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Interorganisational Information Sharing and The Use of Decision Aids in Category Management

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Abstract

Most research on interorganisational information systems has primarily focused on systems that support transaction processing. What is less developed, however, is research on systems that provide interorganisational decision support. In this paper, we explore the effectiveness of these types of systems, by developing a model that introduces the relationship between interorganisational information sharing, decision aids and decisions effectiveness. Specifically, we propose that information sharing will positively influence decision effectiveness if filtering and analytical decisions aids are made available. Relevance and usefulness of the propositions are demonstrated within the category management domain.

1. Introduction

A large body of research has accumulated on the use and impact of electronic data interchange (EDI) and interorganisational information systems (IOS). Early work recognised the strategic importance of these systems (Barrett & Konsynski, 1982; Cash & Konsynski, 1985). Further research examined the theoretical links with interorganisational relationships (Bensaou & Venkatramann, 1996) and business value (Mukhopadhyay, Kekre, & Kalathur, 1995). Later, a substantial amount of empirical research supplemented these theoretical developments (Krcmar, Bjorn-Andersen, & O'Callaghan, 1995). As a result of all this work, our understanding of the development and implementation of interorganisational systems is fairly extensive.

The focus of most of this literature centers around the use of EDI and IOS for transactional processes, such as the development and implementation of purchase order systems (e.g. airline reservation systems) and inventory management systems. What is less developed in this literature, however, is the use of IOS for *decision support systems*. In this type of IOS, an organisation A shares information with organisation B to better support the decision making processes of organisation B. In this paper we address this gap in the literature by exploring these types of IOS in more detail. We develop a

preliminary conceptual model for interorganisational decision support systems, and we illustrate the usefulness of this model by deriving three propositions that associate interorganisational information sharing with decision making performance.

The relevance of this type of IOSs can be illustrated by examining current developments in the retail sector. Over the past decade the retail sector has been witnessing the rise of *category management*, often considered to be a cornerstone of Efficient Consumer Response (ECR) initiatives (see e.g. www.ecrweb.org). A category is a collection of interrelated brands, such as soft drinks, dairy, or pet food. Rather than managing the performance of a single brand in the category, retailers find it increasingly useful to manage the performance of the category as a whole. Among other benefits, this reduces suboptimal brand purchase decisions and offers greater insight in demand fluctuations (Zenor, 1994).

The quality of category management decisions depends on the quality of data that the partners in the retail supply chain are able to provide. Unfortunately, this data is not only difficult to aggregate and assemble because of its sheer size and variety, it is also widely dispersed among the partners in the retail supply chain. Most category managers are therefore confronted with vast amounts of low quality data. The need for interorganisational decision support systems to address this issue has been recognised both in the academic literature (Basuroy, Mantrala, & Walters, 2001) and in practice (ECR-Europe, 1997; Longo, 2002). In this paper we illustrate our model for interorganisational decision making by focusing on category management specifically.

Studies on a variety of category management topics can be found in the literature. Dussart (1998) reviewed the expansion of category management across product categories on a world-wide scale (Dussart, 1998). According to Dussart two basic considerations are emerging in the "ongoing process of building a revised theory of category management": The absolute need for a composite strategy and the need for a more consumer driven focus. Gruen and Shah (2000) examined factors affecting category performance (Gruen & Shah, 2000). Their findings indicate that implementation of category plans have a stronger impact on category performance than did the objectivity of the category plans. Dhar et al. (2001) analyzed variations in category performance across retailers. Based on this analysis they inferred key drivers of effective category management and found that the role a category plays in a store's overall portfolio influences the impact on price, promotion and assortment variables (Dhar, Hoch, & Kumar, 2001).

Prior work on the role of decision support systems in category management is rare. To the best of our knowledge we know of only one academic study on decision support systems in category management. Jiang et al. (1998) describe a prototype system that allows category managers to manage complex models and scanner data to make forecasts (Jiang, Klein, & Pick, 1998).

2. Model

Figure 1 presents our model on the antecedents of category management effectiveness. In this section we will first elobarate on the constructs in this model. We do so by illustrating these constructs with examples from the category management literature. Section 3 will derive three propositions from the model.

