

Management control systems in a supply chain context

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Abstract

This study investigates the impact of local management control systems on the functioning of the supply chain. The paper describes two case studies and focuses on how local management control systems, i.e. within the participating organizations, affect the efficiency and effectiveness of the co-operation between the organizations in the supply chain. In the first case study, a supply chain of several subcontractors, a logistical service provider and a producer of high-quality technological equipment is analysed. In the second case study, a supply chain including eight food manufacturers, two logistic service providers, and two retailers is investigated. Both case studies are exploratory in nature. The behaviour of several players in the chain is explained by examining the present local management control systems. Subsequently, we try to link this behaviour to the implicit supply chain objective, which in both cases is to minimize the costs in the chain. The main conclusion is that in this situation local management control systems call for undesirable behaviour with respect to the implicit chain objective. In addition, suggestions for improvement of the local management control systems are provided.

1. Introduction

For quite some time, the academic world has emphasised the relevance of research in the field of management accounting and supply chain management (Hopwood 1996; Shields 1997; Scapens 1999). In many organizations supply chain management is viewed as an important topic, because it is considered as a means to gain economic benefits in the current era of severe international competition. The literature gives numerous practical examples on how specific forms of supply chain management lead to advantages. Dekker and Van Goor (2000) indicate that supply chain management can be reduced to four forms of cooperation. They distinguish between the following four categories: 1) supply chain management in the field of exchange of information, 2) re-allocation of decision rights, 3) re-allocation of activities, and 4) physical cooperation. Others, for example Ittner *et al.* (1999), include joint product and process development, the use of preferred suppliers and relation-specific investments. The general idea is that companies achieve supply chain benefits when they work together efficiently and effectively. A supply chain is fully coordinated when all decisions are aligned to accomplish a global system supply chain's objective, which is to provide value to the end consumer in terms of products and services, and for each channel participant to garner a profit in doing so (Sahin & Robinson, 2002).

Despite the growing interest, both among practitioners and among researchers, in improving firm performance through the use of supply chains, achieving supply chain management success is not without obstacles, as is illustrated by the following observation from a Deloitte consulting survey: 91 percent of North American manufacturers rank supply chain management as very important or critical to their companies' success, yet only 2 percent of the manufacturers in the same survey rank their supply chains as world class (Elmuti, 2002). In their survey of the supply chain management literature, Sahin & Robinson (2002) attribute lack of coordination in a supply chain to decision makers having incomplete information or incentives that are not compatible with system-wide objectives. They explicitly state that even under conditions of full information availability, the performance of the supply chain can be sub-optimal when each decision maker optimises her individual objective function. These authors however consider the different organizations that participate in the supply chain as the decision-making entities, and focus on incentives at the level of these organizations. As in most previous studies, local performance measurement and incentive issues, at the level of individual managers, are largely ignored.

In our study, we direct our attention to this largely neglected level of the individual manager in firms that operate within a supply chain. For that reason, we concentrate on the design and use of management control systems in these firms. Management control systems typically serve two roles: 1) information provision, and 2) motivation of individual managers within the firm (see, e.g., Otley, 2003). It follows on from this that management control systems are specifically designed to mitigate the kind of coordination problems as described by Sahin & Robinson (2002), ie., incomplete information and incompatible incentives. However, studies of management control usually focus on coordination within companies, whereas this study also includes the effect on the efficiency and effectiveness of the collaborative efforts between companies in a supply chain. Here a supply chain is broadly defined as a system of suppliers, manufacturers, distributors, retailers and customers where material, financial and information flows connect participants in both directions (see Fiala, 2005)

This study will focus on the (re-)design of management control systems within firms that operate in a supply chain. The main question to be addressed is how management control systems affect the functioning of the supply chain. The theoretical framework that has been used is somewhat eclectic, but mainly draws on insights from organizational design and agency literature. . Many researchers use incomplete contracting theory and transaction cost economics to analyse the relationship between suppliers and customers in a supply chain (e.g., Van der Meer-Kooistra and Vosselman, 2000; Dekker, 2003). As Vosselman (2002) indicates, a transaction costs economic perspective may be helpful in offering an economic rationale for phenomena that occur outside the organization. However, it does not have the potential to clearly reveal and depict the processes inside the organization. A basic assumption in these theories is that limitations in contracting options will affect organizational governance design (Gietzmann, 1996; Tirole, 1999). This leads to a specification of general forms of governance expected under certain conditions. One of the basic premises underlying this theory is that firms minimize the sum of production and transaction costs when designing a governance system. Milgrom & Roberts (1992) discuss an important way in which make or buy decisions may violate this assumption: those making the sourcing decision may not strictly maximize firm value if local (e.g. departmental) objectives conflict with firm goals. Based on their field study, Anderson *et al.* (2000) indicate that this assumption may indeed be problematic in practice. It is especially agency theory that takes this problem into account. The issue is very much related to the general agency problem: people in an organization will not automatically act in the best interests of the company. The agency theory

offers insight into how a management control system may be used to mitigate the agency problem. However, the problem with agency theory in this context is that it is mainly concerned with conflicts of interests between people (agents) working together in a hierarchy. In a supply chain setting, such of focus on hierarchy is partly justifiable. There are of course clear interdependencies across organizational boundaries in a supply chain context, which give the set of supply chain companies some features of a hierarchy. Usually, the companies that participate in the supply chain also have potential benefits from supply chain initiatives, and we may thus consider the supply chain objectives to be in line with the objectives of each of the companies participating in the supply chain. All this causes the organisations to get some hybrid features. However, it is vital to recognise that there is a market between companies in the supply chain and that real money payments take place that have an impact on the behaviour of the participating companies in the supply chain (see also Lambert, 2001). Consequently, we may well use agency theory to evaluate the individual behaviour within companies operating in a supply chain. However, we need to pay attention to the hybrid nature of the supply chain organisations. In addition, we will draw on organizational design literature on coordination mechanisms to evaluate the behaviour in the organisations participating in the supply chain.

Following van der Meer-Kooistra & Vosselman (2000), we believe that the management control aspects of interfirm transactional relationships are very complex. And, according to Yin (1989), case research is very suitable for the description and explanation of complex phenomena within its real-life context. Therefore, the research question was examined by means of two case studies. The first case study was executed in a supply chain of several subcontractors, a logistical service provider and a producer of high-quality technological equipment. The second case study was carried out in a supply chain including eight food manufacturers, two logistic service providers, and two retailers. We examined which problems occur in the field of supply chain management and how these problems coincide with the design of local management control system of the parties involved in the supply chain. We used the theoretical notions derived from agency and organizational design theory to analyse the problems that the case companies encounter in realising supply chain benefits.

Based on the two case studies, it can be concluded that the current local management control systems do not support the chosen supply chain objectives. It appears that local management control systems are not able to capture the complex and multifaceted nature of supply chain

cooperation. Therefore, supply chain initiatives can only be implemented if the local management control systems are adjusted. Some possible changes in the local management control systems are put forward for each of the case studies. Although the additional monitoring costs involved may be considerable for each of the suggestions, they are however interesting to take into consideration in order to reduce the residual loss stemming from unrealised supply chain benefits.

