Abstract

A survey of 553 Australian companies indicates that while many organizations have seen significant benefits from the application of such techniques as EDI, product numbering and bar-coding, their acceptance has been far from universal. Many organizations appear to have only implemented in response to requests (or directives) from trading partners. The development of the Internet is proposed to be the means by which electronic trading can be made more accessible and affordable, thus enabling broader adoption and acceptance of business-to-business electronic commerce. This survey research provides evidence that this may indeed be the case, with a broader range of organizations seeing an opportunity to benefit from the adoption of Internet based technologies.


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A STUDY OF THE EXTENT OF E-COMMERCE IMPLEMENTATION AMONG AUSTRALIAN ORGANISATIONS

INTRODUCTION

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" (Wood 1997, p.26). This potential was first identified by Forrester, and is well 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). Cottrill (Cottrill 1997) contends that the Internet will be the enabler that ultimately revolutionises management of the supply chain, and indeed the way business is conducted in some industries. Cottrill talks of a shift to "communities of interest" (i.e. groups of companies) representing a new competitive force in markets with common strategic goals. Motivated by a common need to deliver products quickly in a customer driven market, the importance of logistics in this context will depend on its' importance as a differentiator within the group, with cooperation likely between competitors in areas where they are likely to benefit. The ability of the Internet to overcome problems common to previously used networks will be a major facilitator of this process. Johnson (Johnston and Mak 2000) sees the Internet and EDI being used in conjunction. In this sense the Internet could be used as a means of enhancing current systems and technologies, rather than being a just cheaper alternative to (say) EDI. The focus of this paper is on identifying the extent of adoption and implementation of established e-commerce enabling technologies such as EDI, product numbering and barcoding, as well as establishing characteristic differences between companies with different adoption approaches.

METHODOLOGY

Framework

Implementation of established e-commerce enablers such as bar-coding and EDI can be characterised in three different forms (based on the model for implementation promoted by EAN Australia, the organization responsible for the application and administration of the European Article Numbering standard in Australia):

Reactive: Purely satisfying a request from a trading partner. This is viewed as the lowest level of implementation and is generally restricted to applying barcodes to finished goods, with perhaps some EDI transactions included. Tactical: This approach seeks to extend implementation to specific processes within the business to improve efficiencies in (say) production or inventory control. Strategic: Implementations of this type seek to introduce integrated supply chain management techniques across the entire supply chain in a planned, staged manner.

For the purpose of this paper this model has been used as a framework for identifying the extent to which organizations have adopted and implemented these established technologies. Organizations were placed in one of these categories based on responses to 13 questions relating to the extent of implementation.

Sample

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).

Analysis Methodologies

Having divided the database into three groups according to the extent of implementation (as described
above), comparisons have been made in the following ways:

- The three groups have been compared on the basis of the demographic variables of Industry and
  Company Size and number of years of membership.
- FACTOR ANALYSIS: Exploratory factor analysis was used to establish the reliability and validity of a
  number of constructs to be used as points of comparison. The content and relevant statistics for these
  factors are included below:
  - FACTOR ONE: LEVEL OF UNDERSTANDING  ALPHA = .9474
  - Ten 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 variables relating to reactive planning practices prevalent in member organizations when
    implementing the EAN system.
  - FACTOR THREE: PROACTIVE PLANNING  ALPHA = .8382
  - Four variables relating to proactive planning practices.
  - FACTOR FOUR: OPERATIONAL OUTCOMES  ALPHA = .9702
  - Thirteen variables relating to the contribution of the EAN system to specific operational outcomes.
  - FACTOR FIVE: BOTTOM LINE OUTCOMES  ALPHA = .8541
  - Four variables relating to the contribution of the EAN system to specific bottom line outcomes.
  - Perceptions of cost versus benefit have been captured by two variables, and compared on the basis of
    extent of implementation and by industry.
  - A series of questions relating to current and planned use of company web sites have also been used.
    Comparisons have been made on the basis of extent of implementation and company size. The purpose
    of this section is to provide some insight into the future nature of the implementation of these “emerging”
technologies, as against longer “established” technologies such as EDI.