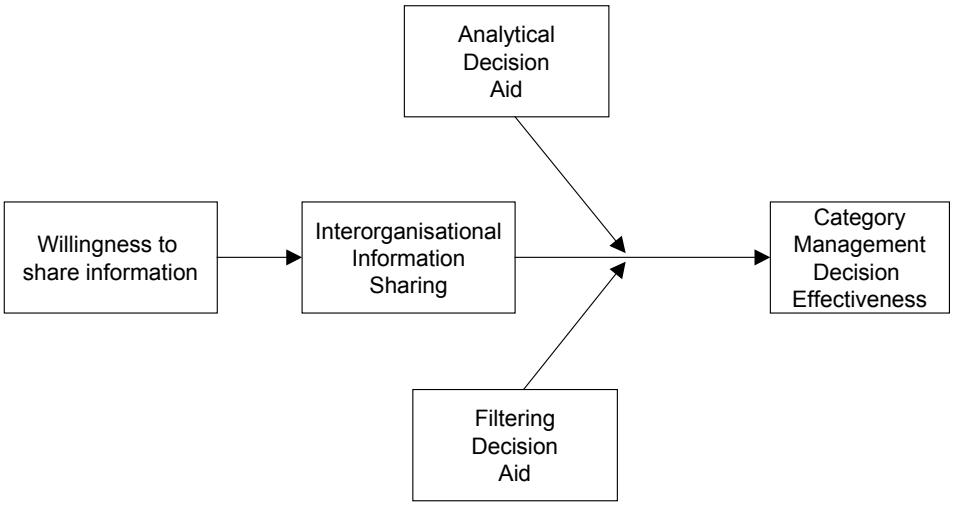

Figure 1: *Information Sharing and Decision Aids in Interorganisational Decision Support Systems*

2.1 Decision Effectiveness

The dependent variable of our model is decision effectiveness. This reflects the quality of the decision made by the organisation that receives information from other organisations. One option to operationalise decision effectiveness is to measure perceptions of the decision makers (e.g. subjective decision quality, perceived decision confidence). Another option is to measure decisions objectively, for example by examining the resulting performance of the decision. We will illustrate the latter option by looking at category management decision performance.

The prototypical category manager is charged with a number of decisions regarding issues like: assortment (brand composition), pricing, promotions, product introductions and inventory levels. These may be short-term and specific to a local retail store, such as which promotions will be initiated in which outlets next quarter. They may also be longer term and may span a number of stores, such as the decision whether the depth of the assortment should be adjusted.

The literature suggests that category performance can be measured in a number of ways. Basuroy et al. (2001) studied the performance of category management by measuring unit sales, market share, revenues and profits (Basuroy et al., 2001). Dhar et al. (2001) studied the use of the Category Development Index (CDI) as performance measure, also referred as fair share analysis. A retailer's category CDI can be calculated by the ratio of the retailers share in the category compared to its overall market share (Dhar et al., 2001).

Category performance is generally considered form one of the following three perspectives (Gruen & Shah, 2000):

1. Retailer's category : e.g. Growth, profitability, fair share
2. Consumer : e.g. Loyalty, satisfaction
3. Cost : e.g. Inventory, handling, turns

Category performance measurement is not only a theoretical issue. The following table shows how some of the aforementioned measures were put into practice as part of a retailer's category business plan (ECR-Europe, 1997)

Table 1: *Example of Category Performance Measures (ECR-Europe, 1997, p.58).*

Perspective	Measures
Consumer	Household penetration, Average Category Transaction, Consumer Satisfaction
Financial (Retailer)	Turnover category, Growth in turnover, Gross profit, Gross margin %, Net margin, Turnover private label, Private label gross margin %,.
Market	Market Share, Cat% of Grocery Market, Fair Share Retailer.
Productivity	Days of inventory, Inventory Value, Retail Service Level, Net Lead Times, Gross profit/unit sehlf space, GMROI, Revenue per Category Transaction, Closure Rate %, Price Index

2.2 Interorganisational Information Sharing

An antecedent of decision effectiveness is interorganisational information sharing. This construct refers to the degree that data is exchanged between two or more organisations. It can be measured by examining the variety of data items that is shared, by examining the number of data items that are shared, or a combination of both. Interorganisational information sharing embodies the supply of data that a decision maker has at his or her disposal.

