

INTER-ORGANIZATIONAL COLLABORATION AND VALUE CREATION IN THE AUTOMOTIVE INDUSTRY

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Abstract

In response to the difficulties experienced by the automotive industry in adopting new procurement technology this research investigates an emerging phenomenon: electronic interorganizational collaborative platforms consisting of e-Hubs, WebEDI, and CAD networks. A study of eight European cases explores collaborative working and information sharing using e-procurement to transform value creation. Outcomes from interviews and workshops reveal conflicting stakeholder motivation and barriers at firm and industry level. Vehicle manufacturers seek significant cost reductions through large-scale hubs, but are overwhelmed by supplier resistance, structural differences, cultural mismatch, and legacy systems. Suppliers are more selective in their use of electronic applications, but are hindered by network complexity, lack of standards, and limited resources. The study concludes with recommendations concerning electronic topology, supplier relationships, disbenefit, leadership, and a transition from traditional inter-organizational systems thinking.

Keywords: collaborative platforms, e-procurement, supplier relationships

1 INTRODUCTION

This research explores inter-organizational collaboration in the automotive industry. Collaboration depends on information sharing and combines multiple stakeholders, mutual benefits and the creation of value (Kanter 1994). Inter-organizational collaboration requires sharing critical business information with buyers, suppliers, and even rivals and is a concern to those seeking to add value from the increasing scale and scope of electronic applications (Amit and Zott 2001). To achieve efficient supply, procurement, and rapid product development, a shift in traditional inter-organizational systems (IOS) thinking is needed to provide responsiveness, transparency, and time-based performance.

European automotive supply chain behaviour is shifting from bilateral, dyadic relationships towards strategic network partnerships. This shift is motivated by the lure of significant cost reductions and driven by advances in e-procurement such as Internet trade exchanges or 'e-Hubs' (Kaplan and Sawhney 2000). However, functionally orientated and self-interested stakeholders inhibit information flow especially in the case of automotive supply chains. If current problems over information sharing remain unresolved, inter-firm collaboration will be difficult and expected benefits will not materialise. At present the rapid spread of electronic applications across old-world industries '*speeds up the mess*' creating overlapping structures and raising complex questions over how to manage powerful stakeholders and ameliorate information system (IS) related barriers (Howard et al. 2003, p.41).

The research investigates collaboration, through the adoption of IOS, between three vehicle manufacturers (VMs) and five component suppliers in the context of business-to-business e-procurement. There are few industry studies that examine value creation using 'e' from the perspective of assemblers and suppliers, hence the research question here asks: *what will encourage and discourage firms working together and sharing information using electronic applications to support a transformation in value creation?* An exploratory multiple case approach is adopted where the unit of analysis is 'the industry' and the phenomenon of the study is 'collaboration and value creation' facilitated by electronic interorganizational collaborative platforms.

Section 2 now reviews collaboration and value creation, e-procurement applications, and stakeholder motivation and barriers. A conceptual framework is devised to help guide the study during fieldwork and to record any changes in thinking during the analysis. Section 3 justifies the study method. Section 4 outlines the findings from the cases. Section 5 conducts the analysis and revisits the framework. Section 6 concludes with implications for industry and research.

2 CONTEXT AND BACKGROUND

2.1 Collaboration and value creation

Collaboration is an essential ingredient in the management of supply chain performance that requires bridging organizational boundaries and forging co-operative relationships. It implies shared responsibilities, resources and benefits, and the creation of value through common information exchange between firms (Kanter 1994, Phillips et al. 2000). Inter-organizational collaboration occurs when firms develop mechanisms such as structures, processes, and skills for bridging organizational and interpersonal differences (Kanter 1994). Collaboration requires some form of motivation generated by the prospect of realising benefit, such as a reduction in transaction costs or an increase in product-related knowledge. This implies '*leveraging benefits [...] to achieve common goals*' where two or more firms share the responsibility for information exchange (Bowersox et al. 2000, p.4). However, there is ongoing debate over the extent to which common goals and values of partners are a prerequisite for successful collaboration. For instance, Cousins (2002 p.71) argues that partnership-style relationships do not exist where organizations are competitive and do not trust each other, rather they simply '*manage risk based on business case decisions.*'

Supply chain relationships are extensively researched where much of the generic supplier relationship literature is derived from the automotive industry. The most widely-discussed issue is the shift from adversarial price-driven relationships, towards more collaborative relationships. Studies include 'partnerships' (Lamming 1993) 'business alliances' (Kanter 1994), and 'adversarial and obligational contractual relations' (Sako 1992). A commonly-held belief is that the trend towards closer collaborative relationships between buyers and suppliers has a positive impact on firm performance. However, while advocating a shift towards more collaborative behaviour, there is little evidence of how firms overcome competitive and political barriers, jointly develop IOS, and work together to 'achieve a level of agility beyond the reach of the individual company' (Van Hoek et al. 2001, p.126). There is also little empirical study to explain value creation or innovation from large-scale e-procurement systems (Amit and Zott 2001). In the case of the automotive industry past studies reveal a tendency towards the coercive use of inter-organizational systems. Webster (1995) in her classic description of the pitfalls of collaborating with vehicle manufacturers using early IOS describes how bespoke EDI is used as a competitive weapon to preserve the power of dominant stakeholders by locking suppliers into procurement relationships and keeping competitors out.

