

**THE ROLE OF KNOWLEDGE TRANSFER IN IMPLEMENTING AND
APPLYING B2B E-COMMERCE: AUSTRALIAN EMPIRICAL
EVIDENCE FROM A SUPPLY CHAIN MANAGEMENT CONTEXT**

Damien Power

*Working Paper 31/02
November 2002*

WORKING PAPER SERIES



ISSN 1327-5216

This paper is a work in progress. Material in the paper cannot be used without permission of the author.

THE ROLE OF KNOWLEDGE TRANSFER IN IMPLEMENTING AND APPLYING B2B E-COMMERCE: AUSTRALIAN EMPIRICAL EVIDENCE FROM A SUPPLY CHAIN MANAGEMENT CONTEXT

LITERATURE REVIEW

The concept of supply chain management is often traced back to Forrester (Forrester 1958; Forrester 1961; Forrester 1968) who identified the dynamics of response to changes in demand in supply chain situations. Forrester identified that there typically is a distortion in demand patterns created by the dynamic complexity present in transferring demand from end users along a chain of supply to manufacturers and material suppliers. One of the key implications of this work was that the inter-dependence of participants in supply chains was highlighted, such that any participant's potential to optimise performance would be constrained by the limitations inherent in the overall system. It has been the identification of this kind of distortion and inefficiency, along with the development of new technologies, that have driven many organizations to look to managing the supply chain within which they operate, rather than simply focusing on their own organization. In many supply chains, this move has been characterised by the adoption of barcode reading technology and the use of EDI to streamline paper and funds based transactions. This has led to the concept of an "integrated supply chain". The basic components of integration typically include cooperation, collaboration, information sharing, trust, partnerships and shared technology. Towill (Towill 1997) defines integration at it's most advanced as a "Seamless Supply Chain" where territorial boundaries between trading partners are eliminated and they effectively operate as if part of the one organization. The achievement of such integrated systems has been the focus of much of the research conducted in this area in the last five years, due to the impact of new technology and the growth of e-commerce business models. Some authors see the major issues as being the need to be able to exchange information in real time across multiple enterprises using open systems (Truman 2000; Unal 2000; Upin, Beckwith et al. 2000). Others have placed a stronger emphasis on the need for more durable and robust relationships between trading partners (Dyer, Cho et al. 1998; Vollmann and Cordon 1998; Whipple and Frankel 2000). Hicks (p.45, Hicks 1997) describes the supply chain as: "...a collection of all components and activities associated with the creation and delivery of a product or service", while Bowman (Bowman 1997) extends this definition to include logistics related business processes such as ordering, inbound and outbound transportation, manufacturing, warehousing and customer service. The potential for integration of the supply chain to improve both profit potential and competitive position is highlighted by Wood when he states that:

".....since the supply chain represents 60% to 80% of a typical company's cost structure, just a 10% reduction can yield a 40% to 50% improvement in pre-tax profits" (p.26, Wood 1997).

This potential was first identified by Forrester, and is extensively documented in the supply chain literature. (Forrester 1958; Forrester 1961; Bhaskaran 1998; Ballou, Gilbert et al. 2000; Belyea 2000; Cachon and Fisher 2000; Chen, Drezner et al. 2000). Despite the apparent opportunities, the adoption of technology to enable the more efficient management of supply chains has been slow, with some of this technology (e.g. EDI) having been available for more than thirty years (Johnston and Mak 2000). Recent rapid changes in technology have had both positive and negative impacts in this context. On the one hand they provide further opportunities for improved supply chain performance. On the other hand, this increasing rate of change promotes obsolescence. Systems that were recently "state of the art" can become outdated legacy systems quite quickly. (Froehlich, Hoover et al. 1999; Hewitt 1999). Recent research has indicated that although the potential benefits are understood, there appear to be many reasons for a lack of speed in application. The application of cooperative practices is also reported by another A. T. Kearney survey (450 companies worldwide) to be on the one hand extensive, but on the other too superficial (Tait 1998). Although 50% maintained key supplier relationships for 6 years or more, only 20% of North American and European companies involved suppliers in important business processes. This survey also identified the most common barriers as being; lack of trust, poor cross business cooperation, lack of skills and experience and data problems. Another survey of 400 e-commerce managers provides some insight into the nature of these problems (Anonymous1 2000).

“.....the single biggest bottleneck to widespread adoption of B2B e-commerce is manual "enablement", or the process of preparing a company, its internal systems and its trading partners to begin conducting transactions over its trading networks”. (p.7, Anonymous 2000)

The survey finds that:

- 56% of respondents conduct B2B transactions with less than 25% of their trading partners.
- 77% perform less than 15 processes electronically with partners.
- 45% perform less than 5000 electronic transactions a month.