Table 2: *Retailer's Data Items*

Data Item	Description
Point of Sale (POS) data	Scanner-based sales data.
Outlet data (Formula characteristics)	Important characteristics of outlets. E.g. square meters, number of employees, sales, etc. This data can be used to benchmark the performance of a specific outlet in comparison with other outlets in the retail chain.
Internal data	E.g inventory, logistical, etc.
Consumer research	Consumer research data concerning the products/services offered by the supplier (manufacturer). Consumer behaviour and trends.
Household panel	Information collected at the level of the household from the household reference person or spouse. Consumer spending databases to track how consumers spends their money. Segment markets by age, family structure, income, lifestyle, education. (Information Resources (IRI), GFK, AC Nielsen, Claritas etc.)
Socio-Demographics	Socio-demographic profiles of the markets you serve.
POS data (Syndicated: IRI, AC Nielsen)	scanner-based marketing and sales information, gathered from a representative sample of stores representing retailers in major markets. (IRI, AC Nielsen)
Loyalty card	Scanner-based marketing data concerning members attending a loyalty program.

In the context of category management, some of the information is available in the category manager's own retail organisation. Other information is owned by suppliers, such as wholesalers and manufacturers. Suppliers and retailers possess different degrees of information relative to consumer needs and purchase behaviour, the competitive environment, and marketing promotions (ECR-Europe, 1997). For example manufacturers typically develop expertise to estimate assortment, pricing, promotion at the brand level.

Table 2 shows which data items the retailer has available itself. Table 3 shows which data items the supplier can share with the retailer.

Table 3: *Supplier's Data Items*

Data Item	Description
Ex factory data	All financial business transactions with customers (e.g. invoice data)
Outlet characteristics (CRM)	Important characteristics of customers. A supplier can, by means of its commercial organization, collect market characteristics. E.g. outlet data like square meters, number of employees, sales, etc. This data can be used to benchmark the performance of a specific outlet in comparison with the total market. Because retailers only know their own outlets this kind of total market metrics can be valuable for them.
Internal data	E.g inventory, logistical, etc.
Consumer research	Consumer research data concerning the brands offered by the supplier (manufacturer). Consumer behaviour and trends.
Household panel	Information collected at the level of the household from the household reference person or spouse. Consumer spending databases to track how consumers spend their money. Segment markets by age, family structure, income, lifestyle, education. (IRI, GFK, AC Nielsen, Claritas etc.)
Socio-Demographics	Socio-demographic profiles of the markets you serve.
POS data (Syndicated: IRI, AC Nielsen)	Scanner-based marketing and sales data, gathered from a representative sample of stores representing retailers in major markets. (IRI, AC Nielsen)

(Based on: ECR-Europe, 1997, www.acnielsen.com, www.claritas.com).

2.3 Decision Aids

In the context of interorganisational decision support systems, we envision two types of decision aids. The first type is *analytical* decision aids, the second type *filtering* decision aids. Analytical aids attempt to derive trends in existing pools of data. These trends are typically derived by estimating a mathematical or statisical model that captures the non-random variations in the data. Filtering aids attempt to shield the decision maker from

irrelevant data. They hide the existing pool of data from the decision maker and display only the data that is deemed relevant.

Category management has been described as "a data-driven, analysis intensive business process" (Category-Management-Report, 1995), and so the advantages of the two types of decision aids are easily recognised. The literature suggests the increasing importance of decision support. For example, without new system assistance, the five staff-days spent analyzing bimonthly store audit data would increase to 5000 staff-days to analyze weekly-level scanner data (McCann & Gallagher, 1989). A tendency to estimate models on ever more detailed levels can be observed. Russell and Petersen (2000) developed a parsimonious market basket model that incorporates a set of conditional choice models (Russell & Petersen, 2000). Russell and Kamakura (1997) exploited long-run basket summary data to developed a model that segments consumers with respect to brand preferences (Russel & Kamakura, 1997). Borin and Farris (1995) developed a shelf management model to support retailers in their decisions which products to stock and how much shelf space should be allocated to these products (Borin & Farris, 1995).

