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Antecedents of Supply Chain Visibility in Retail Supply Chains: A Resource-Based Theory Perspective

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Abstract

Although visibility has become a popular buzzword in the supply chain literature it remains an ill-defined and poorly understood concept. It is assumed that if companies across supply chains have visibility of demand, inventory levels, processes, etc., that organizational performance improves. This research explores the antecedents of high levels of supply chain visibility from a resource-based theory

perspective across five different external supply chain linkages. We find that the level of visibility across these linkages differs considerably based on various contributing factors which are both technology and non-technology based. Using resource-based theory, we identify those factors that can give a sustainable competitive advantage to a supply chain linkage through a “distinctive” or high level of visibility.

1 Introduction

Industries such as the retail sector have long recognized the critical role of supply chain management (Ellram et al., 1989; Mentzer et al., 2000; Hill and Scudder, 2002) and the need to effectively manage the flow of materials, money and information across the supply chain (Lee and Billington, 1993; Gavirneni et al., 1999; Gavirneni, 2002). Recently, the retail sector, enabled by advances in technology (Sahin and Robinson, 2005) has seen a growing trend for organizations to create external linkages based on the sharing of information (e.g. point of sale data (POS), inventory levels, forecasts, etc.) in order to gain increased visibility of their customers and/or suppliers’ operations and activities (Mabert and Venkataraman, 1998; Shore and Venkatachalam, 2003; Fiala, 2005). The purpose of achieving visibility is primarily for improving their own internal decision making and operating performance (Rungtusanatham et al., 2003; Kulp et al., 2004). It has been suggested that the capability to create improved visibility from the development of effective external linkages (Day, 1994), is critical to improving supply chain performance (Lee et al., 1997b, 2000). Whether this capability of creating improved visibility translates into sustainable competitive advantage for the firms or the supply chains is currently unclear in the extant literature (Hoyt and Huq, 2000; Eylon and Allison, 2002; Subramani, 2004).

1.1 Research gap

Previous studies have examined the benefits, in terms of improved performance, of information sharing in supply chains, albeit mostly from a modeling/simulation perspective (Bourland et al., 1996; Chen, 1998; Aviv and Federgruen, 1998; Gavirneni et al., 1999; Gilbert and Ballou, 1999; Cachon and Fisher, 2000; Chen et al., 2000; Lee et al., 2000); although there has been some limited empirical examination of this concept (Gustin et al., 1995; Closs et al., 1997). The results of these studies are generally inconclusive and vary subject to the differing structure of the supply chains under examination (Closs et al., 1997; Cachon and Fisher, 2000; Sahin and Robinson, 2005). The missing link in many of these studies is the link between information sharing and visibility. We suggest that the concept of information sharing is not directly linked to that of improved performance. The previously studied link (between information sharing and improved performance) in fact is the result of a two stage process. When information is initially shared, it must be determined by the recipient whether the information is accurate, trusted, timely, useful, and in a readily usable format (Bailey and Pearson, 1983; Gustin et al., 1995; Closs et al., 1997; Whipple et al., 2002). In other words, does the information shared provide visibility? If the information passes this initial test it must then be incorporated into the decision making processes of the recipient who may now make a more informed decision enabled by better visibility of the sender's current situation (derived from the shared information). It is this more informed decision making that potentially leads to improved performance. This research therefore addresses an important gap in the supply chain literature in that it explores the factors that enable such visibility.

1.2 Theoretical framework

Whether organizational resources and capabilities can generate sustainable competitive advantage has been of interest to academics for many years (**Wernerfelt, 1984; Barney, 1991; Grant, 1991**). In this paper, we identify organizational resources and capabilities that would not only generate improved performance through improved visibility but also have the capability to potentially generate sustainable competitive advantage for a supply chain. We conceptualize not only the link between such resources and capabilities and operational performance but extend it to include the capability of such resources to generate sustainable competitive advantage. We do so by utilizing a Resource-based theory (RBT) framework (**Rungtusanatham et al., 2003**). We use RBT because it explains how the rent generating potential of resources and capabilities can lead to sustainable competitive advantage (**Wernerfelt, 1984; Barney, 1991; Grant, 1991**); and it is particularly suitable when the resources and capabilities are intangible (**Conner, 1991; Taylor-Coates and McDermott, 2002**).

1.3 Conceptualization of visibility

We posit that in the context of external supply chain linkages, certain organizational resources and capabilities enable information to be shared within the linkages which leads to improved visibility and subsequently improved performance. For the resources to be capable of providing a sustainable competitive advantage, the information shared must provide what we refer to in this paper as distinctive visibility. In line with RBT, we argue that distinctive visibility as a capability has the potential of providing a supply chain linkage with a sustainable competitive advantage. How to achieve such distinctive visibility is the main objective of our research. Therefore, our research question is: what are the antecedents of distinctive or high levels of visibility in a supply chain that is characterized by different types of external linkages?

The concept of visibility has been generally understated and has sometimes been used interchangeably with information sharing within the extant literature (**Swaminathan and Tayur, 2003**). We posit that information sharing is an activity and visibility is a potential outcome of such activity. It is this potential visibility which in turn may lead to a more effective supply chain. We define supply chain visibility as “the extent to which actors within a supply chain have access to or share information which they consider as key or useful to their operations and which they consider will be of mutual benefit”. Thus visibility has a range of levels determined by the amount of useful information that is shared across the supply chain. The importance of information sharing is not in question here, however a number of issues raised in the extant literature require further study: the extent to which the information shared is accurate, trusted, timely, useful, and in a readily usable format (**Bailey and Pearson, 1983; Gustin et al., 1995; Mohr and Sohi, 1995; Closs et al., 1997; Whipple et al., 2002**) It is these factors which determine the level of supply chain visibility.

We posit that a high level of visibility that is characterized by the quality of useful information within a supply chain linkage is what makes the visibility distinctive. We contend that sustainable competitive advantage is attainable through a ‘distinctive’ type of supply chain visibility. **Fig. 1** conceptualizes this process, with the focus of this paper on link 1. We assume for the purpose of this research that a distinctive visibility will provide an external linkage with the capability of potentially generating sustainable competitive advantage (i.e. link 2).

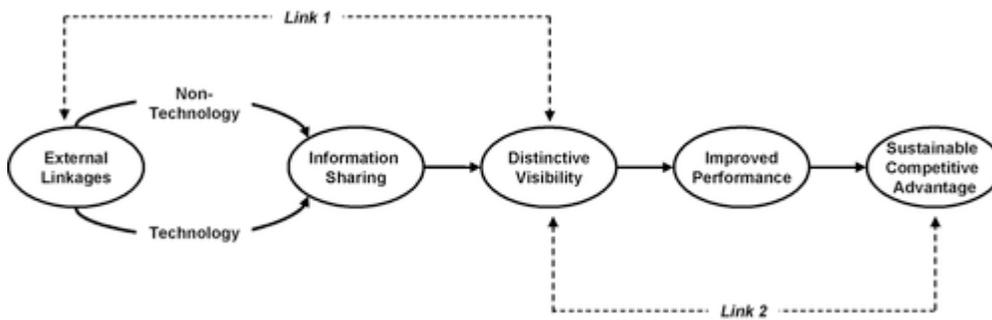


Figure 1. The concept of distinctive supply chain visibility.

1.4 Layout of the paper

In this paper we review the literature on information sharing and visibility especially as it relates to retail supply chains. Next we look at the key tenets of resource-based theory and then explore how RBT can be used as a theoretical lens to identify the factors that can provide distinctive visibility. We then discuss how we collected the case data and made our analysis, examining the relationships between the use of different technology and non-technology-based factors within external linkages that aid supply chain visibility from a RBT perspective. Next we present our within-case analysis followed by our cross-case discussion from which we developed our study propositions. We then discuss the limitations of the study and conclude with a discussion of future research in this area.

2 Literature review

2.1 Information sharing in retail supply chains

Generally, information sharing in a retail supply chain context has received a lot of attention (for example **Chen, 1998; Gavirneni et al., 1999; Cachon and Fisher, 2000; Sahin and Robinson, 2002**), and has been considered as a generic cure for many supply chain operational issues (**Forrester, 1958; Lee et al., 1997a,b; Chen et al., 2000**). There have been multiple industry initiatives that have been based primarily on information sharing: (1) quick response (**Hammond, 1990**); (2) efficient consumer response (**Kurt Salmon, 1993**); (3) sharing point-of-sale (POS) data (**Stalk et al., 1992; Aviv, 2002**); vendor managed Inventory (VMI) (**Waller et al., 1999; Cheung and Lee, 2002**); Collaborative planning, forecasting and replenishment (CPFR) (**Aviv, 2001**). **Swaminathan and Tayur (2003)** argue that the internet (technology) has made it easier to share information. An early example of information sharing was the belief that if organizations could more readily share information then this would eliminate demand amplification (**Forrester, 1958; Towill et al., 1992; Lee et al., 1997b**).