Australian research has identified a range of issues, particularly relevant to small and medium enterprises (SME's), that throw further light on these issues (Anonymous2 2000). In this case it was found that only 28% of companies connected to the Internet used it for procurement of goods and services. These results are in line with some research from the US that found that a high proportion of SME's there saw EDI implementation as simply adding to the cost of doing business (Raymond and Bergeron 1996). Reasons given for this reluctance included preference not to deal directly with a supplier and security concerns. Respondents also indicated a range of reasons why they might be reluctant to move into electronic commerce:

- Moving onto the Internet could lead to uncontrolled growth.
- Fear of alienating intermediaries.
- Satisfaction with current business arrangements.
- Concern about levels of understanding of the technology.
- Time and expense of reengineering processes.
- Fear their products would not be suitable for trading via the Internet.

The issue of security is also one that has been the subject of some research. By Furnell and Karweni (Furnell and Karweni 1999). A survey of 38 consumers and 9 companies found that much of the concern over security is more driven by ignorance than information. This has led some people to distrust the medium. For businesses it was also found that a conducive environment (i.e. government sponsored) would be seen to be an important enabler.

Against this background of opportunity for improvement and an apparent slow rate of adoption of the technologies that this paper finds it's context. One factor not identified in the research is that of knowledge transfer within organizations. Given that there appear to be both impediments to the adoption of B2B e-commerce enabling technology, and opportunities for competitive advantage from their adoption, is it possible that once organizations begin moving down this path there is a process of organizational learning enabling and facilitating further adoption? Do organizations grow into further adoption and application over time through exposure to the possibilities presented by these technologies? In the case of existing technologies (e.g. EDI), is there evidence that once organizations have become exposed to their use, that further use is facilitated, and knowledge of potential benefits and applications grow?

METHODOLOGY

Background

A survey yielding 553 responses from Australian companies was conducted for the purpose of identifying and confirming some of the major issues relating to the implementation of Business to Business (B2B) e-commerce practices. The sample was drawn from organizations who are members of EAN Australia (and are thus using EAN product numbers and barcodes at least at the minimum level of application to outward goods). As such, these organizations have been using established e-commerce enabling technologies for some time. 11000 organizations (the full membership of EAN Australia) were sent survey questionnaires incorporated into a quarterly newsletter. A subsequent survey of non-respondents was also conducted covering 1707 member organizations. This non-respondent survey indicated that only 26% of companies

received the newsletter and found the survey inside. This survey also provided evidence to the effect that the membership database was carrying a 15% error rate (wrong company name, address changed etc.). 925 further surveys were sent out to companies involved in the non-respondent survey. As a result, the true sample size is estimated at 3350 member organizations. There were 553 responses received, an estimated response rate of 16.5%. Comparison of the results from both the member survey and the non-respondent survey indicated that the 553 respondent members were representative of the total membership base. The two variables used for comparison were Primary Business Activity (or Industry) and the number of people employed by the organization. The Chi-square and T-tests used indicated that there were no significant differences between the two groups on these two variables. Confidence in the generalisability of the results is further supported by the number of responses (553), which is in excess of the number required from a sample of 11,000 (375), or alternatively for the estimated sample of 3350 (346) (Krejere and Morgan 1970). The content of the survey focused in particular on; the extent of knowledge of the EAN system and B2B e-commerce generally, objectives and expectations of implementation, planning for implementation, techniques in use, the breakdown of implementation investment expenditure, the extent of implementation, business outcomes, specific organisational and strategy development issues, and the extent of adoption of emerging technologies such as the Internet. The focus of this paper is on the effect of membership of the EAN organization over time on a range of variables such as; extent of implementation; strategic content and planning processes; knowledge of the various technological and operational implications of extended implementation; capability of the organization to effectively implement; and business outcomes.

Methods of Analysis

Factor Analysis

Exploratory factor analysis was used to establish the reliability and validity of a number of constructs to be used as initial points of comparison. The content and relevant statistics for these factors are included below:

FACTOR ONE: LEVEL OF UNDERSTANDING

ALPHA = .9474

Ten Likert scale (LS) variables relating to the level of understanding within the member organizations of the implementation of the EAN system.

FACTOR TWO: REACTIVE PLANNING

ALPHA = .6699

Three (LS) variables relating to reactive planning practices prevalent in member organizations when implementing the EAN system.

