

THE SCOPE AND INTENSITY OF DERIVED BENEFITS FROM E-COMMERCE PENETRATION IN SMEs

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Abstract: This paper attempts to (i) to assess the relative importance of benefits related to the gradual unfolding of business-to-business e-commerce (B-2-B e-commerce) penetration among manufacturing SMEs and (ii) to demonstrate that the scope and intensity of these benefits increase in the later stages of e-commerce penetration as organizational learning gradually takes place. Empirical evidence strongly suggests that these benefits are cumulative and that organizational learning allows SMEs to reap these benefits.

1 INTRODUCTION

Electronic commerce (e-commerce) has raised considerable interest from public policy makers. Their efforts were mainly directed to accelerate its penetration among organizations, especially small-and-medium-sized enterprises (SMEs) and to create a dynamic e-business environment (see for instance, eEurope Action Plan, 2002; OECD 1998 and 2002; US Department of Commerce, 2002a). But is e-commerce more than technohype? Are the expectations from e-commerce penetration unrealistic in the context of SMEs? This paper attempts to answer these questions but departs from previous studies by pursuing the following two objectives: (i) to assess the relative importance of benefits related to the gradual unfolding of business-to-business e-commerce (B-2-B e-commerce) penetration among manufacturing SMEs and (ii) to demonstrate that the scope and intensity of these benefits increase in the later stages of e-commerce penetration as organizational learning gradually

takes place. Our main goal is therefore to gain a better understanding on how SMEs capitalize on the potential of e-commerce.

2 RESEARCH FOCUS

2.1 Measuring E-commerce Penetration from an Evolutionary Perspective

B-2-B e-commerce continues to grow at a steady pace, and its strategic impacts on organizations and industries are increasing (OECD, 2002; Amit and Zott, 2001). In this paper, B-2-B e-commerce is defined broadly as “the use of Internet and related technologies to support any activity that is necessary for an organization to function effectively” (Magal et al., 2001). E-commerce penetration in organizations has been measured from different perspectives. Some studies used measures of firms’

budget allocation for Internet and communication technologies (ICTs), connectivity and type of ICTs in use (Dutta and Evrard, 1999; Grandon and Pearson, 2003; Riquelme, 2002; US Department of Commerce, 2002b; Van Beveren and Thomson, 2002). Statistical agencies and some governmental organizations were more interested in measuring electronic transactions in numbers and dollar volumes (Industry Canada, 2002; OECD, 2002; Statistics Canada, 2001). Other studies focused on business issues related to e-commerce and measured e-commerce penetration by the type of activities it supported or the business solutions that were adopted (Bertchek and Fryges, 2002; Daniel et al., 2002; Mirchandani and Motwani, 2001, Varian et al., 2002).

Although the above approaches for measuring e-commerce penetration may be useful for their respective research objectives, they are of little help in highlighting how these organizations are profiting from using e-commerce. To be able to measure e-commerce unfolding in organizations and its related benefits, we need to measure e-commerce penetration at its locus of impact: business processes. This approach fits with Kauffman and Weill's (1989) view which emphasized the importance of choosing the technology's locus of impact as the primary level of value analysis in IT research. The process oriented approach yielded interesting results in research on IT penetration and its related benefits (Kauffman and Weill, 1989; Barua et al., 1995; Tallon et al. 2000) and has also been used in e-commerce research in both industry case studies (Subramaniam and Shaw, 2002) and survey studies (Barua et al. 2001; Zhu and Kraemer, 2002; Lefebvre and Lefebvre, 2003). Zhu and Kraemer (2002) focused on the dynamic capabilities perspective and translated "net-enabled processes" into "e-commerce capabilities": information, transaction, interaction and supplier integration. More recently, Lefebvre and Lefebvre (2003) went one step further and proposed an e-commerce penetration trajectory model based on sequential stages of e-commerce penetration. Their approach draws on the evolutionary perspective (Nelson and Winter, 1982) of the dynamic capabilities theory and represents a useful starting point to better explore the relationship between e-commerce penetration levels and their derived benefits.

2.2 Manufacturing SMEs and E-commerce

According to the US department of commerce (2002b), manufacturing continues to lead other US

sectors in terms of electronic commerce shipments. Some researchers have even related the productivity growth in the US manufacturing sector, between 1995 and 2000, to the surge of the Internet and e-commerce (McAfee, 2002). Manufacturing SMEs continue to play a major economic role in all industrialized economies (Stevenson and Lundström, 2001) and are increasingly pressured by big manufacturers to adopt e-commerce. SMEs' limited financial and non-financial resources makes it more crucial for them to adequately harness value from e-commerce initiatives and render the trajectory approach even more adequate.