The paper is organized as follows. In section 2, the relation between management control and supply chain management is discussed as well as the complications that may appear when dealing with management control in relation to a supply chain. Section 3 describes the research design of the case studies and the associated questions in the field of control of cross-border company processes, whereas in section 4 the case studies are described. In section 5, the management control problems are discussed as well as possible suggestions for improvement and finally the conclusions are stated in section 6.

2. Management control and supply chain management

In this section, we first describe the necessity to re-examine accounting in the case of hybrid organizations that function within a supply chain (2.1). Then we briefly describe the problems and opportunities of using contracts (2.2). Subsequently, the use of the organizational architecture is presented as a means to study information provision and motivation of individual managers (2.3).

2.1 A re-examination of accounting and control

As a result of implementing supply chain management practices, management processes now quite frequently transcend legal organizational boundaries. As a result, we must be careful to provide local management with the information relevant to ensure effective integration and coordination (Hopwood, 1996). One difficulty in achieving supply chain success is that typically management accounting practice has limited its scope to the boundaries of the firm. This limitation makes it difficult for the firm to take advantage of, for example, any cost-reduction synergies that exist across the supply chain. Such synergies can then only be achieved by coordinating the cost-reduction activities of multiple firms. The objective of supply chain management is then to find lower-cost solutions than would be possible if the firm and its buyers and suppliers attempted to reduce costs independently (see e.g., Kulmala et al., 2002).

The demand for integration and coordination also requires looking at control issues with a more explicit awareness of interdependencies between firms in the supply chain. Gietzmann (1996) argues that cooperation in a supply chain requires a re-examination of accounting governance systems, which have been designed for a combination of hierarchical modes of governance and traditional arms-length transactions. Also, Anderson and Sedatole (2003), state that these new hybrid forms of organization are sufficiently different from markets or hierarchies to demand different modes of management accounting .

2.2 The use of contracts: problems and opportunities

In a supply chain, the implementation of potential improvement proposals that have an effect on supply chain performance has many implications and many hurdles have to be taken. If the supply chain leads to a reallocation of activities for example, it is possible that, at first, the costs and benefits are incorrectly divided among the individual players in the chain. Therefore, closer agreements must be made about this. In these situations contracts or intention statements in which the cooperation and the partitioning of the costs and benefits have been regulated, need to be established in advance. Seal *et al.* (1999) describe a case study at a pair of companies (a subcontractor and a consumer) that wants to start working on joint product development. In the description of the case, insight into the initial alliance agreement is given. This agreement stressed the principle of an open and trusting relationship that ‘delivers tangible and measurable benefits to both sides over a long period, and allows the sharing of ideas and information.’ Furthermore, it had concrete cost reduction targets, it specified areas for continuous improvement, a management review processes and a grievance procedure. From the case study, it becomes clear that these contractual agreements are not sufficient to achieve successful cooperation. Matters such as lack of faith, opportunism, and problems with measuring potential and real advantages appear to put the cooperation under pressure. This puts forward the question whether effective improvements in a supply chain can be reached only by specifying contracts. In this regard, it is interesting to take note of the paper by Frances and Garnsey (1996), who describe the success of supermarket supply chains in the United Kingdom until the mid 1990s. In their analysis the logistical success is attributed, among other things, to the degree to which the supermarkets successfully manage the supply chain in such a way that the stores can react directly to customer demand. Thus they describe among other things the automatic exchange of electronic point of sale (EPOS) data of supermarkets to their subcontractor. Sales in the supermarket automatically lead to action upstream in the supply chain, varying of stock replenishment to production and

purchases of ingredients. It is clear in the paper of Frances and Garnsey that the power is in the hands of the supermarkets. The working method, which underpins this success, was entirely invented by the supermarkets and is centrally enforced using computer systems. In this respect, these forms of cooperation are mainly controlled by means of action controls (Merchant, 1998). Desired behaviour is enforced through information technology.

It follows on from the above that a specification in advance of desired behaviour is not always possible if we think within the context of supply chain management. While the role of the subcontractor in arms-length contracts is restricted to providing clearly specified products under clearly defined conditions, the role of the subcontractor within supply chains is much more complex and many different dimensions are part of the game (Heide, 1994; Ittner *et al.*, 1999). Many aspects of the collaboration between the parties must be settled and both information provision and motivation of the individuals involved have to be handled adequately to solve the problems that occur.

2.3 Information, motivation and organizational architecture

The central problem of management control is how organizations can ensure that managers and workers act in the organizational interest (Otley, 2003). Also in a supply chain context the question is how to realize full coordination and decision alignment to supply chain objectives. Lack of coordination occurs when decision makers have incomplete information or incentives that are not compatible with system-wide objectives. Two methods for accomplishing coordination are centralized decision-making and decentralized decision making utilizing coordination mechanisms (see Lee and Whang, 1999). Under the centralized decision-making approach, a single entity optimises the network. Coordination mechanisms seek to align available information and incentives such that decentralized decision makers act in the best interest of the system.

Also in an organizational architecture framework (see, e.g., Anand and Mendelson, 1997; Jensen and Meckling, 1992), which draws on agency theory, we see a focus on the allocation of decision rights, decision makers' incentives and the firm's information structure. Jensen and Meckling (1992) distinguish between "specific" knowledge, which is costly to transfer among agents, and "general" knowledge which is inexpensive to transmit. The analysis of Jensen and Meckling shows how the location of knowledge and information is intertwined with organizational design.

Decision rights must coincide with relevant knowledge and information, since that helps to improve the quality of the decisions. In a hierarchy the two choice possibilities are as follows: 1) the information is communicated to the person with the decision rights or 2) the decision rights are allocated to the person with knowledge and information. In the first situation, costs are allocated to the person with knowledge and information. In the second situation, costs are incurred from information exchange and frequently we are confronted with restrictions in the recording capacity of the people involved. In the second situation, agency costs arise: monitoring expenditures, bonding expenditures and residual loss. The optimum degree of decentralization is determined by balancing these costs. It follows on from this that a certain degree of non-compliance to firm and supply chain objectives may well be expected, as theory indicates that a management control system will not completely circumvent the agency problem. Given the basic assumptions in agency theory, we can foresee some residual loss from the prevalence of individual and local objectives.

From the above theory, we may conclude that in case of less than full supply chain coordination, we may consider a change in the degree of information sharing, we may well reflect on reallocation of decision-rights and we may discuss an adaptation of the performance measurement systems and performance appraisal systems. However, the optimal degree of decentralization will inevitably lead to some loss of relevant information at the decision maker's position and some residual loss from incomplete monitoring and goal alignment. We expect the objectives of the participating companies to be aligned with the supply chain objective. Therefore, we also anticipate the management control systems installed at the local level in the participating companies to encourage the right behaviour towards the supply chain objective.

In the sections below, we will describe two supply chains and the management control systems that are in place within the companies involved in the supply chains. We will see that the allocation of decision rights within the companies does not automatically have to lead to optimal behaviour from the perspective of the whole supply chain. Potential improvements are not always pursued. In addition, performance measurement within the participating companies proves to be a complicated matter.