FACTOR THREE: PROACTIVE PLANNING

ALPHA = .8382

Four (LS) variables relating to proactive planning practices.

FACTOR FOUR: OPERATIONAL OUTCOMES

ALPHA = .9702

Thirteen (LS) variables relating to the contribution of the EAN system to specific operational outcomes.

FACTOR FIVE: BOTTOM LINE OUTCOMES

ALPHA = .8541

Four (LS) variables relating to the contribution of the EAN system to specific bottom line outcomes.

Another group of variables used related to the Cost/Benefit perceptions of using the EAN methodology. These were two (LS) questions relating to the relative cost / benefit derived from use of the EAN system. Each of these above dimensions were tested across four categories (years of membership) using ANOVA analysis.

Causal Model

A causal model was also developed from the data collected. This model comprised of 6 factor variables as follows:

PROCESS: An unobserved variable made up of three factor variables. These comprised of Challenging Cognitive Frameworks (14 observed (LS) variables), Environmental Scanning (9 observed (LS) variables) and Benchmarking (4 observed (LS) variables). This captures the process of EAN implementation strategy formulation.

CAPABILITY: An unobserved variable made up of four factor variables. These comprised of Stakeholder Involvement (11 observed (LS) variables), Strategic Reengineering (7 observed (LS) variables), Infrastructure Spending (4 observed (LS) variables) and Technology Spending (3 observed (LS) variables). This captures the capability of an organization for EAN system implementation.

KNOWLEDGE: An unobserved variable made up of three factor variables. These comprised of knowledge of the EAN System (10 observed (LS) variables), Knowledge of Potential Outcomes (5 observed (LS)

variables) and Understanding of a Full Implementation (5 observed (LS) variables). This captures the level of knowledge in the organization of the EAN system.

CONTENT: A factor variable made up of 15 observed variables relating to the stated objectives and expectations for the organization form implementation. This captures the espoused content of EAN implementation strategy.

EXTENT OF IMPLEMENTATION: A factor variable made up of 8 observed variables relating to the extent to which implementation has been extended along the organization’s supply chain. This captures the extent to which an organization has implemented the EAN system with trading partners

PERFORMANCE: A factor variable made up of 17 observed variables relating to the perception of the contribution of the EAN system to organizational performance outcomes. This captures the extent to which the EAN system has contributed to organizational performance.

This model was developed through both confirmatory factor analysis and structural testing using the AMOS package. The Goodness of Fit statistics were as follows (indicating an adequate degree of fit and model integrity):

GFI = 0.948

RMR = 0.035

RMSEA = 0.077

FINDINGS

Level of Understanding by Number of Years of Membership

There was no significant difference found in the level of understanding based on how long organizations have been members of EAN Australia. There was no significant correlation found between length of membership and level of understanding. This would appear to indicate no growth in knowledge over time for member organizations. This result was somewhat surprising given that the membership of this organization are regularly contacted through newsletters and membership offerings. The use of the EAN system had also been actively promoted by at least one of the major retail groups over (at least) the past 5-7 years. This organization had provided training programs and consulting resources for organizations wishing to extend implementation. Despite this concerted effort over time from many sources the survey results indicate little difference in knowledge and/or awareness between new and old member organizations.

