

2004

# Exploring Industry Dynamics in eProcurement: Sense Making By Collaborative Investigation

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## Recommended Citation

Howard, Mickey; Vidgen, Richard; and Powell, Philip, "Exploring Industry Dynamics in eProcurement: Sense Making By Collaborative Investigation" (2004). *ECIS 2004 Proceedings*. 56.

<http://aisel.aisnet.org/ecis2004/56>

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# EXPLORING INDUSTRY DYNAMICS IN E-PROCUREMENT: SENSE MAKING BY COLLABORATIVE INVESTIGATION

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## Abstract

*The case study method supported by interviews is used widely by IS researchers. In 'messy' problems, such as the adoption of e-procurement across manufacturing supply chains, a more collaborative approach is needed to explore and make sense of the problem domain. This paper proposes the use of qualitative politicised influence diagrams - QPID – to enable the investigator to structure the process of collaborative investigation as part of an action case strategy. The paper describes how QPID workshops are used as part of a multiple methods research design to support and help practitioners articulate the issues surrounding the adoption of e-procurement in the automotive industry. Four outcomes of the approach are identified: 1) QPID is a systems modelling method that is meaningful to practitioners, 2) QPID can be used to promote good quality conversations, 3) QPID models provide a consistent notation for case description that supports cross-case and industry level analysis, and 4) collaborative workshops, through the creation of trust and shared understanding between researcher and practitioner, can provide a platform for subsequent interventions.*

*Keywords: QPID, action case, systems modeling*

## 1 INTRODUCTION

The challenges faced by the information system (IS) investigator today are rapidly expanding as the world is increasingly suffused with ubiquitous, interdependent, and emergent information technology (IT). Studies into the impact of inter-organizational systems and e-commerce across industry sectors such as automotive, aerospace, healthcare, and electrical, capture the difficulties of conducting in-context research using established methods such as case study or action research (Holland 1995, Farbey et al. 1999). The rise of the Web means the practicalities of conducting IS-related research is increasingly complex in terms of level (e.g., user, firm, industry) and stakeholder (e.g., supplier, buyer, service-provider, end-customer). This paper argues that the case study method when supported primarily by interviews is insufficient to explore complex industry dynamics in organizational research where the problem is best thought of as a ‘mess’, such as the adoption of e-procurement by multiple partners across manufacturing supply chains. It argues for the role of a collaborative process of enquiry as part of an ‘action case’ strategy that enables an element of intervention through the collaboration of researcher and practitioner working together to make sense of a situation and thus construct meaning rather than for the researcher simply to uncover it through interviews. The collaborative investigation process is implemented using workshops that are based around the building of qualitative politicised influence diagrams (QPID) (Powell and Bradford 1998, Powell 2002).

The structure of the paper is as follows. *Section 2* introduces the action case research method and describes the QPID method as a basis for collaborative investigation. *Section 3* outlines the design and execution of the QPID workshop during fieldwork. *Section 4* reports on the results of the study involving eight automotive industry cases, using an illustration of QPID and how it may be incorporated into cross-case analysis. *Section 5* discusses action case and QPID as a practical and appropriate method of collaborative investigation, and raises issues for IS research methodology.

## 2 COLLABORATIVE INVESTIGATION

In order to assist researchers in navigating the multi-disciplinary space of in-context IS research for the ‘organizational laboratory’ Braa and Vidgen (1999) propose a framework defined as a balance between interpretation, reduction and intervention leading to the outcomes of understanding, prediction, and change respectively (Figure 1a). Braa and Vidgen then place traditional methods for IS research within the triangle, recognizing ‘pure’ methods – soft case study, field experiment, and action research – as well as hybrid methods – quasi-experiment and hard case study. They argue for a third hybrid, the action case (Figure 1b) which recognizes that the case study often has a significant interventionary content, while the degree of change that can be enacted via action research is often circumscribed by organizational circumstances.