2.3 E-commerce Benefits

From the literature review, we have divided the benefits associated to B-2-B e-commerce (see for instance, Turner, 2000; Hocque, 2003; Turban et al., 2002) into four main areas which are considered as crucial in the context of manufacturing SMEs:

- (i) costs reductions by lowering transaction costs and inventory levels or by gaining economies of scale (through group buying or purchase consolidation);
- (ii) cycle time reductions with lower lead times, faster product design or speedier ordering of parts and components;
- (iii) quality increases especially with improved customer relationships; and
- (iv) growth in revenues as e-commerce represents, especially for the smaller firms, a low cost way to expand markets and to effectively target market segments.

Benefits associated with B-2-B e-commerce may be even more compelling as they are derived from collaboration between business partners but remain an under-investigated issue (Gebauer and Shaw, 2002; Kendall et al., 2001).

3 METHODOLOGY

3.1 The E-survey

A systematic sample was drawn from an up-to-date government list of all manufacturing SMEs operating in one Canadian province which includes basic information on each firm such as number of employees, volume of sales, geographic location and coordinates including the electronic address of the CEO. SMEs are here defined as firms with less than 500 employees, a definition in accordance with some governmental agencies such as the US Small Business Administration. An electronic

questionnaire was sent to the Chief Executive Officer (CEO) of each of the selected firms. The total number of SMEs participating to the on-line survey was 230 firms and the response rate reached 7.6% which is quite acceptable for this type of survey. Non-response bias does not seem to exist with respect to firm size as no significant differences (goodness of fit tests) were found but there is a slight positive bias towards urban areas. Furthermore, the use of an e-survey may indeed underestimate the number of non-adopters of e-commerce. However, this later issue represents a shortcoming that tends to disappear as smaller firms have gained in the last few years a generalized access to the Internet. In the case of Canadian SMEs that are in a vast majority linked to the Internet, this shortcoming appears minimal in comparison to the cost effectiveness, efficiency and conviviality offered by e-surveys (Couper, 2000; Rogelberg et al., 2001; Dillman, 2000).

3.2 Research Variables

3.2.1 E-commerce Penetration

This article builds on previous work conducted by Lefebvre and Lefebvre (2003) who proposed a six-stage model that differentiates the non-adopters from the adopters (upper part of figure 1). Stage 00 and stage 0 correspond to non-adopters which are not the focus of this paper. Stages 1, 2, 3 and 4 represent e-commerce adopters. Stage 1 is limited to electronic information search and content creation. Stage 2 represents simple e-transactions while stage 3 includes online transactions of increased complexity such as conducting electronic auctions and negotiating contracts online. Stage 4 considers a wider range of e-commerce capabilities that support e-collaboration activities with customers and suppliers.

In order to capture different stages of B-2-B e-commerce penetration (stages 1, 2, 3 and 4), we have identified and validated 36 business processes that could be supported electronically (middle part of figure 1). These processes were also evaluated with respect to their relative level of complexity by a panel of 12 experts. Inter-rater reliability between members of the panel proved to be excellent for most business processes (ranging from 0.7 to 1.0) and satisfactory for the remaining ones ($r = 0.6$). The mean level of complexity for all stage 1 processes was 1.504, 2.829 for stage 2 processes, 3.547 for stage 3 processes and 4.698 for stage 4 processes. Thus, supporting the fact that complexity increases with the stages.

The score of e-commerce penetration in one particular firm simply represents the sum of business processes that are carried out using electronic means ($\sum_{i=1}^{36} BP_i$). To reflect e-commerce initiatives' complexity, a weighted score could also be derived: $\sum_{i=1}^{36} C_i \times BP_i$ (where BP_i corresponds to the business processes listed in figure 1 and $C_i =$ level of complexity of each business process as rated by the panel of 12 experts). These scores were thoroughly validated (Lefebvre and Lefebvre, 2003; Elia et al., 2004).

3.2.2 Derived Benefits

The benefits associated to e-commerce are all based on perceptual measures using 7-point Likert scales. They are derived from the literature review and reflect the manufacturing environment in which these firms operate. The exact wording was validated through on-site interviews with the CEOs of 15 SMEs.