In the context of category management one can think of analyitical decision aids that help to (Grewal, Levy, Mehrotra, & Sharma, 1999):

- Accurately measure merchandise performance;
- support more accurate planning of merchandise assortments;
- set more realistic merchandise goals;
- estimate sales volumes.

2.4 Willingness to Share Information

In our model, interorganisational information sharing is a consequence of willingness to share information. It is conceptualised as the overall degree to which organisations are prepared to share data with the focus organisation, and it is largely measured by perceptions of individual representatives of these organisations.

Organisations may have many reasons to be willing to share data with other organisations. One reason is of course economical: data is then simply bought and money is given in return. Another reason is political: sharing information may improve relationship quality. It enhances goodwill that can be capitalised upon at a later stage.

There are also factors inhibiting the willingness to share information. For example, if sharing information is perceived as a potential disturbance of the balance of power, then organisations are likely to be reluctant to share it. Another factor is the perceived confidentiality of the data. If organisations view the data as too confidential, then they believe that the use of data by other organisations can damage the sharing organisation. This relates to the issue of trust between organisations, and the extent to which each party can confidently assume that data that is shared is used for the correct purposes. There is a large body of literature on trust in interorganisational relationships; we do not review this literature here, but refer to (McKnight, Cummings, & Chervany, 1998), (Hart & Saunders, 1997) and (Oliver, 1990).

The relevance of the willingness to share construct can again be illustrated in the context of category management. Practioners often mention the barriers of manufacturer-retailer rivalries. Objectivity of category plans is a relevant issue regarding category performance (Gruen & Shah, 2000). The sharing of information between supplier and retailer will contribute to plan objectivity. However, suppliers benefit from an increasing share of their products in the category, while retailers strive for an increase of the performance of

the overall category (Gruen & Shah, 2000). Competing interests of suppliers and retailers can create a tension that might hinder the willingness to share information.

3. Propositions

Three propositions can be derived from our model. The first two relate decision aids and interorganisational information sharing to decision effectiveness. The third relates willingness to share information to interorganisational information sharing arrangements. We discuss each of these propositions in sequence.

Central to the theoretical justification of our model is the assumption that too much interorganisational data sharing leads to *information overload*. Information overload is described as ‘’having more relevant information than one can assimilate” (Butcher, 1998). Experimental research in decision making has demonstrated that information overload can even worsen decision effectiveness, in the sense that more data only confuses and distracts the decision maker (Johnson & Payne, 1985). Our assumption is therefore that the contribution of interorganisational information sharing to decision effectiveness is *not necessarily* positive.

To assist in the process of eliminating irrelevant information, filtering decision aids can be used. One type of filtering decision aids is the so called “push” technology. Push technology works “by pushing notices of pre-selected information sources across the computer screen alerting users to new and updated information .”(Edmunds & Morris, 2000). Push technology, like alerts, can be brought into action as part of attention and confirmation, object presentation, presentation formats, spatial layout, attention and confirmation, and user assistance (Gerlach & Kuo, 1991). Alerts can be useful in drawing a manager’s attention to important system responses and to confirm action (Gerlach & Kuo, 1991).

The claim that information systems can help alleviate the problem of information overload by surpressing irrelevant data is, of course, far from new. Already in 1967, Ackoff asserted that managers do not need more relevant information, but less irrelevant information (Ackoff, 1967). But this role of information systems increases in importance in the context of interorganisational decision support. Not only does the number and variety of data items increase, these items are also available at different aggregation levels. For this reason, we propose an interaction effect of the availability of decision aid on the effect of information sharing and decision effectiveness.

Proposition 1

Interorganisational information sharing positively influences decision effectiveness if a filtering decision aid is available

If category management processes are driven by interorganistional information sharing more input will become available for category decision making. To prevent the shared information becoming just another contribution to information overload, filtering, alerting and exception mechanisms can be applied to category support systems. An alert, indicating that the category’s fair share is exceeding a threshold level, can draw the attention of a category manager who is primarily concerned with other things. A filter that separates the effective promotions from the bad ones can save time as well as add value to shared information.