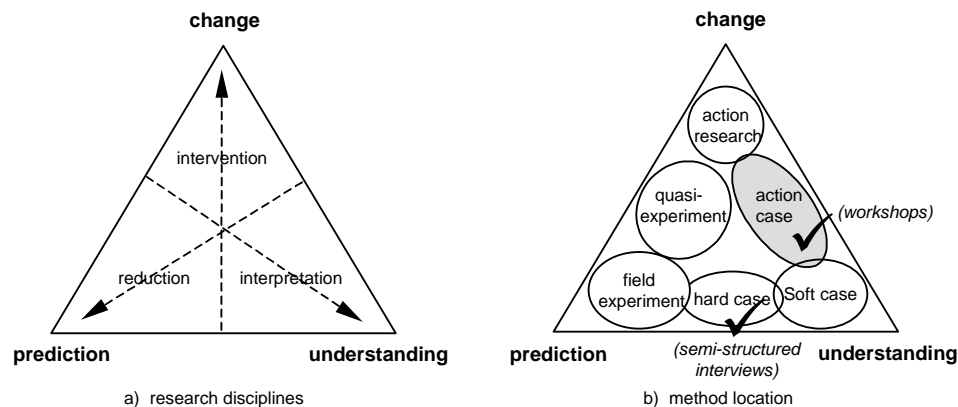


Figure 1 Framework of IS research and methods (adapted from Braa and Vidgen 1999)

Case studies have consistently been one of the most powerful research methods in information systems, operations and supply chain management, particularly in the development of new theory (Voss et al. 2002). Yet criticisms abound of the case approach which is often viewed as a weak sibling and lacking in rigour where *'a paper reports on a few interactions with field sites then sums up with observations and impressions'* (Stuart et al. 2002 p.419). The principal concerns point to fundamental weaknesses throughout the entire process of conducting research, over issues of design, data collection, and analysis. These problems are compounded by confusing the hard and soft case study approach.

Hard case studies adopt a positivist approach, in which an objective reality is described in detail, variables identified and analyzed, and as a result an objective reality is uncovered. The hard case study is adopted in situations where traditional methods of science, primarily the field experiment, is not practicable (for example, when it is not possible to control behavioural events or where there is a focus on contemporary events and their unfolding in real-time). According to Yin (1994), the case study is an empirical enquiry that *'investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident'* (p.13). Difficulties with the hard case include generalizability, lack of control over variables, and the different interpretations by different stakeholders (Galliers 1992).

By contrast, soft case studies adopt an interpretivist stance where reality is assumed to be socially constructed. An interpretivist approach *'depends not on the representativeness of such cases in a statistical sense, but on the plausibility and cogency of the logical reasoning used in describing the results from the cases'* (Walsham 1993 p.15). The interpretivist approach is concerned with gaining understanding, where generalization is the movement from a concrete situation to the social totality beyond the individual case. A soft case study might make use of ethnographic methods, can involve a variety of data collection techniques (e.g. video) and data analysis might involve grounded theory. Clearly, there is much in common between hard and soft case approaches in terms of research aims (both, for example, seek to gain understanding) and techniques used, but the research philosophies underpinning the two methods make them distinctly different in practice.

The origins of action research are usually taken as a view of the limitations of studying real social events in a laboratory and the artificiality of splitting out single behavioural events. The most crucial elements in action research are a collaborative process between researchers and actors, a process of critical enquiry, a focus on social practice and a deliberate process of reflective learning (Argyris et al. 1982). Yet social science is complex because human beings can act in relation to researchers in a way that changes the phenomena investigated and affects the results obtained.

The hard case study approach suggests that the researcher is an objective outsider, recording situations and events impartially and without affecting the organization being studied (i.e. low or zero intervention). However, Braa and Vidgen (1999) argue that *all* research conducted in an organizational setting will have an interventionary element, whether deliberate or unwitting. The action case recognizes explicitly the interventionary aspect of many case studies and the constraints on change in action research. The action case method therefore emerged as a hybrid of soft case (reality is socially constructed and the researcher is part of the situation, not separate) and action research (intervention is desirable and deliberate). Figure 1b illustrates the dilemma often encountered when considering collaborative methods, where action research is strongly dependent on researcher participation and intervention, yet case studies involve passive, interpretive approaches such as interviews and observation. The operationalization of the action case method is illustrated here in a study of IS-related industry transformation and organizational change, i.e. the adoption of e-procurement by the automotive industry. The action case method is implemented using QPID workshops (Figure 1b). A multiple method research design is used to cross-check the workshop findings through hard case

studies conducted with semi-structured interviews. The interviews are grounded in literature and therefore represent an injection of theory that can be in a sense tested. The aim of the workshops is for issues and ideas to emerge through collaboration between researcher and practitioner, i.e. as far as possible the workshop starts from a blank sheet of paper. Thus, the findings of the workshops can be cross-referenced against the reports from the formal interviews – and vice versa.

