra-firm relations considered more important here.

Further we prefer to study the distribution structure rather than the *network structure*, which also involves e.g. suppliers. Finally, the process dimension in the element *strategy policies and processes* mainly relates to the process of comparing and selecting suppliers. As this issue lie outside the scope of our thesis, we choose to exclude the process dimensions in our frame of reference. Hence, the frame of reference used for this thesis can be described by figure 4.2.

*Strategy and policies* describe, from the supplier's point of view, e.g. the service levels to be offered and whether customers are segmented and prioritized in terms of service. For example, promising deliveries within 24 hours or providing emergency services could be considered. Hence, the question is about the role of the distribution system to support the possible strategies, such as differentiation of service to each customer segment. The spare parts user's main concern is assured availability of spares and quality service with reasonable costs.<sup>57</sup>

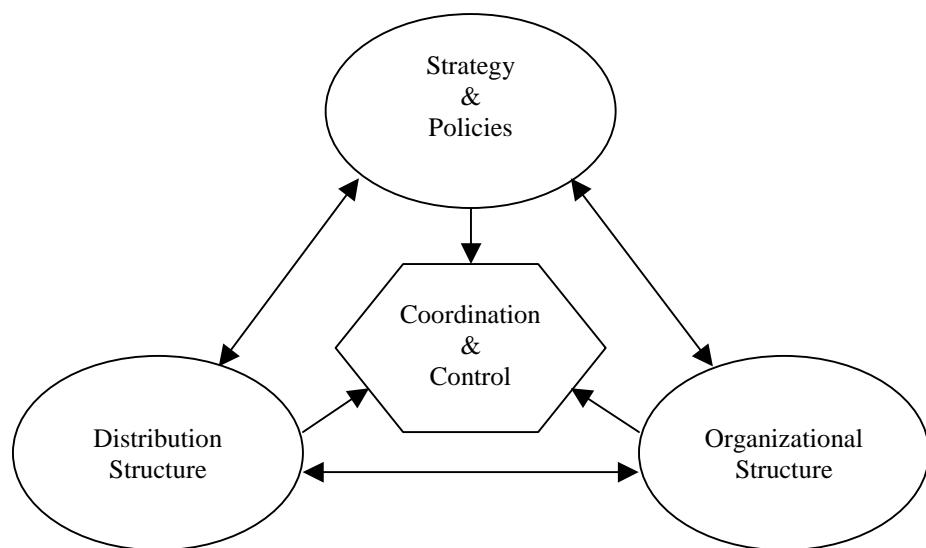


Figure 4.2. The constituting elements of distribution system design.  
Developed from Huiskonen (2001).

*Distribution structure* defines the number of inventory echelons and locations used in the system. Consequently distribution structure involves decisions concerning whether the supply of spare parts should be managed in a centralized or decentralized manner.

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<sup>57</sup> Huiskonen (2001). p. 128

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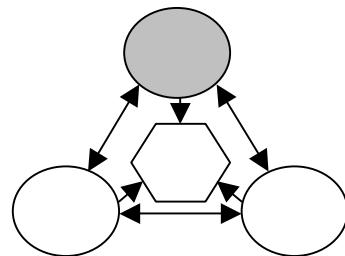
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*Organizational structure* covers formal allocation of work roles and the administrative mechanisms to control and integrate work activities. Organizational structure has two critical components: (1) Formal lines of authority and communication, and (2) the information and data that flow along those lines. Once formal roles are defined, information facilitates control and integration of ongoing activities.<sup>58</sup>

Finally, all three elements have influences on what types of *coordination and control* mechanisms would best support the vital objectives of the logistics system. Coordination and control includes decisions about inventory control principles and information systems used to implement the control procedures. For example, it is well known that in multi - echelon inventory systems, information should be readily available to the upstream parties of the chain. The elements discussed are strongly interrelated with each other and should be considered simultaneously. The importance of open information sharing is crucial for managing the inter-company supply chain effectively.<sup>59</sup>

### 4.3 Strategy and Policies

Strategy and policies are discussed below in terms of *strategy and spare parts, customer service and lead times*. However, strategy, policies and processes might well include other important aspects than the ones discussed below.



#### 4.3.1 Strategy and Spare Parts

Companies involved in strategic logistics management aggressively seek to exploit logistics competencies as a way and means to gain and maintain competitive advantage. Corporate resources are focused to provide value-added services to target customers. Value-added services become strategic resources when they are perceived as sufficiently different and distinct enough by customers to generate loyalty. The full potential of strategic logistics uses fundamental capabilities as a platform for perfecting a differentiated logistical offering that achieves preferred supplier status.<sup>60</sup>

Companies must in most cases make trade-offs between cost leadership or differentiation strategies; otherwise they risk to “get stuck in the middle”.

*“The firm stuck in the middle is almost guaranteed low profitability. It either loses the high volume customers who demand low prices or must bid away its profits to get this business from the low-cost firms. Yet it also loses high-margin business - the cream – to the firms who are focused on high-margin targets or have achieved differentiation*

<sup>58</sup> Bowersox & Daugherty (1995). p. 65

<sup>59</sup> Huiskonen (2001). p. 128

<sup>60</sup> Bowersox & Daugherty (1995). p. 66

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*overall. The firm that is stuck in the middle also probably suffers from a blurred corporate culture and a conflicting set of organizational arrangements and motivation system.”<sup>61</sup>*

In reality, however, firms are not always faced with such stark alternatives. Differentiation is not simply an issue of “to differentiate or not to differentiate”. All companies must decide on which customer requirements to focus on, and where to position their product or service in the market. Firms seeking cost advantages don’t necessarily have to offer a standardized commodity. At the same time, firms that pursue differentiation strategies cannot be oblivious to cost.<sup>62</sup>

When pursuing *cost minimization strategies*, expense reduction is the overriding management objective. Firms utilizing this strategy aggressively pursue cost cutting through their operations and seek to maximize efficiencies and economies of scale. Service quality considerations, rather than being an overriding concern or guiding philosophy, are more likely to focus on meeting minimum industry requirements. These firms seek to attract a highly price sensitive segment of the market.<sup>63</sup>

Pursuing *differentiation strategies* involves accommodation of a high level of customer service requirements. The key is to isolate exactly what product or service attributes will be most valued by potential customers. To be successful in pursuing this strategy the firm must differentiate its service thereby achieving price premiums.<sup>64</sup>

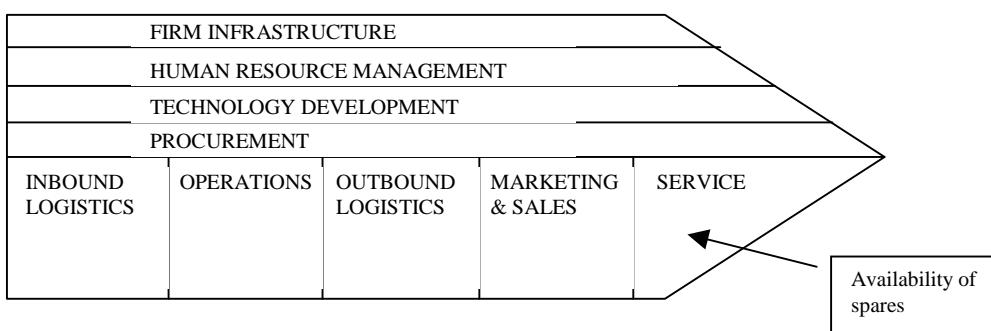


Figure 4.3. Spare parts and the value chain.  
 Source: Grant (2001).

Different from most other kinds of goods spare parts doesn’t fill a purpose on its own. That is, there isn’t a single customer in need of a spare part without the customer making use of the product which the spare part is made for. Hence, when designing a spare parts distribution system it is essential to bear in mind that spare parts can be

<sup>61</sup> Porter (1980). p. 42

<sup>62</sup> Grant (2001). p. 190

<sup>63</sup> Bowersox & Daugherty (1995). p. 67

<sup>64</sup> Bowersox & Daugherty (1995). p. 67

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considered as a part of the extended product offering, as part of the service provided to the users of the products for which the spare parts are intended. Figure 4.3 illustrates this reasoning and shows the spare parts location in the company's value chain. The spare parts supply as a part of service has an increasing importance as a competitive tool. Its effect for winning new customers and binding existing ones depends on the recognition and the fulfilment of customer requirements.<sup>65</sup> The quality of spare parts, the possibility of their repair and an easy assembling and reassembling also has a high effect on the *customer's* value chain. Particularly, the quality of spare parts is an argument of prime importance for the customer's choice of supplier.<sup>66</sup>

As we now have established spare parts distribution as a part of customer service through which competitive benefits can be achieved, we now continue with a more in-depth discussion of the concept of customer service and later on, customer service in relation to spare parts.

### 4.3.2 Customer Service and Spare Parts Distribution

Customer service includes the quality in all the relations between a company and its customers, seen from the customers' point of view. (The term customer service is here used in its academic sense and not as a reference to the organizational function with the same name.) An important component in the concept of customer service is delivery service, which summarizes the customer's perception of the quality on the logistical activities of the supplier. The activities are numerous and different, which implies that delivery service is a concept difficult and complicated to measure.<sup>67</sup>

The role of logistics can be seen as the development of systems and the supporting co-ordination processes to ensure that customer service goals are met. With a starting point in the marketplace, the sequences illustrated in figure 4.4 devise logistic systems design:<sup>68</sup>

Hence it would be wrong to launch straight in, as so many companies do, and seek to reengineer an existing logistics system purely to achieve internal requirements such as cost reduction.<sup>69</sup>

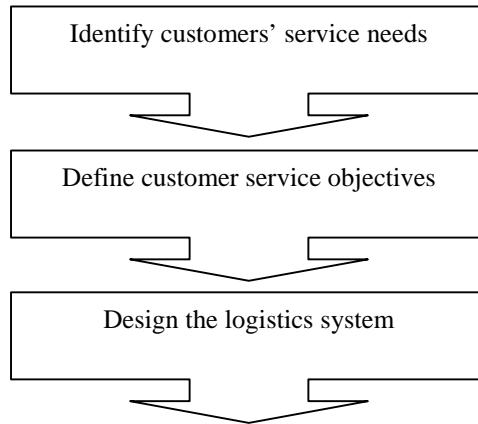


Figure 4.4. Sequences in logistics system design.  
Source: Christopher (1998).

<sup>65</sup> Pfohl & Ester (1999). p. 22

<sup>66</sup> Pfohl & Ester (1999). p. 29

<sup>67</sup> Persson & Virum. Ed. (1998). p. 51

<sup>68</sup> Christopher (1998). p. 47-48

<sup>69</sup> Christopher (1998). p. 48

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While customer service consists of many components, we will focus on those measures that are influenced by the distribution structure. These include:<sup>70</sup>

- Response time
- Product variety
- Product availability
- Customer experience
- Order visibility
- Returnability

Response time is the time between when a customer places an order and receives delivery. Product variety is the number of different products/configurations that a customer desires from the distribution network. Availability is the probability of having a product in stock when a customer order arrives. Customer experience includes the ease with which the customers can place and receive their orders. Order visibility is the ability of the customers to track their orders from placement to delivery. Returnability is the ease with which a customer can return unsatisfactory merchandise and the ability of the supply chain to handle such returns.<sup>71</sup>

The customers' service requirements on spare parts are discussed below in terms of delivery service and on customer communication.

***Customer requirements on delivery service***

Delivery time influences the customer's inventory level with long lead times normally causing more supply uncertainty and higher inventory levels. Delivery time itself depends on the availability of spare parts and on the implemented distribution system. The reliability of deliveries also effects customer's inventory level. A high reliability means meeting the promised delivery date. The avoidance of wrong deliveries demands high reliability within the entire order cycle process especially order taking and order picking.<sup>72</sup>

Expectations from the customer concerning the supply flexibility should be met by a corresponding capability of the supplier to adapt to different customer requests. The adaptation could take place during the process of order processing, delivery procedure, and customer information processing. The flexibility of order procedure can be accomplished by not using minimum order quantity, fixed order quantities and fixed dates of order placing.<sup>73</sup> However, it is to be recognized that offering higher flexibility than the customer require may involve costs that outweighs the benefits.

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<sup>70</sup> Chopra (2003). p. 124

<sup>71</sup> Chopra (2003). p. 124

<sup>72</sup> Pfohl & Ester (1999). p. 28

<sup>73</sup> Pfohl & Ester (1999). p. 28

***Customer requirements on communication***

Customers need consulting for placing their orders (e.g. article number of the requested spare part, technical advice for installation). In order to meet this need different types of support should be considered. For filling the information need manuals or telephone consultation could be used; for supporting the installation, on site technical consulting might be required.

Customer information requests are also connected with the forecasting of spare parts demands and recommendations for the maintenance of machines and spare parts. In this context, the appearance and personality of the sales force and the consulting staff are quite important. That means they have to meet high standards regarding their technical qualification, which comprises the understanding of the customers' technical and organizational problems.<sup>74</sup>

An important prerequisite for a reliable order consulting and a correct order management is a clear and correct numbering and labelling of spare parts. This allows a quick identification, a clear order placement and an easy storage at the customer's facility. A careful documentation of all offered spare parts is also an important condition for customer consulting, in particular if the period of storage is very long, depending on the guaranteed period of spare parts supply.<sup>75</sup>

**4.3.3 Lead Time as Competitive Weapon**

The concept of lead time can be defined in several ways, depending on the viewer's perspective. From a customer's perspective the time from order to delivery, sometimes referred to as order cycle time (OCT) or response time, is the relevant definition. From a supplier perspective the time from order to payment and the total time that working capital is committed are just as important definitions.<sup>76</sup>

The order cycle time could obviously be a source of competitive advantage. The most prevalent assumption is here that the OCT should be short, compared to the competitors', to be such a source. This is of course true, but only to some extent. In order to give advantage the order cycle time must also be reliable and consistent, because the impact of failure to deliver can be more severe than the need to order further in advance.<sup>77</sup>

Concerning the supplier focused measures the point of interest is not so much the time of delivery as the time of payment and the amount of time that elapses between investment and payment. This time is not only dependent on the response time; it also comprises other cycle times within the supply chain. A representation of the total

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<sup>74</sup> Pfohl & Ester (1999). p. 29

<sup>75</sup> Pfohl & Ester (1999). p. 29

<sup>76</sup> Christopher (1998), p 157

<sup>77</sup> Christopher (1998), p 158

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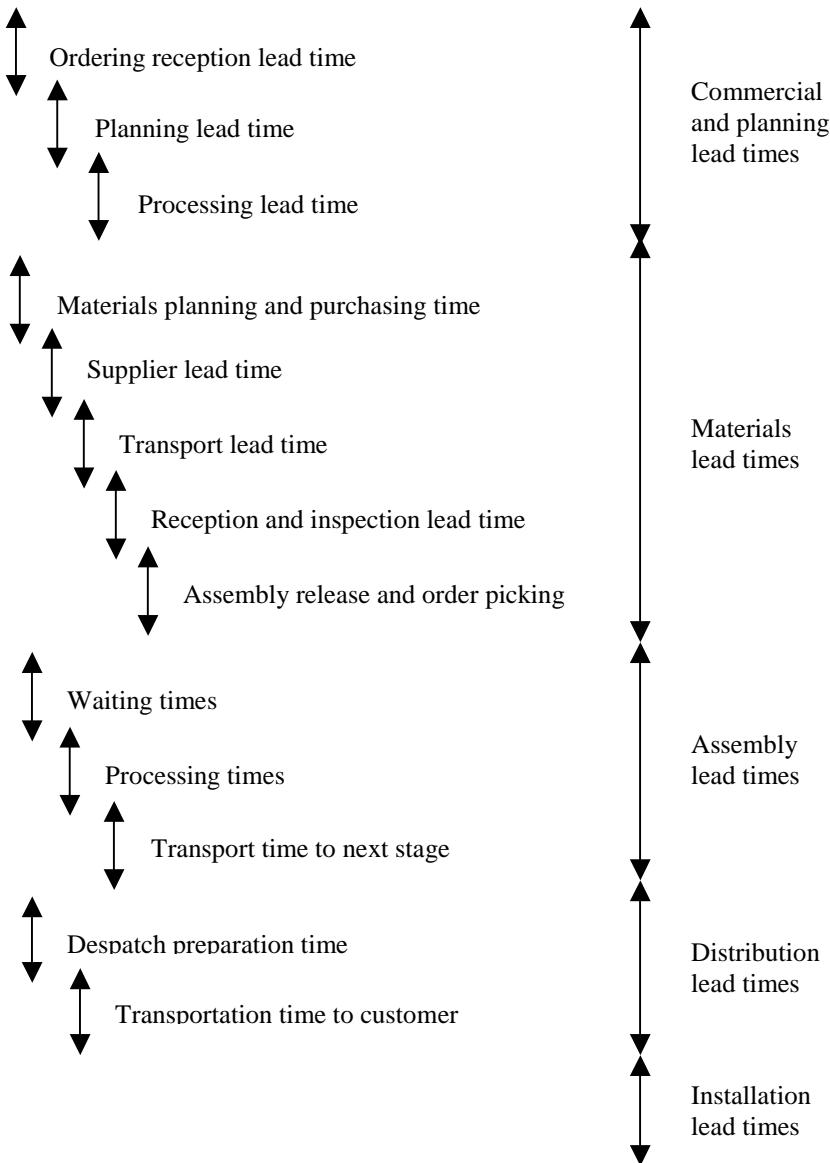
chain is given in figure 4.5<sup>78</sup>. The total lead time is built up cumulatively from procurement to payment. The total lead time is proportionate to three important variables. First, cost builds up as time elapses in the chain. Second, the transparency of the chain is inversely proportionate to its length, that is, the further away from the demand end, the harder to assess the true demand. Third, as the length of the chain increases so does the amount of safety stock in the chain. Approximately the amount of safety stock varies with the square root of the chain length.<sup>79</sup>

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<sup>78</sup> Christopher (1998), p 160  
<sup>79</sup> Christopher (1998), p 161

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Figur 4.5. Lead time components.  
Source: Christopher (1998).

In this thesis only a part of the total supply chain is in focus. That part comprises essentially the order cycle time, but that is, as described above, affected by the cycles before it. In accordance with the system definition used in the thesis those earlier cycles will be treated as given inputs to the process and will not be examined further. Their effect on the order cycle time will however be examined in later chapters.

### **Improving Lead Time**

There are essentially two ways of achieving a shorter lead time: *process improvement* and improvement of *visibility of demand*.<sup>80</sup>

Process improvement deals with the flow of information and material that links the source of supply with the customer. The key issue here is to consider the supply chain not as a series of activities, but as a process. Functional optimization is thus not enough.

The other method, improving visibility of demand, is built on two characteristics present in the supply chain. The chain tends to obscure the real demand from functions upstream. Also the point where demand meets the plan, the demand penetration point, often referred to as the decoupling point (see figure 4.6), is usually located close to the end of the chain.<sup>81</sup> The method for improvement could be described as extending the customer's order cycle. This is not to be understood literally, but rather as a method of gaining time by bringing information about real demand upstream.

Upstream in a logistics chain work and refinement are usually driven by a plan or a forecast. Demand is visible only as orders from the closest unit downstream. This way of working puts the upstream functions in a passive state where they only react to a given signal; the order. In order to enable upstream functions to take a more active stand it is crucial that information about the activities in the marketplace is shared within the whole chain. Obviously a key role in doing so is played by the information system.

Furthermore the demand penetration point can be shifted upstream by postponement. The final commitment of the product to its final form is then postponed to a point, as far as possible downstream. This enables the producer to reduce the range and the amount of products kept in stock while simultaneously increasing service and choice to the customer.

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<sup>80</sup> Christopher (1998). p. 169

<sup>81</sup> Christopher (1998). p. 172

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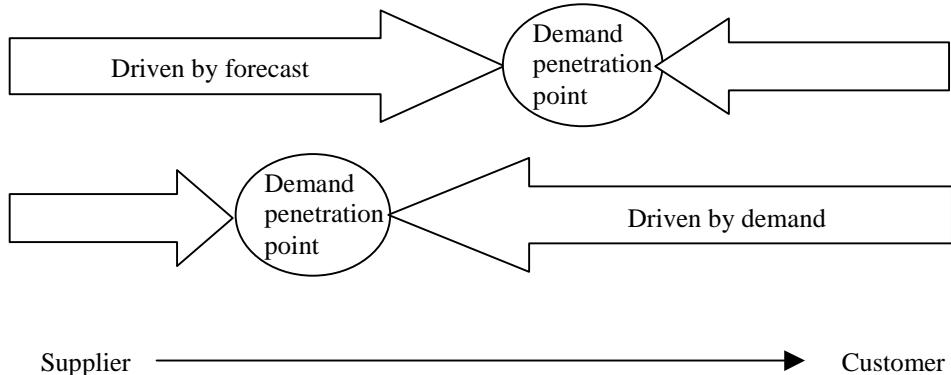


Figure 4.6. Demand penetration points.

Source: Christopher (1998).

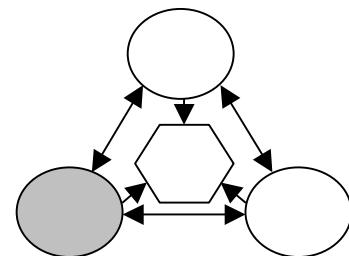
The other factor determining the visibility of demand, the lack of information about real demand, also has a significant potential in increasing the customer order cycle.<sup>82</sup> A major cause of this potential is that demand often is known only in aggregated form. Orders are seldom issued at a rate corresponding to consumption and often intermittently. This makes it difficult for the supplier to assess what the next order will be, since the supplier only has information of the aggregate demand over time which is not of much interest regarding to short term planning.

#### 4.4 Distribution Structure

The issues for distribution structure design are whether local sales should be supported by local or more centralized distribution.<sup>83</sup> Three traditional distribution structures can be identified; *direct distribution*, *central warehouse and direct distribution*, and *central and local warehousing*. These three distribution structures are described below based on the parameters *cross-docking*, *separation of goods and order flow*, and *point of sales data*, which are three ways to improve distribution performance. A more recent distribution structure, referred to as *time based direct distribution* is also discussed. The relationship between distribution structure and cost is also examined below.

##### 4.4.1 Direct Distribution

Direct distribution is characterized by the lack of intermediaries in the channel between producer and customer. Hence, no inventory is held in the structure and the producer uses point of sales data. Because there are no intermediaries there is no



<sup>82</sup> Christopher (1998). p. 173

<sup>83</sup> Schary & Skjött-Larsen (2001). p. 123

separation between the flows of orders and products. This structure is beneficial for single products with large delivery volumes. For products with minor delivery volumes, terminals for consolidation and deconsolidation are used.<sup>84</sup>

#### **4.4.2 Central Warehouse and Direct Distribution**

This structure is characterized by centralized warehousing activities and decentralized sales activities. A decentralized sales office receives the customers' orders, which are forwarded to the central warehouse, where the goods are prepared for direct delivery. There is a separation of goods and order flows since the sales offices do not perform any goods flow activities. Points of sales data are not normally used at the producers in this structure. Should that be the case, the central warehouse is used for reducing the lead times for the physical transportation of the goods.<sup>85</sup>

#### **4.4.3 Central and Local Warehousing**

Central and local warehousing is frequently used for large markets where the customers are widely spread. It is characteristic to have two or more levels of inventories with the objective of offering better service for a large market. The channel intermediaries manages both goods and order flow activities. Hence, there is no separation between the flows. The level of integration is typically low, where each intermediary strives to optimize his own profit. This leads to a situation where each intermediary orders the quantity most profitable for him. Thus, the producer does not use points of sales data. The three distribution structures described above are illustrated below in figure 4.7.