Information availability and sharing for institutions is a classic theme in social and physical science (Barret and Konsynski 1982). Information has been described as an *information processing* capability, a *strategic* capability where technology transforms the nature of product, process and competition, an *enabler of process performance*, and a *competence, knowledge or resource-based* view of the firm (Lee and Whang 1998). This research interprets information from the perspective of adopting collaborative platforms, enabling and transforming processes, and creating value by developing electronic skills and competences. The benefits of information sharing are often expressed in terms of maximising potential opportunities in global markets, reducing costs, and improving cash flow (Jayaram et al. 2000). A primary aim of adopting IOS are where co-ordinated supply chain management can replace costly logistics flows and inventory with information without compromising customer specification or delivery dates (Lee and Whang 1998). Since the early 1990s the automotive industry has increasingly focused on time compression both in product development and building-to-order. This remains the objective for many VMs whose future performance depends on the multiple dimensions of IT infrastructure across manufacturing, design, and customer order fulfilment.

2.2 Electronic interorganizational collaborative platforms

The term 'electronic interorganizational collaborative platforms' is coined here to define the growing phenomenon of Web-enabled tools for procurement, supply, and design purposes. De Boer et al. (2002) describe the difficulty of defining terms such as e-procurement because they include not only the use of Internet applications, but also intranet and extranet applications. The elements which make up these collaborative platforms are divided into three groups: WebEDI, e-Hubs, and CAD networks.

The emergence of WebEDI in the late 1990s, using XML and standard PCs offers a simple, low cost solution for suppliers seeking connection to their business partners via the Internet. e-Commerce differs from EDI as it provides an inter-organizational IS that fosters market-based exchanges between agents in all transaction phases. It overcomes the technological barrier of a bespoke system through Web-enabled technology that uses the Internet for low cost, real-time information exchange with multiple partners. Vehicle manufacturers use WebEDI as an electronic kanban to assist in parts delivery. Toyota is using the Internet to speed communications with suppliers and reduce parts inventory by developing a new e-kanban system at its plants in the UK and France.

e-Hub covers 'Portal', 'Internet trade exchange', 'B2B electronic marketplace', and 'Cyber-purchasing system' (Min and Galle 1999, Kaplan and Sawhney 2000). The appeal of e-hubs is clear - by bringing together or *aggregating* large number of buyers and sellers and automating transactions, they expand choice available to buyers, give sellers access to new customers, and reduce transaction costs (Bakos 1998). e-Hubs provide a virtual marketplace where operators earn revenue by extracting fees for the transactions. Before the technology/dotcom market crash in April 2000 e-hub founders

could expect dual benefits; from cost reductions using Internet auctions, and from the additional revenue arising from the subsequent flotation of the exchange.

The launch of Covisint in 2000 - the biggest and most powerful consortium e-hub - was heralded as the beginning of a new era in automotive purchasing and supply chain management. Founder members Ford, General Motors, and DaimlerChrysler (joined later by Renault and Nissan) anticipated significant price reductions and customer responsiveness by combining purchasing economies of scale with Internet technology. However, rival VMs and component suppliers were already developing their own solutions and were reluctant to subscribe over fears of accepting a subordinate role. As private trade exchanges proliferated Covisint's vision of offering collaborative procurement, lower transaction costs, and the introduction of a universal system standard began to diminish.

CAD networks offer online development using virtual spaces in which the manufacturer and several suppliers can simultaneously collaborate live on joint design projects. Research and development provides the most important link between vehicle assemblers and suppliers since it is one of the clearest manifestations of collaboration on the part of both partners (Lamming 1993). Web-enabled CAD can offer a platform for information sharing not only within product development but cross-functionally across procurement, planning and scheduling, thereby improving process flow and reducing sourcing and development costs. While electronic linkages between product development and other departments remain under-exploited, this research views the potential benefit of CAD networks not just in terms of process efficiencies, but enabling cross-functional joint buyer-supplier purchasing teams and capitalising on collaborative engineering.