## 2.1 Qualitative Politicised Influence Diagrams (QPID)

This research uses System dynamics, or more specifically a technique known as Qualitative Politicised Influence Diagrams - 'QPID' (Powell and Bradford 1998). QPID is derived from Soft Systems Modelling (SSM) pioneered by Checkland and others at Lancaster University in the 1970s. SSM was developed as an antidote to the hard systems thinking which sees organizations as goal seeking entities, where the world is assumed to be systemic and can thus be 'engineered'. The soft systems approach sees organizations as social entities which seek to manage relationships and whose concept of IS involves interpretation and sense making. A number of tools exist which enable the codifying and examination of relationships that exist between different variables by describing the influence of one variable upon another, for instance: *Circle diagrams* (Senge 1990), *Seven Stage Model of SSM* (Checkland and Scholes 1990), and *Qualitative System Dynamics* (Powell and Bradford 1998).

Exploring problems using systemic models helps us to think about the real world, promotes discussion and debate, surfaces hidden assumptions, and questions deep-rooted beliefs. The Seven Stage Model of SSM is frequently used to support an enquiry process where a key aspect is the division between the real world and conceptual systems thinking about the real world (Checkland and Scholes 1990). This is helpful in so far as it provides practitioners with a guide for organizing an intervention, where the starting point is for someone to perceive the situation as problematical. However, it is unhelpful in that it reduces SSM to a set of stages, implying a step-by-step method that can be simply picked up and applied in any situation (Vidgen 2002).

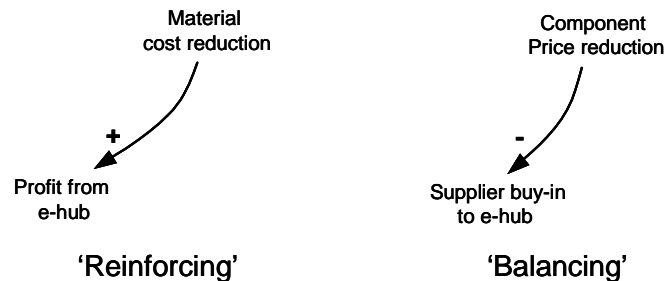


Figure 2 Influence diagram grammar

Systems dynamics enables the representation of processes within the system under consideration, through the medium of cause-and-effect loops and influence diagrams (Weick 1979, Coyle 1977, 1996). The purpose of the influence diagram is to summarise the way in which factors or variables within a dynamic system affect one another. The grammar used here is derived from Coyle (1996), where variables must be capable of expressing a 'thermometer scale', but need not necessarily be numerical (Powell and Bradford 1998). This qualitative approach is also reflected by Senge (1990) who calls for a mind shift in terms of seeing the interrelationships and underlying processes of change, such as the effects of reinforcing and balancing feedback in the system. Figure 2 shows the correlation of the relationship between two variables. If the correlation is 'reinforcing' i.e. both variables either rise or fall, a plus sign is attached to the arrow. If the correlation between variables is 'balancing' i.e. as one variable rises the other falls, a minus sign is attached.

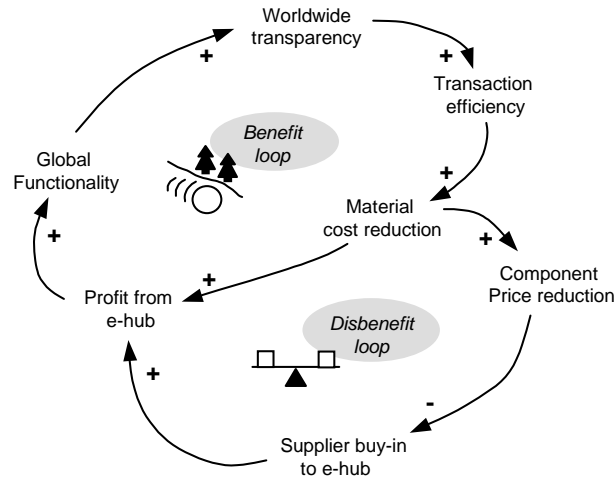


Figure 3 Qualitative system dynamics - the limits to success: 'short term plans for profits that fail'