4 RESULTS

4.1 Profile of Responding Firms

As can be seen from the data presented in Appendix 1, firms in the different stages do not differ significantly with respect to size although more advanced firms tend to be larger. However, firms in stage 3 and 4 do seem to be significantly internationalized.

Scores of e-commerce penetration increase with the stages as does the volume of e-transactions ($p = 0.0000$). These results further validate the stage model.

4.2 The Scope and Intensity of Derived Benefits

In order to evaluate the scope and intensity of perceived benefits from e-commerce penetration, CEOs were asked to evaluate on a seven point scale (7 being the highest) ten potential benefits. Firms belonging to each of the four stages of e-commerce penetration were characterized according to the benefits they derived from the utilization of e-commerce business processes. It was decided to retain only those benefits that ranked 3 or higher on the 7 point-scale for each group of firms.

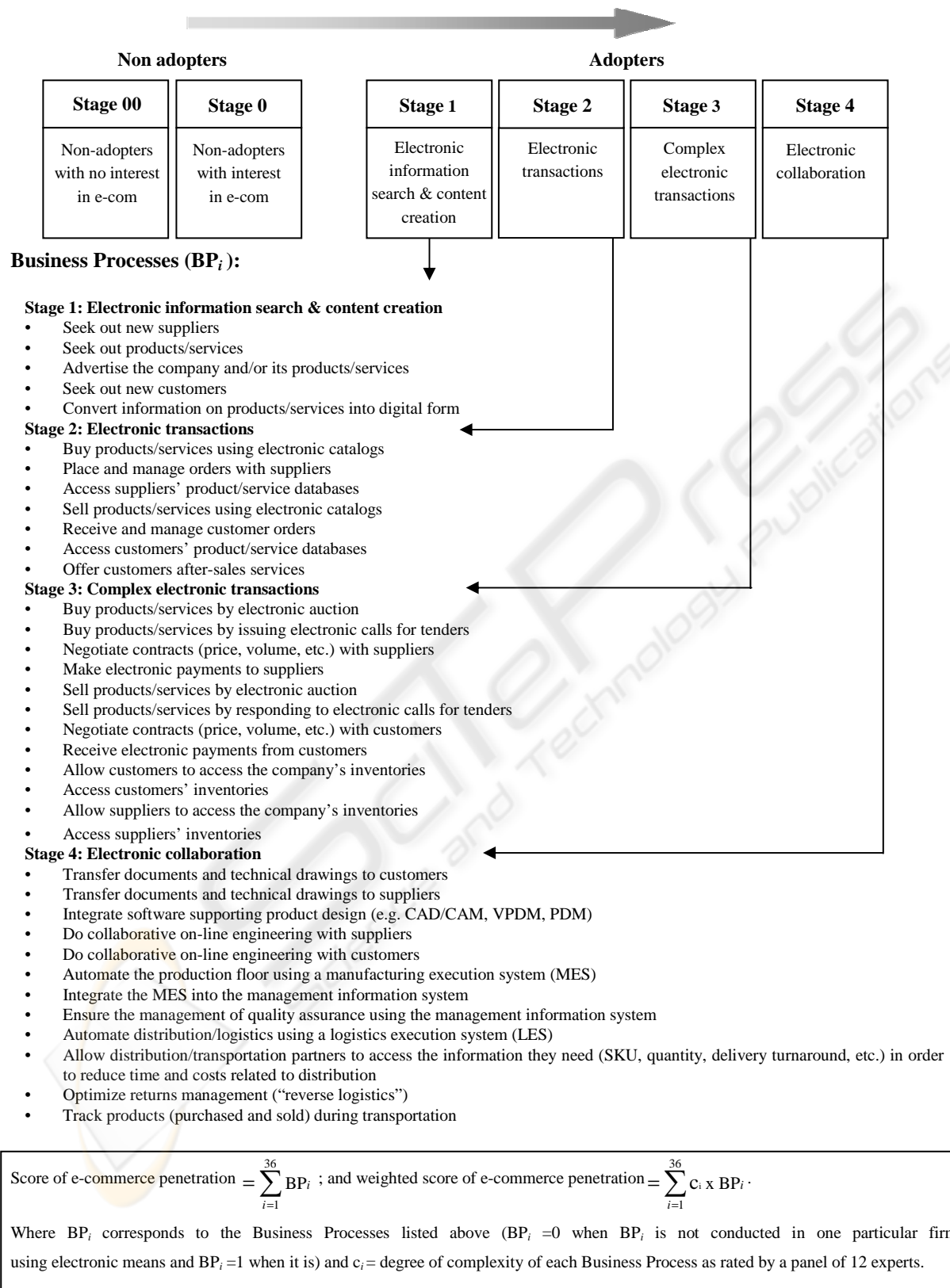


Figure 1: Stage model for e-commerce penetration among manufacturing SMEs

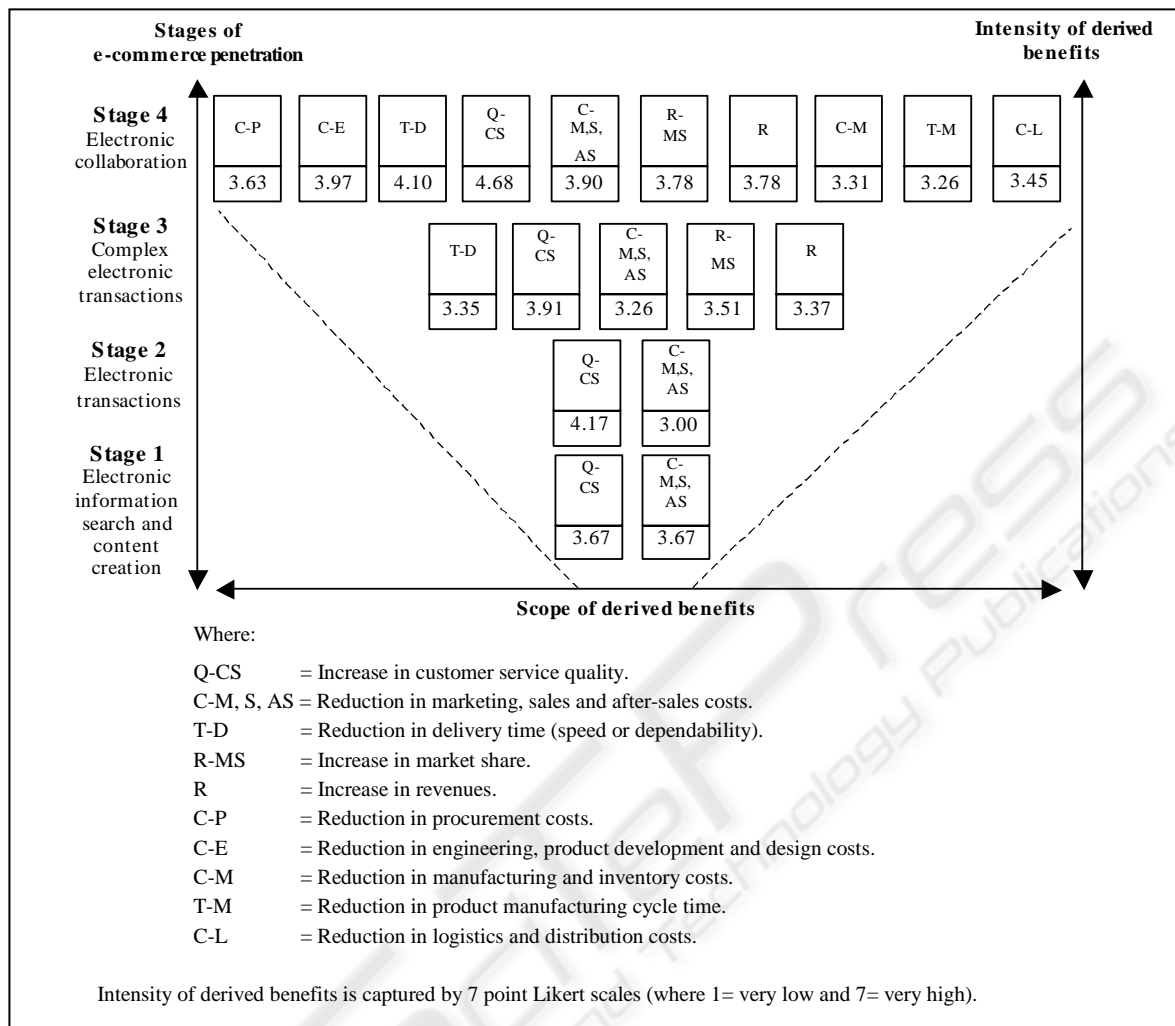


Figure 2: Scope and intensity of derived benefits

The results of this exercise are presented in figure 2. The corresponding analysis is conducted with respect to both scope (number of concurrent benefits that ranked 3 or higher) and intensity (the level of the derived benefits on the 7 point-scale for any one of the 10 benefits).