2.3 Stakeholder motivation and IS-related barriers

To adopt collaborative strategies and survive in electronic markets using IOS, firms must consider not only barriers at organization and industry level, but also the motivation of powerful stakeholders. Supply chain transformation through Web-enabled systems consists not just of inter or intra-organizational change, but requires an extra-organizational or meta-view of relationships between all partners. The question over what motivates supply chain partners to share cannot be explained in terms of neo-classical theory (the firm as a 'black box'), transaction cost, or supply chain dynamics, but requires a holistic view of the supply chain. This means considering concepts such as a commitment to the belief in overall performance benefits, and the effect of relationship attributes such as power, legitimacy and urgency (Mitchell et al. 1997). Relationships do not occur *'in a vacuum of dyadic ties'* but rather in a network of influences involving the simultaneous influence of multiple stakeholders (Rowley 1997, p.890). This fits with the increasing interest in boundary spanning and stakeholders that extend beyond the traditional boundaries of the firm and concerns *'any group or individual who can affect, or is affected by, the achievement of a corporation's purpose'* (Freeman 1984, p.vi).

Stakeholder theory has been described in the past as a 'handmaiden' - often used to support the elaboration of other theories but rarely becomes the focus. The motivation of industry stakeholders reflects current thinking in managing inter-organizational relationships, where the firm is considered an unsatisfactory unit of analysis and it is necessary to take a whole system, or industry, view. This draws on the concept of 'stakeholding' in system research as an approach that seeks to understand organisations from the perspective of social actors. Stakeholders form an integral part of IS planning in industry and part of the 'sociology of technology', where creating value *'is not simply a technical-rational process of "solving problems"; it also involves economic and political processes in articulating interests, building alliances and struggling over outcomes'* (Webster 1995, p.31).

Barriers research can be traced to early IOS literature that considers the interchange of information as the basis of all activity (Barret and Konsynski 1982 p.101). In their assessment of the impact of Inter-Organizational Information Sharing Systems, Barret and Konsynski describe *'factors of concern'* over how such as strategy might be introduced and the effects on organizational structure, the users, and the IS department. Hence, the introduction of IOS require clear strategic objectives and a systematic means of identifying negative factors, hurdles, or barriers that, if not addressed, may hinder

organizational change. Despite the potential of new technology to radically reshape a business, cultural, structural and technical concerns can be a key inhibitor of change (King and Thompson 1996). The success of change often depends on the organization's ability to learn, requiring people to collaborate to share their vision, knowledge and skill, despite organizational defences being one of the most critical barriers to learning and change (Argyris 1990).

A common issue with technology is the belief that simply acquiring applications such as WebEDI or e-Hubs represents a solution. Hagel (2002 p.9) argues that the lessons from the 1980s need to be understood: *'if we have learned one thing...it is that IT is at best a catalyst and an enabler. It is never an answer in itself.'* The integration of new technology in an industry setting requires considerable attention to both the intra and inter-organizational context to achieve constructive interaction and sharing between all partners. The term 'barriers' is used here to mean the barriers to information sharing and is presented in the context of the study assisted by a conceptual framework (Figure 1).

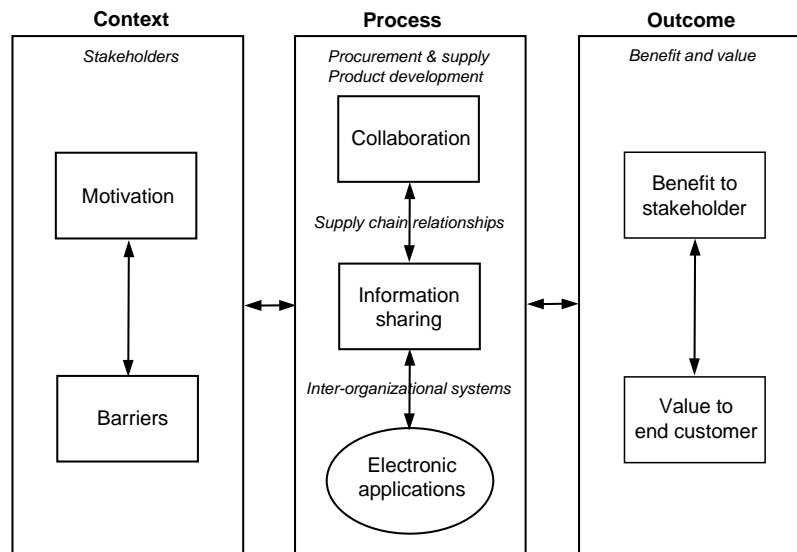


Figure 1. Conceptual framework

The conceptual framework acts as a guide to the researcher during fieldwork. Eisenhardt (1989) highlights the importance of the prior development of a framework and propositions to guide data collection and analysis. Coping with the *'flux of events and ideas in a real situation'* requires the explicit declaration of an intellectual framework of ideas and research themes (Checkland 1991 p.400). While the framework may require 'rethinking' as the researcher tries to make sense of the accumulating experience, its benefit to the investigation lies in forming a secure point of reference during and after the field study.

Despite extensive literature on market structure and electronic trading, the effects of IOS are characterised by little direct research, and *'there is considerable disagreement on the long term outcome and the mechanisms of change'* (Holland 1995 p.121). To understand the interaction between IOS and the environment, the framework must capture enough detail to get close to the problem, yet remain sufficiently flexible to enable exploratory research. Hence, a three-stage model is used to explore stakeholder motivation and barriers (context), collaboration and information sharing through sophisticated electronic applications (process), and benefit to the stakeholder and value to the end customer (outcome).