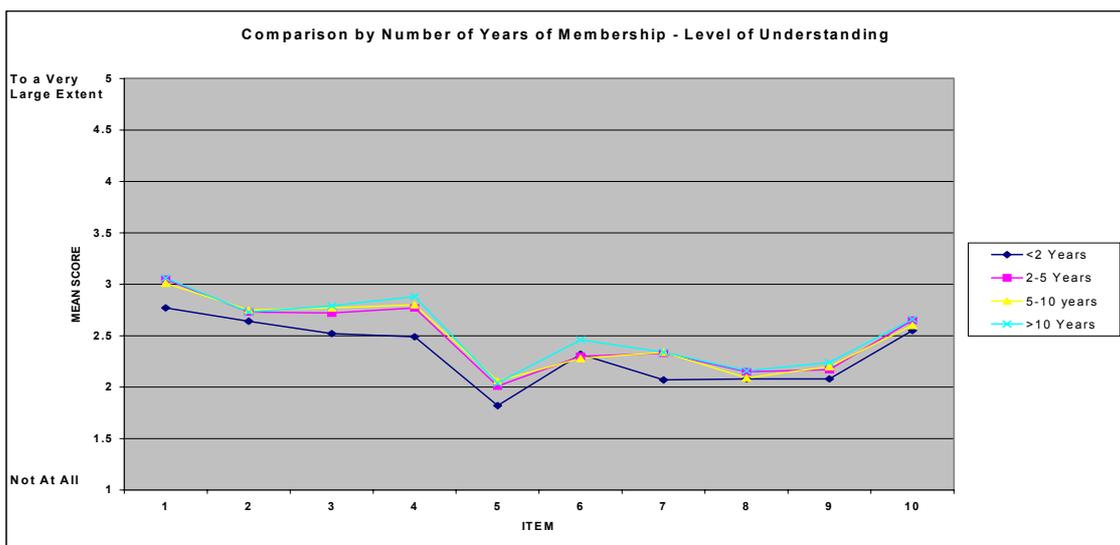


Figure 1: Comparative levels of understanding by years of membership

Perception of Cost/Benefit by Number of Years of Membership

A significant difference ($p < .05$) in perceptions of cost of implementation was found for the group with less than two years of membership. This group have the lowest assessment of cost, an attitude that appears to change as they move into the 2-5 years group, and that also appears to stay about the same from then on. It is also of interest that relative costs and benefits appear to converge the longer companies maintain membership, only to diverge again after around 10 years. This finding is consistent with the early entry cost being quite low for a limited implementation (covering say applying barcodes to outgoing goods only). There appears to be a perception that the benefit side of the equation barely justifies the investment for companies for many years. It is only when companies have been members for more than 10 years that the benefit appears to significantly outweigh the cost. This raises the question of what this perception is based on, given the findings from the previous section indicating that knowledge does not increase over time. It perhaps indicates that knowledge of the system does not increase, but that experience with use of the system perhaps reveals greater potential benefit. Whatever the reason, the lead time for the fulfilment of this potential appears overly long.

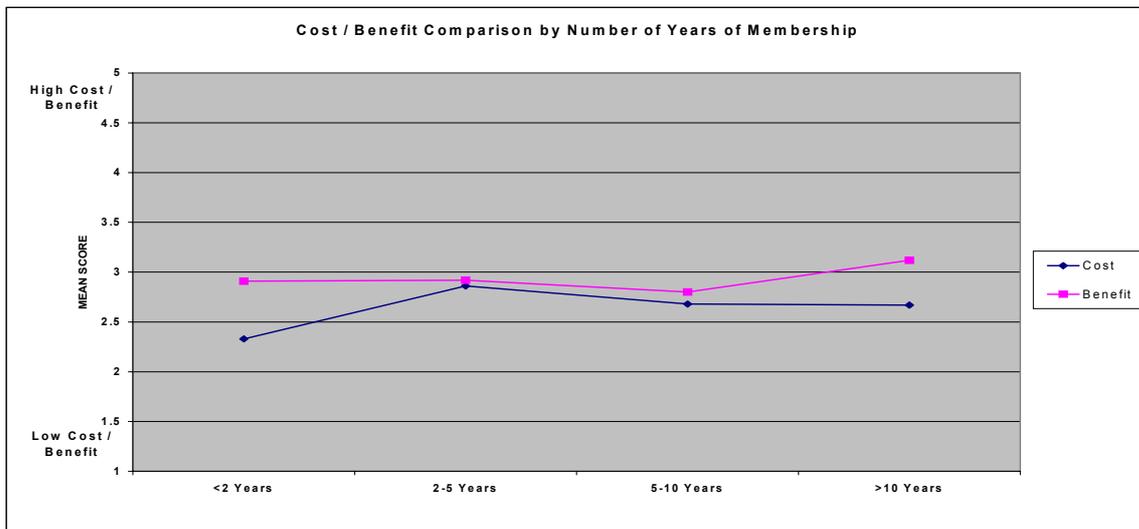


Figure 2: Assessment of Cost / Benefit by Number of Years of Membership

Extent of Planning by Number of Years of Membership

Reactive Planning

The only significant difference recorded in emphasis on Reactive Planning was for the variable relating to the process being driven by trading partners. For this item the companies that had most recently joined (i.e. within the past 2 years) recorded significantly less influence of trading partners as a driver of their planning processes ($p < .05$). For all groups the level of Reactive Planning was almost constant. The lower emphasis on involvement of trading partners is surprising to a degree in companies with limited periods of membership. In light of the fact that a concerted campaign of education and recruitment had been undertaken by a major retail chain over the 12 months prior to the survey being conducted, it could have been expected that young members would be more reactive to trading partner pressure.