DATA ANALYSIS

Extent Of Implementation

The results of this categorisation indicate that the majority of member organizations are Reactive in their
approach to implementation (as per Figure 1) Only 11% of member organizations were found to be Strategic
implementers, 25% were Tactical, and 64% were Reactive.
Analysis of the three implementation approaches (i.e. Reactive, Tactical or Strategic) by primary business activity (or industry type) showed a higher proportion of Manufacturers in the Reactive group (Note: only the three major industry types – Manufacturing, Wholesale Distribution and Retail were used). The Strategic group by contrast showed a higher proportion of Wholesale Distributors and Retailers. The difference recorded between the Strategic and Reactive groups was found to be significant at the p < .05 level. Analysis of the three implementation approaches (i.e. Reactive, Tactical or Strategic) by number of employees (company size) showed a higher proportion smaller companies in the Reactive group. In fact there is a clear relationship apparent between company size and the three groups indicating a higher likelihood that Tactical and Strategic companies will be larger. These results were further confirmed by correlation analysis indicating a moderately strong (0.309) but highly significant (p<.01) positive correlation between company size and extent of implementation. ANOVA analysis also showed that the difference between the three groups on the basis of company size was not likely to be random, and was therefore the result of significant characteristic differences. Figure 2 illustrates this.

Figure 2: Industry Type/Company Size by Extent of Implementation
Levels of Understanding

The difference in the level of understanding between Reactive, Tactical and Strategic implementers is particularly striking. In all cases the difference was found to be highly significant, and in 85% of cases at p < .001. A strong and highly significant positive correlation was also found between the level of understanding and extent of implementation (.586 at p < .001). There was also no significant relationship between the level of knowledge and number of years of membership of EAN Australia. Figure 3 illustrates these results.

Planning Focus

Reactive planning was found to be significantly negatively correlated to Extent of Implementation for all three variables (-.137 at p<.01 for Little Time, -.189 at p<.01 for Low Priority and -.185 at p<.01 for being Led by Trading Partners). Strategic Implementers showed significantly less inclination to be reactive planners than did the Tactical group, who in turn were significantly less inclined to do this than the Reactive implementers. Proactive Planning practices were strongly and highly significantly correlated with extent of implementation for all 4 variables. The results were as follows: .348 at p<.01 for careful planning and costing, .432 at p<.01 for long term strategic planning, .567 at p<.01 for development of detailed business plans and .479 at p<.01 for critical evaluation of supply chain processes. The extent of this correlation and the degree of difference (p<.001 in all 4 cases) between the 3 groups on all four variables is evident in Figure 4 below.

Figure 3: Levels of understanding for Reactive, Tactical and Strategic implementers

Figure 4: Extent of Reactive/Proactive Planning by Extent of Implementation
Perception of Cost/Benefit

Highly significant differences (p<.001) were found between the three implementation categories for both perceived Costs and Benefits as a result of implementation. The three groups see costs increasing as implementation is extended, but there is a significant divergence between cost and benefit as this process unfolds. This divergence is further confirmed by the correlations found between Cost, Benefit and Extent of Implementation. Both were highly significant (p<.01), but they varied greatly in strength (.177 for Cost and .357 for Benefit). This indicates a clear perception of benefit increasing significantly in relation to cost as implementation is extended along a company’s supply chain. No significant difference was found between perceptions of cost for different industry categories. There was, however, a highly significant difference (p<.001) in perception of benefits. The Retail sector recorded the highest level of benefit, while the “Other” category and Manufacturing recorded the lowest. There was no relationship found between perception of cost vs. benefit and number of years of membership. Figure 5 below shows these results.

Figure 5: Assessment of Cost / Benefit by Extent of Implementation and Industry type

Contribution of the EAN System to Operational and Bottom Line Outcomes

Highly significant (p<.001) differences were found between the Strategic, Tactical and Reactive implementation groups for all 11 operational outcomes. These were further supported by strong and highly significant (p<.01) correlations found between each of the operational outcomes and extent of implementation. Table 1 below shows these correlations.