3. Research design

Two case studies were executed for this research. The first case study looked into a supply chain of several subcontractors, a logistical service provider and a producer of high-quality

technological equipment. We label this case study the high-tech supply chain. In the second case study, a supply chain of eight food manufacturers, two logistic service providers, and two retailers was investigated. This case study is referred to as the food supply chain. Both supply chains actively seek to improve the functioning of the supply chain. However, implementation of the proposed initiatives was a complex issue relating to many different aspects, including information systems development. In this paper, management control aspects will be elaborated. In methodological terms, our research may be classified as an exploratory case study to develop emergent theory (Scapens, 1990).

Research Questions

The main research question for the case studies is whether the local management control systems encourage behaviour that is congruent with supply chain objectives. For this purpose, we first need an understanding of the actual processes that take place within the supply chain and the management control systems in place. Secondly, we need an understanding of potential supply chain initiatives and the role of the local management control systems regarding the behaviour of local units in these initiatives. Therefore, the following research questions were addressed in the case studies:

1. Process description. What processes take place within the supply chain? What is going on within the supply chain; what does the supply chain look like?
2. Present management control systems. How does the management control system function within the organisations concerned? Here, we especially look into information exchange/information availability in relation to decision rights and we investigate the performance measurement system.
3. Improving the supply chain. Which problems and/or improvement opportunities play an important role with regard to the functioning of the supply chain? In both supply chains, improvement initiatives are identified.
4. Behaviour explained from a management control perspective. In what way do the local management control systems support or hinder the implementation of improvement proposals in the supply chain? Behaviour with regard to the improvement initiatives is explained from an analysis of the management control system in place. Also here, we especially look into information exchange/information availability in relation to decision rights and we investigate the performance measurement system.

Data collection

The research in the high-tech supply chain was based on interviews and company visits. In this supply chain three types of parties are discerned: the component manufacturers, the logistic service provider, and the high tech manufacturer. The interviews were carried out within the framework of a study on the working method in the supply chain/ the purchasing process of the producer of high-tech equipment. Interviews have been carried out with employees of the logistics department and purchasing department of the manufacturer, and employees of the logistics service provider. The results of the interviews have been documented and discussed with the interviewees and adjusted when needed. The total findings have been discussed in a joint session of the people involved of the producer of the high-tech equipment.

The research in the food supply chain, the second case study, arises out of a larger project called KLICT II. This project was carried out in collaboration between Dutch Universities, food manufacturers, logistic service providers, retailers, and a consultancy firm. The goal of the KLICT II project was related to different aspects of implementation of a specific supply chain improvement project called 'Supply Chain Synchronisation' (SCS). One aspect was related to the management control systems of the participating organisations. The research question was if present management control systems of the participating organisations enable the SCS concept. In the KLICT II project, three types of parties are discerned: the food manufacturers, the logistic service providers, and the retailers.

In the KLICT II project, three types of parties are discerned: the food manufacturers, the logistic service providers, and the retailers. All the food manufacturers supply the retailers, by making use of the logistic service providers. The research output is based on a series of interviews conducted on numerous occasions with sales managers, logistic managers, purchasing managers and controllers of the companies involved. During the interviews, notes were taken that were translated into interview reports. The interviewees checked the interview reports. The research described was carried out between January 2003 and September 2003.

4. Case studies

Two case studies will be described in this section: a) the high-tech supply chain, and b) the food supply chain. The data concerning the supply chains have been made anonymous. Both descriptions start with a description of the processes in the supply chain (research question one),

followed by a description of the management control systems in place at the companies involved in the supply chain (research question two). Then, an analysis is made of problems that occur in the supply chain and/ or opportunities that exist to improve the functioning of the supply chain (research question three). Subsequently, we discuss how the design of the local management control systems impedes the implementation of improvement initiatives (research question four). This discussion is continued in section 5.

4.1 The high-tech supply chain

4.1.1 Process description

Roven Ltd. is a manufacturer of high-quality equipment that operates internationally, and focuses on the business-to-business market. Roven Ltd. concentrates on the development and assembly of this equipment. The equipment can be classified as complex because of the complicated technologies used and the large quantity of components integrated into one system. The production of most of the components is outsourced.

For its total product portfolio, approximately 15,000 different items are purchased each year from a range of 600 subcontractors. These items are mainly components for assembly. Moreover, Roven Ltd. buys specific components for equipment requiring pure service (service components).

All components are bought 'ex works'. This implies that Roven Ltd. is responsible for the delivery of the components of the subcontractor to the production setting in the Netherlands. As a consequence, Roven Ltd. also carries the costs of this delivery. The subcontractors have a worldwide geographical distribution. In the case study, we only focused on the subcontractors who are located in Europe (approximately 90% of the total number of suppliers). All activities related to the delivery of the components of the European subcontractors to the production location of Roven Ltd. were assigned to one logistical service provider.

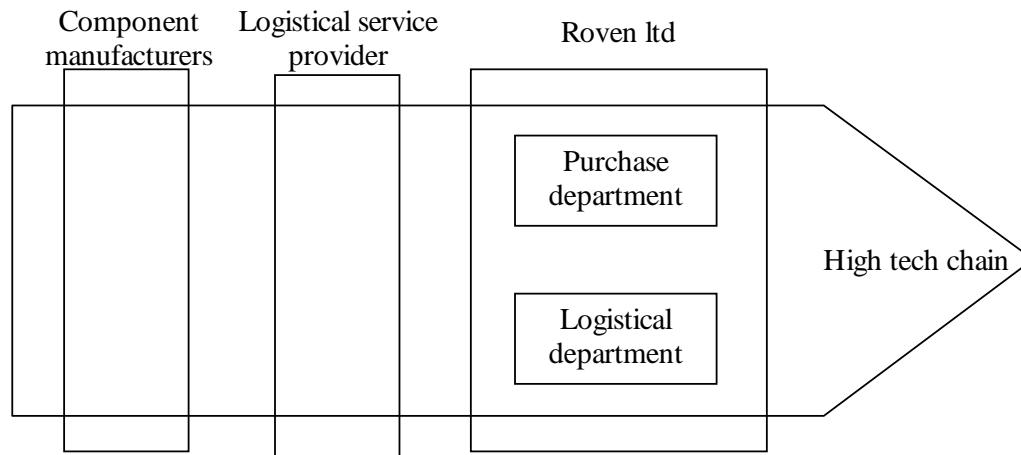


Figure 1: The participants in the high-tech chain

In the case study we distinguish between the following parties: Roven Ltd., especially the purchasing department and the logistical department, the logistic service provider, and the subcontractors. The case study starts from a situation in which Roven Ltd. already decided several years ago on the parties it would be cooperating with. So supplier selection therefore is not an issue any more. The choice for the logistical service provider is a very definite one. The physical processes of the logistical service provider and Roven Ltd. are closely coupled. Roven Ltd. passes on information about the required lot sizes of deliveries to its subcontractors and to the logistical the service provider. Subsequently, the logistical service provider is responsible for on-time delivery of the requested quantities at Roven Ltd. Figure 1 gives a graphical overview of the parties involved in this chain.

4.1.2 Present management control systems

Management control system of Roven Ltd.