Developing a contextual perspective and breaking it down to its *'three essential dimensions'* enables understanding of organizational and industry change (Pettigrew and Whipp 1991, p.26). The approach of focusing on dimensions or *'domains'* for collecting and analysing qualitative data has been used in a variety of settings. For example, cross-functional teams (Denison et al. 1996), and managing

strategic change across the automobile, publishing, banking, and life assurance sectors (Pettigrew and Whipp 1991). Context means the circumstances that form the setting for the event, or '*over-arching structures and systems...that facilitate or inhibit*' an individual, group or organization's impact (Denison et al. 1996 p.1006). Investigating context provides a rich description of events and is particularly useful in research situations involving rapid change, such as the change to world economies brought about by globalisation and the introduction of new information technology.

3 METHOD

This investigation adopts an exploratory, multiple-case research strategy. The case approach is particularly suited to IS research, because it copes with the technically distinctive situation in which there will be more variables of interest than data points and enables an investigation of a contemporary phenomenon within its real-life context. This suits the topic of investigation - collaboration and value creation facilitated by electronic interorganizational collaborative platforms - because it represents an emerging phenomenon and requires a broad investigative scope across multiple settings and levels of analysis. Applications such as Web-EDI and e-Hubs in the automotive sector are considered to be at a nascent stage of development and little understood at industry level, yet closely linked to the contextual situations that exist within and between organizations.

A positivistic approach to this research agenda would assume that phenomena can be studied objectively, can be described by measurable properties, and would use deductive logic to make causal explanations and build predictive power. However, the context for this research is intensely political and social: stakeholders are diverse, have conflicting objectives and a lot to gain (and to lose). Fundamental belief structures, such as 'sell from stock' will have to be renegotiated if collaboration is to be meaningful and hence successful. This research therefore adopts a primarily qualitative approach, using a framework to enable understanding of the motivations and barriers for adopting e-procurement, with the aim of providing insight into value creation and collaborative inter-firm capability. To relate the research framework to a supply chain situation, a multi-method approach is employed, offering more flexibility by cross checking findings from multiple sources of data. This suggests that the research, although broadly interpretivist, will have elements of positivism, thus enabling a reductive process of questioning, analysis, and reflection. This is reflected in the research design that specifies a collaborative process of enquiry (i.e. questioning, observation, and active enquiry) between the researcher, individuals, and groups.

Data collection across eight cases is driven by three primary methods: semi-structured interviews, participant observation, and qualitative politicised influence diagram workshops. A pilot study verifies the framework and propositions. A key element which links the pilot study with the primary methods is the case protocol. The protocol is a major tactic in increasing the reliability of case research and guides the investigator. This document contains the '*instrument, procedures and general rules*' to be followed during data collection (Yin 1994 p.63). The protocol developed during this research contains guidelines for the investigator conducting the study and questions derived from the conceptual framework.

During the fieldwork a total of 65 interviews were conducted, recorded and transcribed using semi-structured questions. The interview data was displayed in tabular form showing realised/expected benefits and information barriers at firm and industry level. Cross-case data analysis revealed the similarities and disimilarities between firms and firm groups. A term that emerged during the data analysis referred to groups of firms as 'industry stakeholders' i.e. vehicle manufacturers, tier 1 suppliers. The results were then reconciled with the concerns raised during the eight system dynamics workshops conducted with managers and directors from each of the cases. A final comparison of the results from both the interviews and workshops enabled cross-checking of the case findings.

4 CASE FINDINGS

This section presents the findings from the eight cases. All address the motivation and barriers encountered during the adoption of e-hubs, WebEDI, or CAD networks across the automotive industry. The identities of the firms have been withheld for reasons of commercial confidentiality.

MotorCo is one of the largest vehicle manufacturers worldwide, but is undergoing a major restructuring following the announcement of a \$4.5 billion loss and 17,000 job cuts in 2002. Its share value is close to junk bond status despite steady sales and the recent acquisition of smaller, premium vehicle manufacturers. The senior management are seeking significant cost reductions across MotorCo's global operations. The plan to return to profitability involves replacing the firm's intranet with a large-scale e-procurement hub supported by the e-auction tool from Covisint. This is an ambitious project that seeks to create an electronic interactive link between the headquarters in North America, European subsidiaries, and tier 1 suppliers. It aims to streamline operational costs through material price reduction, transaction efficiency, and supplier rationalisation. The system is expected to control the purchasing process worldwide, improve manufacturing plant discipline, and promote communication with suppliers. However, the e-hub is already facing delays from conflicting organizational structure worldwide, cultural mismatch, and supplier suspicions over component price cuts. It is acknowledged by the e-hub launch team that *'limited buy-in by stakeholders [and] registration has been a nightmare. In hindsight, our track record hasn't been good with system implementation – in future we need to take bite-size chunks.'* (Change Manager).