Most of the extant literature on information sharing is based on simulation and modeling (see for example **Chen, 1998; Gavirneni et al., 1999; Cachon and Fisher, 2000**) with little empirical work (e.g. **Gustin et al., 1995; Clark and Hammond, 1997; Closs et al., 1997; Yu et al., 2000**). Also, the focus has been on information sharing rather than visibility. We argue that visibility, the focus of this study, is an outcome of information sharing. In the next section, we review the literature on information sharing and visibility and their links with performance.

2.2 Information sharing, visibility and supply chain performance

Several streams of studies have contributed to the current understanding of the importance of information sharing to competitive advantage in the supply chain. Information sharing has been recognized as being valuable and beneficial in retail supply chains (**Chen et al., 2000; Lee et al., 2000; Yu et al., 2000**). A number of authors suggest that the close collaborative linkages enabled by information sharing are critical to effective supply chain management (**Spekman et al., 1998; Moberg et al., 2002; Whipple et al., 2002**). **Dejonckheere et al. (2004)** investigated the impact of information enrichment on the 'Bullwhip' effect in supply chains. They show that information sharing helps to reduce the bullwhip effect significantly, especially at higher levels in the chain. **Huang and Gangopadhyay (2004)** studied the effectiveness of information sharing and found that from the perspectives of end inventory and back-order quantities, distributors and wholesalers gain significantly from information sharing. Many studies have argued that as a result of information sharing there has been better coordination of physical movements within the supply chain (**Clark and Scarf, 1960; Collier, 1982; Gao and Robinson, 1994; Gustin et al., 1995; Closs et al., 1997**); better coordination of decision making (**Whang, 1995**); better price coordination (see for example **Jeuland and Shugan, 1983; Corbett and Tang, 1999**); and optimal inventory holding policies (**Gavirneni et al., 1999**) through vendor-managed inventory in retail supply chains (**Clark and Hammond, 1997; Waller et al., 1999; Yu et al., 2000**).

Many authors have suggested the need for firms to gain visibility of various aspects of their customers and suppliers' operational activities, including: (1) being able to see 'real' demand (**Barratt and Oliveira, 2001; Aviv, 2002; Croson and Donohue, 2003**); (2) being able to see how much inventory a customer is holding (**Barratt and Oliveira, 2001; Aviv, 2002; Karkkainen, 2003; Petersen et al., 2005**); (3) process visibility (**Fawcett and Magnan, 2002; Van der Zee and Van der Vorst, 2005**); (4) using Radio Frequency Identification (RFID) data to provide visibility of products as they move through the supply chain (**Karkkainen, 2003; Prater et al., 2005**). A number of authors have also suggested the benefits that arise from visibility, including: (1) improved responsiveness (**Armistead and Mapes, 1993; Berry et al., 1994; Patterson et al., 2004**); (2) improved planning and replenishment capabilities (**Armistead and Mapes, 1993; Karkkainen, 2003; Mentzer et al., 2004**); (3) improved decision making (**Kent and Mentzer, 2003**); (4) improved quality of products (**Armistead and Mapes, 1993**).

Having high visibility is a key capability for any firm within a supply chain. With high visibility, many of the problems within a supply chain such as the adverse impact of promotions, the 'Bullwhip' effect can be alleviated (**Lee et al., 1997a,b; Dejonckheere et al., 2004**). High visibility is achievable through extensive sharing of useful and meaningful information amongst different players within the supply chain. **Mason-Jones and Towill (1997,1998)** suggest that many supply chain problems (such as uncertainty resulting from demand volatility) could be alleviated by the sharing of true demand (in the form of EPOS data) with all parts of the supply chain on a real-time basis.

Generally, the above review highlights the fundamental need for information sharing to gain visibility if supply chains and the firms within them are to improve their performance. The question should then move beyond the need and the importance of information sharing. The issue should move on to the quality, and the extent to which the shared information is perceived as meaningful and useful (**Bailey and Pearson, 1983; Gustin et al., 1995; Mohr and Sohi, 1995; Closs et al., 1997; Whipple et al., 2002**).

We argue that meeting these requirements is what gives a firm high visibility. As **Figure 1** shows, supply chain visibility may lead to improved performance. Many studies (see for example **Gustin et al., 1995; Clark and Hammond, 1997; Closs et al., 1997; Chen, 1998; Gavirneni et al., 1999; Cachon and Fisher, 2000; Yu et al., 2000**), have investigated the impact of information sharing on operational performance. These studies did not address whether the improved performance lead to a sustainable competitive advantage. This issue can be explored using resource-based theory.

2.3 Resource-based theory: the key elements

Resource-based theory (**Wernerfelt, 1984; Barney, 1991; Grant, 1991; Peteraf, 1993**), also sometimes referred to as the 'resource based view of the firm' (**Barney, 2001; Rungtusanatham et al., 2003**), describes, explains, and predicts how firms can achieve a sustainable competitive advantage through acquisition of and control over resources. Such resources and capabilities are linked to competitive advantage when they are a source of abnormal profits (**Wernerfelt, 1984; Barney, 1991; Peteraf, 1993**). These resources can include both tangible (e.g. equipment) and intangible (e.g. information or process knowledge) assets that enable the production and delivery of goods and services (**Penrose, 1959; Grant, 1991; Amit and Schoemaker, 1993**). Indeed, RBT places a great deal of attention on intangible assets that may be more firm specific (e.g. knowledge and learning) and have the potential to be more significant profit generators than purchasable resources (**Conner, 1991; Taylor-Coates and McDermott, 2002**). **Rungtusanatham et al. (2003)** suggest that control over resources may be a competitive advantage over competitors. As firms may exert different levels of control over different types of resources, these are commonly referred to as bundles of resources (**Barney, 1991**). The differences or bundles should in turn lead to different product and/or service attributes (**Wernerfelt, 1984; Conner, 1991; Schulze, 1994**) that in turn account for the firms' competitive position.

2.3.1 Resource characteristics that lead to sustainable competitive advantage

Several authors have discussed five characteristics of a resource that would offer firms a sustainable competitive advantage (**Barney, 1991; Peteraf, 1993; Rungtusanatham et al., 2003**). (1) Resources should be valuable in that they improve the efficiency or effectiveness of a firm. (2) The resource must be rare in that by exercising control over it, the firm can exploit it to the disadvantage of its competitors. (3) The resource must be imperfectly imitable to prevent competitors from being able to easily develop the resource in-house. (4) The resource must be imperfectly mobile to discourage the ex-post competition for the resource that would offset the advantages of maintaining control of the resource. (5) The resource must not be easily substitutable; otherwise, competitors would be able to identify different, but strategically equivalent, resources to be used for the same purpose. **Rungtusanatham et al. (2003)** have coined these as VRINN resources and capabilities (i.e. valuable, rare, imperfectly mobile, not imitable and not substitutable). Many authors have focused on one or more of these resources and capabilities in particular conditions that may further enhance the opportunity for sustainable competitive advantage: (1) **Penrose (1959)** found that the extent to which resources fit with other existing resources can reduce imitability and deter mobility. This effect can be yet further enhanced if the resources are embedded within a complex social network, making the resource even more difficult to replicate (**Wernerfelt, 1989**). (2) Resources that are recognized as organizational capabilities and incorporated in organizational routines provide enhanced productivity (**Grant, 1991; Amit and Schoemaker, 1993**), for example, information gathering and processing

mechanisms (**Grant and Baden-Fuller, 1995; Galunic and Rodan, 1998**). A review of these enabling factors and how the RBT can be used to aid the investigation is discussed in the next section.

2.4 Enabling factors of information sharing and visibility and resource-based theory

Moberg et al. (2002) argue that the antecedents of information sharing within supply chain settings have not been empirically examined. Based on a review of the extant literature, they identified six variables as potential antecedents of information sharing: information technology commitment, information quality, SCM commitment, organizational size, relationship commitment and trust. They found, however, that only two variables, information quality and relationship commitment were significantly related to strategic information exchange. The adoption characteristics for a variety of technologies and the importance of technologies to successful supply chain operations have been recognized (**Walton and Miller, 1995**). Recent developments in information technology have provided new opportunities for supply chain managers to improve control of their logistics—by enabling information to be shared between parties (e.g. EDI), responsibilities to be realigned (e.g. so that the supplier may access stock level data and take the necessary replenishment action), and new directions taken in strategic development (**Swaminathan and Tayur, 2003**).