Within Roven Ltd. we only discern two departments: the purchasing department and the logistical department. The performance of the purchasing department of Roven Ltd. is primarily measured by a reduction of material (purchasing) costs. The purchasing department strives to realise these savings by closing contracts with the subcontractors in which the specific cooperation conditions (among which price) have been regulated. Because the relations between the parties concerned extend over many years, the prices have been settled at such a level that negotiations concerning the price are only successful if Roven Ltd. puts process adaptations into

operation that are advantageous for the subcontractor. This advantage can then be redirected to Roven Ltd. by means of the price.

The purchasing department also makes contractual agreements with the logistical service provider. However, the performance of this department is not measured in relation to this contract. Since the actual costs of the logistical service provider depends on so many variables, neither the purchasing department nor the logistical department feel responsible for these costs. The actual costs at the logistical service provider depend on volumes, rush orders, countries, truckloads, contract prices, etc. As the decision rights are dispersed among the various departments, responsibility for these costs is lacking.

The performance of the logistical department of Roven Ltd. is primarily measured by service levels realised by the sales organisations. Furthermore, the department is responsible for inventory levels and also for the costs of keeping stock. The logistical department communicates with the logistical service provider about the quantities that must be collected in a specific week at several subcontractors. This means that the logistical department determines the mobilization of the logistical service provider. As mentioned before, the logistical service department is not held accountable for the costs that are made for transport.

The management control system of the logistical service provider

The logistical service provider is profit oriented. It has many customers, amongst them Roven Ltd. The logistical service provider and Roven Ltd. have made an agreement about the transportation rates. The rates depend on the carrying capacity used in a truck during transportation. Figure 2 gives a graphic depiction of the resulting costs given these transportation rates. From this picture, it becomes clear that the lower the percentage of carrying capacity used by Roven Ltd. the more costly a delivery per transportation unit (e.g., a pallet) will be. This is caused by the call-out charges of a truck. The price per transportation unit is of course cheapest if it is done with full trucks only.

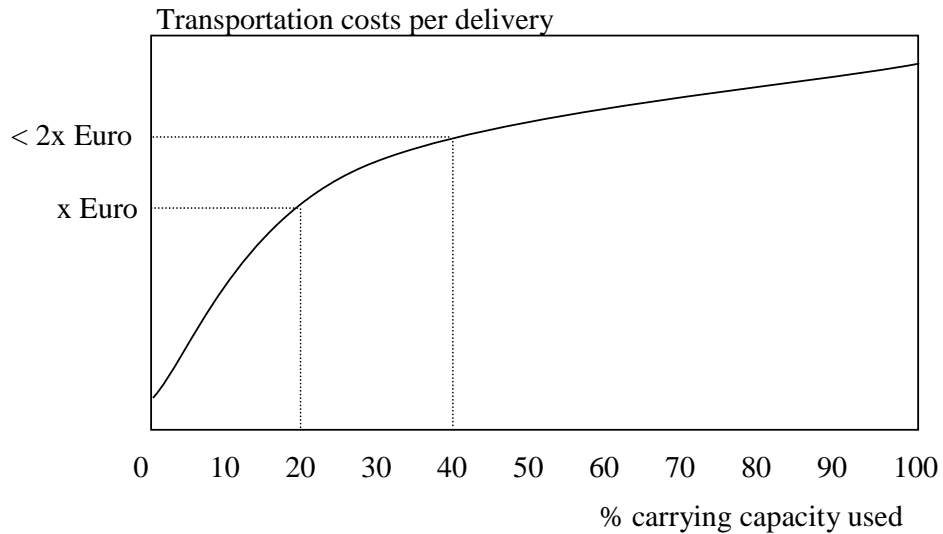


Figure 2 Transportation rates for Roven Ltd.

Management control system of the component manufacturer

The component manufacturers are profit oriented. The component manufacturers have to compete globally. As a consequence these component manufacturers are constantly looking for ways to lower their cost to maintain their competitive ability. The component manufacturers also experience this competition through their contacts with the purchasing department of Roven Ltd. Some manufacturers have even made agreements about annual efficiency improvements. Such agreements explain the constant drive for cost improvements.

4.1.3 Improving the supply chain

The purchasing and logistics departments discuss coordination issues in regular meetings. On several occasions, the purchasing department has expressed the wish to order from the subcontractor in larger quantities. The purchasing department has recognised an important advantage that can be gained when the component manufacturer can adapt the production quantities. In other words, if Roven Ltd. would increase the order quantities, the subcontractors will be prepared to give a discount. The main reason for the subcontractor to do this is that set-up time can be reduced, and that would lead to efficiency gains. However, the purchasing department has no decision rights with regard to purchasing lot sizes. These rights are located at the logistical department. However, the logistical department considers the purchasing lot size as one of the most important drivers of the stock level. A purchasing amount of q leads to an

average stock level (with constant demand) of $0.5 \times q$. Thus, we see that the lower the q the lower the stock level. As a consequence, the logistical department has a natural inclination to keep these quantities as low as possible. As a result, the request to increase purchasing lot sizes has not been fulfilled by the logistics department.

4.1.4 Behaviour explained from a management control perspective

Because the purchasing department cannot enforce a solution, other solutions have been created. The purchasing department has made specific agreements with subcontractors. In these agreements, the subcontractor is allowed to produce in specific (larger) quantities. Roven Ltd. is then obliged to purchase this larger quantity, but keeps the right to call down smaller quantities. These smaller quantities are thus delivered on call.

The consequence of the method described above is that, optically, both the purchasing and the logistics department can achieve the performance targets set with regard to the applicable performance measures -cost reductions on purchased items and inventory level/ inventory costs are realized. However, the performance criteria give the wrong signal. Although the average stock level at Roven Ltd. does not increase by this method, of course the average economic stock level does increase. This economic level is not measured, however. As a consequence, the financial risk for Roven Ltd. increases, particularly if the demand of Roven Ltd. decreases and if a product is phased out. The subcontractor continues the production then in accordance with the production amount agreed on in the contract. To place constraints on the risk for Roven Ltd., the contract states, however, as an additional condition that the obligation to purchase products for Roven Ltd. is limited to the demand of one year as specified in the delivery schedule. The economic inventory may therefore run up to the demand for one year.

Moreover, the method described above has a disadvantageous impact on the transport charges for Roven Ltd. After a production order is finished at the subcontractor's production location, the whole amount of the production order is ready for transport to the production setting of Roven Ltd. The logistical service provider, however, has the task to take these products along in small quantities, which is what happens. The planner at this logistical service provider must notice this inefficient method and could thus identify that savings are possible for Roven Ltd. If the products are already available at the subcontractor, then you can just as well take them along. Given the transportation rate structure this would lead to a cost reduction for Roven Ltd. As can

be inferred from Figure 2, taking along a quantity of a component in two batches is always more expensive than collecting the total quantity at once. The first percentages of carrying capacity used are relatively expensive for Roven Ltd. It is however not always in the direct interest of the logistical service provider to improve the plans of Roven Ltd. From the perspective of the logistical service provider, a change in working method would lead to lost benefits. Moreover, the logistical service provider would also try to fill up empty space in the truck with freight from other customers. Therefore, the first percentages of carrying capacity used in the truck are frequently sold several times. Carrying freight in larger quantities for only one customer per drive would therefore lead to a lower turnover, at least in the short run.