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<sup>84</sup> Norelius (2002). p. 9-10

<sup>85</sup> Norelius (2002). p. 10

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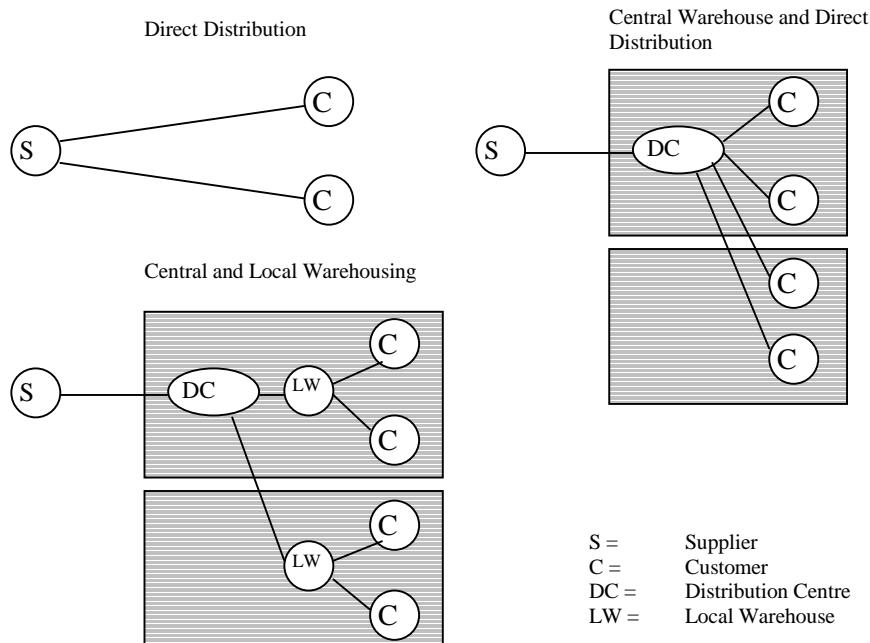


Figure 4.7. Principal distribution systems  
 Source: Schary & Skjøtt-Larsen (2001) modified by the authors.

#### 4.4.4 Time Based Direct Distribution

By relinquishing traditional distribution structures, often containing several local warehouses located near the end user, many companies have been able to obtain a more competitive distribution along with decreased costs of distribution and increased customer service. The traditional distribution structures have been abandoned in favour of a distribution structure called *time based direct distribution*, meaning direct deliveries to the customers from a central warehouse or production unit. In time based direct distribution the focus does not lie on the geographical distance to the customer, as the case with traditional distribution structures. Instead, focus lies on lead time from producer to customer. The lowest total distribution cost is obtained with as few warehouse locations as possible, under *one* condition, that the demanded lead times can be upheld. A transition to time based distribution is claimed to result in competitive advantage, not only through cost leadership but also through differentiation.<sup>86</sup>

Since delivery service has become an essential element of a company's product offering combined with the fact that distribution constitutes a large portion of the total

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<sup>86</sup> Abrahamsson (1992).

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costs of a business, the importance of the improvements yielded by implementing time based direct distribution is considerable.<sup>87</sup>

#### 4.4.5 Distribution Structure and Cost

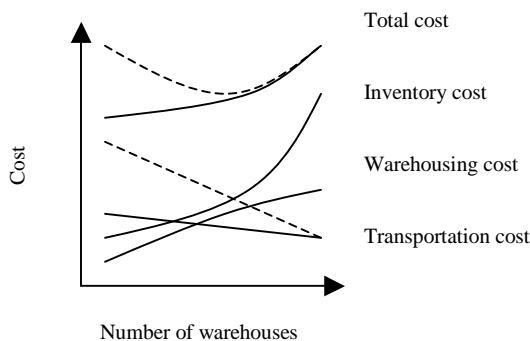


Figure 4.8. Cost as a function of number of warehouses

Source: Abrahamsson (1992).

The two components of spare parts supply costs are the cost of spare parts and the supply costs (delivery or procurement cost). Both components are affected by the spare parts logistics. Cost of spare parts depends on the costs of production and storage, whereas costs for supplying depend on the structure of the distribution system.<sup>88</sup> In this study we will only discuss costs for the supply of spare parts, costs of production lie outside the scope of this thesis. As the costs examined in this study can be considered structurally dependent, aspects of costs are discussed in connection with distribution structures.

When calculating logistical costs, it is of the utmost importance that all costs are simultaneously taken into consideration. A change in the logistics structure will affect several cost categories. To handle this matter, a total cost concept is often used. The concept of total cost rests on an analysis of all the relevant costs and implies that all costs that are altered by a change in the system are taken into consideration.<sup>89</sup> This reasoning often describes the costs for the physical distribution as a function of the number of inventory locations. There is often a trade-off between transportation costs and warehousing costs together with costs for tied up capital. The transportation costs are assumed to decline with the number of stocking locations whereas warehousing and costs for tied up capital are assumed to incline. See figure 4.8.<sup>90</sup>

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<sup>87</sup> Norrman (1995). p. 41

<sup>88</sup> Pfohl & Ester (1999). p. 29

<sup>89</sup> Mattsson (1999). p. 127

<sup>90</sup> Abrahamsson (1992). p. 58

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More current research has however shown that these traditional relations between costs do not *always* hold true. Case studies indicate that figure 4.8 tends to look more like the figure illustrated in figure 4.9.<sup>91</sup>

Thus, the discrepancy lies in a more modest increase in transportation costs when reducing the number of stocking locations. Provided that the proportions of the costs are correctly assessed in the model, this means that when centralizing the distribution structure with fewer stocking locations, the result is always a decrease in total costs; irrespectively of how many stocking locations there are initially.

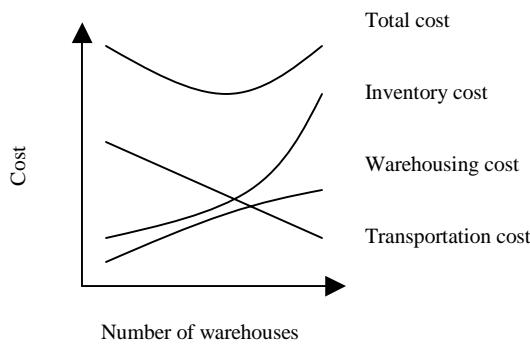


Figure 4.9. Cost as a function of number of warehouses

Source:Abrahamsson (1992).

Although centralizing the distribution in many cases results in total cost reductions, these cost reductions often are difficult to calculate in advance:

*"In 1996, European logistics consultants forecasted that 9 out of 10 companies would change their logistics structures in Europe by replacing local warehouses with distribution centres serving customers in several countries. These types of projects have generally produced the forecast results, although a large number of projects have not reached further than the idea phase: partly because the complexity of such projects has been underestimated, and partly because of problems in measuring the potential cost savings and improvements."<sup>92</sup>*

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<sup>91</sup> Abrahamsson (1992). p. 240-241

<sup>92</sup> Abrahamsson & Aronsson (1999). p. 264

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Most costs are structurally dependent, but in different ways. By exploring the main cost drivers for each individual cost, a model developed by Abrahamsson & Aronsson<sup>93</sup> can be used as a simulation tool for different distribution structures. Depending on the cost driver some local costs will:<sup>94</sup>

- Disappear, when changing the structure in terms of moving operation from one unit to another
- Be moved to another unit, but remain unchanged in size
- Be reduced, because of economies of scale

While economies of scale probably constitute the most important aim in logistics, the potential cost reductions are attained when centralizing and consolidating several minor operational units into one or a few larger units. In other words, economies of scale in warehouse-sustaining activities outweigh the increase in product-related activities such as increased transportation costs. However, the effects of economies of scale are often difficult to express in quantitative terms, and therefore have to be estimated in the light of experience.<sup>95</sup>

When simulating the effects when centralizing operations from several local to a few central units, the model presented below will be used to estimate the consequences of economies of scale. The basic idea behind this approach is that economies of scale can be identified in the company studied. Taking cost for tied up capital as an example, a warehouse distributing more goods compared to another warehouse should have a proportional smaller stock. The effects of economies of scale will be proportional to the changes in cost drivers as  $C^X$ , where:<sup>96</sup>

- $C = C_{tot}/V_1$
- $C_{tot}$  = Total cost driver, e.g. number of units sold in the region that will be served from the new central warehouse
- $V_1$  = Local cost driver, e.g. number of units sold today in the local warehouse that will be transformed to a central warehouse
- $X$  = economies of scale factor, which differs between 0.5 and 0.95, depending on cost parameters and the size of the units

The economies of scale factor, X, is empirically based and depends on the complexity and degree of local specifications of the products handled. The effects due to economies of scale increase with declining complexity and inclining standardisation of products between countries. The economies of scale factor is also heavily dependent on the environment in which the system works.<sup>97</sup>

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<sup>93</sup> Abrahamsson & Aronsson (1999).

<sup>94</sup> Abrahamsson & Aronsson (1999). p. 277

<sup>95</sup> Abrahamsson & Aronsson (1999). p. 277

<sup>96</sup> Abrahamsson & Aronsson (1999). p. 278

<sup>97</sup> Abrahamsson & Aronsson (1999). p. 278

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C is the driver that effects different costs. E.g. suitable cost driver for order handling would be number of customers, and for capital cost volume in operation.

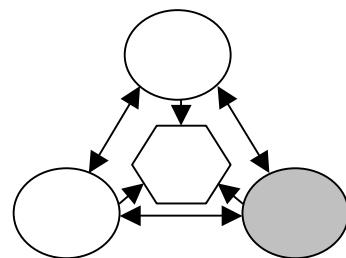
When analysing the changes in costs due to a centralization of the distribution, seven different cost parameters are used by Abrahamsson & Aronsson, see table 4.1.<sup>98</sup>

<b>Table 4.1. Cost Parameters. Source: Abrahamsson &amp; Aronsson (1999).</b>	
Administrative costs	Overhead and personnel costs for planning, supervising, inventory management, purchasing, order taking, etc.
Operation costs	Premises and personnel for production, warehousing, etc. Maintenance and rent of machines and equipment.
Capital costs	Tied up capital, obsolete stock and insurance costs for inventory and work in process.
Transportation costs	Inbound, internal and outbound transportation, divided in standard and express transports.
Communication and IT	Depreciation and maintenance of information systems.
Packaging costs	Packaging for transportation and warehousing.
Other costs	Other logistics costs specific to the system in focus.

The seven cost parameters outlined in table 4.1 are costs that often are easy to quantify, as they in most cases are readily available in the existing databases at the companies. These seven costs are discussed in the analysis, see section 6.5. There are however other types of cost that could be relevant to address, but which can be considered harder to estimate in quantifiable terms. An example of such costs would be cost of lost sales.

## 4.5 Organizational Structure

Distribution Structure, section 4.4, mainly addressed how the physical flow of products could be organized. Design of a distribution system must however address the organizational structure, which involves the formal allocation of work roles and the accompanying mechanisms to control and integrate work activities.



Three structural components, formalization, centralization, and specialization are of interest because they are commonly considered to be important influences on organization performance. *Formalization* is the degree to which decisions and

<sup>98</sup> Abrahamsson & Aronsson (1999). p. 275

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working relationships are governed by formal rules and standard policies and procedures. *Centralization* refers to the locus of decision-making authority and control within an organizational entity. *Specialization* refers to the division of tasks and activities across positions within the system.<sup>99</sup>

Firms implementing cost minimization strategies have frequently developed high levels of internal centralization and formalization, and a relatively low level of specialization. A centralized structure with concentrated decision making facilitates common direction and helps coordinate efforts to achieve maximum cost control. The establishment of formal rules and procedures serve to routinize activities thus minimizing both risk and cost. Cost minimizing firms typically focus on quantity and rely on standardization in production and distribution processes to contain costs.<sup>100</sup>

A firm pursuing differentiation strategies is likely to exhibit moderate internal centralization and formalization. A certain level of formalization and central control are needed to help integrate the distribution operations. However, such control does not need to be as stringent as in the case of cost leadership strategies and specialization is likely to be higher. Specialists possessing detailed knowledge about particular products or customers play a critical role in developing and guaranteeing the delivery of value-added products.<sup>101</sup>

The philosophy arguing that decision-making responsibility should be developed and decentralized at least to the strategic business unit level has manifested itself in many companies in the form of strong local management, often with autonomous decision making at the country level. This may be appropriate for encouraging local initiatives such as sales and marketing communications strategy, however it tends to be dysfunctional when integrated logistics are required. How then can the appropriate balance of local decision-making be achieved in formulating and implementing business strategy? Some general principles are beginning to emerge:<sup>102</sup>

- The strategic structuring and overall control of logistics flows must be centralized to achieve worldwide optimization of costs.
- The control and management of customer service must be localized against the requirements of specific markets to ensure competitive advantage is gained and maintained.
- As the trend towards out-sourcing everything except core competencies increases then so does the need for global coordination.
- A global logistics information system is the pre-requisite for enabling the achievements of local service needs whilst seeking global cost optimization.

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<sup>99</sup> Bowersox & Daugherty (1995). p. 69

<sup>100</sup> Bowersox & Daugherty (1995). p. 69

<sup>101</sup> Bowersox & Daugherty (1995). p. 69

<sup>102</sup> Christopher (1998). p. 141-142

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One way in which sales management can be centralized is at an administrative centre (AC). The creation of an administrative centre normally takes place after a separation of logistics and sales activities. An administrative centre concentrates administrative sales activities previously performed by local sales subsidiaries, and separates them from both the physical distribution and sales. The administrative activities managed by an AC are the ones that could benefit from specialization and economies of scale. These activities include invoicing, pricing, reporting, accounting, follow-up and control.<sup>103</sup>

Taking an AC approach, the procedures for handling orders, invoices and payments may be handled as follows: (1) The customer places the order with the local sales unit and the order is simultaneously transmitted to the DC and AC via an integrated information system; (2) The DC distributes goods to the customer; (3) The AC sends the invoice to the customer; (4) The AC informs the local sales unit that the customer has been invoiced; (5) The customer pays into a local bank account, which belongs to the AC; (6) The local sales units are responsible for collecting debts. With this AC structure, the following results can be obtained:<sup>104</sup>

1. Local sales organizations that concentrate on developing customer relationships, minimizing administration and bureaucracy.
2. Reduced costs and down scaled asset base on local level.
3. Quality upgrade of information and tightened business control.

Figure 4.10 illustrates how sales, order, invoicing, and information flow can be restructured when implementing a time based direct distribution concept. The changes in flows can be summarized as taking a more direct route to the different channel members. Integrated information systems, and no re-entering or changes in orders can characterize the transition to time based direct distribution. Transferring market information and the responsibility and inventory close to production may yield decreases in uncertainty, hence reducing inventory and buffers in the distribution channel. Point-of-sales information is readily available for the production units, reducing the dependence on forecasts for short-term planning.<sup>105</sup>

The ownership of goods usually shifts less frequently in companies that have implemented time based direct distribution. The invoicing process is also often restructured, with a central unit invoicing customers and elimination of invoicing between units within the same corporation. A sales branch office is responsible for sales but not for invoicing.<sup>106</sup>

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<sup>103</sup> Norrman (1997). p. 9-10

<sup>104</sup> Abrahamsson, Brege & Norrman (1998). p. 243

<sup>105</sup> Norrman (1997). p. 7-8

<sup>106</sup> Norrman (1997). p. 8

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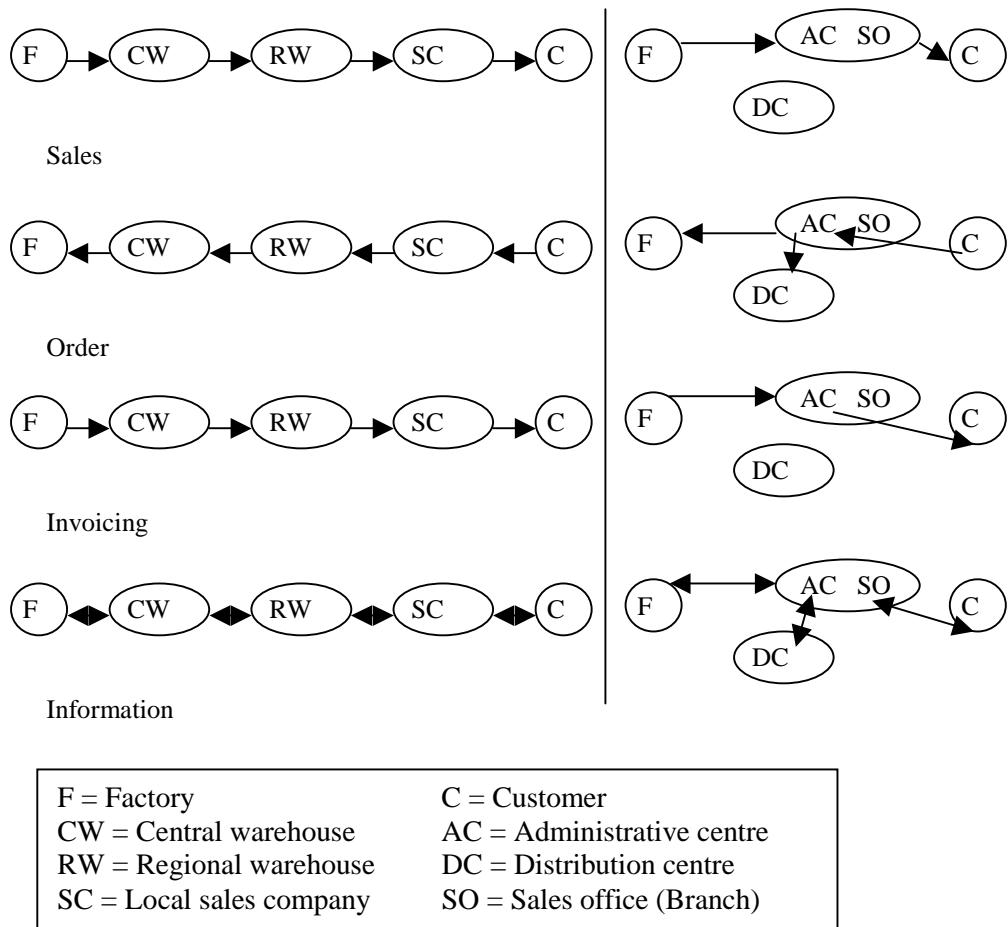
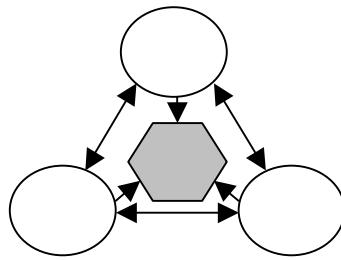


Figure 4.10. Change of activity structures when establishing time based direct distribution. Source: Norrman (1997).

## 4.6 Coordination and Control

### 4.6.1 The Role of the Information System

The management of global logistics is in reality the management of information flows. Any organization with aspirations to global leadership is dependent upon the visibility it can gain of materials flows, inventories and demand throughout the pipeline. Without the ability to see down the pipeline into end user markets, to read actual demand and subsequently to manage replenishment in virtual real-time the system is doomed upon inventory. Time lapses in information are directly translated into inventory. On a global scale it is typically found that the presence of intervening inventories between the plant and the marketplace obscure the view of real demand. Hence the need for information systems which can read demand at every level in the supply chain and provide the driving force for a centrally controlled logistics system.<sup>107</sup>



Thus, the most important contribution of the information system is to bring visibility to the entire supply chain.<sup>108</sup> Successful companies of today share an ability to use information and information technology to achieve quick response.<sup>109</sup> Many of the solutions to the problems discussed in relation to lead times, see section 4.3.3, lie in the potential of the information system.

An adequate information system enables the company to link the customer directly with upstream operations as well as sales and promotion. As a consequence of the progress in information technology this information can also be available in all places desired at the same time<sup>110</sup>. The use of these systems has the potential to convert supply chains into demand chains in the sense that the system as a whole now can respond to a known demand rather than assessing it through forecasts.<sup>111</sup>

Apart from the integrating role the information system can also facilitate the internal ability to plan, co-ordinate and control the activities related to order fulfilment, these functions are shown in figure 4.11.

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<sup>107</sup> Christopher (1998). p. 145

<sup>108</sup> Schary & Skjött-Larsen (2001). p. 291

<sup>109</sup> Christopher (1998). p. 199

<sup>110</sup> Mason-Jones & Towill (1998). p. 93

<sup>111</sup> Christopher (1998). p. 199

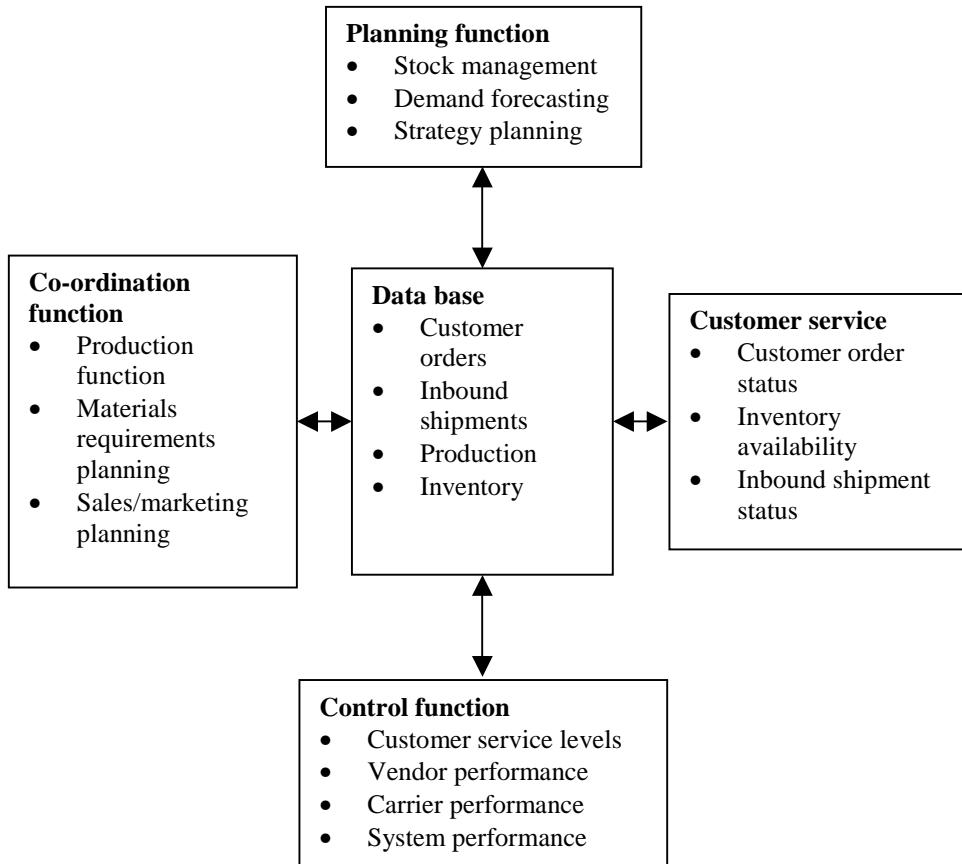


Figure 4.11. Functions of a logistics information system.  
Source: Christopher (1998).