With respect to scope, it becomes generally evident that the number of concurrent benefits increases with the stages of e-commerce penetration, although stages 1 and 2 share the same benefits which are interestingly enough related to customer service and cost reductions in client related activities. The fact that the benefits in the first two stages share a common focus may be explained by the time lag required to achieve these benefits and by unrealistic expectations with respect to time and outcomes on the part of the SMEs. In stage 3, firms tend to experience an increase in the scope of benefits with other added

customer oriented activities like delivery time and with increases in market share and revenues. Only in stage 4 do firms derive benefits associated with increases in engineering, manufacturing, and overall logistics efficiency. This indicates that these may be the most difficult to obtain and that they are captured as a result of a rather long learning process since they affect product related creation, realization and distribution processes.

In terms of intensity, it is also observable from appendix 1 that the level of intensity increases for most of the benefits as SMEs progress in the later stages of B-2-B e-commerce penetration: this suggests again a learning process through which firms evolve. This positive learning trajectory is important as it stresses the fact that SMEs get better over time and that the continued use of e-commerce processes does translate into mounting benefits with respect to both intensity and scope.

5 CONCLUSION

This paper is an attempt to demonstrate how benefits associated with e-commerce in SMEs differ as the level of penetration of e-commerce processes in firms increases. An e-commerce stage model was presented with a spectrum ranging from rather basic e-commerce processes such as electronic information search (stage 1) to more complex processes such as collaboration activities with customers and suppliers (stage 4).

Furthermore, it was shown that the scope (number of benefits) and intensity (number of derived benefits) of these benefits also increases as a firm moves up in the e-commerce stage model indicating that there exists a learning process which allows firms to reap increasing benefits over time. This suggests the existence of an evolutionary pattern with respect to both realized e-commerce penetration and derived e-commerce benefits in SMEs.

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APPENDIX 1

The stage model: SMEs’ characteristics, e-commerce adoption and benefits

	Stage 1 (n=8)	Stage 2 (n=17)	Stage 3 (n=47)	Stage 4 (n=50)	p (4)
SMEs’ characteristics					
Size (annual sales in \$CAN)	18.13M	23.34M	84.46M	139.19M	NS
Level of exports (1)	11.95%	8.78%	17.12%	16.97%	**
Level of imports (1)	12.14%	8.12%	20.61%	32.45%	***
E-commerce adoption					
Score of e-commerce adoption (2)	1.88	3.88	6.55	10.58	*****
Weighted score of e-com. Adoption (2)	2.79	8.22	15.66	31.93	*****
Volume of e-transactions					
% of e-sales (3)	0.00%	1.43%	9.29%	12.58%	****
% of e-procurement (3)	0.00%	0.98%	16.59%	21.27%	****
Benefits derived from e-commerce adoption					
Increase in customer service quality	3.67	4.17	3.91	4.68	NS
Reduction in marketing, sales & after-sales costs	3.67	3.00	3.26	3.90	NS
Reduction in delivery time (speed/dependability)	2.33	2.58	3.35	4.10	*
Increase in market share	2.83	2.92	3.51	3.78	*
Increase in revenues	2.33	2.58	3.37	3.78	*
Reduction in procurement costs	2.83	2.67	2.91	3.63	NS
Reduction in eng., product develop. & design costs	2.00	2.25	2.24	3.97	***
Reduction in manufacturing & inventory costs	2.00	2.00	2.15	3.31	**
Reduction in product manufacturing cycle time	2.17	2.42	2.38	3.26	NS
Reduction in logistics & distribution costs	2.50	2.50	2.68	3.45	NS

(1) Level of exports: ratio of sales realized in foreign markets over total sales. Level of imports: ration of purchases from foreign markets over total purchases. (2) As defined in figure 1. (3) Ratio of e-sales over total sales. Ratio of e-procurement over total procurement. (4) p= level of significance of the Kruskal Wallis Test (non-parametric ANOVA) * = p<0.10; ** = p<0.05 ; *** = p<0.01 ; **** = p<0.001.