Qualitative system dynamics (QSD) provides a practical means of capturing dynamic processes from responses given in a group environment. This involves creating a complete systems diagram by developing a chain of variables that when connected together become a loop. The diagram grows into a series of interweaving loops, driven by the discussion and observation from the participants in the group session. The terms 'balancing' and 'reinforcing' can also be applied to loop analysis. Figure 3 shows the plans for increasing profit by vehicle manufacturers who need global functionality, transparency, and transaction efficiency to achieve material cost reductions. Hence, the benefit loop is shown as 'reinforcing' (snowball symbol). Yet the disbenefit loop reflects the increasing resistance to the project from suppliers. Material cost reduction implies a real threat of component price reductions, resulting in a lack of buy-in to the e-hub from suppliers whose collaboration is vital for the project to realise profit. Hence, the disbenefit loop is shown as 'balancing' (scales symbol).

A further step involves the qualitative politicised influence diagrams - QPID - concerned with 'the degree to which interested parties, the actors, have a motivation and/or a power to affect the dynamics of the system' (Powell and Bradford, 1998, p.154). This requires each arrow - representing the relationship between two variables - to be assigned to interested actors or stakeholders. This hybrid approach is used to build a politicised influence diagram, which allows tracking of important actors and coalitions in the business system (Figure 4).

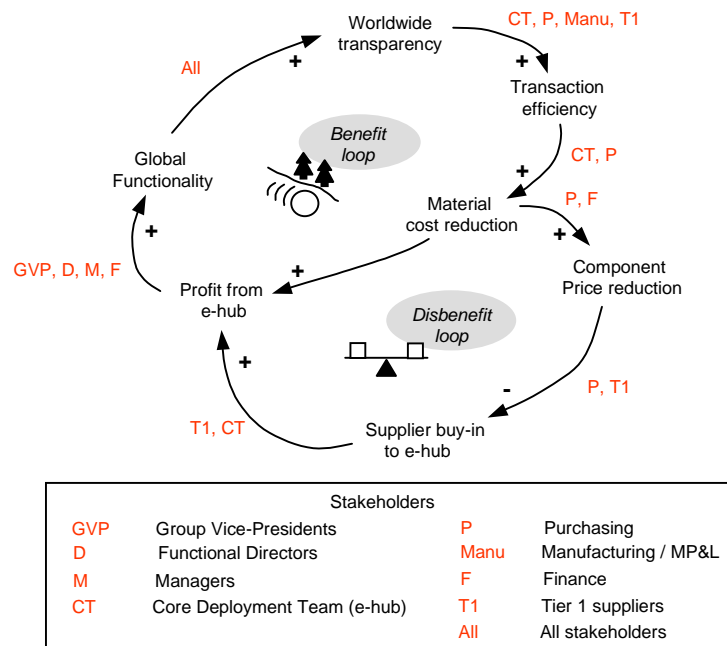


Figure 4      *Qualitative politicised influence diagram (QPID)*

QPID can be used as a strategic tool for deriving management action by recording shifting motivations, opposing intent of competitors and allies, conflict of internal and external wills, and highly politicised environments with powerful constituents (Powell 2002). QPID complements theory on stakeholders (Freeman 1984, Mitchell et al. 1997) by providing a practical means of collaborative investigation during case investigation. It enables participants from a mix of functional backgrounds to reach consensus over sensitive issues such as the adoption of new technology, in a workshop environment. The results from the workshop - a map of interconnecting influence diagrams - represents data that can be cross-referenced with the results from the semi-structured interviews. This is supported by Miles and Huberman (1994, p.172), and Yin (1994, p.91) who argue that the use of many different sources of evidence is a major strength of the case approach. Whereas semi-structured interviews based on literature *uncover* findings, QPID makes sense and *creates* meaning from the data through genuine engagement and '*good quality conversations*' (Streatfield 2001). The QPID workshop design is described further in Section 3.

### 3      **WORKSHOP DESIGN AND EXECUTION**

The investigation adopts a cross-sectional, multiple case study of vehicle manufacturers and suppliers in Europe. Eight firms provide the setting for an investigation into the motivation and barriers to information sharing through sophisticated electronic applications. The firms are selected because they are all faced with decisions over the adoption of electronic applications in procurement, supply, and product development. They are all bound by buyer-supplier relationships ranging from 'transactional' as a simple exchange of goods and services, to 'collaborative partnerships' involving long-term, joint Web-enabled projects.