By making efficient use of the information system the company can increase the customer service level and decrease the cost of inventory. In doing so the system must handle a phenomenon known as the *Forrester Effect*<sup>112</sup>. This effect is a consequence of the division of the supply pipeline into functions, acting on orders and not on demand. When this is the case a small disturbance in one part of the system, typically the demand end can very quickly become magnified as it is distributed upstream. The number of stockholding and re-order points passed and the information available determines the level of magnification<sup>113</sup>. When stockholding and re-order points are few and information about demand is distributed throughout the chain the Forrester Effect can be considerably reduced, if not eliminated<sup>114</sup>.

<sup>112</sup> Christopher (1998). p. 204

<sup>113</sup> Mason-Jones & Towill (1998). p. 98

<sup>114</sup> Christopher (1998). p. 207

As we have seen, the overall communication system must be designed to facilitate input and overall control. “The task is to figure out what each individual knows that the rest of us don’t know but should.”<sup>115</sup>

#### **4.6.2 Spare Parts Operational Control Characteristics**

A well known, and perhaps the most commonly used, classification scheme in logistics is the ABC-classification according to the Pareto-principle<sup>116</sup>. It is easy to use, and serves well the inventory management of materials that are fairly homogeneous in nature and differ from each other mainly by unit price and demand volume. Therefore, ABC-analysis has retained its popularity among the practitioners in directing the control efforts and choosing the sufficient-enough control parameters without the need of item-specific analysis. However, as the variety of control characteristics of items increases, the one-dimensional ABC-classification does not discriminate all the control requirements of different types of items.<sup>117</sup>

The effects of product specific characteristics on distribution system design will be examined below. The need for more specific categorization of spare parts originates in their more varied control requirements, that is, their different effects on the characteristics of the logistics system<sup>118</sup>.

The most relevant control characteristics are *criticality*, *demand* and *value*. The *criticality* of a part is related to the consequences caused by the failure of a part on the process in case a replacement is not readily available, hence it could be called *process criticality*. The impact of a shortage of a critical spare part may be a multiple of its commercial value, which makes e.g. an ordinary ABC-analysis an insufficient control tool. Three degrees of process criticality could be determined based upon the time in which the failure has to be corrected: (1) The failure has to be corrected and the spare should be supplied immediately, (2) The failure can be tolerated with temporary arrangements for a short period of time, during which the spare can be supplied, (3) The failure is not critical for the process, and can be corrected and spares can be supplied after a longer period of time. Using time dimension as a measure of criticality makes it easier to consider control systems, e.g. choosing between material and time buffers to control the system. It also provides both the user and supplier with a common means for setting the objectives and for controlling the performance of operations. The other aspects of criticality are not related to the consequence of failure or shortage, but rather to the *possibilities to control the situation*, and hence they could be called *control criticality*. These include predictability of failure, availability of spare parts suppliers, lead times, etc.

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<sup>115</sup> Bowersox & Daugherty (1995). p. 71

<sup>116</sup> The Pareto-principle states that some elements within a group are of more significance than the others.

<sup>117</sup> Huiskenen (1999). p. 126-127

<sup>118</sup> Huiskenen (1999). p. 128

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From the logistics control point of view, it is most essential to know how much time there is to react to the demand need, that is, whether the need is immediate or whether there is some time to operate. This dichotomy dictates the positioning of stock, that is, whether to use a time buffer or a material buffer against variations in demand. In case of immediate need e.g. local safety stocks are usually the only way of provisioning, but with more time to operate a centralized structure with direct deliveries also becomes an option. Hence, process criticality is a very strong factor in classifying the control situations of spare parts.<sup>119</sup>

The *demand pattern* of spare parts includes the aspects of volume and predictability. Volume of demand as a control characteristic is related to the economies of scale of operations, and is common to all materials in the logistics chain. What is special to spare parts is that among them there is typically a large amount of parts with very low and irregular demand. This feature makes the control more difficult and combined with other characteristics, e.g. high criticality and high price; it lends itself to increase the amount of safety stocks needed to cover unpredictable situations. Furthermore, low volumes as such do not attract suppliers to offer any special services but the responsibility of control may remain mainly with the end user. This is, however, in contrast to the logistics theories, which say that low volume items should be held back in the chain, that is, they should be more centrally located.<sup>120</sup>

*Predictability of demand* is related to the failure process of a part and the possibilities to estimate failure patterns and rates by statistical means. From a control point of view, it is useful to divide the parts in terms of predictability into at least two categories: parts with random failures and parts with a predictable wearing pattern. The predictability of demand has an effect on the choice of the control principle between provisioning and time-phased service and maintenance. Especially, postponing the movement of stocks to the downstream locations makes it possible to consolidate the demand and reduce its variability.<sup>121</sup>

The *value* of a part is a common control characteristic to all materials, and high value makes stocking a non-attractive solution for any part in the logistics chain. High value forces the different parties in the chain to seek solutions other than stock holding. However, if it is not a question of a make-to-order item, stocks have to be held and then it is a complicated matter of objectives, negotiation power and cooperation of the parties in the supply chain to and also an issue of incentives, how the supplies are organized. On the other hand, with low price items, the replenishment arrangements have to be efficient so that the administrative costs do not increase unreasonably in proportion to the value of the items themselves. Because the capital committed is not significant as a whole, replenishment lots can be relatively large. Orders can be based on pre-determined order signals, and automatically generated by a computer. In general, a high value of a part favors positioning materials backward in the supply

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<sup>119</sup> Huiskonen (1999). p. 129

<sup>120</sup> Huiskonen (1999). p. 129-130

<sup>121</sup> Huiskonen (1999). p. 130

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chain.<sup>122</sup> Spare parts control characteristics is summarized in table 4.2. The authors on basis of Huiskonen's theories have constructed the table.

Table 4.2. Summary of Spare Parts Control Characteristics			
	Criticality	Demand	Value
Dimensions	Process and control criticality	Volume and predictability	
Description	Process criticality: Consequences caused by the failure of a part in case a replacement is not readily available.  Control criticality: Related to the possibilities to control the situation.	Possibilities to estimate failure patterns.	Parts value
Measure	Time	Random failure parts and parts with a predictable wearing pattern.  High and low volume parts.	High and low value parts.
Practical implications	Deciding on local or centralized safety stocks.	Unpredictable demand calls for increases in safety stocks.  Postponing the movement of stocks to downstream locations in order to consolidate the demand and reduce its variability.	High value is an incentive to reduce stocks.  High value parts favors positioning up-stream in the chain.

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<sup>122</sup> Huiskonen (1999). p. 130-131

## **4.7 Theoretical Frame of Reference in Brief**

### **4.7.1 Strategy & Policies**

Strategic distribution system decisions were considered to involve making trade-offs between cost leadership and differentiation. Seeking differentiation require high accommodation of customer requirements. A way of seeking differentiation is by offering competitive lead time to customers. Visibility of demand and shifts in the demand penetration point was presented as means of improving lead time. Spare parts were identified as part of the service offered to customers. The importance of customer service devising logistics system design was also stressed.

### **4.7.2 Distribution Structure**

This section discussed different distribution structures and recognized distribution costs as structurally dependent. A traditional total cost model was presented and it was argued that this traditional model in several cases doesn't hold true. Increases in transportation costs when reducing the number of inventory points are not always so dramatic as implied in the model. The cost model used in the study was presented.

### **4.7.3 Organizational Structure**

The relations between strategy and organizational structure were discussed as well as the balancing of decision-making authority, which is a question of centralization and decentralization. An example of activity structure and time based direct distribution was given. The section also addressed the allocation and integration of activities.

### **4.7.4 Coordination and Control**

Coordination and control was discussed in terms of information systems and spare parts control characteristics. Information systems were recognized as powerful means for supporting coordination and control, and for enhancing visibility. The use of information systems was also discussed to have influences on so - called Forrester effects. Different spare part control characteristics facilitate decisions such as up- or downstream location of inventory in the chain. ABC analysis was stated to be an insufficient control characteristic in many cases. Criticality, specificity, demand and value were introduced as complementary control characteristics to the ABC analysis.

When the reader has examined the elements contained in the theoretical model, the close linkages among these should become obvious. However, to illuminate these linkages in a more explicit manner, examples of such relations are given below. See figure 4.12.

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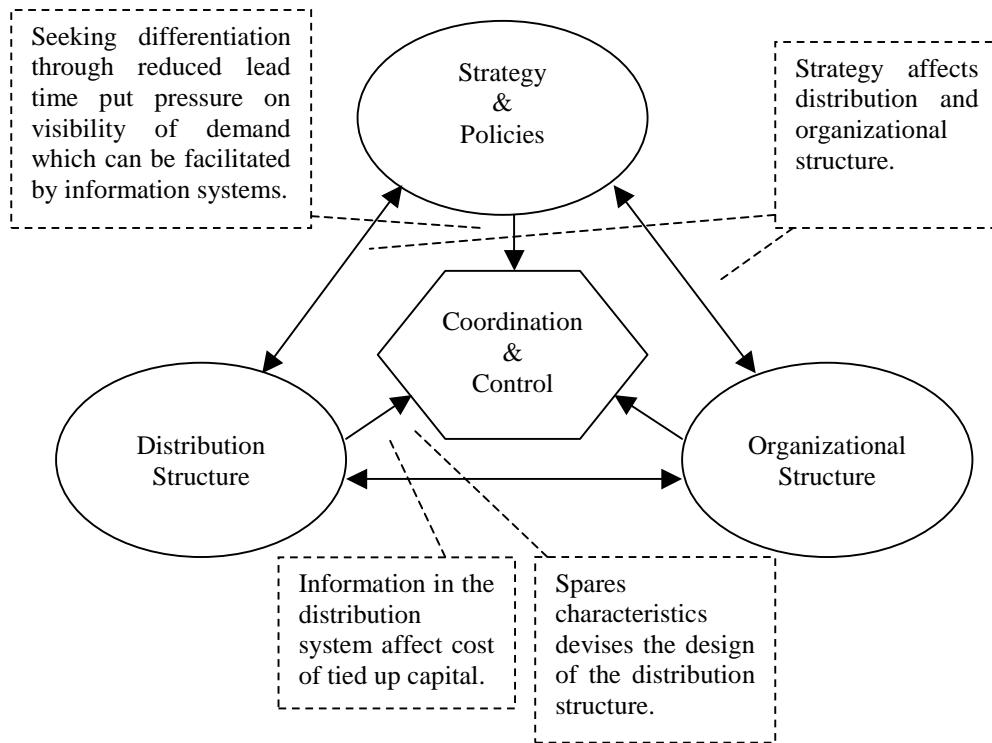


Figure 4.12. Linkages between the elements in the theoretical model.  
Source: Developed from Huiskonen (2001).

## 5 In-Depth Study

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*This chapter follows the same structure as outlined by the theoretical frame of reference. The in-depth study mainly describes the distribution to Germany and France. The Swedish distribution structure is however described, providing a contrast to the German and French distribution structure. The flows of information, goods and capital related to the order process are brought to light. The analytical conclusions drawn in the next-coming chapter are based on the empirical findings here presented.*

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### 5.1 Strategy and Policies

#### 5.1.1 Market Conditions

The three large companies Gambro, Baxter and Fresenius dominate the global monitor market. Each of these three supplies a full range of products including HD, PD and renal intensive care. Besides the three large players, there are about 50 companies supplying only parts of the total product range. Companies that offer only parts and disposables often, however, find it hard to compete since the monitors can be regarded as a “door-opener”, that is, once the customers have bought the monitors they normally also buy spare parts and disposables from the same company. Hence, companies that can't offer a monitor have difficulties in selling their products.

Currently the number of suppliers is decreasing as a result of mergers and acquisitions and exits from the market. The reason for this is mainly that competition in the market is fierce and that customer demands in terms of product range, service and economy are rising. Top priorities for the customers are safety, i.e. safety for the patient in the medical respect, and function of the monitor with as little downtime as possible.

The products supplied, the monitors, are very similar between the brands. One company may come up with a special feature, but within one or two years that feature will have been copied by the others and regarded as standard.<sup>123</sup> In use at the clinics the monitors require a continuous flow of disposable materials, such as filters and bloodlines, in order to be functional. With a monitor life cycle of between five and ten years, these disposable parts are the major contributors to Gambro's profitability, the revenues of the monitor itself having a lesser impact.

#### ***The German Market***

The key success factors for competing in the German monitor market are the ability to offer reliable and high performing products, with competitive price, together with a service organization that customers can rely on. Fast response is regarded as the most

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<sup>123</sup> Rihter, Z., 030410

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important means of obtaining customer satisfaction, binding and for establishing close relationships. Further, the education and training of personnel operating the monitors are highly valued by customers, but also by Gambro, as well-trained users facilitate the service performance. In addition, education leads to customer identification with Gambro products.

Fresenius Medical Care is the largest player in the German monitor market and offers a full product range and a powerful service organization. Price aggressive competition comes from B. Braun, but who offers inferior products in comparison to Gambro and Fresenius. Gambro can however in most cases offer a competitive price due to economies of scale. The competition from Baxter is insignificant in the HD segment, but Baxter holds a strong position in the PD segment possessing an approximate market share of 80 per cent. The previously non-profit organization Kuratorium has entered the market as a new competitor in technical services.

The Fresenius technical service organization is stated to be powerful. However, the service structure differs from Gambro's since the monitors are not dedicated to one specific technician. The Gambro structure is found more beneficial since it facilitates the creation of strong customer relations and a clearer responsibility interface.

Of the total installed dialysis machine fleet of 19,000 for chronic hemodialysis in Germany, Gambro is responsible for 45 per cent, Hospal included, and Fresenius for 40 per cent.

The declaration that competitors' products are perceived by customers as more or less the same, is valid also for the German monitor market. Therefore technical service becomes a vital sales argument and a "conditio sine qua non", that is, the ability to offer excellent technical service becomes a prerequisite for competition.

A large portion, approximately 50 per cent, of the German customers is economy driven private clinics. The public clinics are experiencing a privatizing tendency and are struggling with cost issues. Public clinics constitute about 15 per cent of German customers. The remaining 35 per cent is accounted for by Kuratorium, originally a public organization, recently transformed into a profit driven organization. A recent market trend is that customers consciousness for life cycle cost has increased.

### ***The French Market***

Key success factors for competing in the French monitor market is the ability to offer a *full product range* including monitors, disposables, spare parts, service and support, *reliability* in products and deliveries, competitive *customer life cycle cost*, and *product innovation*. Technical service is an important aspect considered by the customer when choosing between different monitor suppliers.

Gambro holds a significant share of the market when brand name Hospal is included. Of the 13,000 installed monitors in France, there are 4200 Gambro machines and

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4500 Hospal machines. Other players are Fresenius Medical Care and Nikiso with 2900 and 150 monitors installed, respectively.

A recent trend in the French monitor market is the tendency for customers to reduce their inventory levels resulting in an increased demand for quick-response deliveries.

### **5.1.2 Service**

Gambro is currently seeking to broaden its competitive base by providing a range of services related to renal care. The services are divided into seven groups outlined and explained below.

- Technical services: repair and maintenance of the monitors
- IT services: mainly concerning the gathering of statistical data related to renal treatment
- Water treatment systems: providing clean water for treatment
- Logistics services: e.g. vendor managed inventory of disposables
- Education services: training medical personnel in the handling of monitors and therapeutic techniques
- Sourcing: offering to be the sole supplier of products for renal care
- Financial services: offering financial solutions in order to enable more customers to buy the products

From a spares distribution perspective the most relevant dimension of service is obviously technical service. Technical service is the final link between Gambro and its customers in the supply pipeline. The ability to provide technical service is a key factor to attract and retain customers. It might even be said that the ability to provide technical service is a condition that must be met by a company trying to enter the market.<sup>124</sup>

The service contracts are shaped in agreement with each individual customer, that is, there is no such thing as standardized service contracts. However, a trend increasing in popularity is the so-called PPT<sup>125</sup>-agreements. These agreements imply that customers pay Gambro per treatment, that is, Gambro is responsible for all costs, e.g. spare parts, disposables, service hours, etc. These types of contracts facilitate customers' estimations of total cost.

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<sup>124</sup> Rihter, Z., 030410

<sup>125</sup> Price per treatment

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The technical services offered by the European sales subsidiaries are the following:

1. Spare parts
2. Service contracts
3. Do and Charge services
4. Manuals
5. Repair
6. Technical support
7. Technical training

A service contract may involve that Gambro pledge to be responsible for that a broke down monitor is up and running the next day. This type of contract is worth about 2500 euros per machine and year, including both delivery of spare parts and cost of personnel. Do & Charge services imply that a Gambro service technician performs the repair and bills for spare parts and working hours.

If there arise delays in deliveries from the sales subsidiary to the customers, it normally doesn't affect patients' medical conditions. It is recommended that clinics have a five to ten per cent machine backup of the machine fleet operated at the clinic. This recommendation is normally followed by the clinics. However, customer machine downtime has a profit impact as Gambro loses revenue streams due to lost sales of disposables. Further, the highly stressful work situation that prevails in many European clinics today, leaves little room for further friction, which is the inevitable result of a monitor break down. Customer expectations on delivery service are 24 - 48 hours from order to delivery.

The prices of spare parts alone are in most cases not an issue taken into consideration by the customers. If customers already have Gambro machines in use, they are also obliged to buy Gambro spare parts. There is however an increasing tendency of customers trying to assess the life cycle cost associated with dialysis treatment, which has resulted in the so-called PPT-agreements. The costs for customers associated with spare parts are however low compared to the costs associated with disposables.

***Technical Services in Germany***

The most important service aspects for German customers are reliable deliveries of spare parts, quality of components, technical support and information up-dates.

An overriding objective for technical services in Germany is to perform as few service interventions as possible, as personnel cost is much higher than costs for spare parts. Normally a monitor requires two interventions per annum of which one is preventive maintenance.

The largest portion of the performed service consists of formal service contracts. Table 5.1 shows the distribution of different service contracts.

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<b>Table 5.1. Different Types of Service Performed (2003-01).</b> <b>Source: Gambro Technical Service, Germany.</b>		
<i>Types of service</i>	<i>Number of machines</i>	<i>Percentage</i>
Formal service contracts	1685	62
Informal service contracts	660	24
Service on demand	375	14
<i>Subtotal</i>	<i>2720</i>	<i>100</i>

The contracts mainly in use are full-service contracts, which imply that Gambro carries all responsibilities for spare parts and technical service, and service on demand with individual billing for spare parts and service. The full-service contracts are typically worth 2000 € per machine and annum. There are efforts for establishing full-service contracts as they yield stable revenue streams together with customer binding. The service contracts do not contain any agreements on monitor downtime, as downtime partly is related to the handling of the machine. None of Gambro's competitors are offering such guarantees.

A considerable amount of spare parts are used for local activities such as overhaul and repair of monitors. Local repair is highly profitable for the German sales subsidiary and it accounted for approximately 10 per cent of the German technical services revenues in 2002. Considering the types of spare parts purchased, the German sales subsidiary uses to a little extent the maintenance kits aggregated by the ITS.

The total installed machine fleet in Germany are 7000 of which 2720 in some way lie under Gambro service responsibilities. This means that 60 per cent of the outstanding machines lie totally out of the service responsibilities for Gambro. For these machines, little information is known. This means that the service organization is unaware of machine characteristics such as machine hours.

The German service organization does not carry out any quantitative measures on customer service levels. However service levels are received as qualitative feedback from customers, the sales force also receives feedback on perceived image related to service levels.

#### ***Technical Services in France***

The most important aspects of technical service for French customers are reliable deliveries, efficient repair and performing service "on schedule".

In similarity with Germany and Sweden, shortages in supply normally never affect the patients' medical condition. The clinics carry one backup machine for every six to eight machines.

The only contracts used in the French market are full-service contracts with an average value of 1900 € in a price range between 1400 to 3900 €. Of the total installed fleet of Gambro machines, 22 per cent are under full-service contracts.

Preventive maintenance is normally carried out once or twice per annum depending on the monitor's number of operated shifts per week. Approximately 50 per cent of the spare parts is used for planned maintenance implying that 50 per cent of the spare parts is used for acute repair.

Maintenance kits are used to a large extent in France, with good acceptance from customers. There is however a perceived need for better taking care of reasonable remarks from the users, thereby achieving more well - tuned kits since the content in the kits has a large impact on time and cost for service interventions.

### **5.1.3 Supply Policies**

Of approximately 8000 spare part article numbers, 5000 - 6000 are currently held in stock at DC Lund. Spare parts with an age over 5 years are reported to be very slow moving. Approximately 70 per cent of revenues can be assigned to spare parts sourced internally, that is, from the Monitor Division.

Gambro has currently a ten-year supply policy for spare parts. This ten-year policy has however not been clearly defined. That is, there are different interpretations under which terms the ten-year policy is valid, e.g. is it in ten years after the customer has bought the monitor, or does it relate to when the last version of a whole series has been taken out of production? Depending on what interpretation is made the total commitment varies considerably.

Spare parts are to some extent aggregated and sold in maintenance kits. Aggregating parts into kits is a means of reducing the spares article numbers. These kits are built up based upon the need for maintenance, according to different time intervals. However, the receptions of the kits in the market vary considerably between France and Germany. In Germany the customers reject the idea of kits and prefer to replace parts only when they are out of order. In France there is a greater acceptance for the kits and the idea behind them.

## **5.2 Organizational Structure**

The European sales subsidiaries act as profit centres. These perform both administrative and physical handling activities related to the spare parts flow. The use of profit centres implies a mark-up on delivered spare parts from DC Lund to the French and German sales subsidiaries, which set their own prices to customers. It also implies that the sales subsidiaries own the inventories held in stock. However, as the Swedish sales subsidiary does not own any inventories, no such mark-up is made from DC Lund to the Swedish sales subsidiary. Mark-ups on spare parts to the European sales subsidiaries are decided on by International Technical Service and are approximately 50 per cent.

The Distribution Centre handles orders, shipments, planning, invoicing and inventory holding. For Nordic sales, order-taking and invoicing are carried out at the sales

subsidiaries. The Gambro organizational structure is typically functionally oriented with each individual specialized in a few activities, that is, division of labour is made according to functions rather than processes. For example, the shipping department handles all shipping activities and invoicing, but it does not receive orders nor conduct follow-up on invoices sent. Another example is that the DC interface to customers, the order handling personnel, has limited insight into the chain, that is, in back-orders, supplier contacts, and shipment of goods. The DC is separated physically into one administrative entity, located together with other corporate functions, and one handling the physical goods flow activities.

### **5.2.1 Technical Service Organization in Germany**

There are currently 26 employees in the German field force including one manager and two zone leaders. The machine fleet under Gambro responsibility consists of 3135 monitors, which yields an average of 121 machines per technician. Two individuals are employed in the spare parts warehouse and one spare part specialist is involved in the logistics flow, and carries out e.g. the order processing activities and customer support. The German organization also operates a repair shop for the handling of damaged but repairable spare parts. The repaired parts are returned into the spare parts flow and sold to customers. An organizational chart of the German technical services structure is outlined in figure 5.1 (the figure in parenthesis represents the number of employees). The technical service department is a profit centre divided into two legal entities; Gambro and Hospal. The organizational tasks are product oriented.