A second role of information systems in the context of information overload is to assist the analytical processes of the decision maker. For example, sales forecast decisions require not only the intake of previous sales data, but also the transformation of these data

items into meaningful information, so that a reasonable forecast can be made. The purpose of analytical decision aids is to help the decision maker in making these types of analytical decisions.

The effect of the availability of analytical decision aids is similar to the effect of the availability of filtering decision aids. Both reduce the information overload that arises from interorganisational information sharing. Filtering aids aim to tackle overload caused by the number and variety of data items. Analytical aids aim to tackle overload caused by the transformation of these data items into meaningful information. The conceptualisation of the interaction effect between interorganisational information sharing and the analytical decision is therefore similar.

Proposition 2

Interorganisational information sharing positively influences decision effectiveness if an analytical decision aid is available

The ability to transform market data into category knowledge plays a vital role in the support of category management decisions. For example, the need for more detailed analyses can be satisfied by the application of store-level models for local marketing. In these models household panel data, socio-demographic data and POS-data can be combined and transformed into a category potential index reflecting the growth potential of the store's categories. These models take into account all the relevant characteristics of the store's service area.

Our last proposition refers to the antecedent-consequence relationship between willingness to share and information sharing arrangements. This relationship draws attention to the circumstance that data items may not be available because an organisation may not be willing to share them. In "traditional" decision support systems, i.e. those used within an organisation, this is an issue of negligable importance. In interorganisational decision support systems, its importance is paramount.

Proposition 3

Willingness to share information positively influences the degree to which information is shared across different organisations

Retailers can designate suppliers they consider to have the most category management expertise as "category leaders" or "category captains". Assigning the predicate category captain is a reflection of the retailer's willingness to share information with that particular supplier. Receiving proprietary store level sales information (scanner data) for the entire category, including private labels, is part of the prerogative of being category captain (Gruen & Shah, 2000).

4. Discussion

With this paper we have aimed to draw attention to a specific type of interorganisational information systems: those that are developed and implemented for the purpose of decision support, rather than for the purpose of transaction processing. We present a preliminary theoretical model for these types of systems. To the best of our knowledge, this is one of the first in this area. We have also attempted to underscore the relevance and importance of studying this topic by drawing extensively on the practice of category management in the retail sector. Category management decisions by nature must depend on interorganisational information sharing in the retail supply chain.

An important difference between intra- and interorganisational decision support systems, as we have argued, is in the interorganisational supply of data items, the „raw material“ for the decision making process. Using information sharing arrangements, organisations are able to make use of a much greater number and variety of data items than before. This creates almost inevitably problems of information overload, and the role of decision support systems is therefore primarily one of reducing the overload. To illustrate this interaction, examples of filtering and analyitical decisions in the context of category management have been provided.

Another important difference highlighted in this paper is that information sharing agreements are dependent on the willingness to share information. One could argue that an IOS for transaction processing support provides benefits to both organisations. But an IOS for decision support may provide direct benefits only to the receiving organisation, not to the sharing organisation. For this reason, incentives to share information need to be in place before the IOS can really work. Some work on IOS has also touched on the different distributions of costs and benefits (Riggins & Mukhopadhyay, 1993).

We realise that our framework, as it stands, is somewhat limited in expressiveness. For example, we did not cover antecedents related to the decision maker itself, such as cognitive style (Todd & Benbasat, 1999). This is a limitation to our model but could be incorporated easily. Our focus in this paper has been the highlighting of the unique differences of *interorganisational* decision support systems. Of course, most antecedents that are important in intra-organisational decision support systems (such as cognitive style) apply also in interorganisational settings as well.

Empirical support for the model can be sought in a number of ways. The first is to study one or serveral cases of category management implementations. Such an exploratory study should attempt to provide additional insight in the constructs and relationships in our conceptual framework. The second is to conduct a more quantitive survey of a large number of implementations to see if the proposed relationships in the model can be detected in practice. A final area of research is more experimental: an experiment could be set up in which groups are being „treated“ to information sharing agreements and the availability of decision aids. Such an experiment should attempt to find causal relationships between decision aids, interorganisational information sharing arrangements, and decision effectiveness.

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