During the fieldwork, the QPID workshop provided a means of capturing complex situations from the perspective of the organization under investigation, where any variable could be raised, visually recorded, and discussed with firm staff in a group environment. This enabled consensus to be achieved between people holding different viewpoints or backgrounds by using the influence diagram as the focus of the discussion. 3 to 6 participants attended the workshops that lasted around 3 hours and began with a short presentation by the investigator to explain the method. The role of the investigator during the workshops was key to facilitate open discussion in the group while not introducing bias. Each session was primed at the beginning with a short discussion to agree a subject area of mutual relevance to both participant and investigator. It was most important that the subsequent process of data collection did not represent the opinion of the researcher (which would introduce bias into the research), but findings that emerged from a genuine process of collaborative investigation. At the end of the session the influence diagram was transposed from the whiteboard into electronic format, and then sent by e-mail to participating individuals within 24 hours for feedback and verification.

A consistent approach in terms of grammar and general presentation is essential to enable cross-case QPID analysis. The core concerns raised over the adoption and use of sophisticated electronic applications during the QPID workshops are presented as variables in the influence diagram. Stakeholder groups who are concerned, motivated, or claim interest in any variable are represented as an abbreviation, for instance: 'P' - Procurement, 'T1' - tier 1 supplier. The diagram also contains loops that are either 'reinforcing' or 'balancing' according to the stability of system they represent. Balancing maintains the stability of the system where a change in one part is limited or opposed, and is represented by a scales symbol. Reinforcing occurs when changes in the system are amplified, moving it away from its steady state, and is represented by a snowball symbol. A final task for the workshop participants is to label the loops in terms of the subject or concern they represent, for instance 'Change loop, Benefit loop'. An illustration of QPID is now examined in depth.

## 4 ILLUSTRATION

This section presents one example of QPID from the cases of vehicle manufacturers and suppliers in the e-procurement study (Figure 5). It then summarises using a cross-case analysis of QPID from the eight cases. The identity of the organization is protected for reasons of commercial confidentiality.

The QPID in Figure 5 presents the adoption of the ‘ePROCURE’ hub, seen from CarCo’s perspective both as a niche manufacturer of premium family vehicles and as a subsidiary of an American-owned automaker. CarCo views the adoption of the e-hub as an opportunity to move away from its traditional purchasing approach based on gut feel, autonomous management, and manual processes, but is daunted by the prospect of increasing the level of electronic control across the organization. Five loops show CarCo’s concerns over realising benefit through e-procurement internally and across the supply chain, while retaining corporate values and addressing the loss of interpersonal skills.

In order for ePROCURE to realise benefit for CarCo, the benefit loop reinforces the importance of developing transaction efficiency and the capability to distribute data, which lead to cost reduction and increased revenue. The realisation of benefit will reinforce corporate values at the vehicle manufacturer and, in turn, enable the adoption of the e-hub.

The culture loop shows that to be fully accepted internally at CarCo, ePROCURE must improve the quality of decision-making through automated approval and decision-tracking, both vital to support employee job satisfaction. The loop is shown as ‘reinforcing’ because to be accepted by all CarCo personnel, the e-hub must support the strong sense of corporate identity and culture. Functions such as MP&L, Procurement, and Product development are identified as the core internal stakeholders who must take a proactive role in leading the organization through the process of adoption. However, there are already fears over the rise of a ‘machine bureaucracy’ from the e-hub and the loss of the traditional autonomous management style.