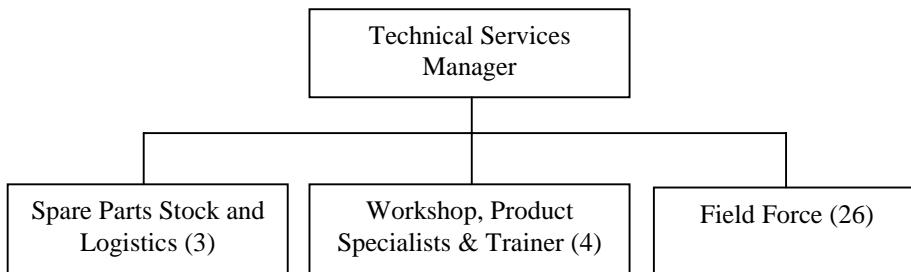


Figure 5.1. The German Technical Service Organization.

### **5.2.2 Technical Service Organization in France**

There are 31 field technicians stationed at 11 local branch offices in France. Technicians are grouped into service teams normally consisting of between one to four individuals. A large portion of the field force, 12 technicians that is, is located close to Paris. Gross margins on spare parts are approximately 45 per cent.

There are 940 monitors, or 22 per cent, serviced under full service contracts. These machines are mainly located in Paris and Bordeaux. A large portion of the installed

machine fleet is to some extent served by Gambro technicians. Gambro technicians also serve the equipment used for water treatment, including e.g. installation, after sales, and maintenance. Service of water treatment equipment is judged to require approximately 8 full-time employments<sup>126</sup>.

Two individuals receive and process incoming orders to the sales subsidiary. These technicians do not possess any significant technical knowledge and are not able to answer questions that e.g. relate to the interchange ability between parts. One individual manages the spare parts inventory and places orders to DC Lund.

A repair shop for PD machines has recently been installed employing one technician. Plans exist of expanding this repair shop to include also HD machines. More advanced repair related to e.g. microprocessors and AC/DC components would not be performed in a HD workshop.

### **5.3 Coordination and Control**

#### **5.3.1 Communication and Coordination**

The spare part planners at the DC handle the communication with suppliers, and the personnel handling orders has no direct information about when inbound deliveries of spare parts are expected to the DC. Hence, if the availability check in SAP is malfunctioning, the order handling personnel is unaware if an order, or part of an order, has been back ordered. This results in difficulties for the order administrator in explaining to the customers why delivery has not taken place and when spare parts are expected to arrive at the DC. The order handling personnel turns to the planning department in order to resolve these issues.

It is not a normal procedure for DC Lund to commit to any specific delivery dates for spares to the French and German sales subsidiaries when the order is received. The reason is that since the availability check function within SAP is not always signalling the right information, the order handling personnel does not know exactly what parts that are being back ordered. Hence, it is difficult to promise any delivery dates. Germany and France never ask for delivery dates in relation to standard transports. Delivery dates are however asked for in connection with express deliveries.

The order handling personnel at the Swedish sales subsidiary rarely communicates with other Gambro units. On unusual occasions ITS or the Swedish service technicians are contacted. In most cases the content in the communication concerns issues on spare parts article numbers. However, order handling personnel states that both internal and external service technicians normally are well informed concerning spare parts article numbers.

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<sup>126</sup>Jambon, F., 2003-06-02

Close cooperation between order handling personnel and service technicians is found beneficial by the Swedish sales subsidiary.<sup>127</sup> Advantages are gained through close relationships with service technicians, who can assist in technical issues, and through increases in insight and control. For example, the risk that service technicians are sent to clinics without receiving parts as expected is minimized. That is, since the order administrator knows what has been back-ordered (assuming that the availability check function within SAP delivers correct information) the service technicians can receive information on delays in deliveries.

A number of order flow related issues can be identified:

- The sales subsidiaries order spare parts that do not exist
- The sales subsidiaries use wrong article numbers

In cases when sales subsidiaries order non-existing products or use wrong article numbers, the issues are solved through communication between the sales subsidiaries, the order handling personnel and the DC planning department or ITS.

The order handling personnel at the DC only receive information on demand through the orders placed by the sales subsidiaries. This means that information on end users' true demand is lacking, since the incoming orders are in aggregated form. If the true demand were known, it would be possible to really know which deliveries are express and which are not. It would also facilitate spare parts planning, because even though the demand pattern can be obtained from the aggregated orders it takes a longer period of time.

Apart from the strict order process, the order handling department also communicates with the sales subsidiaries on issues concerning information on spare parts, e.g. price and lead times, and also regarding complaints. The frequency of communication depends on the specific country. The communication normally takes place with the same individual at the sales subsidiary, the same individual that places the order.

### **5.3.2 Information systems**

The management of monitors and disposables is supported by information systems SAP, i2 and Vega. i2 is essentially a planning system, composed by two main components, the Demand Planner and the Supply Chain Planner. The Demand Planner makes forecasts based upon historical data and statistics. The output is a demand transferred to a global planner by a sales planner on a monthly basis. The demand is used as input into the Supply Chain Planner where it is connected to a number of different parameters, e.g. customers orders, in-stock, safety stock, in transit and shipments. This planning procedure is carried out once a week.

Distribution Centre Lund, which is the entity carrying monitor and disposable inventories have implemented SAP as information system. This is however not the case for the European sales subsidiaries, which are the entities stocking spare parts.

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<sup>127</sup> Interview with order handling personnel at the Swedish sales subsidiary.

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Even if most of the sales subsidiaries are using SAP, this is not the case for the large-volume countries Germany, France and Italy. Further, there exists currently no planning tool implemented for spare parts similar to i2, which is used for the planning of monitors and disposables.

### **5.3.3 Spares Control**

Two different classifications of spare parts have been carried out by Gambro of which one has been made by the DC and the other by the International Technical Service. The latter classifies the spare parts in the following dimensions according to their importance for the performance of the monitor:

- *Group one:* Parts critical for the use of the monitor, parts for essential quality updates and service equipment.
- *Group two:* Wear and tear parts and parts included in group-one parts.
- *Group three:* Rebuilding and maintenance kits.

When making this division, a framework can be created with the ability of prioritizing between which parts that must be available immediately and which parts that allow that the customer is put on hold. This classification has not yet been completed.

The DC classification of spare parts is based upon turnover rates and reveals the following:

*A-articles:* Spare parts contributing to 80 – 85 per cent of revenues. There are approximately 500 articles in this category.

*B-articles:* Articles sold at least once per annum. Around 3000 articles belong to this category.

*C-articles:* This category contains approximately 5000 spare parts not sold within the last year.

This ABC-classification is currently used for managing inventory at the DC.

The spare parts can also be classified according to the purpose it's being used for. Maintenance parts are spares for which demand easily can be forecasted. The reason is that maintenance regularly is made according to the machine's operating hours. However, the demand for parts required when machines break down is naturally harder to predict.

Planned maintenance accounts for approximately 75 per cent of the technical services carried out. Acute services correspond for the rest. However, the distribution between planned and acute services varies according to the product life cycle. At product launch, as much as 75 per cent of the services can be accounted for by acute services. As the product matures, planned maintenance increases its share.

The demand for maintenance parts is predictable on a continental scale, that is, the demanded maintenance parts from the DC can be forecasted whereas the demand at an individual clinic is much harder to predict.

Through a newsletter, service technicians are informed by the ITS on, e.g., recommended upgrading, re-building or spare parts eliminated from the assortment. Service technicians follow these recommendations, under the conditions that the recommendations are valid for the machine fleet served. The ITS newsletters are taken into account by the German service organization in material management and stock maintenance.

Gambro has no policy directing what spare parts to be stored in the German and French service cars and branch offices. This is completely decided on by each individual service technician and based upon experience and efforts to minimize service interventions and technical data, such as e.g. types of dialysis machines served, and operating hours of the machine fleet. However, 50 to 75 per cent of the parts stocked in the cars are "core parts", that is, parts commonly stocked by all technicians within the same country. The limited space in the car also directs what parts to store. A central policy of what the sales subsidiaries are to keep in stock is also lacking, this is decided on by the sales subsidiaries themselves. The stock levels at the DC are, as earlier mentioned, managed by the use of ABC-analysis.

The German sales organization uses forecasts on spare parts to some extent. Planning and forecasting is based upon historical statistics. Maintenance parts and parts used for up-grading are forecasted. The French sales subsidiary manages all locally stored spare parts in the information system Minas. Here forecasts are made and consumption monitored. However in the French regional offices no planning activities are made.

## 5.4 Distribution Structure

### 5.4.1 The Swedish Distribution Structure

The general distribution structure was described in chapter 3 and it was recognized that the Swedish distribution structure somewhat differs from the other countries within Europe. These differences are mainly the lack of spare parts inventory at the sales subsidiary and the means of transportation. The Swedish Postal Service carries out transportation with daily pick up and delivery of parts directly to service technicians' branch offices or customer clinics. The number of clinics in Sweden is approximately 65, many of them with different wards operating dialysis machines.

There are 8 different Gambro stock holding points in Sweden, all constituting of the service technicians' cars. The values of these stocks lie in the interval between 5000

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and 75,000 SEK.<sup>128</sup> The spare parts held in the service cars are parts frequently used, e.g. gaskets, o-rings, etc.

The Swedish sales subsidiary does not keep inventory. The spare parts in the Swedish service technicians' cars do qualify as stock; financial arrangements have however been made to the effect that Monitor Division owns these parts.

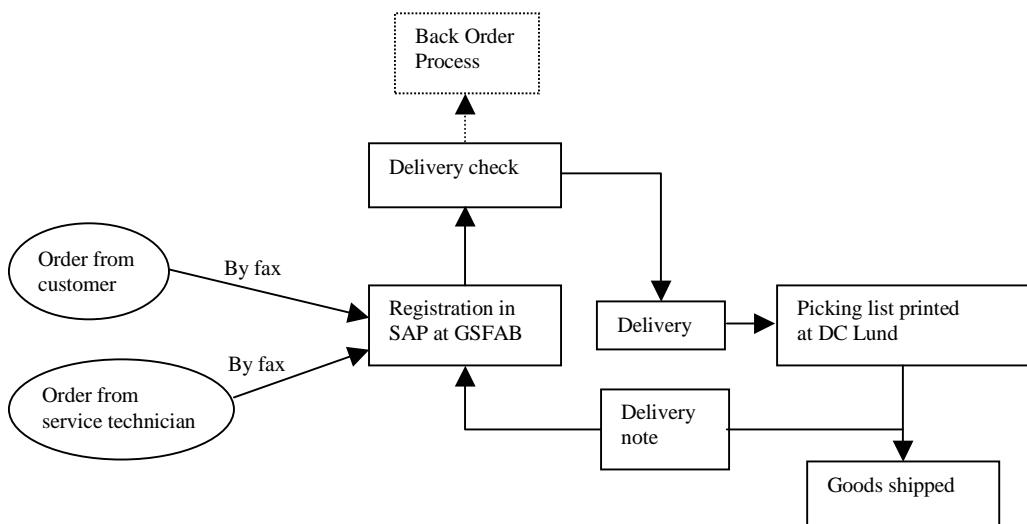


Figure 5.2. The information flow in the Swedish market.

#### **Information flow**

The orders to the Swedish sales subsidiary (GSFAB) are placed by Gambro service technicians or by technicians employed by external clinics, that is, clinics not managed by Gambro Healthcare. Incoming orders are normally received by fax and are then manually registered in SAP as sales orders including information about payment terms, delivery terms, standard or express delivery, article number, number of items, required delivery date, other customer requests and price.

An availability check (including parts availability and clearance of delivery date requested by the customer) is automatically carried out simultaneously as the sales order is created. Delivery date is automatically set.

Immediately after the creation of sales order, a *delivery* is manually created and stored in SAP. When the delivery has been created, the spare parts are reserved at the central warehouse. After a delivery has been made, a picking list is manually created by the order handling personnel and automatically printed out at the central warehouse.

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<sup>128</sup> Interviews with Gambro service personnel.

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After the picking lists have been printed out at the central warehouse in Lund, the lists are manually sorted by delivery date. A delivery note is sent from the central warehouse in Lund to the Swedish sales subsidiary, when goods are packed for transportation.

#### **Physical Flow**

Spare parts are, for the Swedish market, picked continuously during Monday to Friday. The DC manually prioritize between the orders. Prioritized customers are Swedish clinics, Swedish service technicians, express deliveries, Monitor Division and the repair shop. The reason for prioritizing the deliveries to Sweden is that these shipments are small and shipped daily. The goods are not normally put on stock but go directly to use. Spare parts are picked up at the DC by the Postal Service and delivered next day at 09.00, if ordered before 11.00 the previous day.

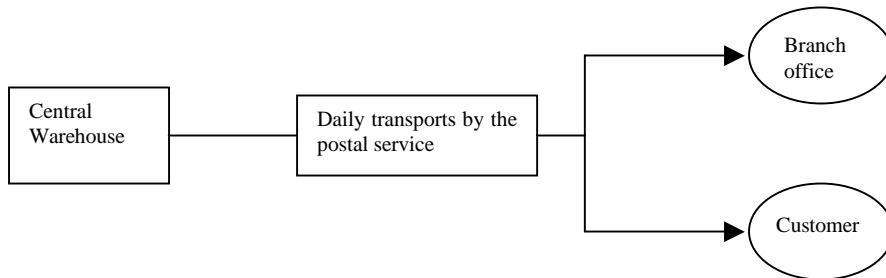


Figure 5.3: The physical flow in the Swedish market.

Delivery of spare parts takes place at the clinics if ordered by external service technicians. Spare parts ordered by Gambro service technicians are normally delivered at small branch offices, located in Bromma and Mölndal, and at the Swedish sales subsidiary in Lund. In some cases, spare parts ordered by Gambro technicians are delivered directly to the clinics by request from the technician. This occurs e.g. if the technician is about to visit that specific clinic and in advance knows what parts he requires.

#### **Financial Flow**

The Swedish sales subsidiary sends an invoice to the customer when the delivery note is returned from the central warehouse. Invoicing is regularly carried out on a running basis, as soon as the delivery note is received. In some cases invoicing is made on a monthly basis. The customers pay within 45 days.

The clinics normally pay for spare parts but not for transportation. Occasionally the spare parts are free of charge for the customer, for example in case of warranty or upgrading recommended by the ITS.

#### **5.4.2 The German Distribution Structure**

In Germany spare parts are stored at the sales subsidiary in Munich. The warehouse comprises approximately 70 square meters and is staffed by two employees handling

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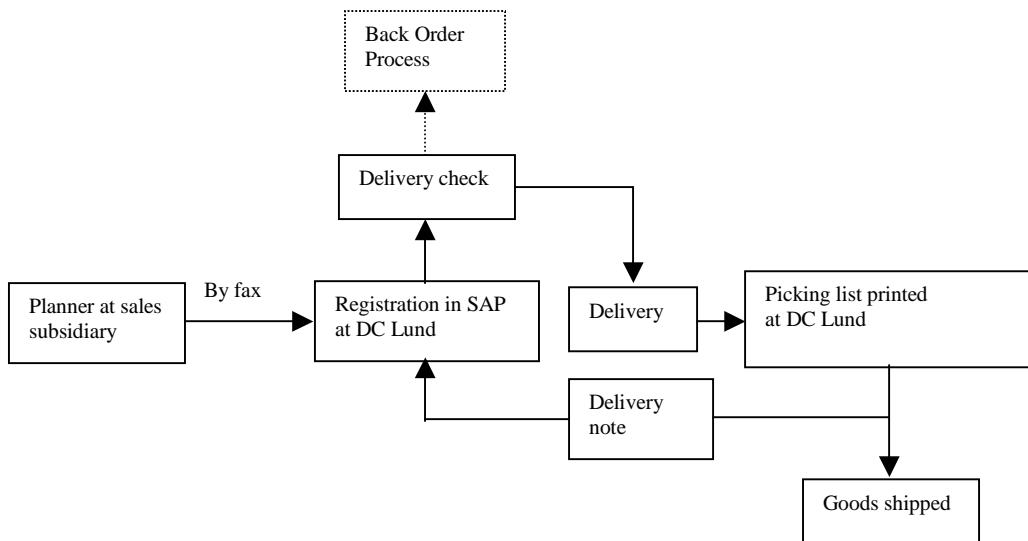


Figure 5.4. The information flow from the German market.

the goods. The warehouse premises also contain Hospal spare parts, brochures and exhibition equipment. Half of the German spare part stock value is found at the sales subsidiary and the other half in the service technicians' cars.

The number of monthly deliveries of spare parts to customers and Gambro service technicians is about 600; of these approximately 20 per cent are repaired spare parts. A typical delivery has a value of 1000 € and a weight of 5 kg. The lead time, from customer order to installation of the part, is 24 to 48 hours when parts are available at the sales subsidiary.

#### ***Information Flow, Customer/Service Technician – Sales Subsidiary***

Customers' orders are placed to the German sales subsidiary throughout normal working hours. Orders received before 13.00 are shipped to customers the same day and normally arrive the day after. Technical personnel usually place the orders, and distribution between different individuals is as follow:

- Gambro service technician: 20%
- Clinic technician: 79%
- Clinic other: 1%

Gambro service technicians regularly place the orders once a week. Approximately half of all incoming orders are received by telephone and the remaining part by fax or e-mail.

In general the customers are well informed about the products and they seldom need guidance in connection with the order placement. However the products are complex and subject to many modifications and upgrades and even highly technically skilled

customers need guidance to keep up with the development. This type of technical support is highly valued by the customers. The reason for this is that it makes it substantially easier for the customers to place their orders and signals a willingness to help. Inversely it makes a very bad impression if the total burden of keeping track of all articles and changes and updates is placed on the customer.<sup>129</sup>

#### ***Information Flow, Sales Subsidiary – DC Lund***

The individual at the German sales subsidiary receiving customer orders is also the same individual that orders spare parts shipped from Lund. Orders are normally used for replenishment and placed via fax, and are never placed directly from German customers or service technicians to the DC. Occasionally orders are placed by e-mail or telephone, often in connection to required express deliveries. Orders are normally placed once a week followed by additional minor ones, one to two times a week. Creation of orders, delivery notes and picking lists are carried out at DC Lund, but otherwise in the same way as at the Swedish sales subsidiary. The German sales subsidiary do not receive any order confirmation unless they specifically request one. Such requests are usually only made in connection with express deliveries.

If spare parts are not currently held in stock at the DC, the DC order handling personnel is made aware of the shortage when the delivery is made in SAP. This shortage information is not directly transmitted to the sales subsidiary. Hence, the sales subsidiary has no information about when to expect deliveries and which spare parts that have entered the back-order process. When goods are replenished at the DC, the order handling personnel prioritize between customer orders. Small, urgent deliveries are prioritized in advance of deliveries intended for DC stock replenishment.

#### ***Physical Flow, DC Lund – Sales Subsidiary***

Picking is carried out continuously during Monday to Friday at DC Lund. The spare parts are packed for transportation at Wednesday and shipped at Friday. At Thursday the DC shipping department books the forwarder. Spare parts packed for shipment are picked up at DC Lund. Standard transports are shipped by truck, and express transports by courier vans. Standard transports are delivered at the German spare parts warehouse in Munich the following Monday. Courier transports to Germany are shipped on the same day if the order is received before 11.00 and are always delivered to the sales subsidiary, normally within 24 hours.

#### ***Physical Flow, Sales Subsidiary – Customer/Service Technician***

Before being distributed to customers in Germany the spare parts are repacked. This activity takes place at the sales subsidiary warehouse and about 90 per cent of the spares are repacked. UPS handles 99 per cent of German domestic deliveries. Customers receive the goods at the clinics; Gambro service technicians receive goods at their homes, or at a clinic. Gambro service technicians normally operate within a radius of 100 kilometres.

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<sup>129</sup> Interview with Gambro service personnel.

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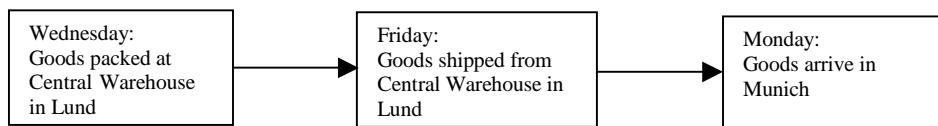


Figure 5.5: The physical flow to Germany.

#### **Financial Flow**

The shipping department at DC Lund sends an invoice to the German sales subsidiary according to prices set by ITS. Invoicing is carried out in connection to the shipment of spare parts. Terms of payment are always the same within the European Union, that is, within 45 days. The DC accounts for transportation costs to the sales subsidiaries and the sales subsidiaries account for transportation costs to customers. In exceptional cases, that is, if the sales subsidiary to a large extent demands express deliveries, the sales subsidiary is billed for transportation. However, when choosing between no-charge standard deliveries or express deliveries for which they are charged, the sales subsidiaries normally choose the first mentioned.

The German customers receive their invoices with the delivery. Payment terms are either ten days with two per cent discount or 30 days net. The invoices are monitored by technical service in cooperation with accounting.

#### **5.4.3 The French Distribution Structure**

Spare parts are stored at the sales subsidiary in Colombes, close to Paris. The warehouse comprises approximately 120 square metres and is staffed by one employee handling the goods. In similarity with Germany, the warehouse premises also contain brochures and exhibition equipment. Inventories are also held in 11 local branch offices and in service technicians' cars. Approximately 30 per cent of the inventories are located at the sales subsidiaries and the remaining part at branch offices or in service cars. In the year of 1998 the number of different spare parts were 1950 in the sales subsidiary stock and between 225 and 460 at the local branch offices<sup>130</sup>.

The local branch offices are located where the density of customers is high. The service technicians operate within of 250 kilometres radius from the branch offices.

The number of monthly deliveries of spare parts to customers and Gambro service technicians is about 900 with an average weight of approximately 2 kilograms. The lead time, from order placement to delivery is normally 48 hours when parts are available at the sales subsidiary. In cases of acute need of spare parts they can be delivered within 16 hours and in some cases in 9 hours when shipped by express

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<sup>130</sup> Consultant Report. Andersen Consulting 1998.

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transports. This possibility is however only utilized when the repair is very urgent due to the high cost associated with the express transports.

***Information Flow, Customer/Service Technician – Sales Subsidiary***

Customer or Gambro service technicians normally place the orders to the sales subsidiary. Occasionally accounting staff at the clinics places the orders. Orders are normally placed by fax or mail (approximately 70 per cent), and the remaining part by phone or e-mail. Two individuals receive and process the orders on normal working hours five days a week.

To facilitate ordering customer and Gambro technicians make use of a spare parts catalogue. The documentation is however often obsolete or lacks references, resulting in a need for guidance by the sales subsidiary.

***Information Flow, DC Lund – Sales Subsidiary***

The order and back order processing activities performed at the DC are the same for German and French Sales. In similarity to the German orders, the French sales subsidiary lacks information on order status, e.g. availability, delivery dates and back orders. The information flow from the French market can be described by the same illustration describing the information flow from the German market, see figure 5.4.

***Physical Flow, DC Lund – Sales Subsidiary***

The physical flow between the DC and the French sales subsidiary is similar to the German flow. For standard transportations picking is carried out at the DC on Wednesday, goods are shipped at Friday and delivery normally takes place the following Tuesday to the sales subsidiary in Paris. A different forwarder than the one used for German transportations is used for standard deliveries. Courier transportations are shipped by UPS and normally delivered to the sales subsidiary within 24 hours. The goods flow to France is illustrated in figure 5.6.