Information sharing in the supply chain has received some considerable attention in terms of the use of technology for inter-organizational information sharing. This has been a predominant theme in the supply chain literature, with electronic data interchange (EDI) as one of the main examples. The majority of the research on EDI proposes a positive link between EDI and buyer–supplier relations. Based on in-depth case studies with fifteen organizations, **Emmelhainz (1987)** concluded, “EDI appears to further improve vendor relationships”. Further, **Monczka and Carter (1988)** found EDI to have a positive impact on buyer–supplier relationships. However, these researchers also noted that collaboration, commitment and communication between the trading partners must precede the EDI implementation effort. In recent years technology has played a major supporting role in supply chain initiatives such as vendor managed inventory (VMI), efficient consumer response (ECR) and collaborative planning forecasting and replenishment (CPFR) (**Barratt and Oliveira, 2001; Holmstrom et al., 2002**).

Despite such initiatives, which have been received with mixed response from industry, there is growing recognition that whilst technology and its supporting infrastructure is an important enabler of information sharing, it is not in itself sufficient and ignores the behavioral and people issues related to information sharing (**Barua and Ravindran, 1996; Whipple et al., 2002; Curry and Moore, 2003**). RBT enables the identification of both technology and non-technological factors of information sharing and visibility. RBT has been previously applied in supply chain management research, with **Rungtusanatham et al. (2003)** suggesting that linkages represent a form of inter-firm relationship and that RBT has been used multiple times to investigate such relationships (**Eisenhardt and Schoonhoven, 1996; Mowery et al., 1996; Lorenzoni and Lipparini, 1999**). **Rungtusanatham et al. (2003)** highlight that when supply chain linkages are seen as capabilities they can be viewed as connections that enable a firm to acquire a VRINN resource, i.e. the benefits of inter-firm relations, where such relations generate and share knowledge that ultimately benefits the firm (Winter, 1995; **Conner and Prahalad, 1996; Grant, 1996; Galunic and Rodan, 1998**). We apply RBT to understand the concept of distinctive visibility and argue that enabling factors (technology or non-

technology) that are not VRINN resources or do not provide VRINN capabilities would not give a distinctive visibility that is capable of providing a sustainable competitive advantage. For instance, EDI in itself or its acquisition is not a VRINN resource. While it may be valuable to a firm, it is not rare, not perfectly immobile; it is still imitable and substitutable. However, the way in which the technology is deployed may provide a VRINN capability which could give a firm a sustained competitive advantage. In this study we are interested in exploring how the use of certain types of technology and collaborative ideas or behavior constitutes VRINN resources and capabilities and provide a VRINN supply chain visibility through information sharing in a retail-manufacturing supply chain network.

3 Methods

3.1 Background and sampling

Since the identification of antecedents represents an uncharted territory for supply chain visibility, we adopt an exploratory theory-building approach based on a number of cases (Eisenhardt, 1989). We developed a semi-structured interview tool using resource-based theory (Wernerfelt, 1984; Barney, 1991; Grant, 1991) as a theoretical lens to guide us in our quest to understand the antecedents of distinctive visibility that may lead to a sustainable competitive advantage. We then collected data from five cases and analyzed the data in terms of the level of visibility; the impact of visibility on operating performance; and the potential for generating a sustainable competitive advantage.

Data was collected between January 2004 and February 2005. Each visit took from 1 day to 1 week and in three of the five cases multiple visits were made. In all five cases follow-up telephone conversations were held to complete the interviews. For triangulation purposes the same questions were asked to multiple informants. Documents were collected from the case organizations and observations made to validate the informant's responses.

To maximize the usefulness of the results we used a theoretical sampling approach (**Eisenhardt, 1989; McCutcheon and Meredith, 1993; Meredith, 1998; Choi and Hong, 2002**). The linkage between RetailCo and ManCo (the names of the organizations have been withheld at their request) is a leading example of a highly collaborative relationship in the UK grocery sector, where their collaboration is based on intensive levels of information sharing. Both organizations agreed to take part in this study as they were extending their collaboration approach to ManCo's supply base for a particular product (in this instance instant coffee). With the inclusion of ManCo's supply base for this product there were seven possible external supply chain linkages open to study, but only five were established and were thus included for the study. This is discussed in more detail in the next section.

3.1.1 Units of analysis and informants

The study comprised five external supply chain linkages between six organizations that supplied the major product components of a single supply chain in the UK consumer packaged goods (CPG) sector (RetailCo–ManCo; ManCo–GlassCo; ManCo–LabelCo; ManCo–LidCo; ManCo–BoardCo). Two remaining linkages were not included in this study as the two suppliers provided products that were treated by ManCo as commodities and so there was little collaboration between them. **Fig. 2** shows the linkages included in this study. Each of the external linkages forms a case study for the purposes of this research.

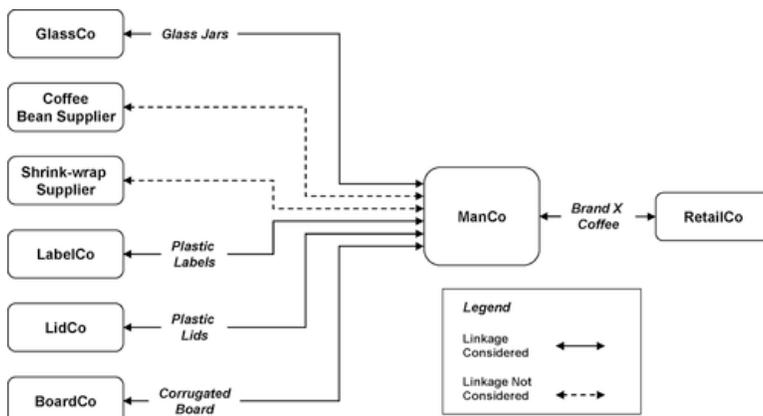


Figure 2. Supply chain linkages.

Data was collected on the type, medium for, nature and quality of information shared (i.e. accuracy, timeliness, etc.), the perceived level of visibility derived from the linkage and the impact of such visibility on operational performance. Within each of the linkages this was achieved through individual interviews with all managers and employees (from both organizations) involved with the linkage. A total of 48 informants were interviewed.

3.2 Data sources

The data for this study came primarily from three data sources: in-depth semi-structured interviews, documents and observations. These will be discussed next.

3.2.1 In-depth semi-structured interviews

To gain a deep understanding of the phenomenon of visibility, an in-depth semi-structured interview technique was used to probe informants regarding the organizations background; the role of information sharing; the level of visibility gained; and the performance impacts of the visibility. A sample of interview tool (interview questions and visibility measurement questions) is included in **Appendix A**. Each of the interviews lasted between an hour and three hours subject to the informant's availability on the days of the interview. Interviews were transcribed and verified by the informants to increase construct validity (Yin, 1989). New interviews were added until no new information was forthcoming, i.e. until a point of saturation was reached (Glaser and Strauss, 1967; Eisenhardt, 1989).

3.2.2 Documents and observation data

Process maps including information sharing activities and flows were received from all six organizations but were asked to be kept in confidence. Additionally, company reports were received providing further background on the organizations.

A site visit occurred at all of the six organizations. During the visit information sharing activities were observed (such as the use of ManCo's collaborative planning system). These observations were made to verify information collected from the interviews and documents.

3.3 Data analysis

As used in previous qualitative research (Harris and Sutton, 1986; Van Maanen, 1983; Choi and Hong, 2002) the analysis sought common patterns across the five linkages, such as the level of information

sharing. Any differences found were noted and reconciled (**Poole and Van de Ven, 1989**). In line with the approach suggested by **Miles and Huberman (1984)**, we begin by conducting the within-case analysis where we present five sets of responses that are unique to the linkages. Following this we perform a cross-case analysis where we compare and contrast the five linkages and as a result of this develop a set of principles that eventually lead to the propositions regarding the distinctive level of visibility and the ability to offer a sustainable competitive advantage.

4 Within-case analysis

Our analysis focused on the antecedents of visibility; the level of visibility; the performance benefits of such visibility; and from a resource-based theory perspective the potential of such visibility for providing the linkage with sustainable competitive advantage is discussed.

4.1 Case: RetailCo–ManCo supply chain linkage #1

ManCo supplied instant coffee in a range of product sizes to RetailCo, via its various distribution centers. RetailCo and ManCo both instigated numerous promotions resulting in severe sales volatility. A number of initiatives were introduced by both parties in order to improve the collaboration between them. This included technology-based enablers such as the development of a collaborative planning system (CPS); an Internet-based extranet; and non-technology-based enablers such as the appointment of a customer service coordinator (CSC).