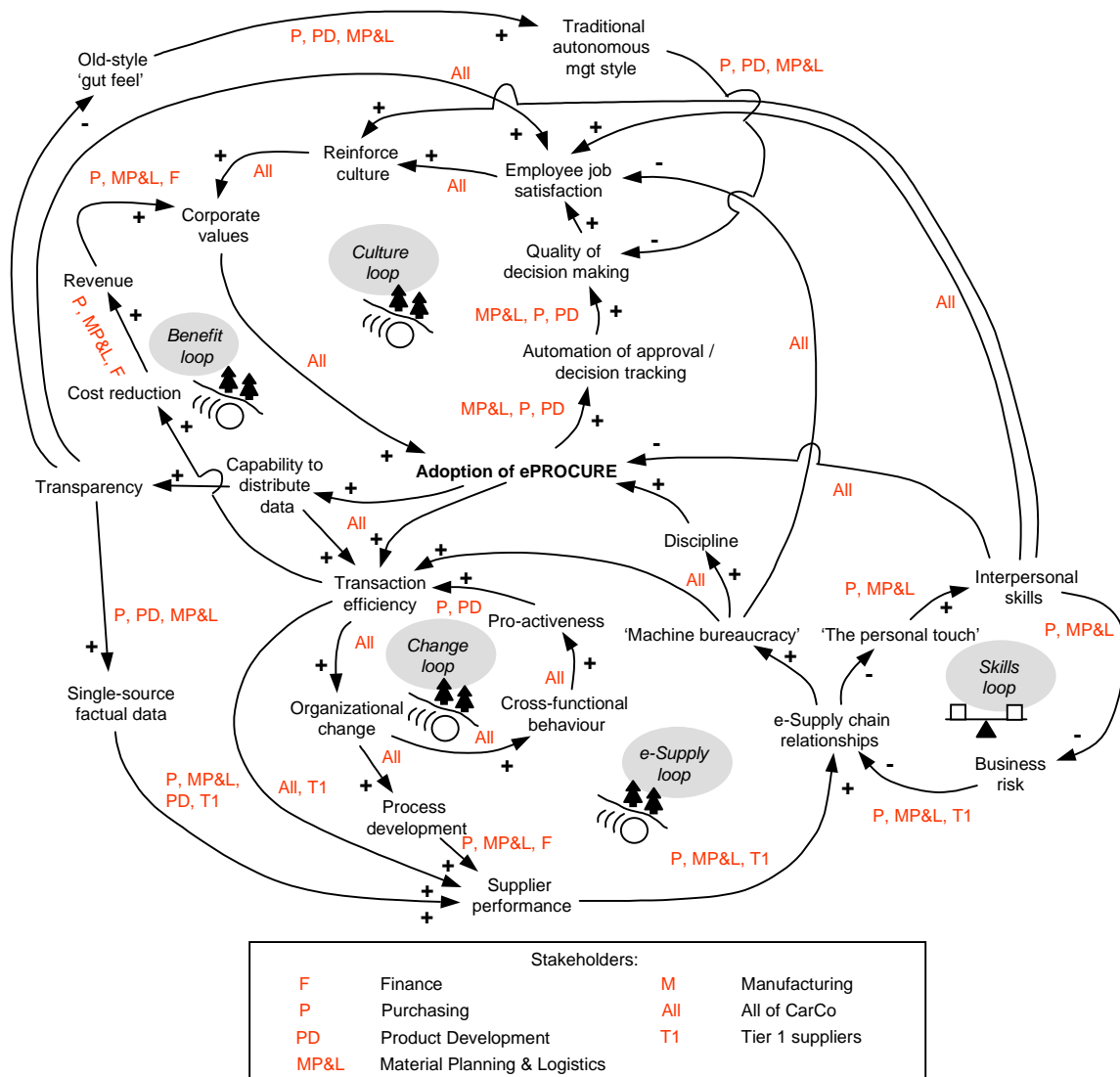


Figure 5 CarCo QPID (October 2002)

The change loop shows that to achieve efficiency benefits from the e-hub requires a significant level of organizational change, driven by cross-functional behaviour from all CarCo departments, and pro-activeness particularly from Procurement and Product Development. This is presented as a 'reinforcing' loop, indicative of the behaviour needed to adopt a system as sophisticated as ePROCURE. The e-supply chain loop is also presented as 'reinforcing', where the anticipated improvements in transaction efficiency are expected to enable organizational change and improve process development, supplier performance and electronic supply chain relationships.

However, the skills loop represents a commonly held fear at CarCo. The development of an e-supply chain by the premium vehicle manufacturer reduces the traditional emphasis on the 'personal touch' during communication with preferred suppliers. The resultant loss of interpersonal skills will increase the long-term business risk to CarCo, who fear the potential for misunderstanding or error over the Internet may increase quality or delivery problems, and ultimately erode brand value. Hence, the skills loop is shown as 'balancing' the current efforts to adopt ePROCURE.