If the entire economic inventory were to be delivered at Roven Ltd. at once, then the measurable inventory costs would change. In this new situation, the subcontractors would be faced with a lower inventory and therefore lower interest costs and lower costs of warehousing. At Roven Ltd., of course, the opposite effect would be noticed and Roven Ltd. would have to be compensated for this effect if the price was going to be renegotiated.

Within Roven Ltd. little attention is paid to the transportation process. However, major savings are possible and therefore Roven Ltd. should focus on process improvements in this area. Even if the logistical service provider were to notice a possible improvement opportunity, by delivering larger quantities for example, the logistical service provider is not able to assess whether this change would also produce economic advantages from the perspective of the whole supply chain. The reason for that is that the logistical service provider aims at more efficient transport, but Roven Ltd. (in this case the logistical department) concentrates on the stock levels within the company. Because the logistical service provider has no insight into the inventory costs that would result from a possibly more efficient transport manner, it is not possible for this firm to come up with a realistic improvement proposal. If Roven Ltd. were to have more insight into the real cost structure with regard to placing orders at the logistical service provider, then Roven Ltd. would be able to reduce the costs of the total chain by taking along the information on this cost structure in its assessments with respect to determining the transport batches. Through the lack of a common objective, possible supply chain optimisation does not take place. In this case, the initiative should therefore come from Roven Ltd. The question is whether such an initiative may be expected from Roven Ltd. at this time, considering the current design of their local management control system.

4.2. The food supply chain

4.2.1 Process description

The food chain researched consists of eight food manufacturers, two logistical service providers and two retailers. In this paper we describe the eight food manufacturers as one party; the two retailers are described as one party too. Since the logistical service provider is closely related to the manufacturers, the activities are described for the manufacturers. In current practice the main supply process in the food chain is as follows. The various plants of the given food manufacturers replenish their regional warehouses. These regional warehouses are either owned or governed by the manufacturers or by a logistical service provider. The regional warehouses subsequently supply the distribution centres of several retail chains. The retailers then take control of the supply of their own retail outlets. In these food supply chains it has become common practice to frequently reorder and deliver (daily or even more often) to reduce inventory out of the downstream supply chain (Deloitte, 2004). The retail outlets are replenished within 8 – 12 hours. As a consequence, the food manufacturer is required to replenish the retail distribution centre within 8 – 24 hours. This forces the food manufacturer to deliver from regional stock. As a result of this policy, large stocks (of non-perishable items) are stored at the regional warehouse of the manufacturer.

In this case study we discern the Purchasing Department and the Logistical Department within the retailers. Within the food manufacturers we discern the Sales Department and the Logistical Department. Figure 3 gives a graphical overview of the parties involved in this chain.

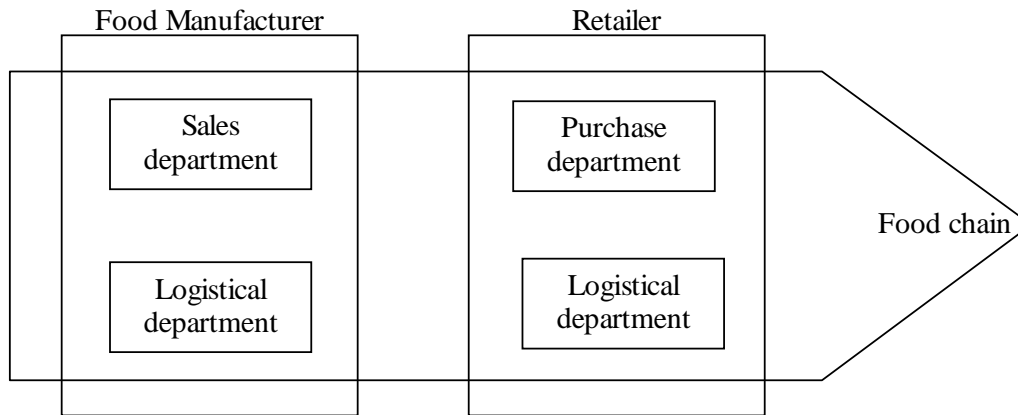


Figure 3 The departments participating in the food supply chain.

4.2.2 Present management control systems

Management control system Food manufacturer

The main financial result indicator of the sales department is the profit margin realised. This profit margin is defined as the actual sales prices of the products sold minus a specific transfer price between the supply organisation and the sales organisation of the manufacturer of the products sold. This transfer price only includes the manufacturing costs and does not include the logistical costs from the manufacturer to the retailers. This implies that the logistical costs do not play a role in the financial result indicator of the sales department. Due to a lack of a sophisticated cost allocation model, the food manufacturer is not able to allocate the logistical costs to customers. The logistical costs are measured at the logistical department level. These costs are only one element of the performance measurement system of the logistical department. The other element is the service levels that are agreed upon with the customers. Although the logistical department sees these logistical costs as important, they are more committed to the service levels.

Each year the sales department negotiates the sales conditions for the coming year with their customers. An important part of the negotiations of course is the sales price. This sales price directly influences the performance of the sales department. Furthermore, during these negotiations, logistical agreements are made, including specific service levels. The logistical department does not take part in these negotiations. They only provide input regarding the

service levels to the sales departments. Of course the outcome of these negotiations determines the costs that will have to be incurred.

The logistical department communicates at irregular intervals with the logistical department of their customers. During these contacts specific operational logistical issues are discussed. For instance, a retailer always orders 19 boxes of a specific product, whereas a full pallet contains 20 boxes. Removing one box from a pallet results in extra costs. When such behaviour is monitored, the logistical department of the manufacturer makes an agreement with the logistical department of the retailer about a slight change of the ordering policy (full pallets), to reduce costs.

Management control system Retailer

The main financial result indicator of the purchasing department of the retailer is purchase savings. Purchase savings are determined as the difference between the purchase prices of the goods bought last year and the actual purchase prices. The logistical costs do not play a role at the purchasing department. The logistical costs are a financial result indicator of the logistical department of the retailer. These costs are really seen as an important result indicator (more than those at the manufacturer). Furthermore, the performance of this department is measured in relation to the service level achieved further in the retail chain (retail outlets).

The purchasing department makes an agreement about the purchase conditions with the sales department of the manufacturer. Again, the logistical department provides input for these negotiations, but does not attend the meetings. Specific logistical issues are discussed in the irregular meetings with the logistical department of the manufacturer.

4.2.3 Improving the supply chain

In 2002, a research group consisting of two Dutch universities and a consulting firm approached the members of this food supply chain to initiate a new method of supply chain cooperation in a project named KLICT 1. In this research project a new supply chain concept was designed: Supply Chain Synchronisation (SCS). The idea behind SCS was to create a retail distribution chain with the overall absolute minimum costs (Deloitte, 2004). With the current products portfolio, where manufacturers might produce hundreds of different products, it is taken for granted that most products cannot be produced daily. To produce efficiently, these products are produced in certain batches. The majority of these products is produced only once a week,

biweekly, once a month, or even less. From a supply chain perspective, once a batch of products has been produced, the inventory is available and its costs are borne. So, the challenge then is to make this inventory effective as soon as possible and, to move the inventory along the supply chain in the cheapest possible way.