CarCo is a premium, North European vehicle manufacturer recently acquired by MotorCo. CarCo is now obliged to integrate a large-scale e-procurement hub into its business. It expects to achieve process efficiency benefits, to develop more strategic buyers using centralised data, and to cope with an expanding new vehicle development programme through fully cross-functional system integration. Yet it acknowledges its processes are currently based on *'paper and personality'* involving time intensive transactions using multiple legacy IT systems. CarCo's culture of autonomy and corporate citizenship is diametrically opposed to its Detroit parent organization. As a partner they are obliged to adopt the e-hub despite its design based on American processes and organizational structures that are very different to their own. The next step is the most critical - production parts - this directly affects the manufacturing plants, goods distribution, and the links with dealers. However, the general opinion is that management has underestimated the resources needed, because *'we have a totally different process from MotorCo...you affect everything with one tool and process. The tool and process we are trying to implement now is adapted for MotorCo. So now we have a culture and system problem together!'* (Materials, planning and logistics Manager).

AutoCo is a Japanese transplant whose European research and development facility is based in the UK. It is currently launching two projects: an Internet-based buyer-supplier portal for standardising the purchasing process, and a CAD-orientated initiative aimed at suppliers that seeks to eliminate the use of paper drawings during the new vehicle development process. Currently, 70% of components are outsourced and developed by suppliers, yet only 20% of the data is submitted digitally. AutoCo is seeking significant cost reductions from its electronic purchasing and design engineering initiatives, yet it is only at the beginning of the project, where savings are so far limited to indirect materials through e-catalogues. Despite ambitious cost targets for new vehicle programmes, the challenges ahead are very considerable indeed. AutoCo must overcome widespread supplier suspicions of Covisint, largely because of its failure to deliver value to the industry as a whole. The current climate of buyer-supplier relations and the traditional shortcomings in Japan to consider IS as part of manufacturing philosophy means introducing a large-scale e-procurement project may simply be viewed as an additional burden to managers. Further, technical consensus is lacking across the industry to provide a secure platform based on mutual agreements over auto-specific Internet standards and protocols. The current lack of consensus over standard formats and protocols in design engineering, procurement, and supply applications means *'its the old argument: VHS or Betamax – its going to happen again.'* (General Manager).

PartCo is a tier 1 supplier that designs and manufactures drive shafts, chassis, and engine parts. It has recently adopted indirect materials e-procurement and plans to extend the current service across its plants in Europe to include direct material purchasing. 'eSource' is an electronic database of tier 2 and 3 suppliers that serves all sites within the group and holds data on supplier metrics, visible across the whole firm. 'Ariba' is an internal electronic marketplace that generates and receives bids for non-production parts. PartCo's decision to adopt a private hub managed by an application service provider reflects its concerns over joining Covisint and the need to improve purchasing performance (cost) in the global economic downturn. It fears the scale of VM e-hubs and is suspicious of their readiness to support a supplier relationship. PartCo's concern focuses not only on the VM, but also on maintaining adequate dialogue and interaction with tier 2 suppliers. Internally, the decentralised structure of PartCo means difficulty in gaining support across all departments and resolving which function should pay for the system. While there is some criticism of senior management being too near the forefront of e-business development, a potentially more serious barrier is resistance to change from the elimination of the traditional procurement manager role. Further, technical transmission glitches such as failure to receive and transmit using the Ariba marketplace provides justification for non-believers of the system. Yet it is not technology that is generally considered the greatest hurdle during adoption, but the *'human side, particularly with suppliers'* (IT Manager).

WireCo is the biggest tier 1 supplier worldwide and the fourth largest in Europe. It operates in two business sectors, vehicle propulsion and interiors/electrical, and owns 100 sites across Europe. WireCo has recently implemented WebEDI - a homegrown project developed to increase the efficiency of sequenced in-line supply (SILS) operations by providing access to up-to-date information, and reducing transaction and communication costs. WebEDI creates visibility across a supply chain by introducing real time interaction between tier 1 and 2 supply partners using PCs equipped with Web browsers. WireCo anticipates changes in production schedules, preventing material shortfalls, and reducing the risk of premium freight charges. It offers a considerable advantage over legacy EDI systems by providing a cheap data transfer format that is common to all suppliers. The most significant benefit to all participants is the reduction of component stocks through reliable information exchange and eliminating processes which involve the fax or phone. More reliable information means less stock is required to cover 'just in case' scenarios in the event of human or technical error. Yet WireCo is concerned over the issue of burgeoning inter-organizational system complexity, not only in terms of traditional EDI formats and protocols, but over the number of e-hubs appearing across the supply chain. The traditional way of working is where *'everything is run by the VM'*. The introduction of Web-enabled information systems with greater supply chain transparency means responsibility for some operations are being transferred from the vehicle manufacturer to supply partners with proven IS capability such as WireCo *'a lot of the supply problems come to us'* (Operations Director).