Figure 5 shows CarCo's culture of autonomy and corporate citizenship is diametrically opposed to its North American parent organization, because of the importance placed in job satisfaction and

interpersonal skills over short-term profit at the firm. While CarCo acknowledges the potential benefits of the system, it also stresses the risk to the firm of attempting to automate information sharing based on foreign processes and organizational structures that are very different to its own. Hence, the CarCo QPID suggests that the success of e-procurement projects may not only be governed by size or scale, but by the issues of structural and cultural fit between collaborating organizations. This section now summarizes the outcomes of the QPID analysis across all cases.

#### 4.1 Cross-case analysis

The eight cases present the range and intensity of stakeholder concerns in the automotive industry over the adoption and use of sophisticated electronic applications. QPID provides a link between the case descriptions and analysis by introducing sense making from system dynamics (Checkland 1981), loops of learning (Senge 1990), and politicised stakeholder interactions (Powell and Bradford 1998). It provides a holistic view of the IS-related problems encountered from the organizational perspective and which interact at supply chain or industry level. Yet QPID provides the investigator with more than rich descriptions. This research uses QPID to reveal not only the nature of core concerns, but also to attribute them to specific functions, divisions, organizations, and groups of organizations. Through a process of collaborative investigation QPID enables a practical means of exploring and recording the stakeholder dynamics that exist during periods of change. This is especially useful when separating complex and embedded phenomenon such as e-procurement from an organizational context. Table 1 summarizes the core concerns from the loop analysis of all vehicle manufacturers and suppliers.

Organization	Type	<i>Firm change</i>	<i>Industry change</i>	<i>Decision Strategy</i>	<i>Technology</i>	<i>Culture</i>	<i>Skills / Capability</i>	<i>Performance</i>	<i>Benefit</i>	<i>Disbenefit</i>
MotorCo	VM	✓	✓						✓	
CarCo	VM	✓	✓			✓	✓	✓	✓	
AutoCo	VM						✓✓	✓		
PartCo	T1	✓	✓	✓				✓		
WireCo	T1	✓	✓	✓	✓					
BumperCo	T1	✓					✓	✓	✓	
BeltCo	T2	✓				✓			✓✓	
LampCo	T2	✓	✓	✓			✓	✓	✓	✓

**Key:** VM: Vehicle Manufacturer, T1: Tier 1 supplier, T2: Tier 2 supplier      ✓ = Loop occurs once

✓✓ = Loop occurs twice

*Table 1 Summary of loop analysis from QPID workshops*

Taken as a whole, the eight QPIDs reflect the instability that exists overall during the current period of e-procurement adoption across the automotive industry. Seven of the eight cases are unstable, where expected benefits such as performance improvements are inhibited by supplier resistance, cultural mismatch, and quality of strategic decision making. Table 1 reflects the strong concerns for organizational and industry change during e-procurement adoption. Yet only suppliers raise the issue of strategic decisions and their affects on the process of change. While AutoCo includes the CEO and Vice Presidents as stakeholders, none of the other vehicle manufacturers include strategy or decision-related concerns, despite worries over cultural mismatch and over-ambitious performance targets. Considerably more attention is given to decision making and strategy by the cases of tier 1 and tier 2 suppliers. This suggests that major stakeholder groups have underestimated the impact of 'e-leadership' in supporting and guiding the development of e-procurement within and between firms across the industry.

A surprise finding from the eight QPIDs is the low attention paid to the concern over information technology. This suggests firms are beginning to realise that the effort in adopting sophisticated electronic applications must be directed towards other areas of the business such as organizational development, inter-firm learning, and user knowledge, rather than simply seeking ever more powerful e-tools. Table 1 shows the concerns of vehicle manufacturers and suppliers over the relative lack of 'e' skills and capabilities across the industry, reflected in the comments of the CarCo Procurement Manager where *'technology has developed far quicker than human behaviour'*.

The summary in Table 1 emphasises the concern of all industry stakeholders for the improvement of firm performance and benefits through e-procurement. This is primarily expressed in terms of cost, quality, and delivery, but also includes transaction efficiency such as the reduction of manual processes and paperwork. However, only one of the cases refers to the possibility of 'disbenefit' arising from the adoption of e-procurement. Disbenefit or risk to the firm is represented in QPID as a significant factor in change - often overlooked during the analysis phase of new projects - that counteracts the outcome of expected benefits. This must be addressed before the industry can adopt new technology as a whole and transform itself from its current unstable state.