Table 1: Correlations – Operational Outcomes with Extent of Implementation

<table>
<thead>
<tr>
<th>Reduced Fin. Goods Inventory</th>
<th>Reduced WIP Inventory</th>
<th>Reduced Raw Material Inventory</th>
<th>Product Traceability</th>
<th>Stock Accuracy</th>
<th>Reduced Time for Stock Takes</th>
<th>Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.448</td>
<td>0.454</td>
<td>0.384</td>
<td>0.429</td>
<td>0.467</td>
<td>0.471</td>
<td>0.539</td>
</tr>
</tbody>
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<thead>
<tr>
<th>Product Quality</th>
<th>Flexibility</th>
<th>Reduced Cycle Time</th>
<th>Improved Cash Flow</th>
<th>Reduced Claims</th>
<th>Reduced Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.046</td>
<td>0.464</td>
<td>0.52</td>
<td>0.417</td>
<td>0.484</td>
<td>0.454</td>
</tr>
</tbody>
</table>

Strategic implementers have a significantly stronger perception of the contribution of the EAN system to operational outcomes than do the Tactical group, who in turn have a significantly stronger view than the Reactive group. Highly significant (p<.001) differences were found between the Strategic, Tactical and Reactive implementation groups for all 4 bottom line outcomes. These were further supported by strong and highly significant (p<.01) correlations found between each of the bottom line outcomes and extent of implementation. Table 2 below shows these correlations.
Table 2: Correlations – Bottom Line Outcomes with Extent of Implementation

<table>
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</thead>
<tbody>
<tr>
<td></td>
<td>0.251</td>
<td>0.479</td>
<td>0.332</td>
<td>0.421</td>
</tr>
</tbody>
</table>

As for the operational outcomes, the Strategic implementers see the EAN system to be extremely important to achieving these bottom line results. Their perception is significantly stronger than the Tactical group, whose perception is in turn significantly stronger than the Reactive implementers. Figure 6 below shows these results.

Figure 6: Assessment of the contribution of the EAN system to operational and bottom line outcomes by extent of implementation

Comparative Functions of Websites

When the answers to the following two questions are compared based on the extent of implementation; "Does your organization currently have an operational website?" and "If NO - Does your organization plan to implement a website?"; it becomes apparent that there is a strong relationship between having a current operational website and being a Strategic or Tactical implementer. This relationship does not hold, however, for plans to implement websites. In this case there is a universal bias toward developing and implementing an Internet presence across all three groups. In fact, a higher percentage of Strategic implementers indicate that they do not intend to implement a website at any time in the future. The results also indicate that organizations with current websites have tended to use them more for establishing a presence, providing product information, general company information and public relations. They have placed less emphasis on transactional issues such as customer service, direct marketing and business to business (B2B) dealings with suppliers and customers. This is contrasted with organizations planning to implement websites, who appear to be placing an equal (or in some cases greater emphasis) on commercial transactions. Further comparison based on the extent of implementation shows that the same patterns are being repeated. Of particular interest is the fact that although there is still a gap between the three groups in the extent to which they plan to use sites for B2B transactions, customer service etc., they are all moving together in this direction. This is in contrast with just about every other facet of the EAN system tested through the survey, where the difference between the three groups is significantly different on most dimensions. The convergence of these three groups in this area of technology adoption is an indication of a potential shift in perception that could have an impact on future application of the EAN system in the Tactical and Reactive groups. Figures 7&8 below illustrate this.
CONCLUSION

This survey of 553 EAN Australia members found that the majority of the membership could be classified as “Reactive” implementers (estimated at 64%) based on the extent of implementation along the supply chain. Of the balance, 25% are estimated to be “Tactical” and 11% “Strategic” implementers. The results clearly indicate that the “Tactical” and “Strategic” groups derive significantly greater business benefit from the use of the EAN system, are more knowledgeable of the techniques and implications of use, and perceive implementation to deliver significantly greater benefits over time relative to the cost of implementation. Between the “Strategic” and “Tactical” groups, there is also an indication that the “Strategic” group perceive all of these outcomes to be central to the effective operations of their organizations. By contrast, the “Reactive” group can be characterised as at best ambivalent, and at worst extremely negative about the EAN system, the techniques and methodologies, and the contribution of the system to potential and/or real business outcomes. The one area where the three groups converge is in the adoption of the Internet and the establishment of websites. It is evident that the three groups share common goals in applying web-based technologies to transacting business with both customers and suppliers.
REFERENCES