BumperCo is a tier 1 supplier of front-end modules (painted bumper systems) with 17 plants across Europe. The UK site has recently been the first to adopt an Enterprise Resource Planning (ERP) system and plans to link tier 2 suppliers using WebEDI. ERP is a manufacturing management system that BumperCo aims to control stock movements, logistics, and finance. The aim is to create visible information flow from a single source within the firm. Since the early 1980s, the variety of standard car bumpers has increased ten times from black, to colour-keyed skins with additional accessories such as fog lamps. Vehicle manufacturers now demand different front-end modules to differentiate a vehicle model, with various designs to cater for world markets. The explosion in component variety is reflected in the exponential rise in complexity that must be handled by the information system. BumperCo currently receives 7,000 messages a day relating to part description, time of delivery, and quantity, and maintains as many EDI networks as there are vehicle manufacturers - a significant barrier to efficient information sharing. There is also the suspicion that VMs will only use e-business to reduce supplier prices: *'e-procurement only benefits commodity products'* (Commercial Director). While the organization has largely overcome its own problems relating to IT legacy, it recognizes that sharing across supply chains goes beyond the technical. *'We have to define what we want in the message and make sure both partners can supply it in a sensible way'*. Yet information sharing will continue to suffer for as long as there is not standard data across the supply chain. Without the generic

capability of e-procurement, ERP will ultimately fall down over the need for *'multi-mode processing: the one to many relationships of suppliers to customers'* (Supply Chain Director).

BeltCo is a tier 2 supplier that manufactures seatbelt and airbags. As a response to the perceived limitations of ERP the Supply Director proposes to introduce a Takt-based system in the organization. Takt time is the speed at which parts must be manufactured in order to satisfy demand and is the heartbeat of any lean system. The system will introduce levelled production, visible to supply partners, that enables a pull-based sequenced in-line supply of parts to the vehicle assembly line. The core of the system uses WebEDI and sophisticated supply software that takes traditional just-in-time principles and incorporates them into a package containing error proofing and event management. The system will be rolled out across tier 3 suppliers and embraces the principle of pull-based production. This means building components to order - not for stock - and reducing the level of capital tied in the supply chain, all of which depends on the reliability of information. BeltCo considers itself a specialist supplier with unique technical competencies. It rejects the idea of VM tools such as electronic request-for-quote and will only participate in VM trials simply to maintain good relations. However, the Supply Director anticipates internal resistance from the IT department when they learn of the proposed plans to eliminate ERP and the redeployment of personnel to other departments. Further, senior management support is unlikely be offered until the project is well under way, when the benefits can be clearly observed in production. A sub-culture is emerging at BeltCo where the general view towards developing new ideas is *'don't ask for guidance – someone will tell you if it is wrong'*. This means a clandestine approach is often adopted for new projects, with the attitude of *'run this without asking the bosses'*. It is felt that management *'don't care very much about the Internet'*, because they see *'very few'* genuine opportunities (Supply Director).

LampCo is a tier 2 supplier manufacturing lighting systems for vehicle headlamps and rear lighting units in Europe. It is exploring the adoption of appropriate technology for more efficient business, particularly the use of WebEDI and e-hubs for stock movement reporting and component quality control. The supplier has recently been requested by several vehicle manufacturers to use WebEDI for component pick-up sheets and advance shipping notes, and asked to use Covisint for purchasing and stock control. WebEDI has benefited the firm by improving communication with tier 3 suppliers and eliminating information reliability issues from faxing hundreds of pages of weekly schedules to dozens of suppliers. Eliminating paperwork and fully embracing electronic communication means guaranteed data delivery and avoiding questions such as *'Did the message ever get there?'* and *'Was there paper in their fax machine?'* Yet the benefit of Covisint is less clear. Covisint not only hosts auctions, but also acts as the outer package for a pre-production electronic component release system connected to supplier performance metrics. However, the time needed to log-on, navigate the system, and for the VM to respond to queries is inefficient. At a time of burgeoning electronic complexity across the industry LampCo cannot afford to support customised VM systems that add little value and charge the supplier for user training. LampCo's Supply Manager considers that the biggest mistake for management would be to adopt new technology for the sake of *'keeping up with IT'*. There is also increasing concern in Purchasing at the prospect of further developments: *'as new technology comes on board our customers take advantage of it and force it down on us. We won't be in a position to support everything they throw at us!'* (Systems Manager). If the current rate of new system adoption continues suppliers will not be able to cope with electronic communication: *'I just wish the vehicle manufacturers would get together and come up with a common standard'* (Purchasing Manager).

5 ANALYSIS

The eight cases suggest an industry divided by functional barriers and lacking integration and connectivity. The findings also illustrate the difficulty of being able to distinguish between concerns over technology, process, and organizations. This research contends that a more complex relationship exists between benefits, barriers and change during collaboration and information sharing through electronic applications than simply concerns in the past over the integration of technology. The conceptual framework is now revisited to structure the analysis of the findings.