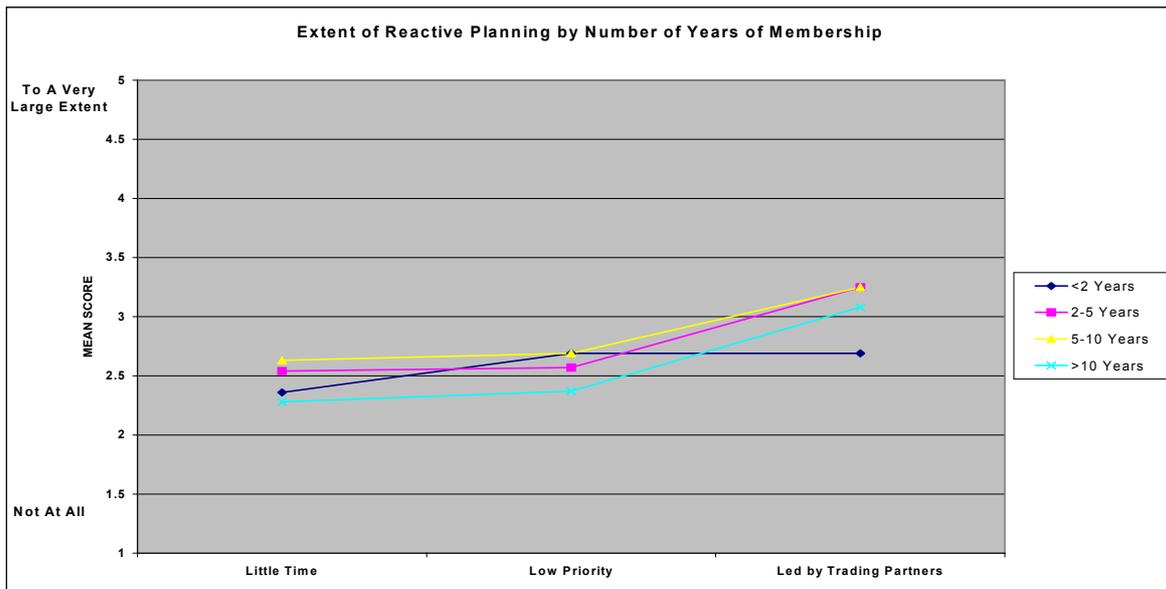


Figure 3: Extent of Reactive Planning by Number of Years of Membership

Proactive Planning

There were no significant differences found in extent of Proactive Planning based on number of years of membership. On the face of it this may appear surprising, given that it could be reasonably expected that organizations would become more proactive over time in trying to plan and implement further aspects of the EAN system. It is, however, not surprising in light of the previous two findings. If organizations show little or no increase in knowledge over time, and perceive little benefit relative to cost for many years, there would appear to be little incentive for them to be proactive about extending implementation.

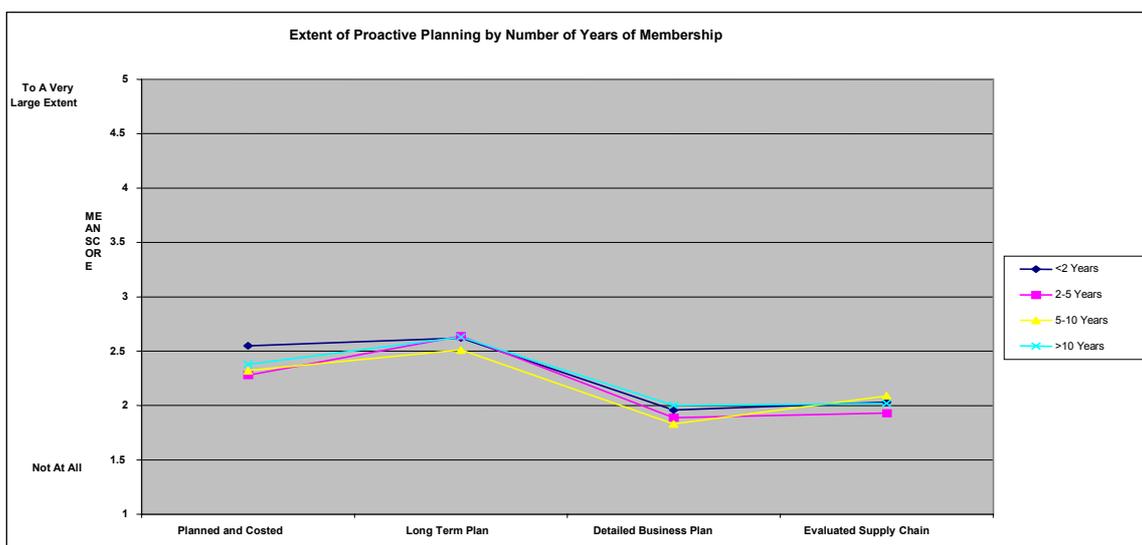


Figure 4: Extent of Proactive Planning by Number of Years of Membership

Business Outcomes by Number of Years of Membership

Operational Outcomes

There were no significant differences found in perception of the contribution of the EAN system to operational or bottom line outcomes based on number of years of membership. This would again support the previous findings that time is not a primary determinant of, or indeed has little substantial relationship with knowledge of the system, planning and perception of cost vs. benefit.