4.1.1 Technology-based enablers of visibility

Table 1 shows the types of information shared in this linkage and the media used for sharing this information. A major element of the collaborative linkage had been the development, primarily by ManCo, of a collaborative planning internet-based extranet (CPS) which provided real-time visibility of planned and forthcoming promotions (offered by both RetailCo and ManCo). The CPS also facilitated the sharing of forecasts for the product groups and individual stock keeping units (SKUs). Once a promotion had been agreed (in terms of a jointly agreed forecast and initial product allocations) by both parties, the CPS was used to monitor daily sales, fed by RetailCo's extranet, and to trigger (via email) the production of more products or to cease production if sales were not reaching previously agreed targets. Additionally, email and fax were used to share very specific and detailed information between respective departments in and between both ManCo and RetailCo.

Table 1. Case analysis display

Linkage	Types of information shared (upstream)	Types of information shared (downstream)	Technology used for information sharing	Non-technology enablers of information sharing	Perceived level of visibility	Impact on operational performance
RetailCo– ManCo	Adv notice service failure, ASN (DC to DC), promotional uplift info, suggested orders, advertising activities, filling plans, order invoices, promotional forecast, promotional plans, stock avail/order, new product info, rolling forecasts	DC service level, DC stock, depot profiles, layer and pallet multiples, performance data, POS, store stocks, forecast, future range, live range, rolling forecasts	Collaborative planning system (CPS), web-based EDI (Internet), EDI. Fax, email	Face-to-face meetings, telephone, customer service coordinator	High and distinctive. Useful and high quality information shared. Satisfied RBT VRINN qualification	Reduced inventory levels, quality issues, increased product availability
ManCo– GlassCo	Cost drivers, other business KPIs, production plans, quality KPIs, stock levels	Actual fills, consignment stock levels, filling schedules, net monthly requirement, brand performance, filling line performance, rolling forecasts, supplier development info	Web-based EDI (Internet), EDI	Face-to-face	Relatively low. Lack of full access to information. Did not satisfy RBT VRINN qualification	Improved responsiveness
ManCo– LabelCo	Printing volumes, printing yields, stock available	Approval of repro changes, delivery requirements, forecasts, line changes, net monthly requirement, packaging design changes, product orders, promotional plans, consignment stock levels, production schedule, quality requirements	email	Phone, mail	Relatively low. Lack of full access to information. Did not satisfy RBT VRINN qualification	Reduced inventory levels
ManCo– LidCo	Lead-time, stock levels	Orders, product development plans, net monthly requirement, production schedule	EDI	Face-to-face, mail	Very low visibility	No visible impact

ManCo– BoardCo	Case details pallet configurations	Packaging changes, promotional plan changes, RetailCo's POS, revised prom. forecasts, obsoletes/discontinues, product orders, promotional plans, net monthly requirement, production plan, production schedule, annual usages	Collaborative planning system (CPS), EDI	Customer service manager	High and distinctive. Useful and high quality information shared. Satisfied RBT VRINN qualification	Reduced inventory levels, increased flexibility and improved product availability
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The CPS was the main technology-based enabler of visibility for the linkage. Using the 'RBT VRINN' framework, it is argued that the CPS was certainly valuable to the linkage in the sense that it increased both efficiency (seen in reduced levels of inventory at the end of a promotion) and effectiveness (seen in improved levels of availability of products on RetailCo's shelves). While collaborative planning has grown across the grocery and consumer packaged goods industries very few such initiatives have focused on the issue of promotions in so much detail and with such success, and therefore the CPS was certainly rare. The CPS was not imperfectly mobile and had been offered to some of ManCo's other retail customers. The main benefactor of this was ManCo in terms of getting most of its large customers that are responsible for the majority of its promotions to utilize the CPS. The technology behind the CPS may be imitable but when combined with the corporate cultures and socially complex personal interactions, the CPS could provide a capability that would not be imitable and not substitutable. Hence from the RBT perspective, the capability provided by the use of CPS satisfies the 'RBT VRINN' qualification and it certainly enabled the linkage to have full access to high quality information that was perceived as beneficial and useful to both parties resulting in a 'distinctive visibility' (or a VRINN supply chain visibility) for the linkage. We argue that such visibility could lead to a sustainable competitive advantage for the linkage.

4.1.2 Other enablers of visibility

In addition to the various technologies used for sharing information, it was noted that there was still significant personal interaction between RetailCo and ManCo, centered on the customer service coordinator (CSC) who relayed considerable information between various functional departments within the linkage:

“Besides the technology, the customer service coordinator is a major source of information flow between us and RetailCo. Without this role, the visibility for both us and RetailCo would be significantly lower in terms of accurate, verified information that we can both act on” Logistics Director, ManCo

The role of the CSC was a focal point for gaining visibility for the linkage between ManCo and RetailCo. The contribution made by the CSC was certainly valuable in the sense that early warning and resolution of problems could occur, which means that the trust and integrity between ManCo and RetailCo was maintained. The idea behind the CSC is not new, but what separates the CSC from other similar occurrences was the relatively unfettered access granted to RetailCo's internal systems. The trust involved was considerable and is seen as rare. The concept of the CSC is not imperfectly mobile; however, the success of the CSC was to a large extent governed by the culture and level of trust between the two organizations. Although the CSC concept appeared to be a formal arrangement, there was a lot of informality in the way it worked. The nature of the personal relationships that the CSC had developed made the arrangement successful. It is therefore argued that the way the CSC was deployed in this linkage made it valuable, rare, imperfectly mobile, not imitable and not substitutable. Therefore, in line with RBT, the CSC can be regarded as a VRINN resource that gave the linkage a 'distinctive visibility' through the facilitation of access to useful information.

4.2 Case: ManCo–GlassCo supply chain linkage #2

GlassCo supplied two types of glass jars to ManCo, which were then filled with coffee and sold to ManCo's retail customers. With growing quality and availability issues ManCo had decided to try to

develop a more collaborative relationship with GlassCo, primarily to overcome the problems that it was experiencing with its filling line. There were many instances of the filling line being stopped due to broken glass jars. GlassCo was brought in to assist with overcoming this problem. It turned out that the filling line was not correctly setup and had nothing to do with the quality of the glass jars. The consultation with GlassCo helped to quickly resolve the problem.

4.2.1 Technology-based enablers of visibility

Unlike its relationship with RetailCo, ManCo used a more simplistic version of its CPS (i.e. extranet-based but with less functionality) to share its net monthly requirements, consignment stock balances, standard product orders, quarterly production schedule and forecast with GlassCo. As the relationship between ManCo and GlassCo continued to develop, it was planned to share additional data in the form of POS data, promotional plans, and annual brand plans via the simplified CPS. This was not happening due to the belief that GlassCo were not sufficiently sophisticated (in terms of using the CPS technology) nor capable of handling the POS data and promotional plans. There was also the belief that only GlassCo's volumes were impacted by ManCo's promotional activities and that there was limited benefit to be derived from sharing the additional information. GlassCo used EDI to share its stock levels and order fill rates with ManCo.

The key enabler of the visibility derived from this linkage is the simplistic version of the CPS developed by ManCo. By its very nature the more simplistic version, whilst it was still relatively valuable in terms of improving the performance of both ManCo and GlassCo it was not as valuable or as rare as the full-versioned CPS. The simplistic version of the CPS is also seen as being more imitable than the full-versioned CPS. For comparison purposes, the simplistic version of the CPS is close to some of the publicly available systems that support the concept of Collaborative Planning Forecasting and Replenishment (CPFR). From a technology point of view the simplistic version of the CPS is seen as substitutable. Also, from the behavioral characteristics point of view, less commitment was made by both parties to collaborate. The use of the simplified CPS in this linkage had some operational performance impacts including improved responsiveness and reduced inventory levels for ManCo and GlassCo. However, the simplified CPS did not satisfy the RBT VRINN qualification and it did not enable full access to high quality and useful information (some of the informants commented that a large portion of relevant information could not be accessed via the CPS). Therefore, it could not provide the linkage with a 'distinctive visibility'. Hence, the potential of the linkage to enjoy a sustainable competitive advantage through supply chain visibility was limited.

4.2.2 Other enablers of visibility

In addition to the various technologies used for sharing information, it was noted that there was a moderately high level of interaction between ManCo and GlassCo. The detail of the information shared by GlassCo in regular monthly face-to-face meetings with ManCo is displayed in **Table 1**. The face-to-face meetings enabled personal interactions and relationships to be developed. These had the potential of providing a distinctive visibility for the linkage if they had been well exploited. There is no doubt that they were valuable and that the information shared enabled GlassCo to better align their production and replenishment. However, using the RBT VRINN framework, relationships derived from face-to-face meetings were neither rare nor imperfectly mobile because there was nothing special or complex about the relationships. They were based on formal arrangements that could be easily copied.

It is argued that other manufacturers who used glass containers could, in time, develop similar relationships. The face-to-face meetings did not provide a distinctive visibility for this particular linkage.