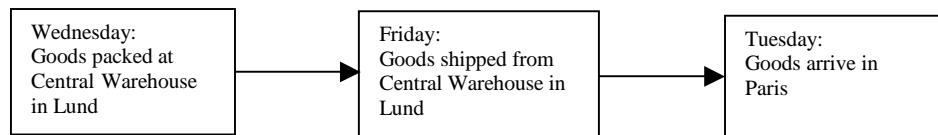


Figure 5.6. The physical flow to France

***Physical Flow, Sales Subsidiary – Customer/Service Technician***

Spare parts are unpacked and physically checked at arrival to the sales subsidiary. Spare parts are picked, manually corrected and packed for transportation the day after the order has been received. Repackaging mainly occurs for high-quantity parts, e.g. o-rings and water filters.

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Lead times from customer order placement to delivery are normally 48 hours. The local branch offices receive deliveries once a week. A courier forwarder ships 90 per cent of all domestic deliveries.

Deliveries of maintenance kits are scheduled to some extent as some customers receive standard quantity deliveries every two months.

#### ***The Financial Flow***

Activities related to the financial flow and carried out at the DC are mainly the same for German and French Sales. The French sales subsidiary does not charge customers for transports. Customers normally pay the sales subsidiaries in 90 days after receiving the invoice.

#### **5.4.4 Distribution Structure and Cost**

##### ***Inventory Carrying Cost***

The value of tied up capital and obsolete stock in the end of 2002 were as follows in table 5.2. Tied up capital includes the value of obsolete stock.

<b>Table 5.2. Value of Tied up Capital and Obsolete Stock (KSEK) End of 2002.</b>		
<b>Source: DC Control</b>		
	<i>Tied Up Capital</i>	<i>Obsolete Stock</i>
DC Lund	55,592	3653
Germany	16,710	1680
France	15,270	420

There exists a central policy for reporting obsolescence; this policy is however not completely followed neither by the DC nor the German and French sales subsidiaries. In addition the real value of obsolete stock is most likely higher than reported<sup>131</sup>.

Values of tied up capital and obsolete stock for Germany and France include a mark-up set in Lund for “selling” spare parts to the sales subsidiaries. This mark-up is approximately 50 per cent<sup>132</sup>. The values of tied up capital also include the inventories located in the service technicians’ cars, and in case of France, also inventories in the local branch offices. Further the values correspond not only to Gambro spare parts but also to water systems equipment spare parts. In France, these parts correspond for 20 per cent of the total stock value. In Germany the car inventories corresponds to approximately half of the total stock value. The sales subsidiary in France stocks approximately 30 per cent of the spare parts value.

The internal cost of capital within Gambro is currently 15 per cent<sup>133</sup>. This capital cost will be used in the analysis when transforming stock values into costs.

<sup>131</sup> GRP and DC Control.

<sup>132</sup> International Technical Services.

<sup>133</sup> DC Control.

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### **Transportation Costs**

Costs for courier transportations between the DC and the sales subsidiaries are based upon shipping documents. The forwarders have provided standard transportation costs. Costs for transportations between Lund and the sales subsidiaries are shown in table 5.3, costs for domestic deliveries are shown in table 5.4.

<b>Table 5.3. Annual Transportation Costs from DC to Sales Subsidiaries during 2002 (KSEK).</b>		
	<i>Courier</i>	<i>Standard</i>
Germany	67	110
France	34	155

<b>Table 5.4. Annual Costs for Domestic Deliveries during 2002 (KSEK).</b>		
Germany		234
France		900

Costs for domestic deliveries also include deliveries of repaired spare parts and parts for water treatment equipment, which in fact lies outside the scope of the thesis.

### **Operation Costs**

The German and French warehouse premises are used for both Gambro and Hospital branded spare parts and for other goods such as exhibition material and brochures. The personnel in the German and French warehouses are subsequently managing other goods than Gambro branded spare parts. Therefore the personnel costs and rent for managing only Gambro branded spare parts have been estimated by reducing the actual costs by half. Warehousing costs are shown in table 5.5 and have been provided by DC Control and the German and French sales organizations. DC costs are budgeted costs for 2003. German and French warehousing costs have been estimated based upon area of the premises, standard rents and salaries.

<b>Table 5.5. Annual Warehousing Costs (KSEK).</b>		
	<i>Rent</i>	<i>Personnel</i>
DC	1800	2953
Germany	59	400
France	202	234

### **Other Costs**

Besides costs for transportation, inventory and operations, costs also suggested taking into consideration when centralizing in the theoretical frame of reference were communication and IT, packaging, administrative and other costs.

Communication and IT costs are not taken into consideration, as we do not see these costs as exclusively dependent on the alternative distribution structures. Packaging costs at the German sales subsidiary and warehouse overhead at the French and German sales subsidiaries have not been possible to assess, as they cannot be separated to relate only to Gambro branded spare parts. Packaging, warehouse

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overhead and administrative costs are shown in figure 5.6. No other costs have been included in the study.

<b>Table 5.6. Packaging and Administrative Costs (KSEK). Source: DC Control and the German and French Sales Subsidiaries.</b>			
	<i>Packaging</i>	<i>Administrative</i>	<i>Warehouse overhead</i>
DC	1000	2575 <sup>1</sup>	216
Germany	Not available	450 <sup>2</sup>	
France	90	900 <sup>3</sup>	

<sup>1</sup> Planning personnel 1216 plus order and shipping 1359  
<sup>2</sup> Order handling and forwarding personnel. Based upon figures from the French sales subsidiary. Half the number of employees has been assumed to result in half the costs.  
<sup>3</sup> Order handling and forwarding personnel.

#### **Cost Driver**

As a driver for the warehousing costs and for inventory cost we use the cost of goods sold. In the framework for calculating costs when centralizing presented in the theoretical frame of reference the driver for these costs was suggested to be the volume handled. Due to the dissimilarities, e.g. value and size, between the vast numbers of parts, the volume handled cannot be used as a cost driver. Instead we use the cost of goods sold as driver for warehousing and inventory cost, see table 5.7. These costs relate to the goods delivered from the DC.

<b>Table 5.7. Cost of Goods Sold in 2002 (KSEK). Source: DC Control</b>	
DC total	96,142
To Germany	12,335
To France	16,710

#### **5.4.5 Chapter Summary**

In order to summarize the in-depth study, some characteristics and conditions for the distribution to Sweden, Germany and France are shown in table 5.8.

<b>Table 5.8. Conditions and Characteristics for the Distribution</b>			
	<i>Sweden</i>	<i>Germany</i>	<i>France</i>
Required lead time	24 hours	24 hours	48 hours
Sales subsidiary stock	No	Yes	Yes
Existence of local branch offices	Yes (without stock)	No	Yes (with stock)
Use of maintenance kits	Extensively used	Used to a small extent	Extensively used
Customer payment terms	45 days	30 days	90 days
Order flow	Customer-Sales sub	Customer-Sales sub-DC Lund	Customer-Sales sub-DC Lund
Number of service technicians	8	26	31
Gambro machine fleet	700	7000	4200
Customer use of Gambro technicians	High	Low	High

## 6 Analysis

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*The empirical findings are analysed facilitated by the theoretical frame of reference presented in chapter 4. The findings presented for the distribution to the Swedish market are not exposed to an evaluation in a change-perspective, as is the case with Germany and France. However, the Swedish DC activities are evaluated as they clearly affect, as well as they are affected by, the distribution to Germany and France. The analytical conclusions drawn are finally related to the implications of alternative changes in the distribution system.*

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### 6.1 Strategy and Policies

#### 6.1.1 Strategy

It has earlier been pointed out that the dialysis machines produced by Gambro do not significantly differ from the competitors. The products are mature and efforts to come up with new features to differentiate the products seem meaningless as the competitors easily replicate new features. Therefore the remaining ways to compete are finding other differentiators or pricing. Some of Gambro's European adversaries are price aggressive. Reciprocating this price competition with further reductions in price would deteriorate profits. However, Gambro is not currently competing on price but rather appears to be seeking differentiation in dimensions outside of the core product, e.g. service. Hence it is of the utmost importance that the distribution and organizational structures are configured in such a way that this service can be upheld, or even better, excel competitors.

In mature markets both cost advantage and differentiation advantage are difficult to attain. Such markets are characterized by diminishing product and process innovation, increased buyer knowledge and well established market positions between competitors. All of these features are present in the European monitor market. The source of competitive advantage in the market tends to shift from differentiation to cost. However, the fact that products and processes are standardized makes it hard to sustain a pure cost advantage. This makes it necessary to try to overcome the obstacles of differentiation and strategic innovation.

Since Gambro seeks competitive advantage by following differentiation strategies rather than cost leadership, the overriding objective when redesigning the distribution structure will be to ensure that this differentiating service can be delivered. Costs can obviously not be disregarded since there currently are trends in the market towards increased cost consciousness as many clinics struggle with cost issues. In Germany many clinics also are private which means that they are profit driven and have a high cost awareness.

### **6.1.2 Customer Service**

Customer service in this section will mainly be discussed in terms of service requirements which the distribution system has to fulfil. There is however other important aspects of customer service related to the distribution of spare parts such as customers' requirements on communication. These other aspects on customer service will be discussed in relation to coordination and control, see section 6.4.2.

A number of customer categories for the spare parts distribution can be identified. One category consists of the clinical staff that is in need of equipment that is up and running. Downtimes will put them under pressure as their working environment already is stressing. If this customer category is not satisfied it will have severe impacts on sales of dialysis machines. A second category of customers is the external clinics' service technicians. It is equally important to offer the same service to them as well; otherwise they will not be able to perform their work, which will have negative influences on decision-makers. Gambro's own service technicians can also be seen as customers. It is highly significant to be able to provide these technicians with the spare parts they need since the service personnel is a major contributor to the costs related to technical services. To send a technician to a clinic without proper equipment is a costly behaviour. Further, it is important to avoid inferior service to Gambro's own technicians as highly motivated service personnel is a key success factor if Gambro shall be able to compete through differentiating service.

When reflecting the customer service to provide it is important to bear in mind that a majority of the spare parts supplied from the German and French sales subsidiaries is sent directly to clinics and not through the Gambro service technicians. Hence there are many clinics demanding only spare parts. Therefore, it might be argued, it should be highly prioritized to be able to provide quick deliveries to these customers.

The end user, the patient that is, has small influence over service decisions and is in this context not to regard as a customer for several reasons. First, the patients are not in control of the funds used to pay for their treatment. Funding is in the vast majority of the cases instead handled by some public or private social insurance system and these systems by far outweigh the users in terms of bargaining power towards the clinics. Further the majority of patients lack the technical and medical understanding necessary to evaluate the monitor supplier.

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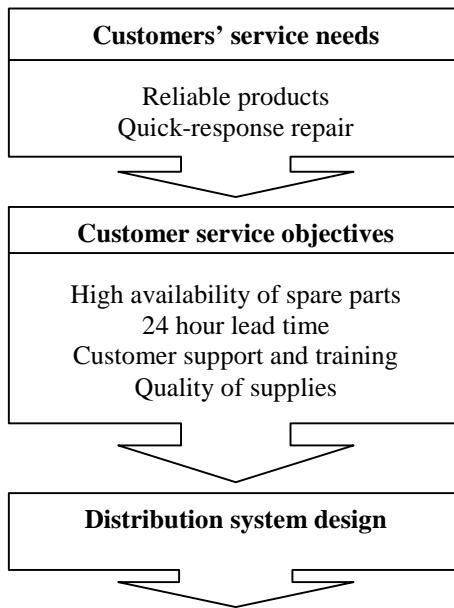


Figure 6.1. Customers' service needs and service objectives devising the Gambro spare parts distribution system design.

Since it has been found to be highly significant to compete in the monitor market with differentiating service and since customers are in need of products with as little down time as possible, we can conclude that the most important service needs that have to be met are reliable products and quick-response repair. The products' reliability related to the distribution is dependent on the quality of supplies. In order to fulfil these service needs the distribution system must meet the service objectives of high availability and 24 hour lead time. Ensured availability is a prerequisite for quick response and 24 hours is the customers' definition of response perceived as quick. Customer experience is also an important service objective that Gambro currently seeks to exploit. By educating clinical staff and technicians, the personnel increase their skills with handling the equipment, which reduces the technical service required, simultaneously the staff gets used to the Gambro products. Customer support and training is not directly affected by the distribution system. However, in order to retain customers and achieve their confidence, the distribution system must be perceived by customers as high-performing. The service requirements that must be met by the spare parts distribution system are summarized as shown in figure 6.1.

Further, the distribution system can currently be classified as flexible as there are no policies regarding minimum order quantities, fixed order quantities, or fixed dates of order placing, neither from customers to sales subsidiaries, nor from sales subsidiaries to the distribution centre. However, it can be questioned whether this flexibility is

highly valued by customers or if it is of minor importance and only contributing to unnecessary increases in costs and complexity. There are however examples of where restrictions in flexibility have been causing problems in the field, e.g. when customers have to pay for a whole maintenance kit when only a fraction of the kit has been needed. Hence, flexibility in association with order time and quantity might not be a strong enough factor to win orders, but could still be a necessary service to provide for competing in the market.

### **6.1.3 Lead Time**

The lead time discussed from now on is what earlier has been referred to as the order cycle time or response time, that is, the time from customer order to delivery. Other definitions of lead time, such as time from order to payment, can be made. They are however of lesser interest for this thesis and device to a lesser degree than the order cycle time the distribution system design. In the theoretical frame of reference it was argued that short and consistent lead times could be a source of competitive advantage. However in the case of Gambro spare part distribution, short lead times are indeed an important key success factor, but offering 24 hour deliveries within Europe are more of a prerequisite for competition than a source of sustainable competitive advantage.

One of the most commonly used techniques to achieve protection against long lead times is to keep safety stock. Gambro's customers usually hold small inventories, however, the volumes that can be stored are restricted since premises are limited and there is no staff employed explicitly to manage spare parts inventories. Hence, the clinics inventories can not be used as buffers against long lead times. Therefore, the availability within the distribution system must be high.

The current lead times are highly fluctuating. Lead times from the German and French sales subsidiaries are normally 24 - 48 hours when spare parts are readily available at the local warehouses. However when spare parts not are available neither at the sales subsidiaries nor at the DC and must be sourced, lead times can be as lengthy as months.

The physical distribution to France and Germany is currently carried out with a combination of standard and courier transports. The courier transports from DC Lund can reach customers almost anywhere in those two markets within 24 hours. The standard transports take significantly longer, between four and five days. The actual time for transportation does however not account for the total lead time. For example parts are shipped to Germany and France packed on Wednesday at DC Lund while the actual transport does not leave until Friday, thus adding two days to the lead-time. The shipments normally arrive at the German and French sales subsidiaries the following Monday and Tuesday, respectively. Delays of one day do occur. Orders that have not arrived in time to be packed on Wednesday either will have to be sent with express transport or be delayed until the next standard transport a week later. Thus the lead time for transports is not in reality four to five days but rather between

six and fourteen days. The difference between the best and the worst case depends on the fact that transports are carried out only once a week, thus goods not packed in time will not be shipped until a week after order placement. If goods were shipped on a daily basis, standard transportation lead time could be reduced to four days.

A prerequisite for changing the distribution structure is that the current lead times from sales subsidiaries to customers can be upheld or improved. If spare parts were to be transferred to the distribution centre and delivered directly to customers, both the German and the French customers could normally have the spare parts in their hands within 24 hours as UPS delivers overnight, assuming that the spare parts are available at the DC.

As it is today, orders received at the DC on Wednesdays are delivered to the German and French sales subsidiaries on Mondays or Tuesdays if shipments are sent by standard transports. This means that lead times for standard transportations can be up to twelve to thirteen days resulting in cost build-ups as time elapses. It also reduces the transparency in the chain, which yields difficulties in assessing true demand. A final implication of such lengthy lead times is increases in safety stock at all inventory locations resulting in cost increases.

## **6.2 Distribution Structure**

The physical distribution structure operating in Gambro at present can best be described as a central and local warehouse concept. The number of inventory levels is three in Germany, DC Lund, sales subsidiary and service cars, and three to four in France since part of the goods flow passes the local branch offices. The flows of information and goods are not separated.

This type of distribution structure is traditionally often used when the market is large and the customers are widely spread geographically. The supposed advantage with the structure is that high levels of customer service are guaranteed. Direct distribution theory however suggests that the geographical distance to the customer is not central when determining the outline of the physical distribution structure. Instead the lead time for the transports should be considered as the dominant factor in the design process.

The structure with central and local warehouses is also known to cause other effects in the organization. In many cases the level of integration between units is low and performance is optimized on unit level rather than on system level. These aspects of the structure will be further examined in section 6.3.

### **6.2.1 Distribution Structure and Cost**

The cost model developed by Abrahamsson & Aronsson cannot directly be applied to the distribution structure currently in use at Gambro. This is due to the fact that the supply of spare parts to France and Germany already flow through the DC which is

not in accordance with the assumptions in the cost model, which implies that the volumes in the sales subsidiary that is to be eliminated not currently flow through the warehouse to which these volumes are to be transferred. The findings presented by Abrahamsson & Aronsson can however be used as a basis for a qualitative discussion concerning the cost impact when centralizing stock. One of these findings is that the effect of economies of scale increases with increasing assortment overlapping. Since the assortment overlapping between the DC and Germany, and between the DC and France are considerable, the effect of economies of scale will be large if centralizing inventories at the DC. That is, the increase in inventories at the DC will be minor when the inventories are transferred from the German and French sales subsidiaries to the DC. Warehousing staff at the DC also supports this statement.

The impacts on costs when centralizing inventories are presented in the evaluation of the two alternative distribution structures see sections 6.5.1 and 6.5.2 below.

### **6.3 Organizational Structure**

The *formalization* in the organizational structure involved in the distribution of spare parts in Gambro can currently be characterized as low. That is, there are few rules, standard policies and procedures, directing decision making and working relationships. This declaration can be supported by a number of illustrations; for example, the order handling personnel at the DC prioritize between different orders without facilitation of a formal policy. Further there are no standardized procedures for deciding on which transportations that will be shipped by courier and which that are to be sent by standard transports. Rather, this is decided on in accordance to the sales subsidiaries' requests. Also, there are no policies regarding minimum order quantities, fixed order quantities, or fixed dates of order placing, neither from customers to sales subsidiaries, nor from sales subsidiaries to the distribution centre.

Formalization related to inventory management is also low. This is illustrated with the lack of policies directing amount and types of inventories both in service technicians' cars and at the local sales subsidiaries. Service technicians completely decide on what spare parts to keep in stock in their service cars based solely on their own experience.

There is also a lack of formalization when agreements are made in relation to service contracts. Normally a large amount of bargaining is involved with the customers before any contracts can be realized.

*Centralization* within the organizational structure is low. Local sales subsidiaries decide to a large extent what to keep in stock, which technical services strategies to pursue, and what types of contracts to make. An illuminating example of the low degree of centralization is that local sales subsidiaries originally not were supposed to hold any inventories at all. However stocks were built up there anyway.

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Low degrees of centralization are also present in the pricing to customers where decisions are made by the sales subsidiaries that individually add their own margins to the costs for purchasing the spare parts from the DC. Further, the customers' payment terms are locally decided on with large discrepancies. German customers pay within 10-30 days, Swedish customers within 45 and French customers within 90 days.

Naturally there are also corporate wide directions and central decisions influencing the sales subsidiaries, as a certain level of central control is needed for facilitating the distribution operations. This central decision-making does not, however, affect us in the conclusion that the organizational structure can be characterized as containing low degrees of centralization.

*Specialization* refers to the division of tasks and activities across positions within the organization. Since not all the working roles within the Gambro staff have been thoroughly examined, little can be said concerning the degree of specialization. However personnel involved in DC activities such as planning, shipping, order handling and warehousing are mainly highly specialized within their functional tasks. High levels of specialization in functional tasks are also found at the sales subsidiaries. For example there are different individuals at the French sales subsidiary receiving customer orders and placing orders to the DC.

Individuals possessing more general knowledge are normally found at the management level. Some staff at lower hierarchical levels have however been found to possess profound knowledge in several cross-functional areas. The reasons for this can mainly be considered to be long employment period at Gambro, working in many organizational positions, or staff currently or earlier employed as project leaders.

The degrees of formalization, centralization and specialization within the organizational structure involved in the distribution of spare parts at Gambro Renal Products are summarized in table 6.1, which follows from the discussion above.

<b>Table 6.1. Formalization, Centralization and Specialization related to Strategy.</b>			
	<i>Gambro</i>	<i>Cost Minimization</i>	<i>Differentiation</i>
Formalization	Low	High	Low
Centralization	Low	High	Low
Specialization	High	Low	High

The mapping in table 6.1 illustrates that Gambro's organizational structure involved in the spare parts distribution well corresponds to the organizational structures in firms pursuing differentiation strategies. This result is in accordance with the earlier suggestion that Gambro should strive for (which they currently are) competitive advantage through differentiation related to the spare parts distribution.

However the levels of formalization, centralization and specialization related to cost minimization and differentiation strategies suggested by the theory are essentially

discussed on a *company* level. Hence the organizational structure distributing spare parts in Gambro does not necessarily possess the most relevant degrees of formalization, centralization and specialization discussed above. That is it might e.g. be more suitable to possess higher levels of centralization when seeking to differentiate through spare parts distribution. This reasoning will be more thoroughly explored in the section below.

The strong local management can be motivated since local service organizations seem to be highly efficient and to hold strong positions in their local markets. However the distribution of spare parts is not as efficient as the service organizations in the both countries. The insufficiencies in the spare parts flow can be interpreted as signals indicating that the local decision-making ought to be balanced in order to achieve a more integrated flow. In the theoretical frame of reference one suggestion for achieving this balancing act was to keep the control and management of customer service local and the strategic structuring and overall control of logistics flow centralized. Currently the control of customer service is local which implies that no changes have to be made in this respect. The control of the logistics flow might however be relevant to centralize.

In the theoretical frame of reference it was stated that the existence of a global logistics information system was a prerequisite for satisfying local service needs whilst seeking global cost optimization. This will not, however, be discussed in this section but will be further examined in relation to coordination and control, see section 6.4.2.

## 6.4 Coordination and Control

### 6.4.1 Spare Parts Control

Control over the central warehouse levels of spare parts is currently carried out by the use of ABC-analysis. This is the most common classification method in logistics and it is easy to understand. However the analysis operates under the assumption that the products are fairly homogeneous in nature and mainly differ in price and demand volume. Since the spare parts range from o-rings to circuit cards and the number of articles is currently 8000 it is by no means obvious that ABC-analysis is the most suitable choice. A categorization taking into account the variations in control requirements could include the variables *criticality*, *demand* and *value*. The possibilities of such an analysis are examined below.

The process criticality for most Gambro spare parts is high since the operational security levels also are high, that is, small disruptions will cause the machine to automatically shut down. There is however parts that can be considered to be uncritical e.g. monitor wheels. It would be suitable for Gambro to carry out a criticality analysis for spare parts in time dimensions. Since the availability of spares not currently is at a satisfactory level, efforts to improve availability can be focused on those parts that need to be delivered immediately.

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In Gambro a mapping of the process criticality of spare parts is currently in progress. This mapping is however not carried out by the Supply Division but by ITS, further it lacks any connection with the existing ABC-classification and contains no considerations on time dimensions.