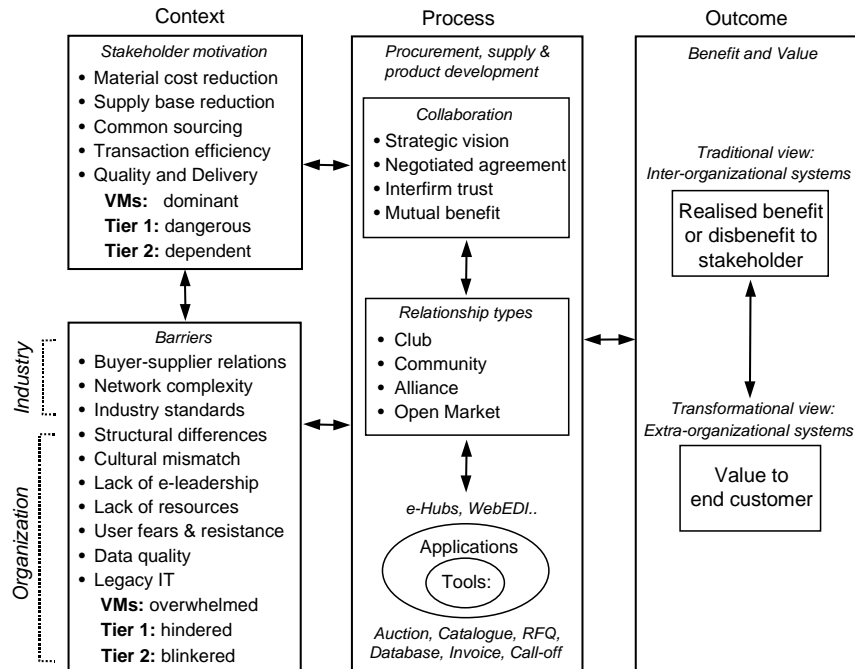


Figure 2 Synthesis of findings

The context of the problem is presented in Figure 2 where vehicle manufacturers are motivated by their expectation of cost benefits from ambitious, large-scale e-hub and digital data projects. Yet as traditionally dominant stakeholders they are overwhelmed by legacy systems, structural differences, and supplier resistance. Tier 1 suppliers have been more successful, realising benefits by being more selective over electronic applications and can be considered dangerous to vehicle manufacturers if they use their new competences outside the VM's sphere of control. Yet the tier 1s are hindered over concerns of how they fit into the plans for e-hubs such as Covisint. Further, their skills in developing e-supply networks are often taken for granted. Tier 2 suppliers are only just beginning to consider the benefits from electronic applications and are dependent on more powerful players. They are uncertain over what IT to adopt in the future and lack the resources for initiating change.

The lack of collaboration and information sharing is implied here not only in the technical sense of burgeoning electronic networks, but also as the result of sub-optimal buyer-supplier relationships. This illustrates the difficulties in distinguishing between inter-organizational (industry) and intra-organizational (firm) barriers. Firm level IT barriers are well-documented and classified in the literature, but industry-level barriers are less so (King and Thompson 1996). As the sophistication of electronic applications have increased, so too has the significance of barriers that lie *between*, as well as within, organizations. For instance, the power of the Internet has enabled MotorCo to connect its purchasing organisation with the CarCo, but this has led to severe structural differences and cultural

mismatch. While the origins of a barrier may reside within the firm (i.e. culture), the scope of the Web means it now extends far beyond traditional boundaries represented by a firm or network.

Overall the synthesis in Figure 2 presents the current state of collaboration and value creation through electronic interorganizational collaborative platforms during procurement, supply and product development. Industry stakeholders are struggling to adopt electronic applications (i.e. e-Hubs, WebEDI) and e-tools (i.e. auctions, RFQs, databases) because they are often failing to recognise the importance of strategic vision, negotiated agreement, interfirm trust, and mutual benefit in collaborative e-procurement relationships. Four relationship types emerge from the data - Club, Open market, Community, and Alliance - where only the latter three represent sustainable alternatives for value creation in the automotive industry:

- *Club* is based on exclusive membership where a primary concern is control and price optimisation
- *Open market* is the simplest form of application based on buyer-supplier aggregation and liquidity
- *Community* is based on open membership, collective benefit, and exploratory relationships
- *Alliance* is based on a strategic relationship that fosters trust through long-term collaboration

This addresses the concerns over the 'plans for short-term profit' approach adopted by many VMs whose large-scale e-hubs are now close to failure. To unravel the mess of competing, overlapping electronic networks, all stakeholders must address both firm and industry level barriers, while acknowledging the role played by relationships during the adoption and use of e-procurement. Hence the outcome in Figure 2 of firm interaction through e-procurement can be expressed in terms of benefit and value. A traditional view involving inter-organizational systems is that of benefit or disbenefit to the stakeholder - similar to the 'competitive weapon' approach of bespoke EDI. A more holistic, transformational view of the industry involves collaborative platforms and extra-organizational systems where multiple stakeholders consider not benefit just for themselves, but value from the perspective of the end-customer.