## 5 DISCUSSION AND CONCLUSIONS

This paper has argued that to gain a deep understanding of the role of e-hubs and the adoption of e-procurement in the automotive industry there needs to be a collaborative process of enquiry where the researcher works with practitioners to make sense and establish meaning. This perspective is grounded in the soft case study where meaning is considered to be socially constructed rather than just 'out there'. If meaning is to be constructed rather than simply received (e.g. through interviews) then some form of collaborative process needs to be defined to support the intervention. This mix of soft case study (interpretation) and action research (intervention) is characterized as action case and the vehicle for collaboration proposed is the QPID workshop. This does not mean that QPID workshops necessarily replace case study and action research. In the research described here, traditional case study interviews using a semi-structured interview protocol were also conducted to gain background data and to give a different perspective on the situation, allowing the interpretivist workshops to be supplemented by a harder perspective. From this exploration of action case four issues are identified.

First, there are similarities between the SSM rich picture and QPID diagrams, and between SSM conceptual models and QPID diagrams. However, practitioners can resist using rich pictures, feeling that they are too informal, and can find the language of conceptual models and root definitions with a CATWOE acronym containing Weltanschauung difficult concepts to grasp. QPID strikes a balance between the informality of the rich picture and the formal rigour of the conceptual model. However, this does not mean the approaches are mutually exclusive or that they are incompatible; the sophisticated researcher may well use SSM in mode 2, whereby soft systems ideas guide the intervention rather than a systematic following of the SSM seven-stage process.

Second, QPID enables the investigator to structure the process of collaborative investigation, as part of an action case strategy, that enables an element of intervention through a joint struggle of researcher and practitioner to make sense of a situation and thus create meaning rather than uncover it. It enables the investigator to view problems that are complex, polyphonic, and 'messy' from the perspective of the stakeholders under investigation. In the research illustrated, it enables an intervention with groups of senior managers from global corporations, combines the political perspectives of multiple stakeholders, and provides a holistic view of industry dynamics concerning the adoption of e-procurement. In this sense, QPID promotes good quality conversations, a key factor in the evolution of organizations according to Streatfield (2001).

Third, QPID applied across multiple organizations provides a common way of documenting case situations such that they can be compared and cross-analyzed in a consistent way, providing a rigour that might otherwise be missing in less structured workshop sessions. To be successful in studies

involving multiple cases, it must identify common themes and differences between the QPID workshops and reconcile data from other methods such as interviews. This is argued to strengthen case validity by replicating a predicted pattern of variables, improve reliability of findings, and hence develop deeper understanding from explanation building (Miles and Huberman 1994, Yin 1999).

Fourth, the QPID workshops can also form the basis for a more significant programme of action - one that might indeed be more likely to be effective if the workshops have established a shared understanding and trust between participants. This action may involve the researcher and thus constitute action research or it may be taken forward by the practitioners independently of the researcher, and thus the workshops are a facilitator of organizational development.

While QPID offers several advantages to the investigator there are clearly also limitations to this approach. A chief concern is the management and reduction of bias - a common concern during action-based research methods (Argyris et al. 1982). For instance, researcher bias may be present as ideas from one workshop are taken to another workshop. Multiple workshops, conducted by more than one investigator at each firm might reduce the instances of bias, but this raises the issue of resources. In comparison to structured interviews and observation, QPID workshops consume more research resource in terms of organization, facilitation, and presentation of data. While it can be argued that the potential benefits outweigh the investment, QPID workshops - like the case approach - may only suit researchers with particular skillsets and outlook. Certainly, it is important that the researcher is trained in facilitation skills if the workshops are to be effective.

A further concern is over the labelling of loops and the definition of categories. For example, in Figure 5 why is business risk part of the skills loop and not the change loop? The loop categories suggest a direct comparison is possible across all the cases (Table 1). However, each QPID workshop represents a unique view of the world from the perspective of the participants whose values may not correspond with those held by other organizations. The challenge for the investigator is to understand these similarities and dissimilarities while presenting the findings as closely as possible to reflect the meaning of data in its original context.

Future work will investigate how QPID might be used with other systems approaches, such as SSM and complex adaptive systems (Stacey 2003), and how it can be extended to support more significant interventions in action research. Further work is also needed to explore the role of QPID in cross-case analysis to support research into large units of research, such as at industry level.

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