4.3 Case: ManCo–LabelCo supply chain linkage #3

LabelCo supplied a range of plastic labels to ManCo. These had product details printed on them including additional promotional materials. The labels were placed on the glass jars during the filling process. The long-term goal was to develop a vendor managed inventory approach, where LabelCo would then actively manage ManCo's inventory of plastic labels. In addition to this, ManCo were looking to create visibility of the promotional planning process for LabelCo.

4.3.1 *Technology-based enablers of visibility*

Table 1 shows the detail of the types of information shared in this linkage. Email was the main medium used to share the information. The plan was to share more information such as promotional plans via the CPS developed jointly by ManCo and RetailCo as the relationship between ManCo and LabelCo continued to develop. LabelCo did not yet possess the capability to take the data straight into its own production planning processes. Although the information was only shared via email, it was valuable in that it enabled LabelCo to better align its production schedule with that of ManCo. Using the RBT VRINN framework, it is argued that the email as a resource is not rare or imperfectly mobile, and is certainly imitable. As the email is not rare and is imitable it can be said to be substitutable. Also, there was no evidence that the use of this resource provided any kind of VRINN capability. It is not surprising, therefore, to find that the use of the email in this linkage did not provide a 'distinctive visibility' for the linkage as it was also limited in terms of the amount of useful information that it could facilitate. However, the linkage saw some operational performance improvements in terms of lower operational costs from a reduction in inventory levels. These were attributed to the use of email as it provided some level of visibility albeit not distinctive:

“We saw a significant drop in the level of finished goods inventory, mostly because we now have better visibility of their (ManCo's) needs.” Logistics Manager: LabelCo.

4.3.2 *Other enablers of visibility*

Promotional plans, packaging design changes, line changes and approval of reproduction proof changes were shared via the telephone although for record purposes were verified by use of email. ManCo's quality specifications were also shared through regular mail with LabelCo. The personal relationships between the employees from ManCo and LabelCo were the main focus of this linkage in terms of creating visibility. The relationship focused on the sharing of information about promotions. There is no doubt that this was valuable in the sense that it allowed LabelCo to be more responsive to changes in promotional plans and to better align their production schedules with those of ManCo. However, the analysis of the interview transcripts and a review of email documents did not reveal anything (such as evidence of informal social relationships, etc.) that indicated a special relationship that might be difficult to substitute. It is argued that other manufacturers who used paper labels could, in time, develop similar relationships that LabelCo had with ManCo. We find, therefore, that the relationships and personal interactions as practiced did not help in providing the linkage with a 'distinctive visibility', especially as several informants commented that the information being shared

often lacked clarity. Hence in line with RBT the potential for the linkage to gain sustainable competitive advantage through visibility was limited.

4.4 Case: ManCo–LidCo supply chain linkage #4

LidCo supplied ManCo with plastic lids which were attached to the glass jars after they were filled with coffee and sealed with a metallized paper seal. The lids had the products brand logo on them. Whilst LidCo was the sole supplier for plastic and paper labels for ManCo's beverage products, it was a relatively small company and was seen as being less sophisticated by ManCo. There was no significant collaboration between ManCo and LidCo, despite LidCo being a sole supplier of plastic lids. Any interdependency between the two companies was clearly not recognized, and the prevailing nature of the relationship was due to the prevailing power of ManCo.

4.4.1 Technology-based enablers of visibility

ManCo only shared orders with LidCo via EDI and had no plans to change this, or to use its CPS. The reason cited for this is that promotions had little perceived impact on the number of plastic lids supplied by LidCo, as there were no promotional materials printed on the plastic lids. Using the RBT VRINN framework, we argue that the use of EDI to facilitate visibility in this linkage was valuable but not rare. EDI is imitable and is certainly substitutable. There was no evidence to suggest that other behavioral factors were associated with the use of EDI in this linkage. Also, the use of EDI did not solve the problems of inadequacy and low quality of information being shared. Hence, the visibility achieved through the deployment of this resource was not 'distinctive' and the linkage, therefore, had limited potential of gaining a sustainable competitive advantage through the visibility achieved. There was no evidence that the visibility gained or lack of it had an impact on the operational performance of the linkage.

4.4.2 Other enablers of visibility

Bi-weekly meetings and mail were also used to share information. The value provided by the use of mail is questionable as its use cannot be considered rare and was certainly not imperfectly mobile. The use of mail as a resource was easily imitable and therefore along with the lack of rarity, was substitutable.

4.5 Case: ManCo–BoardCo supply chain linkage #5

BoardCo supplied corrugated board to ManCo in the form of trays, on which the finished product was placed. The trays had significant amounts of promotional information printed on them. The relationship between ManCo and BoardCo was the most sophisticated of all the supplier relationships that ManCo had. The transformation of the relationship occurred when ManCo realized how dependent it was on BoardCo in terms of promotional activity. ManCo was unaware of the impact of the lack of availability of corrugated board with promotional designs during promotional periods, and had underestimated the impact of changing packaging designs, resulting in a 2 week delay whilst a new printing plate was manufactured. There was also the possibility of a stock-out for RetailCo due to delayed shipments.

4.5.1 Technology-based enablers of visibility

ManCo's CPS was used to share its net monthly requirements together with standard product orders with BoardCo. BoardCo shared details of its pallet configurations and case details with ManCo via the

CPS. BoardCo also had real-time access to ManCo's CPS, which provided them with advanced warning of promotions, and more importantly any ongoing changes to promotional plans, such as revised forecasts and even live POS data from the first few days of a promotion. Whilst the quarterly production and scheduling plans were shared by way of email, there was a plan to make these available via the CPS. Using the RBT VRINN framework, the use of ManCo's CPS as a resource was found to be valuable and it impacted on operational performance in that it enabled levels of inventory to be reduced whilst levels of product availability to ManCo were improved. Perhaps the technology upon which the CPS itself was based might not have been rare, but evidence from the case suggests that the capability developed in the linkage as a result of behavioral factors that were associated with its deployment and use (including compatible companies' cultures and social complex personal relationships developed) appeared to be imperfectly mobile, not imitable and not substitutable. The capability developed through the CPS not only satisfied the VRINN qualification, it enabled both companies in the linkage to have full access to high quality and useful information resulting in a 'distinctive visibility'. The visibility gained impacted positively on operational performance (i.e. reduced inventory levels, increased flexibility of response and improved product availability) and had the potential of providing a sustainable competitive advantage.

4.5.2 Other enablers of visibility

In addition to the various technologies used for sharing information, it was noted that there were also significant personal interactions between ManCo and BoardCo. These interactions centered on BoardCo's Customer Service Manager (CSM), who similar to ManCo's CSC, spent at least 2 days a week at ManCo's head office and shared considerable information between various functional departments within both ManCo and BoardCo. An example of this face-to-face information sharing was the updating of packaging change notifications. This enabled BoardCo to keep up-to-date with changes made to packaging specifications required by ManCo. The role of the CSM was a focal point for gaining distinctive visibility for the linkage between ManCo and BoardCo. Using the RBT VRINN framework, it is argued that the contribution made by the CSM was certainly valuable in the sense that early warning and resolution of problems could occur, which means that the trust and integrity between ManCo and BoardCo was maintained and reinforced. The idea behind the CSM's role is not new, but what separated the CSM from other similar occurrences was the relatively unfettered access granted to ManCo's employees. Although this did not extend to internal systems the access to employees was extensive, enabling the CSM to verify large amounts of information. The trust involved was considerable and is seen as rare. The concept of the CSM itself was certainly not imperfectly mobile; however, the success of the CSM was to a large extent governed by the culture and the level of trust between the two organizations. Evidence from the interview analysis suggests that the level of trust was very high and it is therefore argued that in this linkage, the way the CSM was deployed provided a capability that was imperfectly mobile. The nature of the personal relationships that the CSM developed had also resulted in a capability that could not easily be copied. For example, evidence from the interview analysis shows that the CSM was perceived to be of a good character by ManCo employees. The CSM often went out for social activities with ManCo representatives. The likable personality of the CSM was clearly instrumental in fostering the relationship. This is a capability that is not easily substitutable and it enabled the sharing of high quality and useful information resulting in distinctive visibility within the linkage. This visibility enabled a quality management program to be

successfully implemented and it helped BoardCo to win an increased volume of business from ManCo, outside of the products considered here.

5 Development of propositions

This study is focused on the concept of distinctive visibility. We use RBT to argue that only resources and capabilities that are VRINN would be capable of providing a distinctive visibility for a supply chain linkage. Such visibility we argue has the potential of providing the linkage with a sustainable competitive advantage. Therefore our first proposition is:

***P1 1.** A distinctive visibility is required in a supply chain linkage to achieve a sustained competitive advantage for the firms involved in the linkage.*

This is a theoretical proposition because this relationship was not explored empirically in this study. It is interesting to see from the study that distinctive visibility was not present in those linkages (**Table 1**) where information sharing was mainly based on the use of resources that were not accompanied by special personal relationships, informal procedures, social interactions and high levels of trust. There may be some level of visibility and positive impact on operational performance in such linkages. However, due to the lack of distinctive visibility, the potential to achieve a sustainable competitive advantage in such linkages may be limited.