Another relevant control characteristic for Gambro spare parts would be control criticality. That is, definitions of spare parts in dimensions such as the predictability of their failure, availability and lead times. Parts with a predictable failure pattern could be replaced within the frames of preventive maintenance. The idea of letting lead time decide on where inventory should be located is also in accordance with the theory behind time based direct distribution, that is, if lead times can be upheld, inventory favours a centralized position. It also recognizes the importance of whether there is time to react to demand needs, by usage of time or material buffers. Since lead times between the French and German local warehouses and their customers are 24 to 48 hours, and lead times from Lund to the customers are the same it implies a positioning of material in the central warehouse. The time dimension of control criticality would be 24 hours for most parts, since customers expect to receive service within this period and since the service organizations require quick deliveries in order to supply a high performing service offering.

Gambro spare parts can be classified into maintenance and breakdown parts. In relation to market introductions the distribution between these two categories might be 75 per cent off breakdown and 25 per cent off maintenance. After this introductory period, the distribution is normally the opposite. Hence, in normal cases a significant proportion of the spare parts are used for maintenance. It has earlier been stated that the maintenance parts would be possible to predict, at least at an aggregate level, that is, at the DC. Since the demand for these parts could be well estimated, there would be no need for keeping buffer stocks.

When a new product or a new product generation is introduced in the market, there is currently no information on how the product will age during its life cycle. That is, information is lacking on when the machine parts will be worn out in time. In case such information existed, it would facilitate the planning of maintenance as parts could be replaced according to hours operated by the machine. Down time due to spare parts dysfunction could hence be reduced. Such preventive maintenance is also reported to require very little effort to sell in the market.

When discussing the demand pattern of spare parts it would also be relevant to discuss the volumes sold. Parts with a predictable demand and a high turnover, could favour from a decentralized position since they could be forwarded in large aggregate volumes, thereby minimizing transportation cost. Regarding the parts that have an unpredictable wearing pattern, in this case referred to as breakdown parts, they would benefit from a positioning at the DC since it would result in consolidation of demand and reduced variability.

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The typical approach to handle the variations in demand is to concentrate the low volume parts back in the chain and to stock only the parts that are frequently demanded locally. In Gambro no such policy exists, rather both the first and second levels of stocks include parts highly demanded and parts infrequently demanded. In cases when the low volume parts have a high value and/or a short life cycle this is not an appropriate approach. If such parts were to be kept in the central warehouse, availability would most likely increase and capital cost and cost for obsolete stock be reduced. Further, short lead times throughout the entire supply chain for high value parts should be pursued in order to minimize the capital cost. Low value parts carry a lesser capital cost and can thus be stocked in larger volumes and longer lead times from upstream suppliers can be tolerated.

It is highly significant to bear in mind the rationale behind a classification of spare parts. We propose that such a classification can be divided in dimensions addressing *internal* or *external efficiency* within the distribution system. External efficiency relates to where to locate inventories so that customer service is optimized. Internal efficiency concerns the management of inventories. The same classification cannot obviously in all cases be used for optimizing both inventory levels and deciding on where to position stock. In our case we suggest that Gambro addresses these issues and considers if the current ABC-classification is the most proper tool for deciding on which parts to keep in stock in service cars, branch offices, sales subsidiaries and at the distribution center, even if it might be suitable for managing inventories at the DC.

Since information on true demand is lacking, the chain would normally be forecast driven. However forecasts are currently not *extensively* used, neither at the distribution centre nor at the sales subsidiaries. To make accurate forecasts on approximately 8000 different article numbers is not an easy task. The numerous amounts of different spare parts make accurate forecasting complicated even if reductions are to take place in the future. Since forecasting is not satisfactory enough today, it might be relevant to consider the possibilities of trying to assess true demand rather than trying to make improvements in the existing forecasting activities.

In this context it might be relevant trying to use a combination of forecasting and real demand when planning the spare parts distribution in the short term. Since maintenance parts are predictable on an aggregate level upstream in the chain, availability of these parts can be based upon forecasting. Maintenance parts contribute to a majority of the spare part revenues simultaneously as the number of maintenance parts is a small portion of the total number of parts. These characteristics would make the use of forecasting easier. Maintenance parts are further sold in to kits, extensively in some countries e.g. France and to a smaller extent in some, e.g. Germany. Increasing the sold volumes of kits will further facilitate the forecasting of maintenance parts.

Concerning the maintenance kits it shall be observed that they are meant to be used after a certain number of machine hours. Accordingly there are kits for servicing the monitors after e.g. 2000 hours, 5000 hours and so on. There is also a great deal of knowledge in the service organizations about the individual monitors that they service. Theoretically machine hours per monitor and year could be extracted from this knowledge and linked with the required service intervals. This would give a very good estimation of the number of kits needed per year and region.

If maintenance parts can be forecasted to a larger extent facilitating a standardization of related procedures, parts with an unpredictable demand can receive larger attention. More resources devoted to unpredictable parts in combination with information on real demand may lead to improvements in the distribution.

#### **6.4.2 Information Systems**

An adequate and well functioning information system is pivotal for successful logistics operations. While the goods are carried by physical means to the customer the information system is the virtual vehicle for the flow of orders and data going the other way. In order for the total distribution system to operate efficiently, both these flows have to be efficient, because one is dependent upon the other. This fairly simple fact needs to be recognized when analysing the information system.

The distribution related information flows in Gambro could currently hardly be described as a coherent system. Rather there are several different systems linked together, typically without digital interfaces. At DC Lund spare parts are handled within SAP and the system is used for order handling, planning and forecasting. The system is in general well adapted for the task and supports the distribution activities carried out at DC Lund.

The information systems used at the German and French sales subsidiaries are however other than the one in use at the DC, which to some extent limits integration and visibility. As a consequence orders from these are not received digitally but by fax and are then manually registered in SAP. This way of working has two major deficits. First, orders are processed twice as customer orders are registered at the sales subsidiary and sales subsidiary orders are registered at the DC. Obviously this puts an unnecessary workload on the organization and no additional value is created.

The lack of digital interface also means that the information flow is interrupted and delayed. The presence of local warehouses worsens the situation by further obscuring the real demand from actors upstream. This is a more serious problem than the first because in this case the information system is failing in its very purpose – to bring visibility of demand to upstream functions.

If a change in the distribution structure were to take place a potential obstacle that have to be overcome is the lack of homogeneous information systems. Neither the DC, nor the German sales subsidiary or the French sales subsidiary has the same

information system in use. Common information systems will be necessary if e.g. direct distribution will be implemented as it puts increased demand on visibility and coordination when no intervening stock can be used as buffer.

However, the pure existence of a powerful company wide information system does not guarantee efficient supplies. The information system will only facilitate and enhance the distribution if the structure is well organized and if the information system is used effectively.

This reasoning is well illustrated in the distribution of spare parts in Gambro. That is, most of the European sales subsidiaries actually are using SAP, which is a powerful information system and which also is used by the DC. The existence of a powerful and commonly used information system has however not automatically resulted in a high performing distribution system as it currently struggles with insufficient service levels and high costs. In fact, supplies of spare parts to countries where SAP have been implemented at the sales subsidiaries do not perform more satisfactory than to those countries where SAP have not been implemented. In some cases it is even the other way around. This can be explained by at least two factors.

First, the potential in the information system is currently not fully exploited. That is the information system could be more extensively used when planning, co-ordinating and controlling the order related activities e.g. through stock management, demand forecasting and customer order status. For example, replenishment at the DC is based upon historic consumption and inventory levels at the DC, without considering inventories at the sales subsidiaries. The information system could further be used for reducing the number of order points in the structure and for shifting the demand penetration point upstream in the chain.

As SAP enables the DC to read actual demand and subsequently manage replenishment in real-time it would be able to reduce inventory levels. However as the structure is designed today, time lapses in information result in increased inventory levels. It was earlier stated that one of the most important contributions of the information system was to provide visibility to the entire chain. Information systems are however not currently used for enabling visibility in the distribution structure. Enhanced visibility is a prerequisite which opens the possibilities of transforming the supply chain to a demand chain.

The need for information systems that can read actual demand along the supply chain and provide the driving force for a centrally controlled logistics system was pointed out in the theory chapter. The current insufficiencies in Gambro's spare part distribution illustrate that the existence of such an information system is not enough. The information system must also be efficiently used in an adequate manner. Hence improvements within the existing structure could be made by more efficient use of the information system.

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Second, the lack of performance discrepancies in the distribution to countries where SAP is in use and to those where SAP is lacking, might be due to the structure the information system is facilitating. That is, in the structure's current shape, the full potential of the information system cannot be realized. Changes in the current distribution system in e.g. order and goods flow could make the lack of common information systems more obvious.

So far information systems have mainly been discussed in terms of the SAP, which is an ERP-system (Enterprise Resource Planning). Currently SAP is installed at DC Lund and in most European sales companies but not in France or Germany. Since SAP is already in use in most countries it might seem an obvious choice to use the system for facilitating control of the spare parts flow. However SAP, as all ERP's, has disadvantages. The first of these is cost; acquisition and implementation of SAP in two countries would be a very expensive operation. Second, a change of system will result in a temporary decrease in control efficiency. The reason for this is that a new system will require learning both on individual and organizational levels. The cost of the latter shall not be underestimated – the mere existence of a technically well functioning system does not result in efficiency gains, as shown above.

In our case there are at least two alternatives to an ERP-system. The first is to use another system to bridge the gaps between the existing systems. A second option is to use some kind of web-based solution. Both these alternatives will be examined.

Gambro currently uses i2 for planning the distribution of its finished products. The i2 system belongs to the category of bridging systems and allows France and Germany to operate their own, respective information systems. The number and types of monitors are however significantly fewer than the number and types of spare parts, resulting in that i2 in its current configuration cannot be used for managing spare parts. Hence, ability to plan the spare parts flow within i2 would require an additional application to be purchased.

Using i2 to control the spare parts would have several benefits. It would give a quick solution to the control problem since it would not disturb the existing planning routines. Further it would at least give a limited transparency in the supply pipeline. On the negative side the use of i2 requires that competence is built up and maintained for one extra system. The use of four (SAP, Scout<sup>134</sup>, Minos<sup>135</sup> and i2) different systems also means that the development and upgrading of all these systems has to be monitored and followed, probably resulting in increased costs over time compared to managing only one system. Further, incorporating several information systems increase the risk for errors and instability within the total system.

The second option, using a web-based interface, offers other benefits and drawbacks. It is possible today to acquire software, enabling orders to be received from the web

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<sup>134</sup> ERP used in Germany

<sup>135</sup> ERP used in France

directly into SAP. This would most likely be the least expensive solution in order to link the supply chain closer together. Orders could be received digitally to DC Lund or to a sales subsidiary and no other changes would have to be done concerning the information system. One major question is however who should place the orders.

If orders were placed by the sales companies little would change compared to today, except the media. The orders could also be placed directly by the customers themselves. If direct distribution were implemented orders could be placed to the sales subsidiary or to DC Lund. Concerning the current structure or the centralization of the slow moving parts, which would be very similar, orders could preferably be placed to the sales subsidiary. Having the customers to place the orders would require a significantly different approach, because the same service that currently is performed by the order handling personnel must then be performed by the web interface.

Order placing is in itself not a complicated issue, but problems would arise when the customer lacks product information or technical knowledge. It has earlier been pointed out that the personnel handling the orders at the sales subsidiaries also perform an important support task. Interviews with service personnel have shown that the possibility to get technical support in connection with order placement is highly valued by customers. Gambro is currently perceived by many customers to be the supplier with the best ability to offer such support. A change in the order placement procedure for the customers thus has to be conducted in a way that preserves this advantage. This could be done by incorporating the interactive manual, currently being produced by the ITS, into the interface. Support could also be offered by telephone. In both cases the customers' need for support in their own language must be taken into account.

The analysis conducted so far has pointed out some general aspects that will be relevant to address when changing the distribution structure of spare parts in Gambro. We now proceed with a more specific analysis of the alternative distribution structures proposed in the introductory chapter.

## **6.5 Evaluation of the Two Alternative Distribution Structures**

### **6.5.1 Direct Distribution with All Inventories Centrally Located**

#### *Service*

Since 24-48 hour lead times could be upheld if all inventories were to be centrally located at the DC, direct distribution can be implemented if following time based direct distribution theory. In Sweden, a direct distribution structure with lack of a sales subsidiary stock also has shown to be highly efficient. Swedish service managers are also more satisfied with the spare parts distribution than their French and German colleagues. This can be interpreted as if the direct distribution concept would be preferable. However as there are resemblances between the Swedish and the German and French service organizations and market conditions e.g. geographically

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large markets, there are also differences. The most relevant differences are the Swedish sales subsidiary's closeness to the DC, the number of customers and the small volumes handled. Since the distribution to Swedish customers is made daily and with small shipments, the central warehouse personnel are able to prioritize these deliveries. Hence, shortages are not as likely to occur for deliveries to the Swedish customer compared to the customers in France and Germany.

The current distribution structure diversifies risks. That is, since inventories are held at many different locations it implies some insurance against risks such as fire or strikes. If all spare parts were destroyed, it would have disastrous consequences for Gambro's European businesses and patients might suffer. Therefore centralized inventories have to be held at least at two physically separated premises.

***Organization***

There are many factors indicating that the organization involved with distributing spare parts in Lund stands ready for an implementation of a direct distribution concept. A centralization of the distribution structure can be managed within the central warehouse premises held today and with the same equipment. No increases in staff are judged to be required at the central warehouse.

Further, the Netherlands, Belgium, Portugal and Spain currently receive small and frequent deliveries. The central warehouse personnel recognize this as an introductory step towards direct distribution. A smoother distribution of deliveries in time is perceived to reduce the workload upon the warehouse personnel. However, the deliveries are not yet directly sent to clinics or service technicians, transhipments take place at local sales subs.

If a transition to direct distribution currently would take place, there will be no need of implementing shift work at the central warehouse. The reason is that the forwarders currently contracted not are able to pick up goods at later times of the day. However, implementing direct distribution would most likely force time delays in the working hours, that is, some of the workers would start working later than they do today, approximately at 9.00 finishing at later hours, around 18.00 A similar delay in working hours is currently at work at the finished products central warehouse. If the forwarders were able to pick up goods at later hours, implementation of shift work could be of interest.

There are several examples of companies that successfully have implemented an administrative centre (AC) after implementing a time based direct distribution concept (see section 4.5). The benefits from such implementation have been customer relationship focused local sales organizations, reduced costs and tightened business control together with enhanced quality in information. The administrative centre would be responsible for activities that would benefit from specialization and economies of scale such as invoicing, pricing, reporting, follow-up and control.

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The theoretical AC concept is compared with the current administrative structure involved in the spare parts flow, see table 6.2. In the discussion that follows from this comparison, the administrative activities that in theory should be handled at an administrative centre are assumed to take place at the DC, which currently handles many of the administrative activities related to the distribution of spare parts.

<b>Table 6.2. Current Administrative Activities in Gambro Compared with the AC Concept.</b>	
<i>AC Concept</i>	<i>Gambro</i>
The customer places the order with the local sales unit and the order is simultaneously transmitted to the DC and AC via an integrated information system.	The customer places the order with the local sales unit and the order is transmitted to the DC by fax.
The DC distributes the goods to the customer.	The DC distributes the goods to the local sales unit. The local sales unit distributes the goods to the customers.
The AC sends the invoice to the customer.	The DC sends the invoice to the sales unit. The sales unit sends the invoice to the customer.
The AC informs the local sales unit that the customer has been invoiced.	
The customer pays into a local bank account, which belongs to the AC.	The customer pays into a local bank account, which belongs to the sales unit. The sales unit pays the DC.
The local sales unit is responsible for collecting debts.	The local sales unit is responsible for collecting debts from customers. GRP Business Control is responsible for collecting debts from the sales unit.

#### *The order process*

There are several ways in which the orders could be transferred from customers and Gambro service technicians to the DC, each carrying its benefits and disadvantages. There are also some prerequisites that have to be met for all alternative solutions. A first prerequisite is to continue to offer technical support in the local language in relation to the order placement.

A second prerequisite is to keep the control of the spare parts flow at the same location where order related communication takes place with customers. Today, the customers order spare parts from the sales subsidiary, which also has a stock from which it distributes the spare parts to the customers. It has earlier been pointed out the importance of possessing this control and thereby avoiding e.g. situations where service technicians are sent to clinics without finding any spare parts when they arrive. Therefore it will be difficult to retain the order process in its current shape, that is, having the orders sent by fax to the DC when there are no stocks at the sales subsidiaries. Hence, the AC concept where customers place orders to the sales subsidiary with a simultaneous transmission of orders to the DC would be suitable.

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A change of the current order flow, where order handling personnel at the sales subsidiaries will take over much of the DC activities will most likely leave the personnel at the sales subsidiaries unaffected. The reason is that as the change results in adding some activities, it also reduces other. For instance, there will be no need for placing orders to the DC. The DC personnel however, will see many of the activities currently handled by them being transferred to the sales subsidiaries. This will not necessarily result in reductions in the DC workforce but can rather be seen as an opportunity of extending the order handling personnel's responsibilities along the chain. That is, the order handling personnel employed with the countries not affected by the direct distribution concept, i.e. the export countries, can be given extended responsibilities for the booking of forwarders and for communicating with suppliers. Since enlarged responsibilities increase the workload it would be suitable to transfer the order handling personnel affected by the direct distribution concept to work with the export countries together with extended responsibilities in the chain. Further the DC personnel will most likely have to possess the overriding control of stock picking since it will be difficult to manage shortage situations if the control of the orders not is located at the DC, where the responsibilities of supplier management is located.

As there are benefits related to the solution where sales subsidiaries handle the order processing activities, the benefits including closeness to the customers, ease to provide technical support in the local language, there are also some obstacles that have to be overcome. It will be problematic in Germany and France since SAP hasn't been implemented at the sales subsidiaries. It is possible that SAP will be implemented in the future. However this is not decided on only in relation to the spare parts flow. Implementing such a powerful tool as SAP with the only purpose of managing spare part orders would be a waste of resources. However, the implementation of some kind of common information system will be necessary.

If compatible information systems will be implemented, a second obstacle to overcome is to achieve control and standardization of the order processing activities. Having several individuals all over Europe to register orders would require standardized procedures; otherwise the situation at the central warehouse will be quite precarious.

An alternative design of the order process that could be relevant to consider is having the customers placing the orders directly to the DC. The benefits of such a solution are that compatible information systems not *necessarily* have to be implemented, and that standardization of the order-processing activities are easier to achieve as they are carried out at one location. However, even if compatible information systems not are required for facilitating order placement, a need for such systems will most likely appear anyhow. The reason is that the downstream information flows, e.g. delivery dates and back-order information, from DC to sales subsidiaries have to be highly efficient so that sales organizations are able to plan and coordinate their service activities. Further, an obvious disadvantage with this solution is that the sales

subsidiaries' relationships to the customers are weakened as natural communication between sales subsidiary and customer is lost.

A second disadvantage is that it would require that the order handling personnel speak excellent French and German, which they currently do not. Hence a staffing issue occurs where new individuals have to be employed which will bring along significant costs if the current staff still would be employed. Further, if no staff is to be discharged, new tasks have to be dedicated to these individuals. Since Germany and France are used as cases studies, which will be generalized for the entire European market, one must also recognize that if this order process would be implemented for all countries, it would imply that the order-handling personnel also speak Spanish, Portuguese, etc.

This second design solution would increase the workload upon the DC personnel as the number of incoming orders would increase heavily. The individuals receiving orders at the sales subsidiaries will most likely still be required since service technicians and customers still will be in need of technical guidance. The solution will most likely require that the customers and service technicians have a straighter product catalogue to order from and that article numbers further are reduced. Otherwise it will be difficult for the order handling personnel at the DC to solve the issues that arise when technicians or customers order spare parts that no longer exist or that have been replaced by up-graded parts. Today these issues are in most cases solved before the orders are placed to the DC by the sales subsidiaries. One potential way to facilitate the order process when orders are placed directly to DC Lund is the interactive manual currently developed by ITS. Furthermore it might be possible to have some of the customers or service technicians to place their orders by using this interactive manual since it can be made compatible with SAP. Finally, in addition to the issues related to this design of the order process, it is also contradictory to the AC theory.

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The two alternative designs of the order process are illustrated in figure 6.2. It also illustrates the current order process. The benefits and disadvantages of the two solutions are summarized in table 6.3.

<b>Table 6.3. Benefits and Disadvantages of Different Order Process Designs.</b>		
	<i>Benefits</i>	<i>Disadvantages</i>
Customer place order to the sales subsidiary	<ul style="list-style-type: none"> <li>- Remained closeness to the customers</li> <li>- Ease to provide technical support in the local language</li> <li>- Enables that the order handling personnel at the DC can be given extended responsibilities</li> </ul>	<ul style="list-style-type: none"> <li>- Requires implementation of compatible information systems in France, Germany and Italy</li> <li>- Need for high availability</li> <li>- Need standardization and control of order-processing activities</li> </ul>
Customer place order to the DC	<ul style="list-style-type: none"> <li>- Control remains in-house at the DC</li> </ul>	<ul style="list-style-type: none"> <li>- Decreases closeness between customer and sales subsidiary</li> <li>- Requires order handling personnel with high-skilled language capabilities</li> <li>- Increases workload upon order handling staff</li> </ul>

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Current order process      Alternative design No.1      Alternative design No.2

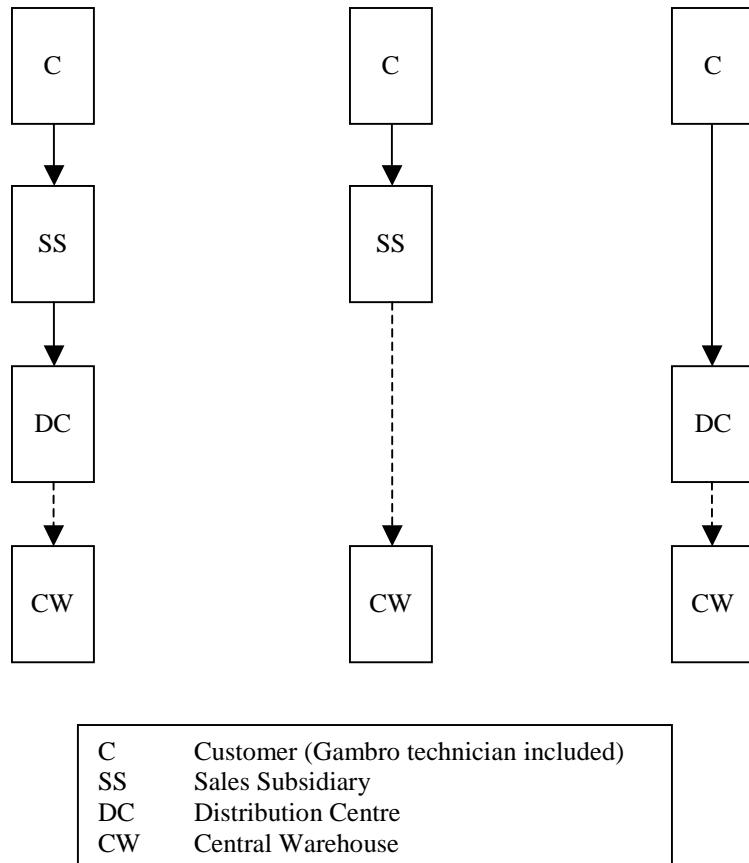


Figure 6.2. Alternative order process designs.