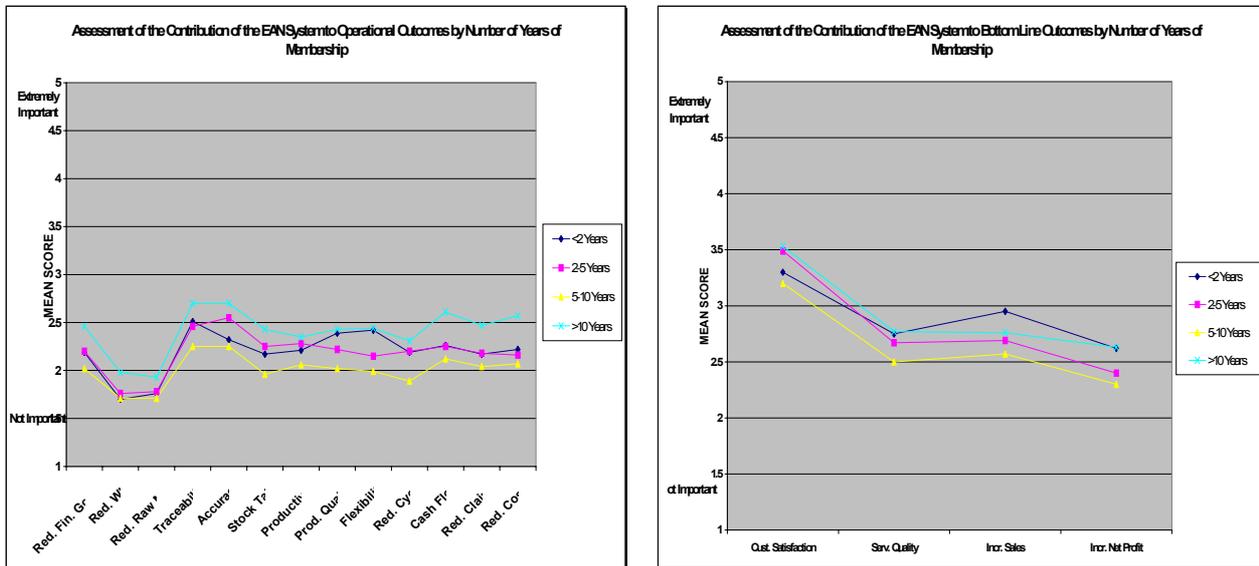


Figure 5: Assessment of the contribution of the EAN system to operational and bottom line outcomes by number of years of membership

Extent of Implementation by Number of Years of Membership

Although there are some differences apparent in the comparison of the three groups on the basis of number of years of membership, ANOVA tests showed that these differences were not statistically significant. There was also no significant correlation found between years of membership and the extent of implementation. Figure 6 below provides a graphical representation of the comparative results.

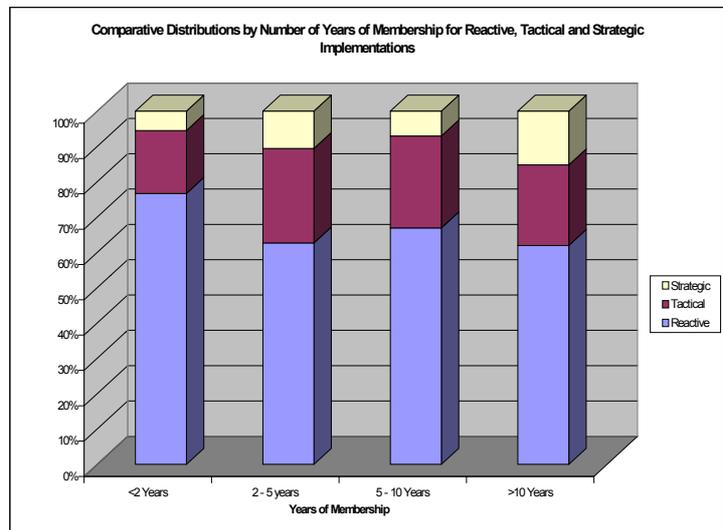


Figure 6: Comparison between Reactive, Tactical and Strategic groups by number of years of membership

Comparison of the Causal Model by Number of Years of Membership

When the causal model is compared on the basis of two groups – the first representing companies that have been members of EAN for less than 5 years, the second members for greater than 5 years – the two groups

are found to be significantly different on the basis of the model. In particular, they are found to diverge in terms of the strength and significance of the relationship between Knowledge and Capability.