***P2 1.** The use of certain resources or mechanisms can aid visibility and even improve operational performance in supply chain linkages which may not lead to a sustainable competitive advantage because the visibility achieved is not distinctive.*

Table 1 shows that linkages 1 and 5 (i.e. RetailCo–ManCo and ManCo–BoardCo) clearly used the more sophisticated type of resources to aid the visibility in their linkages (i.e. the CPS, CSC and CSM). It is not surprising then to observe that these linkages had distinctive or relatively higher levels of visibility than the other linkages studied. The parties in the linkages had full access to useful and high quality information. However, the distinctive visibility did not simply result from the use of the mechanisms. The use of these mechanisms from the perspective of the resource-based theory would not by themselves provide a distinctive visibility (i.e. the type of visibility that can provide a sustained competitive advantage). This is because although they appeared to be valuable, they were not imperfectly mobile, were imitable, not rare and were substitutable.

What appears to be the antecedent of distinctive visibility in these linkages is actually the way that the mechanisms were deployed in the linkages. Interview analysis shows that trust and commitment were central to the successful use of the mechanisms. For instance, the BoardCo's CSM in the ManCo–BoardCo linkage was an individual with a likable character who simply got on very well with the people that he worked with in the linkage. Although there was a formal contract that guided the operations of the CSM, the success of it was due more to the informal relationships that were developed. These built the trust that was required to foster the sharing of data in the linkage. The way the mechanisms were deployed provided the linkages with unique capabilities that were not only valuable but rare, imperfectly mobile, not imitable and not substitutable. This is an antecedent of distinctive visibility in these two linkages.

P3 1. Informal procedures, appropriate behavioral patterns, trust and commitment are needed to support the deployment of relevant resources in order to provide a distinctive visibility for a supply chain linkage.

Our analyses reveal that the absence of distinctive visibility in some of the linkages studied may be due to the relatively low perceived level of interdependencies between the firms in the linkages. The dominant player ManCo in these linkages appeared not to be interested in developing closer relationships with the organizations in some linkages because it perceived the linkages to be of less strategic importance. For example, data analysis reveals that BoardCo (a sole supplier for ManCo) had significantly grown its volume with ManCo to approximately 70% of its total volume. LidCo, LabelCo and GlassCo were all sole suppliers for ManCo, but also supplied other grocery manufacturers, however their volumes with ManCo did not exceed 20%. Therefore, the inter-dependency between BoardCo and ManCo was high compared to the other linkages. It is, therefore, not surprising to see that both parties in the BoardCo and ManCo linkage put in relatively more effort and commitment into making the relationship work thus ensuring high visibility of the linkage compared to the other linkages. Thus, a high level of inter-dependency is an antecedent of distinctive visibility.

P4 1. The deployment of appropriate resources and mechanisms and the achievement of distinctive visibility in a particular linkage are related to the perceived strategic importance or interdependency of the partners involved in the linkages.

5.1 Discussions and conclusions

Many studies have looked at the relationship between information sharing and performance (**Gustin et al., 1995; Bourland et al., 1996; Closs et al., 1997; Chen, 1998; Aviv and Federgruen, 1998; Gavirneni et al., 1999; Gilbert and Ballou, 1999; Cachon and Fisher, 2000; Chen et al., 2000; Lee et al., 2000**). The missing link in many of these studies is the link between information sharing and visibility. In this paper we have improved on previous research by empirically showing that the outcome of information sharing is visibility which then could lead to an improved operational performance of a supply chain. We defined supply chain visibility as “the extent to which actors within a supply chain have access to or share information which they consider as key or useful to their operations and which they consider will be of mutual benefit”. We know from previous studies (e.g. **Mabert and Venkataramanan, 1998; Shore and Venkatachalam, 2003**) that the deployment of certain resources in supply chain linkage enables information to be shared which could provide an improved performance for the linkage. We argue, however, that the deployment of the resources may not be capable of providing a sustainable competitive advantage for the linkage involved. This is because with time, resources are potentially imitable, not rare, not imperfectly mobile and are substitutable (i.e. the VRINN framework **Rungtusanatham et al., 2003**). Therefore, the visibility that such resources provide tends not to be distinctive. We have also contributed to the research in this area by introducing the concept of distinctive visibility. We have used five case studies to look for data to fit the VRINN framework developed from the resource-based theory literature (**Rungtusanatham et al., 2003**) to identify those resources and capabilities that could give a supply chain linkage distinctive visibility. That is, the resources must be valuable, rare, imperfectly mobile, not imitable and not substitutable. Based on the RBT, we argue that such distinctive visibility has the potential of not only providing a supply chain with an improved operational performance but also with a sustainable competitive advantage. By

borrowing RBT from the strategy literature to explore this relationship, this study has contributed to an important area in supply chain management.

Other theories such as transaction cost economics (**Williamson, 1981**) could have been used to explore the impact of a range of levels of visibility on the transaction costs between a customer and a supplier in a supply chain linkage. Any reduction in transaction costs could then be seen as a source of competitive advantage. However, RBT seems to provide the best framework (i.e. **Rungtusanatham et al., 2003** VRINN) for addressing our research question in terms of the identification of resources and how the rent generating potential of such resources and capabilities can lead to sustainable competitive advantage (**Wernerfelt, 1984; Barney, 1991; Grant, 1991**).

The results obtained from this research are insightful. For example, we find that not all technological and non-technological resources employed in a supply chain linkage have the potential of providing a distinctive visibility for the supply chain and as an extension, a sustainable competitive advantage. We find that while their use may lead to an improved supply chain operational performance, the use of resources and capabilities that do not meet the VRINN criteria of the RBT may not provide a supply chain with a distinctive visibility and a sustainable competitive advantage. We also find that the manner in which resources are deployed in a supply chain linkage is important in the achievement of distinctive visibility and sustainable competitive advantage. For example, we find that using intangible assets and resources such as informal procedures (e.g. ManCo's Customer Service Coordinator's informal discussions with RetailCo's employees) and appropriate behavioral patterns (e.g. ManCo's Customer Service Coordinator's not abusing the trust afforded by RetailCo's decision to allow them open access to their internal systems) in deploying relevant resources tends to provide a linkage with distinctive visibility.

Finally, we argue that an organization may be involved with many linkages in its supply chain. However, the level of visibility that it enjoys may differ across the linkages. The differences depend on the strength of a particular linkage as it relates to the deployment of resources (technology and non-technology) as well as time spent in developing the relationship, informal procedures, trust and commitment of the partners involved in the relationship.

6 Limitations and further studies

The use of case studies to examine the antecedents has some very obvious limitations. The issue of generalizability is one. Also, measures of key variables were based largely on interview data collected from several informants and in some cases on our observations and the analysis of documents. However, this study relies on analytical generalization (**Yin, 1989**) and was exploratory in nature seeking to identify linkages between variables. Thus, it is suggested that the propositions developed be tested statistically by means of a survey that utilizes a larger sample and in different contexts other than retail supply chains to improve their external validity. The scope of this study was limited to exploring the relationship between certain mechanisms and distinctive visibility. In future studies, to follow **Eisenhardt (1989)** recommendations for theory building, the relationship between distinctive visibility and competitive advantage also needs to be investigated from a dual theoretical perspective of resource-based theory together with, for example, transaction cost economics (**Williamson, 1985**).

It would also be of interest to consider the issue of visibility across internal linkages and the potential for sustainable competitive advantage.

Appendix A. Interview Tool

General information and overview

1. Get company background—history, # of employees, annual sales, products. What are your roles and responsibilities across the linkage?

Antecedents of information sharing/visibility

2. Through which medium is information shared? How effective is this medium? How unique is this medium to the linkage? What other factors facilitate the exchange of information in the linkage? How unique are these factors to the linkage?

Current and Potential Information shared

3. What information is shared and should be shared? Between whom? When and how frequently? In what format? What is the quality of the information shared? Is the information time sensitive?

4. How is the information used? If not –why not? What are the barriers to using shared information in the supply chain? What would need to change to make the information usable? For what purpose is the information used? What mechanisms are in place for using the information?

Benefits from information sharing

5. In what ways does/would information sharing between supply chain partners enhance their business activities? What are the potential benefits of sharing information with supply chain partners? What are the actual benefits (e.g. operational performance) accruing from information being shared across the supply chain?

6. Are there any disadvantages from sharing information with supply chain partners?

7. What has been the impact of sharing information across the supply chain? What is the perceived usefulness of the information that is shared?