#### *Invoicing*

The AC concept suggests that customers should be invoiced from the administrative centre, which would be from the DC in the case of Gambro. It is however doubtful if this solution would be suitable in this case since the sales subsidiaries act as profit centres. Having the sales subsidiaries to be responsible for collecting debts that won't go to their own pockets will not be appreciated. There will also be difficulties having customers pay to an account that belongs to the DC since the sales subsidiaries are entitled to a margin. The most suitable solution would therefore be to maintain the current invoice procedure, that is, the DC invoices the sales subsidiaries, which invoices the customers. The invoice sent to the sales subsidiaries will with this solution be used as a basis for the invoices sent to customers. This set-up is enabled by SAP and is currently up and running for the distribution to Nordic customers and doesn't imply that the DC must have availability to customer prices. The solution would most likely result in an increased workload upon the shipping department at

the DC, as the invoicing frequency will incline. Simultaneously it would not affect the invoicing personnel at the sales subsidiaries as they currently are sending small and frequent invoices to the customers. Further, because invoices are sent to the sales subsidiaries there will be no need for the DC to inform the sales subsidiaries that the customer has been invoiced as recommended by the AC concept. This can be regarded as a straighter way of transmitting information along the chain. Moreover, this will not require any changes in the current financial structure, that is, the bank account to which customers pay can still belong to the sales subsidiaries. Hence the debts collected by the sales subsidiaries will fall into their own pockets.

### ***Coordination and Control***

An implementation of direct distribution of spare parts will put a considerable amount of stress on the information system. Currently the physical structure is configured to compensate low availability and long lead times for orders from sales companies to DC Lund. The compensating mechanism is the local warehouses. The presence of these makes longer lead times tolerable, both for the physical flow and for the information flow. Their removal, however, will require substantially better performance from the information system in order to maintain or increase distribution efficiency.

The current configuration with different information systems on local level where orders are being faxed to the DC where they are manually registered in SAP will no longer be sufficient. There are two reasons for this. First it delays the order process. Second the lack of digital system integration disrupts the visibility, thus causing the need for even more time-consuming fax and telephone messages. These shortages could be avoided by implementing a common information system for the entire chain.

In the Scandinavian countries this has already been done. Here the order handler at the sales subsidiary receives the order from the customer and registers it in SAP. The moment this is done the information concerning that order is known throughout the chain. The order handling personnel can also access information about availability and delivery, thus being able to answer to any such question from the customer. In this way the order handling activities are in effect reduced to one half. Further the information pipeline becomes transparent meaning that the order handling personnel can see stock levels etc. upstream and the planners at DC Lund receive data on real demand.

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The two alternative designs of the order process presented above would result in the demand penetration point shifting upstream in the chain. It would be easier to assess real demand, as there would be no distortions or consolidations of orders. Enhanced visibility is also one of the key components in Global Supply's definition of the supply chain management concept:

*“... by having better visibility of information and increased co-ordination, it will be possible to produce more accurately towards actual demand. The goods will be pulled by customer demand.”*

The two optional solutions for the order process minimize time lapses in information, which theoretically would lead to reductions in inventory. Implementing direct distribution, with one of the order processes suggested above together with an integrated information system would reduce Forrester effects in the chain, because stockholding and re-order points will be reduced. Moreover, the elimination of intervening inventories makes it easier to assess the real demand. However, to achieve this increased visibility in the pipeline will require implementation of a common information system. Naturally, this doesn't necessarily has to be SAP. However, limiting the number of information systems in the company may be worth considering.

It is not only the order process that would need facilitation by an information system. Other important functions that need facilitation if the direct distribution concept is to be introduced is stock management and demand forecasting.

The information system also has to facilitate the control function. That is, it will be essential to keep track of the performance in the system. The information system could therefore be used to estimate customer service levels, which earlier have been pointed out to be important. Further it not only enables to measure performance, if a common information system is implemented, this performance will be visible for all parties in the chain.

The communication abilities at the DC also have to be improved. Today the sales subsidiaries normally don't achieve any information on when spare parts will be delivered. If direct distribution were to be implemented, promising delivery dates to the sales subsidiaries however would be essential. Otherwise, the planning of service activities will be difficult to manage.

Besides a more efficient information system, direct distribution will also require improvements in the control of spare parts. The current control system used for inventory management at the DC is built upon ABC-analysis; the shortcomings of this method have been pointed out in earlier sections. Control principles will be needed for managing inventories both in the DC and in the service technicians' cars.

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From the discussion related to spare parts control above, see section 6.4.1, it follows that all the three characteristics criticality, demand and value have potential for resulting in improved control of inventory levels and for decisions related to where stock should be located. However the vast number of spare parts requires that the control characteristics used will be fairly simple. Further the main objective is to choose relevant control characteristics so that the *service levels will be high* and that the *costs are minimized*.

To enhance service levels, there will be a need to focus on parts that have a high process criticality, that is, parts that are needed to secure that the monitors are up and running. Further there will be a need of addressing the high demanded parts, the maintenance parts. Otherwise it will be difficult for the sales subsidiaries to effectively plan their service interventions, which could result in a serious cost impact.

		High	Benefit from centralization due to reduced variability	Locate in service cars
Criticality			Require low levels of availability	Locate in service cars
	Low	Low	Focus to reduce inventories of high value items	High

Figure 6.3. Demand/Criticality matrix for deciding on positioning of stock.

If process criticality and demand are combined in a two dimensional matrix, the parts in the left lower quadrant, the uncritical parts with a low demand, would require low levels of availability. See figure 6.3. Of these parts, there will be a need of reducing inventories of the high value items. It might even be worth considering trying to position these parts further upstream at the suppliers. The parts in the upper left quadrant, parts with a low demand and high criticality, would benefit from the centralization since the volumes will be consolidated and variability reduced. The remaining quadrants contain parts with a high demand. These parts would favour from a forward positioning in the chain, that is, in the service cars. The direct distribution concept, as it currently is formulated, implies that A-articles will be the ones to keep in the service technicians' cars. This would not however be suitable since A-articles can contain articles with low demands, but with a high value.

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If uncritical parts with a low demand should be managed by minimization, parts with a high demand and/or high criticality need management by optimization. In order to optimize inventories levels of these parts it might be suitable to focus the attention on those parts that have a *high value*. Low value part safety stocks could be liberal since bulk has a small cost impact. Hence, optimization efforts need to be focused on parts with a high value, high demand and/or high criticality.

### **Cost**

#### *Capital Cost*

The value of stock in the service technicians' cars will approximately remain the same if the sales subsidiaries' stocks are eliminated. The reasons are that the value neither can increase, since the space in the car already is fully exploited, nor decrease, since the turnover rate for these inventories is high. Hence the *maximum annual saving* for tied up capital is 560,000 SEK for Germany and France respectively, which are the capital costs for inventories held at the sales subsidiaries<sup>136</sup>.

#### *Transportation Cost*

Costs for standard transportations will be eliminated if implementing direct distribution, since all spare parts will be forwarded by courier transportations. The domestic delivery costs will also disappear when all items are distributed from Sweden. When calculating transportation costs for the direct distribution structure, we use the current frequency of domestic deliveries and current shipment weights from the DC to achieve an average cost per shipment. Then we apply the tariff rate from Sweden. Estimated transportation costs will then be as shown in table 6.3. These estimated costs are most likely higher than they would be in reality. The reason is that tariff rates are constructed through bargaining between Gambro and the forwarder. Since the volumes shipped will increase dramatically if all shipments were to be sent by courier vans, the bargaining position will be strengthened, resulting in lower tariffs. Current and future transportation costs and the subsequent cost impact when implementing direct deliveries are shown in table 6.4.

**Table 6.3. Transportation Costs When Implementing Direct Distribution (SEK)**

	<i>Number of Deliveries</i>	<i>Average Weight</i>	<i>Tariff Rate</i>	<i>Cost</i>
Germany	5760	2 kg	163	+940,000
France	10,800	2 kg	193	+2,080,000

**Table 6.4. Transportation Cost Impact When Implementing Direct Distribution (SEK)**

	<i>Actual Cost (DC-Sales Sub.)</i>	<i>Actual Cost (Domestic)</i>	<i>Future Cost</i>	<i>Cost Increase</i>
	Standard	Courier		
Germany	-110,000	-70,000	-230,000	+940,000
France	-160,000	-30,000	-900,000	+2 080,000

<sup>136</sup> For calculation of capital costs, see appendix XX.

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*Warehousing Cost*

Since a centralization of inventories can be managed with the same warehouse personnel and premises, the savings will equalize the costs for warehouse personnel and premises at the sales subsidiaries. These costs are presented in the in-depth study, see table 5.5.

*Total Cost Impact When Implementing Direct Distribution*

The total effects on the costs studied if direct distribution is implemented and the sales subsidiaries' stocks are centralized at the DC, are shown in table 6.5.

<b>Table 6.5. Total Cost Impact when Implementing Direct Distribution (SEK)</b>				
	Tied up Capital	Transportation	Warehousing	Total Impact
Germany	-560,000	+530,000	-460,000	-490,000
France	-560,000	+990,000	-440,000	-10,000

The calculations show that implementing direct distribution to France would have small impacts on the total costs studied. However potential saves lie in the personnel costs for order handling personnel, packaging and in reduced costs of obsolescence due to increased control. However, as we don't see these costs as exclusively dependent on the physical deliveries of goods but also dependent on how the order process will be shaped out, we choose not to include these potential savings in the calculation.

The annual saving if implementing direct distribution to Germany is calculated to be approximately 500,000 SEK. Naturally, similar to France, potential savings also lie in other costs. However some potential cost increases have not been included, e.g. costs for implementing new information systems, and one-time costs including e.g. scrapping and transportation of stock from sales subsidiaries to the DC.

The calculations made for France support the traditional total cost framework, stating that centralization will increase the total cost due to severe increases in transportation costs.

Calculations for Germany and France support the more recent theories developed by Abrahamsson stating that the increases in transportation costs will be outweighed by decreases in other costs, resulting in reductions of total costs. However, not all costs have been included in the study and the total cost decrease for France is relatively small implying that the outcomes in reality are uncertain.

We see these results as expressions of that both the traditional and the more recent total costs approach may be valid, differing from case to case depending on the distribution structure studied. A limitation in our study is that the distribution is addressed separately for Germany and France. If the distribution for the entire European market had been studied, the results might well have been different.

### 6.5.2 Centralizing B- and C-articles

#### *Service*

This structure implies that A-articles, and B-articles to some extent, will be stored at the sales subsidiaries, while all C-articles will be stored at the DC. Keeping slow moving goods back in the chain and stocking fast moving goods further down stream is suggested in traditional logistics theories. However as pointed out earlier the A-articles may include parts with low demand. Hence, in similarity with the direct distribution structure the use of ABC-analysis when deciding on inventory levels might be misleading.

Since transportation lead times can be upheld when inventories are transferred to the distribution centre, customer service levels will at least not be worsened if parts are available at the DC. Implementation of a structure where B- and C-articles will be centralized will, in theory, produce higher availability by the concentration of slow moving parts. However the mere relocation of stock is not sufficient to ensure that service levels are *improved*, repositioning of inventories must also be supported by other factors in the system context. Thus a change in the stocking policy must also be supported by changes in other parts of the system in order to produce the desired results. Such changes include a proper spare part control tool, which has been discussed earlier in the thesis, see sections 6.4.1 and 6.5.1.

Centralizing only B- and C-articles will remain the diversification of risks to some extent since A-articles will be held at several locations. B- and C-articles will however be exposed to incidents like fire implying that considerations have to be made in order to hedge these risks. Such consideration could involve keeping inventories at least at two different locations or ensuring availability from suppliers.

#### *Organization*

Since we judge that a direct distribution concept could be managed within the current central warehouse premises and personnel so will also be the case if only B- and C-articles are centralized.

The inventory levels of A-articles at DC Lund may have to rise if increases in service levels are to be realized. However, since the alternative with B- and C-articles also implies that A-articles are shipped daily, inventory levels do not necessarily have to rise due to the implementation of shorter replenishment intervals. A system based on smaller but more frequent shipments is already in use for the shipment of spare parts to Benelux, Portugal and Spain and has resulted in a more continuous flow of spare parts, which gives both a more even work-pace at the central warehouse and lower levels of safety stock on regional level.

Implementing central storage of slow moving parts would require the ability to respond quickly to demand. To increase flexibility shipments could take place as late as possible in the day. In similarity to the direct distribution concept the working hours for the personnel at the warehouse would then have to be adjusted accordingly.

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Transportation of B- and C-articles will only take place on response to customer order. The possibility to forecast or plan for this situation will be very small. In order to maintain a high service level availability of the articles at DC Lund must be ensured and transport lead times must be short. For these articles express transport should therefore be used in order to keep the lead-time below 48 hours.

For the *physical flow* of B- and C-articles two *general alternatives* could be distinguished. Spare parts are either shipped from DC Lund to the sales subsidiaries and from there to the customer or directly from DC Lund to the customer. If the parts were shipped as first described it would mean that the flow of B- and C-articles would be the same as for the A-articles. This results in a system that is easy to manage, since all spare parts follow the same flow. Transportation costs related to this solution will also be lower compared to if spare parts would be delivered directly to customers since aggregated deliveries could be used to the sales subsidiaries. A drawback with this system is however that it increases lead time with at least 24 hours since spare parts have to be repacked at the sales subsidiaries before being distributed to customers. Further it results in non-value adding activities when spare parts are handled at the sales subsidiary. Aggregated deliveries imply a risk that inventories of B- and C-articles are rebuilt at the sales subsidiaries. This can however be considered to be a management issue which lies outside the scope of this thesis.

If transports were carried out directly from DC Lund to the customer, the total transport time would amount to 24 hours in the best case. From a transport lead time perspective this solution is thus to be preferred. From a management perspective, on the other hand, it means that two flows have to be managed and coordinated thus adding to the organizational workload. Further the shipping department at DC Lund will have to handle a significantly larger number of destinations, adding activities that have to be performed and increasing the risk of errors.

Shipment of A-articles, in this structure, will exclusively be for the purpose of stock replenishment. Assumed that forecasting is carried off in a satisfactory manner, the shipments could be planned in advance. This implies that the goods could be shipped with standard transport in order to keep costs down. Cost calculations below however assume that shipments will be sent with courier transports since the use of standard transports will require accurate forecasting abilities.

#### ***Coordination and Control***

The most important flow of coordinating information is the order flow. In general terms this flow shall be efficient in order to keep lead times short and the process simple, both for the in-house user and for the customer.

In this distribution structure, customers will still order A-articles from the sales subsidiaries since the parts will be delivered from there. This implies that customers and service technicians continue to order also B-and C-articles from the sales subsidiary since it would result in the clearest interface to customers and service

technicians. Since those parts no longer are held in stock at the sales subsidiaries the requirements on coordination and communication abilities will increase. Hence there is a need for addressing the order process design not only for the direct distribution structure but also in a structure where B- and C-articles are centralized.

Internally the ability to exchange information is of great importance and crucial for that ability is the potential and the utilization of the information system. Currently there is no such system in place that supports transparency in the chain efficiently in neither France nor Germany. The potential of e.g. SAP, that is already operational at DC Lund, has been explained in earlier sections. Assuming that a well functioning and well-managed information system was in place, order placement could take place just anywhere from the internal perspective. The major reason for this is the potential of information technology to make information available simultaneously everywhere in the supply chain. Thus orders received at local level would be visible at DC Lund the very moment they were registered in the information system. This, in turn, would both facilitate planning on central level and reduce lead times for the delivery of B- and C-articles, stored at DC Lund.

### ***Cost***

#### ***Capital Cost***

In similarity with the direct distribution concept, inventory carrying costs for parts in the service technicians' cars will remain unchanged. The B- and C-articles correspond for approximately 20 per cent of revenues. The stock value of these parts in the sales subsidiaries and branch offices are however uncertain. Hence there are difficulties when trying to estimate the potential changes in capital costs when centralizing these articles to the DC.

Since replenishment of the sales subsidiary stock will occur more frequently it will be possible to reduce inventory levels. There is no valid argument for the DC inventory of A-articles to go up if more frequent deliveries are carried out. A smoother outbound flow from the DC might even allow reductions in the safety stock.

This structure will most likely lead to significant reductions in obsolescence. Since most A-articles are frequently demanded, obsolescence will decrease at the sales subsidiary. In similarity, since most B- and C-articles are infrequently demanded consolidations of these parts will reduce variability in demand resulting in decreased obsolescence.

We therefore assume that the main potential savings in capital costs in this structure will be reduced costs for obsolete stock due to increased control and reduced variability of infrequently demanded parts and total reductions in the stock of A-inventories.

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Due to the difficulties in assessing the impact on capital cost in this structure we do not estimate this potential saving in quantitative terms.

*Transportation Cost*

Standard transportations from the DC will disappear in this structure and so will the related costs as daily deliveries imply that courier transportations are used. Calculations of the transportation costs from the DC to the sales subsidiaries are shown in table 6.6. In these calculations we assume that B- and C-articles are shipped consolidated to the sales subsidiaries where re-packed for customers. This solution is discussed in organization section above.

<b>Table 6.6. Impact on Transportation Costs if Centralizing B- and C-articles (SEK.)</b>				
	Total current cost	Domestic deliveries in new structure <sup>1</sup>	DC to sales sub. in new structure <sup>2</sup>	Cost impact
Germany	-410	+230	+220	+40
France	-1050	+900	+750	+600

<sup>1</sup> Remain unchanged  
<sup>2</sup> See appendix 1.

The calculations show that this structure yields minor increases in German transportation costs, and severe increases in the French. Compared to the direct distribution concept the increases in transportation costs are much lower to Germany (90 per cent lower) in this structure and significantly lower to France (40 per cent lower).

*Warehousing Cost*

The costs for warehousing personnel and rent will remain the same at the sales subsidiaries if all B- and C-articles are transferred to the DC since both premises and personnel will be required for handling the A-articles. The reductions in stock due to the centralization of certain articles are not assumed to affect the premises and personnel needed.

Since increases in German related transportation costs are modest, total costs will most likely decrease when reductions in tied up capital are taken into consideration. However this structure will probably result in a total costs increase in distribution to France as the potential savings in tied up capital will be lesser than 560,000 SEK, which is the inventory capital cost for the French sales subsidiary.

## 7 Conclusion

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*In chapter 6 the distribution system for spare parts was analysed, in this chapter we focus on the most significant analytical findings. Key areas for improvement are identified and the two alternative distribution structures are evaluated. Further the results of the study are related to a general context and propositions for future research are presented.*

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The redesign of Gambro's spare part distribution is, as we have shown, a task that encompasses and affects many different areas and requires careful considerations of factors both inside and outside the organization. However complex this system appears it is of the greatest importance not to lose sight of the fact that distribution, as indeed any of the activities in Gambro, is carried out to meet a demand in the market. Thus the conditions in the market and the Gambro's strategy must be the ultimate governing logic for the distribution system.

We have shown that the monitor market best can be characterized as mature and that Gambro, accordingly, seems to be striving for strategic innovation, outside of the core product.

In the market customers require high availability of monitors in order to keep their own costs down. Consequently spare parts must be available and be delivered in requested quantity and on time. Regardless of the shape of the distribution structure these demands must be taken into account – if external efficiency is not kept at an acceptable level the level of internal efficiency does not matter.

### 7.1 Improvement Areas

We consider the lack of central control to be one of the most important aspects to address in order to reach improvements in the spare parts distribution. Central procedures for inventory management, reporting obsolescence, forecasting, and calculating costs for carrying stock could be implemented in order to reach reliable and consistent supplies of spare parts to customers.

Further, even if local sales management will remain decentralized it will be relevant to consider to centrally direct and standardize the customer service offered, including an assessment of which activities and offers that are value-adding for customers and which that are not. Differentiated services could be offered to customers, but standardized worldwide in order to reduce costs. More standardized procedures could also be a means of ensuring that the same quality can be upheld at all times and to all related parties. For example, one area where central policies could be relevant to consider is the measurement of customer service levels. Central procedures for such measures are currently lacking, or measured in qualitative terms. An important benefit that would follow, except for facilitating performance improvements, are enhanced

visibility in the chain. That is, the DC would be able to follow the performance in the whole chain, which is the relevant performance to observe, and not only as it is today when DC staff only are aware of delivery precision to sales subsidiaries. The idea of standardizing logistics procedures is also present in the Global Supply Vision:

*“To be one global team, managing by objectives. Optimizing the supply chain of each product by working in a standardized way with all parties in the supply chain.”*

Another area possible to improve, which could have positive effects on the distribution, is the long lead times. Currently they might be as lengthy as up to two weeks, resulting in increased inventory levels and tied up capital. The current lead times can be improved within the existing structure by using more frequent shipments. However, the reductions in tied up capital and complexity that will be the benefits from this, have to be balanced against the increases in transportation costs that will follow.

## 7.2 Comments on the Alternative Distribution Structures

One major deficit in the alternative distribution structures as they originally were formulated is the use of traditional ABC-analysis for deciding on inventory locations. The A-article category may well contain infrequently demanded parts with a high value. To position such items downstream in the supply chain is contradictory to theory since availability increases and cost decreases if these parts are positioned upstream in the chain. Further the ABC-classification is primarily aimed at the needs of the distributing company. In order for the system to satisfy also customer needs the customer value of the different articles must also be taken into account when deciding on inventory levels and locations.

We have seen that it is highly significant to use a proper classification scheme of parts both when deciding on positioning of stock and for managing inventory. Using ABC-analysis may well be sufficient for managing inventories, similarly it may be insufficient for deciding on where to locate inventories.

We recommend using other types of control dimensions than revenue when deciding on inventory locations. Once such dimension closely related to the ABC-analysis is *demand*. The demand for parts can also easily be assessed and is easy to update.

When deciding on positioning of stock it will also be of the utmost importance to recognize local conditions. For example, it will not be suitable to carry A-articles in service technicians' cars as A-articles are defined at the DC. Car inventory may vary considerably depending on the types of customers and machines served.

In relation to the structure where B-and C-articles only will be held at the DC, there will be a clear need of deciding on how this structure will be sustained. That is, the development of policies for addressing the situation when former A-articles have

become B- and C-articles in time and have to be transferred to the DC. Naturally, this will also imply costs for transportation and quality controls.

When implementing a new distribution structure, some relevant differences between Germany and France will be significant to consider. First, both the alternatives seem to result in larger savings for the German distribution compared to France. The reason is the severe increases in French transportation costs. We have also seen that costs not only are difficult to estimate in advance due to insecurities of what the outcomes will be. They are also hard to estimate since current costs are hard to assess and since many costs also are dependent on other factors than the physical distribution e.g. which information systems that will be necessary to implement.

Second, the French sales subsidiary makes use of the maintenance kits to a much larger extent than the German. One reason for this difference is that a large portion of German customers does not make use of Gambro technicians at all. Therefore it is harder to sell kits that may contain parts perceived by customers not to be required. The use of maintenance kits facilitates forecasting, as the demand for maintenance kits is relatively easy to predict.