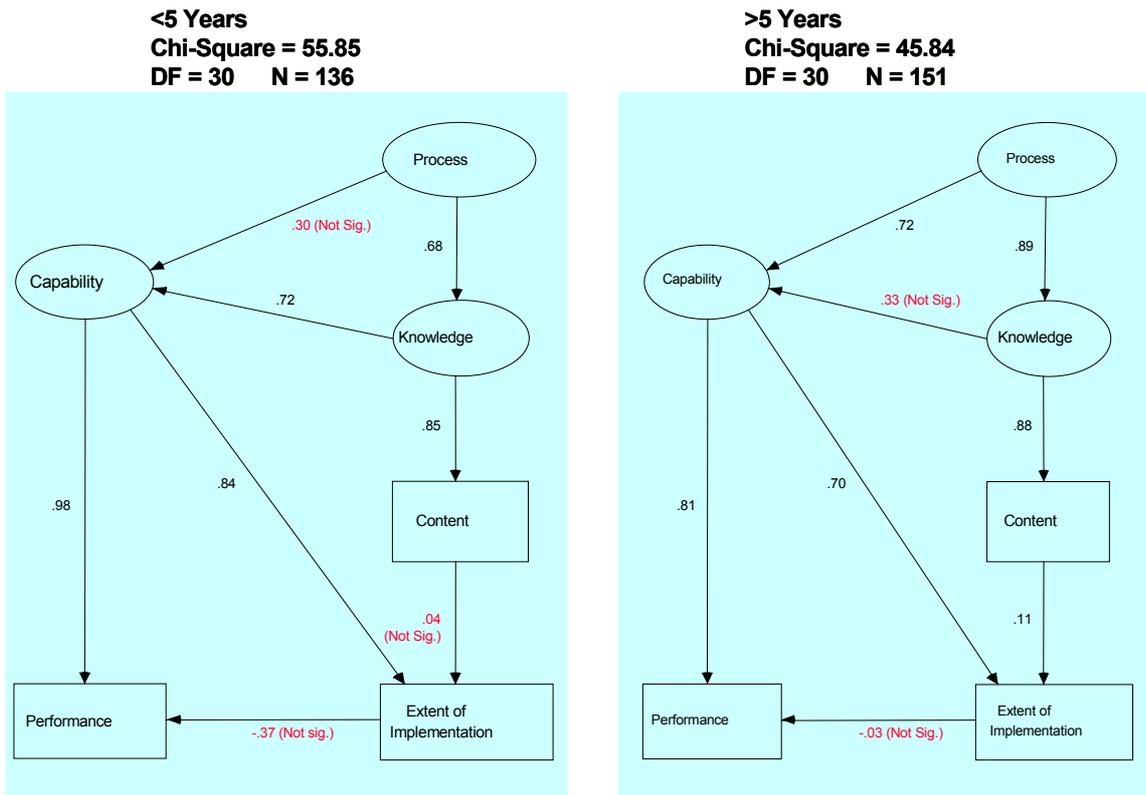


Figure 7: Comparison between organizations with <5 years membership and organizations with >5 years membership by number of years of membership

When comparing these models it is apparent that there is a stronger path from Process to Knowledge to Content to Extent of implementation in the companies with longer terms of membership. The Path from Process to Capability to Performance is also stronger. At the same time, the path from Knowledge to Capability is strong and significant in the younger companies, and weak and non-significant in the older companies. The results indicate that for companies that have been members for longer periods the knowledge of the EAN system has become (perhaps) tacit and embedded in the organization. As a result, for these companies one reasonable conclusion is that knowledge of the EAN system has been transferred into Capability over time. For younger companies, it is perhaps still a strong informant of Capability.

CONCLUSIONS

The findings of the survey indicate that the number of years of membership are not necessarily related to extent of implementation. Organizations do not appear to extend implementation of B2B technologies and practices as an outcome of knowledge gained over a number of years of membership. It is also apparent that the number of years of membership do not determine levels of knowledge, expectations, extent of implementation or business outcomes. Is it therefore reasonable to conclude that there is no learning going on in these organizations? The causal model would indicate that this may be the wrong conclusion to draw, as there is some indication that there are different processes of knowledge use and application at work in organizations with more experience in the use of the EAN system. As time goes on, the results from the causal model indicate that Knowledge of the EAN system has a role in shaping Capability of the organization in younger companies. This relationship is not apparent in companies with longer terms of membership. Although time (number of years of membership) does not appear to be related to any of the superficial indicators of growth and learning, there is nonetheless evidence of real knowledge transfer over time. Learning over time may be indicated less by the volume of knowledge, than by the quality and integrity of the transfer process.