8. What are the key enablers of information sharing/exchange in the supply chain?

Visibility across the linkage

9. How much visibility has been gained from sharing this information? How useful is this visibility?

10. What operational performance benefits are derived from the visibility arising from the information sharing across the linkage?

References

- R. Amit, P.J.H. Schoemaker. Strategic assets and organizational rent. *Strategic Management Journal*. 1993; **14**: 33– 46.
- C.G. Armistead, J. Mapes. The impact of supply chain integration on operating performance. *Logistics Information Management*. 1993; **6**(4): 9– 14.
- Y. Aviv. The effect of collaborative forecasting on supply chain performance. *Management Science*. 2001; **47**(10): 1326– 1343.
- Y. Aviv. Gaining benefits from joint forecasting and replenishment processes: the case of auto-correlated demand. *Manufacturing and Service Operations Management*. 2002; **4**(1): 55– 74.
- Y. Aviv, A. Federgruen. In The benefits of design for postponement. S. Tayur, M. Magazine, R. Ganeshan, eds. *Quantitative Modelling for Supply Chain Management*, Kluwer Academic Publishers. 1998.

- J. Bailey, S. Pearson. Development of a tool for measuring and analyzing computer user satisfaction. *Management Science*. 1983; **29**(5): 530– 545.
- J. Barney. Resource-based theories of competitive advantage: a ten year retrospective on the resource-based view. *Journal of Management*. 2001; **27**: 643– 650.
- J.B. Barney. Firm resources and sustained competitive advantage. *Journal of Management*. 1991; **17**(1): 99– 120.
- M.A. Barratt, A. Oliveira. Exploring the experiences of collaborative planning initiatives. *International Journal of Physical Distribution and Logistics Management*. 2001; **31**(4): 266– 289.
- A. Barua, S. Ravindran. Reengineering information sharing behavior in organizations. *Journal of Information Technology*. 1996; **11**: 261– 272.
- D. Berry, D.R. Towill, N. Wadsley. Supply chain management in the electronics products industry. *International Journal of Physical Distribution and Logistics management*. 1994; **24**(10): 20– 32.
- K.E. Bourland, S.G. Powell, D.F. Pyke. Exploiting timely demand information to reduce inventories. *European Journal of Operational Research*. 1996; **92**(2): 239– 253.
- G.P. Cachon, M. Fisher. Supply chain inventory management and the value of shared information. *Management Science*. 2000; **46**(8): 1032– 1048.
- F. Chen. Echelon reorder points, installation reorder points, and the value of decentralized demand information. *Management Science*. 1998; **44**(12): 1221– 1234.
- F. Chen, Z. Drezner, J.K. Ryan, D. Simchi-Levi. Quantifying the bull-whip effect in a simple supply chain: the impact of forecasting, lead-times and information. *Management Science*. 2000; **46**(3): 436– 443.
- K.I. Cheung, H.L. Lee. The inventory benefit of shipment coordination and stock rebalancing in a supply chain. *Management Science*. 2002; **48**(2): 300– 306.
- T.Y. Choi, Y. Hong. Unveiling the structure of supply networks: case studies in Honda, Acura and DaimlerChrysler. *Journal of Operations Management*. 2002; **20**: 469– 493.
- A. Clark, H. Scarf. Optimal policies for a multi-echelon inventory problem. *Management Science*. 1960; **46**(3): 475– 490.
- T.H. Clark, J. Hammond. Reengineering channel reordering processes to improve total supply chain performance. *Production Operations Management*. 1997; **6**(1): 248– 265.
- D.J. Closs, T.J. Goldsby, S.R. Clinton. Information technology influences on world class logistics capability. *International Journal of Physical Distribution and Logistics Management*. 1997; **27**(1): 4– 17.
- D.A. Collier. Research issues for multi-level lot sizing in MRP systems. *Journal of Operations Management*. 1982; **2**(2): 113– 123.
- K.R. Conner. A historical comparison of resource-based theory and five schools of thought within industrial organization economics: do we have a new theory of the firm?. *Journal of Management*. 1991; **17**: 121– 154.
- K.R. Conner, C.K. Prahalad. A resource-based theory of the firm: knowledge versus optimism. *Organization Science*. 1996; **7**: 477– 501.
- C.J. Corbett, C.S. Tang. In Designing supply contracts: contract type and information asymmetry. S. Tayur, R. Ganeshan, M. Magazine, eds. *Quantitative Models for Supply Chain Management*. Norwell, MA: Kluwer Academic Publishers. 1999, 270– 297.
- R. Croson, K. Donohue. Impact of pos data sharing on supply chain management: an experimental study. *Production and Operations Management*. 2003; **12**(1): 1– 11.

- A. Curry, C. Moore. Assessing information culture—an exploratory model. *International Journal of Information Management*. 2003; **23**: 91– 110.
- G.S. Day. The capabilities of market-driven organizations. *Journal of Marketing*. 1994; **58**(10): 37– 52.
- J. Dejonckheere, S.M. Disney, M.R. Lambrecht, D.R. Towill. The impact of information enrichment on the bullwhip effect in supply chains: a control engineering perspective. *European Journal of Operational Research*. 2004; **153**(3): 727– 746.
- K.M. Eisenhardt, C.B. Schoonhoven. Resource-based view of strategic alliance formation: strategic and social effects in entrepreneurial firms. *Organization Science*. 1996; **7**(2): 136– 150.
- K.M. Eisenhardt. Building theories from case study research. *Academy of Management Review*. 1989; **14**(4): 532– 550.
- L.M. Ellram, B.J. La Londe, M.M. Weber. Retail logistics. *International Journal of Physical Distribution and Materials Management*. 1989; **19**(12): 29– 39.
- M.A. Emmelhainz. Electronic data interchange: does it change the purchasing. *Journal of Purchasing and Materials Management*. 1987; **23**(4): 2– 8.
- D. Eylon, S.T. Allison. The paradox of ambiguous information in collaborative and competitive settings. *Group and Organization Management*. 2002; **27**(2): 172– 208.
- S.E. Fawcett, G.M. Magnan. The rhetoric and reality of supply chain integration. *International Journal of Physical Distribution and Logistics Management*. 2002; **32**(5): 339– 361.
- P. Fiala. Information sharing in supply chains. *Omega*. 2005; **33**: 419– 423.
- J.W. Forrester. Industrial dynamics. *Harvard Business Review* July–August 1958; 37– 66
- D.C. Galunic, S. Rodan. Resource recombinations in the firm: knowledge structures and the potential for Schumpeterian innovation. *Strategic Management Journal*. 1998; **19**: 1193– 1201.
- L.L. Gao, E.P. Robinson. An arborescent network formulation of dual accent based procedure for the two stage multi-item dynamic demand lot-size problem. *Decision Sciences*. 1994; **25**(1): 103– 121.
- S. Gavirneni, R. Kapuscinski, S. Tayur. Value of information in capacitated supply chains. *Management Science*. 1999; **45**(1): 16– 24.
- S. Gavirneni. Information flows in capacitated supply chains with fixed ordering costs. *Management Science*. 2002; **48**(5): 644– 651.
- S.M. Gilbert, R.H. Ballou. Supply chain benefits from advanced customer commitments. *Journal of Operations Management*. 1999; **18**(1): 61– 73.
- Glaser, B.G., Strauss, A.L., 1967. The discovery of grounded theory: strategies for qualitative research. Aldine, Chicago.
- R.M. Grant. The resource-based theory of competitive advantage: implications for strategy formulation. *California Management Review*. 1991; **33**(3): 114– 135.
- R.M. Grant. Towards a knowledge-based theory of the firm. *Strategic Management Journal*. 1996; **17**: 109– 122.
- Grant, R.M., Baden-Fuller, C., 1995. A knowledge-based theory of inter-firm collaboration. *Academy of Management Best Paper Proceedings*, pp. 17–21.
- C.M. Gustin, P.J. Daugherty, T.P. Stank. The effects of information availability on logistics integration. *Journal of Business Logistics*. 1995; **16**(1): 1– 21.
- Hammond, J.H., 1990. Quick response in the apparel industry. Harvard Business School Note N9-690-038, Cambridge, MA.
- S.G. Harris, R.I. Sutton. Functions of parting ceremonies in dying organizations. *Academy of Management Journal*. 1986; **29**: 5– 30.