A final discrepancy between Germany and France is the customers' demand on lead time, which is 48 hours in France and 24 hours in Germany. Transportation cost calculations for France is based on the assumption that goods are delivered within 24 hours. Hence French transportation costs can be lowered if 48 hour lead time is accepted. However, increasing customer requirements may lead to increasing demand for shorter lead times. Therefore it might yield competitive advantages if offering this service level before customer preferences have changed.

Considering the future distribution structures both the studied alternatives offer their respective advantages and disadvantages. In this analysis it is easy to focus on the more theoretical aspects of the alternatives and to regard the factors for themselves and not in the proper system. These different perspectives will lead to different conclusions.

From a strict academic standpoint we find that direct distribution of spare parts is the more favourable option for Gambro. It would further increase centralization of control, discussed above, and increase the strategic leverage of distribution as a source of competitive advantage.

However tempting it is to embrace this conclusion, the discussion about efficiency in the beginning of this section must be taken into account. The statement that direct distribution is preferable is purely normative, not taking the practical implications of a transition into account. Since these are significant and it is an absolute condition that external efficiency is upheld at present level during the transition, the conclusion is not immediately applicable in the empirical context.

Both the studied alternatives will theoretically give rise to a higher availability. It is however important to recognize that this increased availability not automatically is transferred to increased service levels to the customer. To fully exploit the increases in availability and to transfer the availability into satisfying customer needs will require significant organizational capabilities, e.g. communication skills, and considerations such as how to design the order process.

The best solution for Gambro is direct distribution, but the transition is best conducted gradually. Aside from what is said above, a logical first step would be to create a transparent distribution process by implementing a common information system. Second, the ability to turn this transparency into an advantage in terms of better performance must be built up. This would best be done by the centralization of the slow moving parts. Such a step would give the opportunity of testing the system towards its main objective while working in a smaller scale and with a slightly bigger margin for errors. When these capabilities are mastered the prerequisites for full-scale direct distribution are filled.

### **7.3 Considerations Outside the Scope of the Thesis**

During the course of this study it has been apparent time and again that the distribution system is heavily affected by factors well beyond the system definition. Here we will highlight three such factors; the design of the monitor, the supplier performance and the Hospal branded parts.

Monitor design, being a product development issue, is obviously very far from distribution. However one problem in the spare part distribution is very clearly linked to product design and that is the great number of articles. The construction of older monitor types has not been based on modular design. This has made the number of articles increase disproportionately whenever a new type or generation is introduced, thus further complicating the task of supplying the monitors with spare parts. This clearly shows the importance of considering the supply chain in the most literal sense of the word and taking the full product life cycle into consideration, even at the earliest design stage.

In earlier chapters the issue of spare parts control has been thoroughly analysed. This analysis did however not take into account the quality of the suppliers. It is nonetheless important to recognize this factor since deficiencies originating from the suppliers in terms of reliability and quality may cause disturbances in the whole distribution chain that cannot be corrected downstream. Thus it is a serious problem both that suppliers of Gambro spare parts are unreliable and that the purchase function is not focused on spare parts. In order to achieve greater availability and reliability in the Gambro distribution system supplier management must be focused also on spares – else the system will never reach its full potential.

The study was limited from examining the distribution of Hospal branded spare parts that are distributed from a DC in Mirandola, Italy. The sales subsidiaries however distribute both Gambro and Hospal branded spare parts to their respective markets. At present, both flows are similar in their design. Implementing any of the alternative distribution structures will disrupt this similarity. Managing two flows that are radically different might complicate the things on local level. Thus attention has to be paid to this issue when deciding on future distribution structure for Gambro spare parts.

## 7.4 Contribution of the Study

Even though the distribution of dialysis machines spare parts is a rather narrow area, some findings in this study can be used for other firms distributing spare parts.

- According to some theoretical sources, e.g. Abrahamsson and Aronsson, lead-time should be the governing variable when deciding on whether to implement direct distribution or not. In this thesis we have seen that direct distribution is not necessarily the preferable solution, even if required lead-times can be upheld. The reason for this is that direct distribution is not merely a question of transport; it requires other capabilities to be developed in the organization. The ability to plan and coordinate the flow is one such capability. In the case of Gambro a centralization of items will put large requirements on the downstream information flow if sales organizations shall be able to plan their service activities efficiently.
- The study also points out the importance of addressing the design of the order flow when changing distribution structure. We have found that the order process suggested by the AC concept developed by Norrman, where customers place orders to the sales subsidiary and then automatically are transmitted to the DC will be suitable. However we choose to reject the AC concept suggestion that customers pay to a local bank account that belongs to the AC since it is not suitable for organizations with a profit centre structure.
- The effects on total costs when changing distribution structures are largely dependent upon the specific conditions that act upon the system. Hence we cannot support the findings presented by Abrahamsson stating that centralization always lead to reductions in total costs. Rather this theory may be valid but depend to a large extent on the structure studied. Here a remark must however be made since we only have studied centralization of inventories for single stocks individually. The effects on cost might well be different if direct distribution were to be implemented for all European countries due to synergies.

## 7.5 Future Research

Simultaneously as this study was limited from several aspects it also neglected relevant issues, which also have shown to be of outmost importance to examine

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before any changes in the distribution structure can be carried out. These issues are considered relevant in the individual case of Gambro's spare parts distribution as well as for other firms considering changes in their logistics structures and also for academic research. Such relevant issues are:

- Disruptions in demand caused by certain customers, in the case of Gambro these customers are the "export countries", i.e. countries where Gambro lack a distribution network. These customers have an irregular demand pattern and often the order quantities are large. This behaviour causes difficulties since a large and unexpected order will disrupt planning and possibly result in shortages. This issue can be regarded as a strategic one, that is, how to prioritize between customers. For Gambro one solution might be to put export customers on hold, thereby safeguarding European supplies. However, export customers may well contribute to a significant share of the revenue streams. Hence, putting them on hold may be economically devastating. Other possible solutions are separate stocks and increased amount of safety stocks, both contributing to increases in costs for tied up capital. Another solution is taking a more active relationship management approach, thereby trying to smooth out export customers demand pattern.
- The need for efficient supplier management when trying to increase the efficiency of the distribution system. Securing the quality and timeliness of the inbound flow is essential because such problems are increasingly difficult to correct downstream.
- Product development is an area largely affecting the distribution of spare parts. There are obvious incentives to seek more platform-based products resulting in more interchangeable parts between generations. Platform-based products would most likely result in reductions in article numbers, thereby reducing complexities in the flow together with reduced obsolescence. A more platform-based product would also make the use of forecasts easier.

The quality of the engineering design also affects the output demanded of the distribution system. If quality is low new product launches will cause dramatic rises in the percentage use of break down parts. It might thus be relevant to address the control systems used for new product development. In the case of Gambro, the sales subsidiaries are charged for warranty costs although these costs in fact are created in the development phase. This is not an optimal arrangement since it fails to acknowledge the relation between product development and performance in the field. To charge the product development organization for warranty costs would be financially complicated, however it is relevant to seek incentive arrangements for product development that reflect the total life cycle cost to a larger extent. This might lead to products that are easier to serve and requires less service interventions.

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- Implementing new organizational structures is often a challenging task that for example involves the identification of key change agents in order to overcome significant power structures. Even if these kinds of issues are dealt with in the academic field, it is not extensively examined in relation to logistics and distribution structures. Creating a trustful relationship between the distribution centres and sales organizations, as well as between other parties in the chain, will be highly significant.

The complex issues discussed above all point out the importance of taking a holistic perspective when seeking to redesign distribution structures. Such a holistic perspective is provided by recent SCM theories and illuminates the difference between supply chain management and traditional logistics.

## References

### Literature

- Abrahamsson, M. (1992). *Tidsstyrd direktdistribution, Drivkrafter och logistiska konkurrensfördelar med centrallagring av producentvaror*. Linköping Studies in Management and Economics. Dissertation; 21 Linköping, Studentlitteratur.
- Abrahamsson, M., Brege, S. & Norrman, A. (1998). *Distribution channel re-engineering – organizational separation of the distribution and sales functions in the European market*. Transport Logistics, Vol. 1, No.4, pp. 237-249.
- Abrahamsson, M. & Aronsson, H. (1999). *Measuring Logistics Structure*. International Journal of Logistics: Research and Applications, Vol. 2, No. 3, pp. 263-284.
- Arbnor, I. & Bjerke, B. (1998). *Företagsekonomisk metodlära*. Second edition. Studentlitteratur.
- Aronsson, H. (2000). *Three Perspectives on Supply Chain Design*. Linköping Studies in Management and Economics. Dissertation; 44 Linköping, Linköping University.
- Barney, J.B. (1991). *Firm Resources and Sustained Competitive Advantage*. Journal of Management. No. 17, pp. 99-120.
- Bowersox, D.J. & Daugherty, P.J. (1995). *Logistics Paradigms: The Impact of Information Technology*. Journal of Business Logistics. Vol. 16, No. 1, pp. 65-80.
- Chandler, A.D. (1962). *Strategy and Structure: Chapters in the History of the American Industrial Enterprise*. MIT Press.
- Chopra, S. (2003). *Designing the Distribution Network in a Supply Chain*. Transportation Research. Part E, pp. 123-140.
- Christopher, M. (1998). *Logistics and Supply Chain Management*. Irwin.
- Eriksson, L.T. & Wiedersheim, P.F. (1997). Att utreda, forska och rapportera. Liber.
- Gadde, L-E. (1980). *Distributionsstrategier på producentvarumarknaden*. Liber.
- Grant, R.M. (2001). *Contemporary Strategy Analysis*. Third edition. Blackwell.
- Hall, D.J. & Saias, M.A. (1980). *Strategy Follows Structure!* Strategic Management Journal. Vol. 1, No. 1, pp. 149-163.

Spare Parts Distribution at Gambro Renal Products  
*Evaluation of Alternative Distribution Structures for the European Market*

---

- Huiskonen, J. (1999). *Maintenance Spare Parts Logistics: Special Characteristics and Strategic Choices*. International Journal of Production Economics, 71, pp. 125-133.
- Kotler, P., Armstrong, G., Saunders., J. & Wong, V. (1999). *Principles of Marketing*. Second European edition. Prentice Hall, New Jersey, US.
- Mason-Jones, R. & Towill, D.R. (1998). *Time Compression in the Supply Chain: Information Management is the Vital Ingredient*. Logistics Information Management. Vol. 11, No. 2, pp. 93-104.
- Mattsson, S-A. (1999). *Improving Supply Chain Efficiency and Effectiveness*. Växjö Universitet.
- New, S.J. & Payne, P. (1995). *Research Framework in Logistics. 3 Models, 7 Dinners and a Survey*. International Journal of Physical Distribution and Logistics Management. Vol. 25, No. 10, pp. 60-77.
- Norelius, H. (2002). *Merge in Transit, A non-stock distribution structure*. Linköping Studies in Science and Technology. Thesis; 935 Linköping, Linköping University.
- Norrmann, A. (1995). *Organisation vid tidsstyrda direktistribution*. Linköping Studies in Science and Technology. Thesis; 515 Linköping, Linköping University.
- Norrmann, A. (1997). *Organizing Timebased Distribution in Transnational Corporations, Interaction Between Logistics and Organizational Structures*. Linköping Studies in Management and Economics. Dissertations; 33, Linköping University.
- Persson, G. & Virum, H. Ed. (1998). *Logistik för konkurrenskraft*. Liber Ekonomi.
- Pfohl, H-C. & Ester, B. (1999). *Benchmarking for Spare Parts Logistics*. Benchmarking: An International Journal, Vol. 6, No. 3, pp. 22-39.
- Picard, J. (1983). *Physical Distribution in Multinationals: The Position of Authority*. International Journal of Physical Distribution and Materials Management. Vol. 13, No. 1, pp. 20-32.
- Porter, M.E. (1980). *Competitive Strategy*. The Free Press. New York.
- Prahalad, C.K. & Hamel, G. (1990). *The Core Competences of the Corporation*. Harvard Business Review. May-June, pp. 79-91.
- Schary, P.B. & Skjött-Larsen, T. (2001). *Managing the Global Supply Chain*. Second edition. Copenhagen Business School Press.

Spare Parts Distribution at Gambro Renal Products  
*Evaluation of Alternative Distribution Structures for the European Market*

---

### **Bibliography**

- Abrahamsson, M. (1993). *Time-Based Distribution*. The International Journal of Logistics Management, Vol. 4, No.2, pp. 75-83.
- Bowersox, D., & Closs, D. (1996). *Logistical Management: The Intergrated Supply Chain Process*. McGraw-Hill.
- Burns, T. & Stalker, G.M. (1961). *The Management of Innovation*. Social Science Paperbacks.
- Christopher, M. (2000). *The Agile Supply Chain, Competing in Volatile Markets*. Industrial Marketing Management, No. 29, pp. 37-44.
- Coyle, J.J. et al. (1992). *The Management of Business Logistics*. West Publishing Company, St. Paul.
- Galbraith, J.K. (1973). *Designing Complex Organizations*. Addison-Wesley.
- Mintzberg, H. (1983). *Structure in Fives: Designing Effective Organizations*. Prentice Hall.
- Lawrence, P.R. & Lorsch, J.W. (1969). *Organization and Environment*. Irwin.
- Tencor, I. (1988). *Organize for Logistics*. Logistics World. June, pp. 97-99.

### **External Company Material**

- Larsson, I. Ed. (1998). *Gambro – en företagshistorik*. Lund.
- Gambro Annual Report 2002.
- Gambro Annual Report 2001.

### **Internal Company Material**

Consultant Report. Andersen Consulting (1998).

Gambro Intranet.

### **The Internet**

[www.gambro.com](http://www.gambro.com). January to June 2003.

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### Interview Respondents

<b>Gambro Personnel</b>		
<i>Respondent</i>	<i>Title</i>	<i>Date</i>
Bengt Andersson	Technical Services Manager GSFAB	030204,030409
Lars Bergqvist	Line Manager, MD	030204
Bo Borg	Traffic Manager, DC Lund	030408
Arlene Dahl	Quality Manager, DC Lund	030210
Stefan Ericsson	Project Coordinator, DC Lund	Continuously
Vicky Fredriksson	Order Handler, GSFAB	030402
Harald Hofstätter	Technical Services Manager, Germany	030522
Francis Jambon	Technical Services Manager, France	030602
Dave Kerr	Manager, ITS	030211, 030410
Daniel Larsson	Engineer, ITS	030206
Johanna Mattsson	Order Handler, DC Lund	030401
Inger Nilsson	Supply Chain Planner, DC Lund	030205
Mikael Nygren	Manager Planning Dept., DC Lund	030203
Niklas Olsson	Supply Chain Planner, DC Lund	030205
Zlatko Rihter	Marketing Manager, GRP	030410
Carl-Johan Rijpma	Applications Manager, Renal Care Products Overhead	030331
Jacob Rye Christensen	Supply Chain Manager, Renal Care Products Overhead	030403
Per Sandberg	Logistics Manager, DC Lund	Continuously
Roger Svensson	Dispatch Manager Spares, DC Lund	030402
Ingegerd Wahl	Technical Support CWP, ITS	030423
<b>Clinical Staff</b>		
Jan Kurkus	M. D., Associate Professor, Department of Nephrology, University Hospital Lund	030516
<b>Researchers</b>		
Mats Abrahamsson	Professor, Department of Logistics Management , LiTH	030304
Stig-Arne Mattsson	Adjunct Professor, Department of Engineering Logistics, LTH	030217
Andreas Norrman	Ph. D. Department of Engineering Logistics, LTH	030207
Fredrik Olsson	Ph. D. Student, Department of Production Management, LTH	030214

## Appendix 1

### Capital Cost

(i) Value of Stock and Obsolescence 2002 (KSEK)			
	Total Stock	Obsolescence	Total Stock excl. Obsolescence
DC	55 592	3 653	51 393
Germany*	16 710	1 680	15 030
France*	15 270	420	14 850

\* includes mark-up from DC to sales subs.

(ii) Value of Stock and Obsolescence 2002 (KSEK) **			
	Total Stock	Obsolescence	Total Stock excl. Obsolescence
DC	55 592	3 653	51 393
Germany	8 355	840	7 515
France	7 635	210	7 425

\*\* a mark-up of 50 per cent has been subtracted from the sales subs. figures according to ITS.

(iii) Inventory Carrying Cost 2002 (KSEK) ***			
	Tied Up Capital	Obsolete Stock	Total Stock
DC	7 791	548	8 339
Germany	564	126	627
France	557	32	573

\*\*\* based on internal cost of capital equal to 15 per cent

#### Comment to (iii)

Since half of the spare parts value consists of car stock, costs for tied up capital in Germany and France are reduced by half the value. No exact figure on the value of car stock has been identified for France. However we assume that the car stock value corresponds for half of the total stock value, which is the case in Germany.

## Appendix 2

### Questionnaire for Sales Subsidiaries

#### Marketing and sales

1. What are the key success factors for competing in the French monitor market?  
How is Gambro currently competing in the French market?
2. Please describe the competition in the market!
3. What competitive part is played by technical service?
4. In what way, if any, does the spares distribution influence the competitive ability?
5. In which ways can the spares distribution better support Gambro's competitive ability?
6. Which different customer categories can be identified in France, how are these characterized?
7. What does the customers require in terms of lead time (time from order placement to delivery)?

#### Technical service

1. How many service technicians are currently employed in the French service organization? Where are they located? Approximately how many monitors are the technicians responsible for?
2. Are some customers prioritised in terms of technical service (how/why)?
3. Which service aspects are the most important to the customer, e.g. reliable deliveries, price, technical support, etc.?
4. What problems arise due to delays in deliveries to from the sales company to the customers?
5. How often is the need for spares so urgent that shortages may affect the patient's medical condition?
6. To what extent do the clinics have back-up monitors in case a monitor should break down?
7. What directs the Gambro service technicians' stocking policy of their service cars?

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8. Is the demand for spare parts predictable? If so, which kind of parts and how is the prediction made?
9. Which percentage of the clinics uses Gambro technicians? To what extent are the Gambro technicians used? (e.g. percentage of the technical service carried out)? For what purpose do the clinics use the Gambro service technicians (e.g. planned maintenance, break down repair, etc.)?
10. What contracts are in use regarding technical service to customers?
11. What are the approximate values of different contracts?
12. What directs when maintenance is carried out (e.g. machine hours, yearly basis, etc.)?
13. Do the service contracts contain any agreements on monitor down-time? How are these agreements shaped out?
14. Are there penalties for violating eventual agreements on monitor down-time?
15. How are service technicians affected by the ITS Newsletter regarding the ordering of spare parts?
16. What cooperation and communication takes place between the French sales subsidiary and ITS concerning spare parts?
17. What is the approximate distribution between spare parts used for planned maintenance and for acute repair?
18. Have there aroused difficulties in the field due to the aggregation of spare parts into kits (e.g. are customers willing to pay for unused parts)? How can these eventual difficulties be resolved?
19. Are customer service levels (from Sales company to customer) measured? If measured, what is the current performance and how are customer service levels defined?
20. What is known to the service organization concerning the machine fleet operating in France (e.g. number of monitors, distribution between different types/models, machine age, machine hours operated)? Is this knowledge dependent on the monitors' location between customers (e.g. Is the knowledge level higher related to machines served by Gambro technicians than to machines entirely served by the clinics' own technicians)?

### **Information Flow**

1. Who places the order for spares to the French sales sub, e.g. Gambro service technician, clinics' technicians, nurses, etc. What is the approximate distribution between these?
2. When (e.g. on a daily basis) and why (e.g. forecasted demand for next week) are orders placed to the sales subsidiary?
3. How are orders received (e.g. telephone, fax, e-mail, etc.), and what is the approximate distribution between different media (e.g. 50 per cent of orders received by fax)? Who receives the order at the sales subsidiary?
4. What order handling activities take place between the point in time when the order is received at the sales subsidiary and the point in time when the order is forwarded to DC Lund? What is the time elapsed from order reception at the sales subsidiary to order placement to DC Lund?
5. On what basis are orders aggregated to DC Lund?
6. What communication takes place between other organizational entities related to the order flow (e.g. between order handling personnel at the sales sub and technical staff)? What is the content in the communication?
7. Which order related information (e.g. availability, delivery dates, back-orders) is known from the point in time when orders are placed to the DC to the point in time when delivery is carried out?
8. Do clinics or Gambro service technicians need guidance in advance of the order placement (if so is the case, how frequently)?
9. Are service technicians and clinics well informed on spare parts article numbers or do they need guidance?
10. What functions less satisfactory today in the information flow related to spare parts and between which functions (what is the reason and how can it be adjusted)?
11. How is local information systems used related to the spare parts flow (e.g. stock management, demand forecasting, customer order status, inventory availability, inbound shipment status, performance measures, materials requirements planning)? What types of information system are used?
12. Are there any policies regarding minimum order quantity, fixed order quantities or fixed order dates when customers or clinics place the orders?

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13. Are the incoming orders from customer classified according to urgency, besides separation of courier and standard transports?
14. In what processes related to the spare parts flow would the sales subsidiary need more insight?
15. Please add other aspects relevant to the information flow related to spare parts!

### **Physical Flow**

1. Which activities take place related to the physical flow of spare parts from the time the parts are delivered to France to the point in time when the parts are in place and operating at the monitors?
2. Are spare parts re-packaged for domestic deliveries at the sales company? How?
3. Where are spare parts stored (e.g. sales subsidiary, spare parts local warehouse, service cars, clinics)? What is the approximate distribution between these?
4. How large (area) are the premises used for spare parts inventory holding?
5. How many labor hours are approximately required for managing the spare parts inventory?
6. What policies guide the stock levels at the different stocking locations (e.g. re-order points)?
7. Where and when (how often) do domestic deliveries take place (please describe how the French clinics and service technicians receive the spare parts and from where)? What is the approximate value of individual domestic deliveries, on average?
8. What are the different lead-times in the flow?

From order placement by service technician to spare part operating at the monitor

From order placement by technician to order placement by sales sub

From order placement by sales sub to delivery in French local warehouses

From delivery at local warehouse to delivery at service technician/clinic

From delivery at service/technician clinic to spare parts up and running

9. Are spare parts sourced from other suppliers than Gambro? What types of parts and approximate volume (value)?
10. What parts function less satisfactorily today in the physical flow related to spare parts (what is the reason and how can it be adjusted)?

11. Have there been any recent improvements in the spare parts flow? If so, which parts of the flow?
12. Have the transfer of the responsibilities for spare parts from Monitor Division to DC Lund resulted in any improvements in the spare parts flow? Have the transfer resulted in any disadvantages?

### **Financial Flow**

1. When and how (e.g. on an aggregate basis, or dependent on contractual type) are the French customers invoiced by the sales subsidiary?
2. How are invoices built up (what do customers pay for e.g. transportation, etc.)?
3. Under what payment terms do customers pay to the French sales subsidiary?
4. Who is responsible for the monitoring of the invoice (e.g. who takes actions if customers are late with their payments)?
5. What functions less satisfactory today in the financial flow related to spare parts (what is the reason and how can it be adjusted)?

Please add other aspects relevant to the financial flow related to spare parts!

### **Spares distribution costs**

What are the costs in the French subsidiary for the following:

- Order handling and forwarding
- Housing/Premises
- Operations personnel (for warehousing)
- Tied up capital (in stock)
- Obsolete stock
- Standard transports
- Express transports
- Packaging for transportation & warehousing

Please observe that this only refers to costs associated with Gambro branded spares. We are aware that this list is detailed, but would very much appreciate as precise answers as possible.