REFERENCES

- Anonymous1 (2000). "Survey reveals B2B growth bottleneck." Warehousing Management 7,(11):December, 7.
- Anonymous2, 2000, Survey of Technology and E-commerce in Australian Small and Medium Business, National Office for the Information Economy / Telstra Corporation Limited, June
- Ballou, R. H., Gilbert, S. M. and Mukherjee, A. (2000). "New managerial challenges from supply chain opportunities." Industrial Marketing Management 29,(1)7-18.
- Belyea, K. (2000). "How Electrolux takes cost out of the chain." Purchasing 128,(5)59-65.
- Bhaskaran, S. (1998). "Simulation analysis of a manufacturing supply chain." Decision Sciences 29,(3)633-657.
- Bowman, R. J. (1997). "The state of the supply chain." Distribution 96,(1)28.
- Cachon, G. P. and Fisher, M. (2000). "Supply chain inventory management and the value of shared information." Management Science 46,(8):August, 1032-1048.
- Chen, F., Drezner, Z., Ryan, J. K. and Simchi-Levi, D. (2000). "Quantifying the bullwhip effect in a simple supply chain: The impact of forecasting, lead times, and information." Management Science 46,(3)436-443.
- Dyer, J. H., Cho, D. S. and Chu, W. J. (1998). "Strategic Supplier Segmentation: The next best practice in supply chain management." California Management Review 40,(2)57.
- Forrester, J. (1958). "Industrial dynamics, a major breakthrough for decision makers." Harvard Business Review (July-August),37-66.
- Forrester, J. W. (1961). Industrial Dynamics. Cambridge, MA., MIT Press.
- Forrester, J. W. (1968). Principles of Systems. Cambridge, MA., MIT Press.
- Froehlich, G., Hoover, H. J., Liew, W. and Sorenson, P. G. (1999). "Application framework issues when evolving business applications for electronic commerce." Information Systems 24,(6)457-473.
- Furnell, S. M. and Karweni, T. (1999). "Security implications of electronic commerce: a survey of consumers and businesses." Internet Research-Electronic Networking Applications & Policy 9,(5)372-382.
- Hewitt, F. (1999). "Information technology mediated Business Process Management - lessons from the supply chain." International Journal of Technology Management 17,(1-2)37-53.
- Hicks, D. A. (1997). "The manager's guide to supply chain and logistics problem solving tools and techniques - Part 1: Understanding the Techniques." IIE Solutions 29,(9)43-47.
- Johnston, R. B. and Mak, H. C. (2000). "An emerging vision of Internet-enabled supply-chain electronic commerce." International Journal of Electronic Commerce 4,(4)43-59.
- Krejere, R. V. and Morgan, D. W. (1970). "Determining sample size for research activities." Educational and Technological Measurement 30,607-610.
- Raymond, L. and Bergeron, F. (1996). "EDI success in small and medium enterprises: A field study." Journal of Organizational Computing and Electronic Commerce 6,(2)161-172.
- Tait, D. (1998). "Make strong relationships a priority." Canadian Manager 23,(1)21, 28.
- Towill, D. R. (1997). "The seamless supply chain - the predators strategic advantage." International Journal of the Techniques of Manufacturing 13,(1)37-56.
- Truman, G. (2000). "Integration in electronic exchange environments." Journal of Management Information Systems 17,(1)209-244.
- Unal, A. (2000). "Electronic commerce and multi-enterprise supply/value/business chains." Information Sciences 127,(1-2)63-68.

- Upin, E. B., Beckwith, M. J., Jennings, C. L., Chen, B. Y. and Schaeffer, K. B., 2000, B2B: Building technology bridges outside the four walls of the enterprise, Robertson Stephens Research, August 15
- Vollmann, T. E. and Cordon, C. (1998). "Building successful customer-supplier alliances." Long Range Planning 31,((5))684-694.
- Whipple, J. M. and Frankel, R. (2000). "Strategic alliance success factors." The Journal of Supply Chain Management 36,(3)21-28.
- Wood, A. (1997). "Extending the supply chain: Strengthening links with IT." Chemical Week 159,(25)26.