- C.A. Hill, G.D. Scudder. The use of electronic data interchange for supply chain coordination in the food industry. *Journal of Operations Management*. 2002; **20**(4): 375– 387.
- J. Holmstrom, K. Framling, R. Kaipia, J. Saranen. Collaborative planning forecasting and replenishment: new solutions needed for mass collaboration. *Supply Chain Management*. 2002; **7**(3/4): 136– 145.
- J. Hoyt, F. Huq. From arms length to collaborative relationships in the supply chain: an evolutionary process. *International Journal of Physical Distribution and Logistics Management*. 2000; **30**(9): 750– 764.
- Z. Huang, A. Gangopadhyay. A simulation study of supply chain management to measure the impact of information sharing. *Information Resources Management Journal*. 2004; **17**(3): 20– 31.
- A. Jeuland, S.M. Shugan. Managing channel profits. *Marketing Science*. 1983; **2**(3): 239– 272.
- M. Karkkainen. Increasing efficiency in the supply chain for short shelf life goods using RFID tagging. *International Journal of Retail & Distribution Management*. 2003; **31**(10): 529– 537.
- J.L. Kent, J.T. Mentzer. The effect of investment in inter-organizational information technology in a retail supply chain. *Journal of Business Logistics*. 2003; **24**(2): 155– 176.
- S.C. Kulp, H.L. Lee, E. Ofek. Manufacturer benefits from information integration with retail customers. *Management Science*. 2004; **50**(4): 431– 444.
- Kurt Salmon Associates. *Efficient Consumer Response: Enhancing Consumer Value in the Grocery Industry*. Washington DC: Food Marketing Institute. 1993.
- H.L. Lee, C. Billington. Material management in decentralized supply chains. *Operations Research*. 1993; **41**(5): 835– 847.
- H.L. Lee, V. Padmanabhan, S. Whang. The bullwhip effect in supply chains. *Sloan Management Review*. 1997; **38**(3). pp. 93–102.
- H.L. Lee, V. Padmanabhan, S. Whang. Information distortion in a supply chain. *Management Science*. 1997; **43**(4): 546– 558.
- H.L. Lee, K.C. So, C.S. Tang. The value of information sharing in a two level supply chain. *Management Science*. 2000; **46**(5): 626– 643.
- G. Lorenzoni, A. Lipparini. The leveraging of inter-firm relationships as a distinctive organizational capability: a longitudinal study. *Strategic Management Journal*. 1999; **20**: 317– 338.
- V.A. Mabert, M.A. Venkataramanan. Special research focus on supply chain linkages: challenges for design and management in the 21st century. *Decision Sciences*. 1998; **29**(3): 537– 552.
- R. Mason-Jones, D.R. Towill. Information enrichment: designing the supply chain for competitive advantage. *Supply Chain Management*. 1997; **2**(4): 137– 148.
- R. Mason-Jones, D.R. Towill. Time compression in the supply chain: information management is the vital ingredient. *Logistics Information Management*. 1998; **11**(2): 93– 104.
- D.M. McCutcheon, J.R. Meredith. Conducting case study research in operations management. *Journal of Operations Management*. 1993; **11**(3): 239– 256.
- J.T. Mentzer, S. Min, L.M. Bobbitt. Toward a unified theory of logistics. *International Journal of Physical Distribution and Logistics Management*. 2004; **34**(7/8): 606.
- J.T. Mentzer, S. Min, Z.G. Zacharia. The nature of inter-firm partnering in supply chain management. *Journal of Retailing*. 2000; **76**(4): 549– 568.
- J.R. Meredith. Building operations management theory through case and field research. *Journal of Operations Management*. 1998; **16**(4): 439– 452.
- M. Miles, A.M. Huberman. *Qualitative Data Analysis*. Beverly Hills, CA: Sage Publications. 1984.

- C.R. Moberg, B.D. Cutler, A. Gross, T.W. Speh. Identifying antecedents of information within supply chains. *International Journal of Physical Distribution and Logistics Management*. 2002; **32**(9): 755– 770.
- J. Mohr, R.S. Sohi. Communication flows in distribution channels: impact on assessments of communication quality and satisfaction. *Journal of Retailing*. 1995; **71**(4): 393– 416.
- R.M. Monczka, J.R. Carter. Implementing electronic data interchange. *Journal of Purchasing and Materials Management*. 1988; **24**(2): 2– 9.
- D.C. Mowery, J.E. Oxley, B.S. Silverman. Strategic alliances and inter-firm knowledge transfer. *Strategic Management Journal*. Winter 1996; **17**: 77– 91.
- K.A. Patterson, C.M. Grimm, T.M. Corsi. Diffusion of supply chain technologies. *Transportation Journal*. 2004; **43**(3): 5– 23.
- E.T. Penrose. *The Theory of the Growth of the Firm*. New York, NY: Wiley. 1959.
- M. Peteraf. The cornerstones of competitive advantage: a resource-based view. *Strategic Management Journal*. 1993; **14**: 179– 192.
- K.J. Petersen, G.L. Ragatz, R.M. Monczka. An examination of collaborative planning effectiveness and supply chain performance. *Journal of Supply Chain Management*. 2005; **41**(2): 14– 25.
- M.S. Poole, A.H. Van de Ven. Using paradox to build management and organization theory. *Academy of Management Review*. 1989; **14**(4): 562– 578.
- E. Prater, G.V. Frazier, P.M. Reyes. Future impacts of RFID on e-supply chains in grocery retailing. *Supply Chain Management*. 2005; **10**(2): 134– 142.
- M. Rungtusanatham, F. Salvador, C. Forza, T.Y. Choi. Supply-chain linkages and operational performance: a resource-based perspective. *International Journal of Operations and Production Management*. 2003; **23**: 1084– 1099.
- F. Sahin, E.P. Robinson. Flow coordination and information sharing in supply chains: review, implications and directions for future research. *Decision Sciences*. 2002; **33**(4): 504– 536.
- F. Sahin, E.P. Robinson. Information Sharing and coordination in make-to-order supply chains. *Journal of Operations Management*. 2005; **23**: 579– 598.
- W.S. Schulze. In The two schools of thought in resource-based theory: definitions and implications for research. P. Shrivastava, A.S. Huff, J.E. Dutton, eds. *Resource-Based Views of the Firm*. Greenwich, CT: JAI Press. 1994.
- B. Shore, A.R. Venkatachalam. Evaluating the information sharing capabilities of supply chain partners: a fussy logic model. *International Journal of Physical Distribution and Logistics Management*. 2003; **33**(9/10): 804– 824.
- R.E. Spekman, J.W. Kamauff Jr., N. Myhr. An empirical investigation in to supply chain management: a perspective on partnerships. *Supply Chain Management*. 1998; **3**(2): 53– 67.
- G. Stalk, P. Evans, E. Schulman. Competing on capabilities: the new role of corporate strategy. *Harvard Business Review* March–April 1992; 57– 69
- M. Subramani. How do suppliers benefit from information technology use in supply chain relationships?. *MIS Quarterly*. 2004; **28**(1): 45– 73.
- J.M. Swaminathan, S.R. Tayur. Models for supply chains in E-Business. *Management Science*. 2003; **49**(10): 1387– 1406.
- T. Taylor-Coates, C.M. McDermott. An exploratory analysis of new competencies: a resource based view perspective. *Journal of Operations Management*. 2002; **20**: 435– 450.
- D.R. Towill, M.M. Naim, J. Wikner. Industrial dynamics simulation models in the design of supply chains. *International Journal of Physical Distribution and Logistics Management*. 1992; **22**(5): 3– 13.

- D.J. Van der Zee, J.G.A.J. Van der Vorst. A modeling framework for supply chain simulation: opportunities for improved decision making. *Decision Sciences*. 2005; **36**(1): 65– 95.
- J. Van Maanen. In Epilogue: qualitative methods reclaimed. J. Van Maanen, ed. *Qualitative Methodology*. Beverly Hills: Sage. 1983.
- M. Waller, M.E. Johnson, T. Davis. Vendor-managed inventory in the retail supply chain. *Journal of Business Logistics*. 1999; **20**(1): 183– 203.
- L.W. Walton, L.G. Miller. Moving toward LIS theory development: a framework of technology adoption within channels. *Journal of Business Logistics*. 1995; **16**(2): 117– 136.
- B. Wernerfelt. A resource-based view of the firm. *Strategic Management Journal*. 1984; **5**: 171– 180.
- S. Whang. Coordination in operations: a taxonomy. *Journal of Operations Management*. 1995; **12**: 413– 422.
- J.M. Whipple, R. Frankel, P.J. Daugherty. Information support for alliances: performance implications. *Journal of Business Logistics*. 2002; **23**(2): 67– 82.
- O.E. Williamson. The economics of organization: the transaction cost approach. *American Journal of Sociology*. 1981; **87**(3): 548– 577.
- O.E. Williamson. *The Economic Institutions of Capitalism*. New York: Free Press. 1985.
- R. Yin. *Case Study Research: Design and Methods*. 1st ed.. Thousand Oaks, California: Sage Publications. 1989.
- Z. Yu, H. Yan, T.C.E. Cheng. Benefits of information sharing with supply chain partnerships. *Industrial Management & Data Systems*. 2000; **101**(3): 114– 119.