In the current situation, the inventory is sent to the retailer in relatively small transportation batches, just to fulfil the service level required and to minimise the inventory at the retailer. From a supply chain perspective the stocks left at the manufacturer are quite ineffective. Stocks can run out at the stores, where there is plenty of stock in the warehouses of the manufacturer. Furthermore, the set-up of logistical processes in this chain is quite inefficient due to the relatively high transportation costs and materials handling costs (Martens, 2003). The efficiency (lower costs) and effectiveness (higher service levels) of this food chain can be improved by means of this Supply Chain Synchronisation Concept. In this concept, the inventory is made effective as soon as possible by moving it downstream in the supply chain immediately after production. Simulation shows that the overall inventory in the supply chain drops to the minimum by applying this concept (Deloitte & Touche, 2002). This is one element in the SCS concept. To move the inventory along the supply chain in the cheapest possible way, it should be moved in the largest possible quantities, i.e. using full pallets and in full truckloads. That way both handling and administrative overhead are minimal. Furthermore, time pressure should be minimal, so as to create optimal conditions for the levelling of workload over time. SCS implies that manufacturers immediately send $\alpha\%$ of the production batch to the warehouse of the retailers. In a following shipment $(100 - \alpha)\%$ is sent. This implies that only two shipments from manufacturer to the retailer per production batch occur.

During the KLICT I project, simulations were made that prove this concept would result in lower costs for the supply chain as a whole. These lower costs in the supply chain are related to less handling, less administrative costs, less transportation costs, and lower inventory levels.

After this project a new project was initiated, called KLICT 2. The aim of this project was to look at specific implementation issues. One important part was the allocation of the costs and benefits of this new method of cooperation. The SCS concept lowers the cost of the total supply chain. When taking a closer look, the costs of the retailer increase whereas the costs of the manufacturer decrease, still leaving a net advantage. Figure 4 gives a graphical representation of the benefits

(where plus is a reduction in costs and minus is an increase in costs). As a result, compensation to the retailer has to take place.

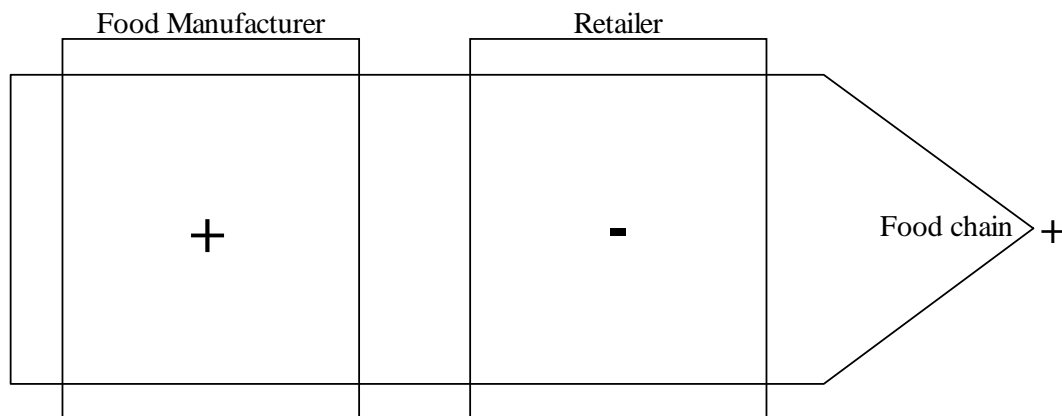


Figure 4 The main consequences of implementation of a supply chain initiative.

Compensation could take place based on the performance of the retailer in the chain. In this way, the retailer can see the SCS concept as a service for which the manufacturer has to pay. However, this requires a detailed recording of the performance of the retailer. A retailer could well purchase 5,000 to 30,000 articles. For each article a detailed registration would be necessary. In this chain, however, neither the manufacturer nor the retailer keep record of the logistical performance at such a detailed level. For this reason, compensation is sought through a discount on the sales price. In this way the sales department gives a discount to the retailer when the rules of the SCS concept are adapted. Following this approach, both parties (manufacturer and retailer) trust that each party complies with the rules of the SCS concept in such a way that the savings for the total supply chain are realised. Of course the performance of the parties involved regarding the principles of the SCS concept is monitored, but not exactly measured. If this were to be put into practice, the cost and benefits could be equally divided over the different parties in the supply chain.

4.2.4 Behaviour explained from a Management Control System perspective.

In this section, we discuss the effects of this compensation on the management control systems of the separate parties involved in this supply chain. When the compensation takes place through the adjustments in sales prices / purchase prices, the following effects on the management

control systems can be found. First, the benefits of the SCS concept are equally divided over the parties in the chain. As a result both parties are encouraged to participate in the project. When the management control systems of the different departments are taken into account, interesting insight can be obtained. As regards the retailer, the purchasing department sees an improvement in the retailer's performance indicator. Due to lower purchase prices the result indicator increases. The costs of the logistical department increase due to the new supply chain concept (costs of inventory increase). This results in a poorer performance of the logistical department. When the management control system of the manufacturer is considered, the following situation can be observed. First of all, the performance of the total organisation increases. Part of the benefits of the SCS is paid to the retailers but some of the benefits can still be kept. When the different departments are considered, one can see that the performance of the sales department decreases due to a decrease in sales prices; the performance of the logistical department is increased due to lower logistical costs. The sales department now has to lower its margins to decrease logistical costs that they are not formally responsible for. In Figure 5 the effects of these actions on the management control systems are presented.

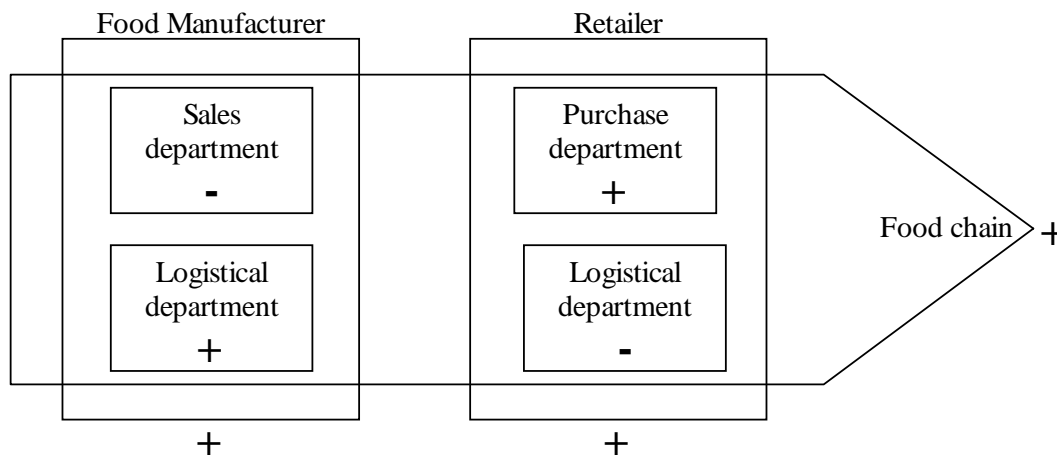


Figure 5 Effects on local management control systems.