6 CONCLUSION

Industry transformation is socially, politically and technically complex. The automotive sector in Europe is facing a difficult period characterised by over-crowded markets, punctured profits, and little opportunity for growth. Stakeholders in the industry are faced with different barriers to change (intra-organizational) and have different interests and more or less to gain/lose (inter-organizational). Hence the unit of analysis for this work is the industry, not the individual firm, but to understand industry dynamics requires examination of the barriers to change within firms. Several areas of concern clearly emerge from this research that reach to the core of the industry, most notably inter-organizational relationships and the impact of electronic interorganizational collaborative platforms. If the industry ignores these concerns then others will take the initiative, and regions such as the UK will enter a terminal decline. There are five recommendations for management that also impact on theory.

6.1 The automotive industry must consider e-supply topology

e-Procurement is still at a nascent stage of development across the industry and there is considerable work to be done in building an electronic supply topology or IT infrastructure. This can only be achieved by vehicle manufacturers and suppliers working together, collaborating with organizations such as Odette to achieve a set of common Web standards and protocols across purchasing, supply, and product development. Topology implies a foundation of interconnecting Web services, legislation, as well as standards that connect Europe with other regions around the world. There are already over one thousand XML schema in use across Europe today, and without an adequate supporting infrastructure the level of complexity will increase. This means that the benefits from e-procurement will be limited, realised by only a small number of partners, or may not materialise at all.

6.2 Too much conflict: the Club versus the Community

Buyer-supplier relationships are key to the adoption and use of e-procurement. Yet considerable conflict between industry stakeholders was revealed during the case analysis. VMs are expecting short-term price gains through an exclusive Club approach to e-hubs, driven by limited ownership and control. Suppliers are suspicious of VM hubs and auctions, and resistant to the enforced collaboration approach where they are expected to adopt new technology regardless of the consequences to them. Tier 1 suppliers are now leading in terms of the Community approach through e-hubs such as SupplyOn and exploratory projects with WebEDI, where the focus is on open membership and shared knowledge. Further research is needed to present an 'e-procurement typology' as a guide to understanding firm relationships and electronic membership. This study reveals limited evidence of inter-organizational relationships based on interfirm trust, strategic vision, negotiated agreement, and mutual benefit - all needed to strengthen interfirm ties and foster collaboration.

6.3 Electronic applications result in disbenefit as well as benefit

In the rush to adopt electronic applications, VMs and suppliers are often paying little attention to the idea that e-hubs and WebEDI can result in *disbenefit* as well as benefit. For instance, the capital outlay needed to launch large-scale e-hub and digital data projects runs to billions of euros, but there is little contingency for delay or downsizing. The risk to the organization in terms of incurring additional costs or quality issues affecting vehicle brand value, means 'getting it wrong' can outweigh the original benefit. Further, there is evidence of tier 2 suppliers being coerced into adopting incomplete or even malfunctioning supply systems, meaning additional effort in communicating with VMs. Yet smaller suppliers are reluctant to refuse in case they lose their contract.

6.4 Procurement needs better e-leadership

Poor leadership during the introduction of e-procurement is revealed by the research at all levels of the supply chain from both vehicle manufacturers and suppliers. This ranges from a general lack of e-business awareness, to an inability (or reluctance) to offer support and guidance, or simply setting objectives that are too ambitious. The ignominious fall of Jac Nasser, once CEO of the largest and most influential vehicle manufacturers, is evidence of the potential for the Internet to accelerate the decline of an individual or corporation, regardless of position or power. To improve e-leadership skills across the industry, some lessons may be learnt from the Swedes who are beginning to customise e-learning for more senior users who require a strategic grasp of technology rather than a 'picks and clicks' approach. Further, some firms are considering developing the idea of an Electronic Code of Conduct as a means of communicating the top management vision for change in terms of what it will mean for the day-to-day working conditions of line personnel.

6.5 Extra-organizational systems not inter-organizational systems

Extra-organizational systems (EOS) differ from inter-organizational systems in that they reject bilateral, bespoke systems used as competitive weapons, and instead embrace the concept of multiple firms sharing industry-level systems using generic e-procurement to create value through collaborative platforms. Yet EOS raises the challenge of inter-organizational collaboration across the industry, in a similar manner to the concept of building cars only to customer order (Howard et al. 2003). There are considerable barriers that must be mitigated at firm and industry level before the opportunities presented by electronic applications can be realised within and between procurement, supply, and product development. Using the conceptual framework this research provides a starting point in terms of understanding the motivations for, and barriers against, the adoption of e-procurement across the automotive industry, and how it can ultimately support a transformation in the value created for the end-customer.

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