Let us take a look at an example to illustrate the processes described above. Suppose that applying the SCS concept leaves a total chain result of € 605. This result consists of a decrease in logistical cost of € 3,778 for the manufacturer and an increase of the logistical costs of € 3,173 for the retailer. It is clear that in this project the retailer has to be compensated. The compensation is

carried out through a decrease in the sales prices of the products involved. If the manufacturer lowers his prices by € 3,475, the benefits of the chain project are equally divided between the partners involved. Figure 6 shows the numerical effects on the local management control systems.

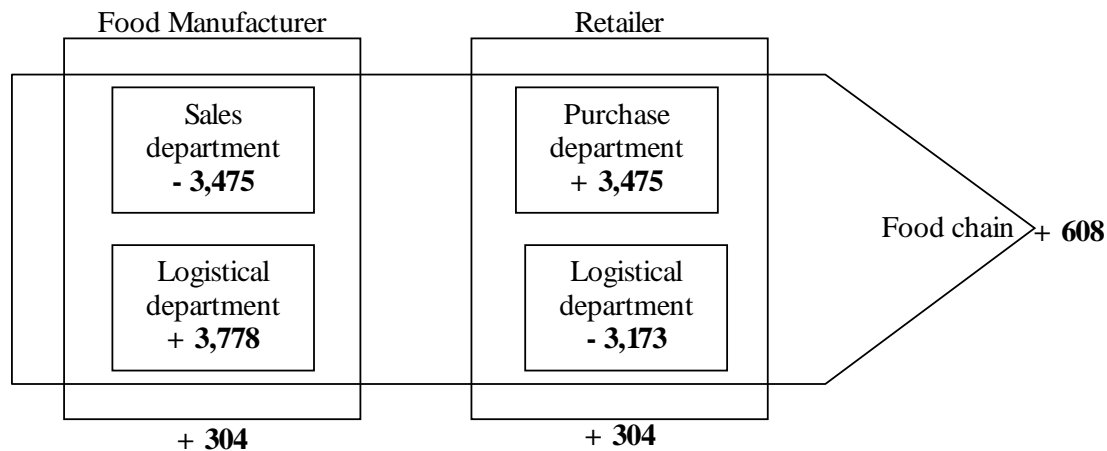


Figure 6 Numerical effects on local management control systems.

When the cost and benefits are allocated to different players in the supply chain through an adjustment in the sales / purchase price, an interesting process occurs. The present management control system encourages the department to increase its own performance, but does not stimulate cooperation in a supply chain to achieve specific supply chain goals. This causes the following problem. Based on its financial result controls, the account manager of the sales department of the manufacturer does not have a real drive to make the SCS concept a success during the negotiations. Although the SCS concept would work out for the best of the supply chain, and would also work out well for the partners involved (after installing an appropriate compensation mechanism), it works out much more negatively for the account manager. The account manager would be likely to interfere with negotiations to make the SCS concept fall. The same holds for the logistical managers of the retailer. Due to the SCS concept the financial performance of his department decreases. Due to specific actions (order quantities that differentiate from the alpha concept, manipulating demand forecasts, manipulating stock levels, etc.), the logistical department could also hinder the SCS concept.

5. Discussion

The two case studies have enabled us to examine the role of the local management control system within both the high-tech supply chain and the food supply chain, and to analyse if local management control systems encourage or hinder cooperation within the supply chain. The underlying question is which management control system offers the best guarantee for a good control of the partners in the supply chain. In the remainder of this paper we will discuss this question concentrating on issues relating to: 1) information exchange and 2) decision-making powers and performance measurement.

Information exchange

Seal *et al.* (1999) indicate that it is very important that information exchange actually takes place for the management of the supply chain relation. The authors emphasize that cost information can be important to maintain the relation. Especially specific 'open book' arrangements are suitable to ensure that the margins for the subcontractors remain reasonable and that a certain degree of trust between the subcontractor and the customer can be developed.

If we look at the first case study in the high-tech supply chain, then we see that within the organisation of Roven Ltd. a dialogue takes place between the purchasing department and the logistical department, to enable both parties to formulate a better strategy concerning stock levels and transportation sizes. The information that is necessary to take the correct decisions thus is present within the participating departments in the organisation. However, the performance criteria that are used contribute to the fact that the different departments are busy maximising their own performance, but not the performance of the whole organisation, not to mention the performance of the whole supply chain. We can also infer from the case study that an action control system would be difficult to install, since this requires a specification in advance of the decisions that have to be taken.

By the frequent visits to the subcontractor, the logistical service provider obtains insight into the stock levels and could take the initiative to adapt the transportation size based on that knowledge. However, the contract with the customer does not encourage the provider to take this initiative. As regards the subcontractor, more or less the same pattern applies in fact. Both the subcontractor and logistical service provider have insight into stock levels and transportation

sizes, therefore they should be able to formulate an idea for improvement. However, the incentive to effectively provide this idea is lacking.

Also Roven Ltd. must be able to improve the assessment of the transportation costs by acquiring further information on the real cost structure of the logistical service provider. Here, too, we must note that until now little action has been undertaken.

In the second case study information exchange between the parties involved is very important as well. If we look at the logistical department and the sales department of the manufacturer, it is very important for both departments to develop a strategy relating the potential benefits of the SCS concept and the maximum amount of discount that can be given to the retailer. The logistical department in particular should be able to give insight into the benefits that can be gained with the SCS concept. A similar discussion could take place with the retailer between the purchasing department and the logistical department. Information asymmetry occurs in both companies between both departments. For instance, the purchasing department would have to trust the estimations about the increases of logistical costs made by logistical department. Information asymmetry also occurs between the retailer and the manufacturer with regard to the potential logistical benefits. Therefore, the parties in the supply chain would need to talk about a model that is accepted by all parties, which could serve as a reference model to calculate the costs and benefits. However, such a model would incorporate confidential information and therefore is difficult to obtain.

As a final point, we found that cost information alone is not sufficient to optimise the supply chain. In both cases, we saw that the necessary information concerning transportation charges had to be completed with information on stocks and delivery reliability. Based on the two case studies, we also saw that the information exchange between the parties involved in the supply chain is indeed an issue. This observation not only applies to the exchange of information between companies but also to information flows between departments of one company. Although the necessary information is often available somewhere within the companies involved, the transfer of this information to the people with the decision rights is problematic, due to the management control systems used. We can therefore conclude that in spite of the broad availability of the required information for all parties, the incentives are lacking to proceed with effective chain integration. We will therefore continue with a discussion of the management

control system for the participating parties, the system for the partitioning of decision rights and the system for performance measurement.

Decision rights and performance measurement

In the first case study, we see that the decision rights of two related decisions are rather low down in the organisation, i.e. at the purchasing department and at the logistical department. The performance measurement system is arranged in such a way that both departments only pursue their own local objective; purchase savings and stock reductions. A possibility would be to design the performance measuring system in such a way that both departments are evaluated using a common objective. A disadvantage of this system would then be that a part of this common objective is largely "uncontrollable", since the decision rights are much narrower than this objective. The advantage, however, is that initiatives to increase cooperation in the supply chain will come about much earlier if the departments are effectively evaluated on such a common objective.

Another possibility would be to allocate the decision rights for both decisions to one of the two departments. However this would lead to the fact that the purchasing department would have to acquire all required logistical knowledge or that the logistical department would have all the required purchasing knowledge. This approach would then probably become too costly. Alternatives could be to centralise decision making (for example within a department of Supply Chain Management, which would include both purchasing and logistics) or to work with a problem-solving team (a supply chain team).

If the decision making is centralised then the performance measurement - and appraisal -system must be adapted. For example, an integrated objective could be defined for a department supply chain management and this department would then be assessed on both logistical and purchase costs. These costs would have to be built up of a combination of purchase costs, transportation charges and stock-keeping costs. In this way local and optical optimisation efforts could be prevented.

As regards the logistical service provider, the management control system would have to be designed in such a way that improvement initiatives concerning process improvement are appreciated. Since the required knowledge and information for process improvement are present

on the 'shop floor', and with the truck drivers, the system must stimulate these employees to actively think about possible improvements. In the first place, it is important to communicate the supply chain objectives through the whole organisation. And, subsequently, to create a structure where these initiatives are taken up by others (for example by a supply chain coordinator). This person should focus especially on making sure that the proposed initiative results in positive effects for the logistical service provider. Since it is impossible to specify all bits and pieces completely in advance in a contract, it seems worthwhile to make agreements concerning the working method to be followed in case of improvement options, which would lead to a cost reduction for the logistical service provider. Another possibility would be to close a contract based on a tariff structure that makes it interesting for the logistical service provider to organize the most efficient transport for Roven Ltd too. Naturally this would also lead to an effort on the part of the logistical service provider to reduce these transportation costs.

A more far-reaching form of change in management control systems in the chain would be to allocate the decision rights with respect to the transportation sizes to the logistical service provider. We would then get a vendor-managed inventory system, a VMI system (see e.g., Kulp, 2002). The advantage of such a system is that it is possible for every decision to take into account the total supply chain costs. Kulp indicates that an important success factor when using VMI-systems is the willingness of the customer to communicate accurate and reliable information on stock levels to the subcontractor who has the decision rights. In this case that would mean therefore that Roven Ltd. would have to communicate the necessary information to the logistical service provider. The logistical service provider could then take into account this information as well as its own information with respect to the cost structure of the transportation orders already planned. A good monitoring of the performance of the logistical service provider and a system for partitioning of the achieved supply chain advantages, however, is essential for such a system to be able to succeed.

To resume, we note that potential supply chain improvement advantages can be achieved by changing management control systems within the organisations in the supply chain. Possible improvements can be achieved 1) by communicating properly within Roven Ltd. and within the logistical service provider, and 2) the common supply chain strategy, which is the basis for the management control systems in the participating companies. Moreover, a VMI-system within Roven Ltd. could be considered or centralized decision-making concerning purchase and

transportation sizes at a higher level in the organisation (for example to a supply chain coordinator). This would have the advantage that both the impact on the stock keeping costs and the impact on the transportation charges could be taken into account in the decision-making process. Furthermore, it is important to link the performance measurement - and reward - systems within Roven Ltd. and within the logistical service provider to the common supply chain strategy. It then follows that the contract with the logistical service provider has to be arranged in such a way that improvement initiatives are eventually paid in real money to the logistical service provider, as we are still operating in a market.

In the second case study, we see that the costs and benefits of the supply chain initiative are unequally divided across the supply chain. As a result, compensation to the negatively affected company has to be arranged. Lowering the sales prices of the products involved could be considered the easiest way to compensate the retailer. However, this method of compensation would still lead to an imbalanced spread of the costs and benefits across the departments within the companies involved in the supply chain initiative. Therefore, we must conclude that the management control systems have been designed in such a way that the sales department of the manufacturer and the logistical department of the retailer are not fully motivated to work in line with the supply chain initiative. One way to improve the situation would be to design the performance measurement system such that both departments within one company are evaluated using a common objective. The advantages and disadvantages of implementing such a system are similar to the considerations mentioned in relation to the first case. Another possibility is to differentiate in performance indicators between the departments. The sales department could then be made responsible for the total margin per customer (including the logistical costs) and the logistical department purely for logistical parameters such as service levels. Consequently, the retailer could choose for a similar set-up: the purchasing department would be made responsible for the purchasing costs including the costs for logistics, and the logistical department for the logistical parameters. However, the use of margin per customer as a performance indicator requires an advanced costing system, which is able to trace logistical costs to specific customers. Such a system is not available to these manufacturers at present. Furthermore, there is a risk that the sales / purchasing departments would become responsible for a part of the costs that they cannot directly influence.

Another option would be to create an internal market between the logistical department and the sales department and between the logistical department and the purchasing department. The manufacturer's logistical department could then negotiate with the sales department about the price that they are willing to pay to the sales department for working with the SCS concept. This internal price could then be used for negotiations with the retailer. The same process could be implemented with the retailer, where the purchasing department would have to reach a deal with the logistical department about the price they would have to pay for working with the SCS concept. A major disadvantage of introducing this internal market option would be that it leads to many administrative costs.

The application of the supply chain synchronisation concept requires numerous operational decisions. As a result, it is problematic to allocate the decision rights to the sales department of the manufacturer. In addition, moving the decision rights from the sales department to the logistical department is too expensive. The logistical department does not incorporate sales knowledge, and transferring this knowledge to this department would probably be too costly. An intelligent solution to circumvent this management control system design would be to introduce specific action controls into the operation. In the information system one could install a concept that only allows work to be done according to the supply chain synchronisation concept. However, this would require some investment in the information systems installed.

6. Conclusions

In this paper, two case studies are described that reflect on the cooperation between several parties in a supply chain context. In the case studies, we described how local management control systems unfavourably influence the achievement of the supply chain objective.

The question addressed in this research is whether cooperation in a supply chain necessitates changes in local management control. On the basis of the study, it can be concluded that the current local management control system does not promote the chosen supply chain objectives. The will to strive for improvements at the level of the supply chain will only come about if the local management control systems are adjusted. Supply chain initiatives usually require actions in more than one department within the participating companies. In addition, cooperation between companies needs mutual approval and assistance. The case studies provide evidence that the present management control systems are not able to grasp the complicated nature of supply chain

management. This leads to supply chain initiatives not being implemented, due to a lack of commitment at the part of the local units involved. The residual loss from non-congruent behaviour therefore is substantial.

A final question that should be answered is how local management control systems must be arranged to encourage the achievement of supply chain objectives. In this paper, possible suggestions are made for improvement, such as using a common supply chain strategy as a basis for the management control system, to allocate decision rights differently and to redesign the performance measuring system accordingly. Although the additional monitoring costs may be considerable, they could however outweigh the residual loss stemming from unrealised supply chain benefits. Subsequently, effectively measuring the success of these suggestions could become the subject of future research.

An additional avenue for further research could be the study of the whole supply chain as one organizational architecture. We then see that the property rights of the supply chain are divided among several participating parties and that the decision rights are allocated in agreement with the partitioning of the property rights. The disadvantage of such a situation is that the interest of the whole supply chain is not pursued automatically. Future lines of research could look into the location of property and decision rights in relation to the location in which the information is available, and how more information exchange or a different location of decision rights would contribute to better supply chain management.

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