The Evolving B2B E-Commerce and Supply Chain Management: A Chronological Mémoire

Richard W. Monroe
Paul T. Barrett

Abstract

Purpose – *B2B e-commerce in the U.S. has grown substantially in the last two decades. This study aims to describe that growth and explore factors that contribute to the magnitude and timing of growth.*

Method – *Sixteen years of historical data is analysed to quantify the growth rate in B2B e-commerce in the U.S. A literature review guides the discussion of factors contributing to the growth.*

Findings – *For the period from 2000 to 2015, B2B e-commerce in the U.S. grew by an average rate of more than 10 percent year-over-year. The growth gained momentum in the period from 2003 through 2005 after a slow start in the prior years.*

Limitations – *The study analyses aggregated data for the entire U.S. manufacturing sector which limits the ability to explore those manufacturing industry sectors that may be leaders or laggards.*

Implications – *The study suggests that major contributing factors are systems integration and the stage within a maturity model for the company working towards integration. Managers should set reasonable goals and timelines based on project complexity and the organisation's maturity level for systems integration.*

Originality - *Both theory and practice are informed by examining the growth of B2B e-commerce for a sixteen-year period. Consequently, this study provides an historical view for the evolution of B2B e-commerce and the maturation of related information systems and supply chain management processes in the U.S. manufacturing sector.*

Keywords: e-commerce, technology systems, systems integration, maturity model, supply chain integration

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Introduction

Over the last two decades, businesses have witnessed significant digitalisation of information sharing with customers and suppliers. In addition to information sharing, electronic marketplaces and a host of electronic transactions have become commonplace, albeit not without its challenges (Albrecht, Dean & Hanson, 2005). Business-to-business (B2B) e-commerce is the prime example where digital technology has had a profound effect on business processes. E-commerce, by a very basic definition, is "conducting business transactions with suppliers and customers electronically" (Guinipero & Sawchuk, 2000). Another fundamental description defines e-commerce as "the use of the Internet to facilitate, execute, and process business transactions" (DeLone & McLean, 2004).

Businesses have implemented these new digital technologies for a variety of reasons. Motivations include replacing outdated legacy systems, avoiding the largely exaggerated Y2K catastrophe and genuinely seeking to improve both internal and external business processes. Saving money through cost reductions is implicit in these motivations. As Zhu *et al.* (2017) point out, early adopters of B2B e-commerce have established aggressive investment policies for updating technology platforms as a routine. With that strategy came an advantage the researchers referred to as switching costs, costs that provide returns on investment related to higher quality technology performance (Zhu *et al.*, 2017). However, while late adopters of B2B have typically experienced somewhat lower initial information technology (IT) costs than early adopters, late adopters tend to switch technology only when the IT costs fall significantly (Zhu *et al.*, 2017). In general, in exchange for the substantial investments to acquire these technologies, a long list of benefits is promised by system developers and expected by system users. The issue became the timing of those benefits which continues to be a major concern today.

In the early 2000s, organizations had made some progress on their internal integration through information technology (IT) initiatives, especially enterprise systems (ES) (Davenport, 2000). Those that had achieved some measure of success with internal integration were turning their focus externally to the supply chain (Davenport & Brooks, 2004). From the early successes, it

became evident that the supply chain, with the heavy emphasis on business transactions and reliance on information, offered considerable opportunities for lower inventory investments and reduced working capital (Davenport & Brooks, 2004). Using IT to enhance supply chain performance also leads to higher functioning, stronger relationships with suppliers and customers (Davenport & Brooks, 2004). Hazen and Byrd (2012) caution that adopting "off-the-shelf" logistics information technology (LIT) is not sufficient for gaining competitive advantage. They suggest that LIT investments must be combined with other relevant and complementary resources to gain company-wide synergies that lead to superior supply chain performance (Hazen & Byrd, 2012).

There was limited progress with B2B e-commerce integration into supply chain processes in the 2000 to 2001 timeframe. As evidence, Remko van Hoek (2001) called for supply chain leaders "to make the supply chain dimension of e-business a reality," because it was "largely neglected and managed poorly" and "virtually non-existing" (van Hoek, 2001). By 2002, however, progress was mounting, as Handfield and Nichols (2002) suggested that technology change was happening at a much faster rate. Specifically, e-procurement had begun to impact supply chain integration but the authors believed that the progress at that point was merely "scratching the surface" (Handfield & Nichols, 2002).

This study undertakes an historical and longitudinal look at the growth in business-to-business (B2B) e-commerce. This includes an investigation of whether B2B e-commerce has grown at the same rate as overall business activity has grown, and what these growth rate comparisons might inform us about the future growth trend of B2B. An additional analysis focuses on the integration of the different systems that strategically and operationally link the many interrelated business processes in the supply chain. An enhanced understanding of these interconnected systems can yield an enterprise view of what may lie ahead for B2B and supply chain management.

E-Commerce Statistics

An annual report published by the U.S. Department of Commerce, Economics and Statistics Administration, and the U.S. Census Bureau is known as "E-Stats" (U.S. Census Bureau, 2017). The statistics contained in "E-Stats" are actually taken from five different surveys which focus on the various sectors of the economy. For the Manufacturing sector, two different surveys are utilized: the Economic Census – Manufacturing and the Annual Survey of Manufactures (ASM) (U.S. Census Bureau, 2017). The ASM is a survey which collects a wide range of data from more than 50,000 manufacturing plants in the United States (U.S. Census Bureau, 2017).

E-Commerce Growth

E-commerce accounted for 46 percent of the Total Value of Shipments by manufacturers and wholesale merchandisers in 2010 (U.S. Census Bureau, 2012). By 2015, the e-commerce share was more than 63 percent of the Total Value of Shipments for manufacturers (U.S. Census Bureau, 2017). This compares with an 18 percent share of the Total Value of Shipments in 2001 (U.S. Census Bureau, 2010; 2012). The growth of e-commerce as a larger share of the Total Value of Shipments is evident and meaningful when comparing 2015 data to 2001 data (U.S. Census Bureau, 2017).

As a reference, a comparison of business-to-consumer (B2C) e-commerce for retail with B2B e-commerce is provided. The most recent statistics for B2C and B2B are shown in Table 1:

Table 1: B2C and B2B Comparison for U.S.

	2015 for B2C (retail)	**2015 for B2B (manufacturing)**
Year/Year Growth Rate	Approx. 13%	Approx. 10%
Percent of Total	Approx. 7%	Approx. 63%
Total Dollar Amount	$ 340,164,000,000	$3,495,326,000,000

Source: U.S. Census Bureau (2017), www.census.gov/estats

From Table 1, there is a relatively small difference in the Growth Rate for B2C and B2B. A big difference can be seen in the Percent of Total with B2B outpacing B2C by a wide margin with 63% versus roughly 7%. This means that manufacturing has converted a greater volume of transactions to e-commerce compared to the volume of e-commerce for retail. The Total Dollar Amount also highlights a huge disparity with B2B accounting for almost $3.5 trillion while B2C accounts for $340 billion – a tenfold difference. The results of this comparison for Percent of Total and Total Dollar Amount clearly show the significance of B2B and the reason for investigating e-commerce in the manufacturing sector further.

A graph showing the overall trend of B2B e-commerce for the Manufacturing sector can be seen in Figure 1. The early years start from approximately three-quarters of a trillion dollars and gradually move to a sustained period of double-digit growth bringing the total for B2B to approximately $3.5 trillion in recent years.

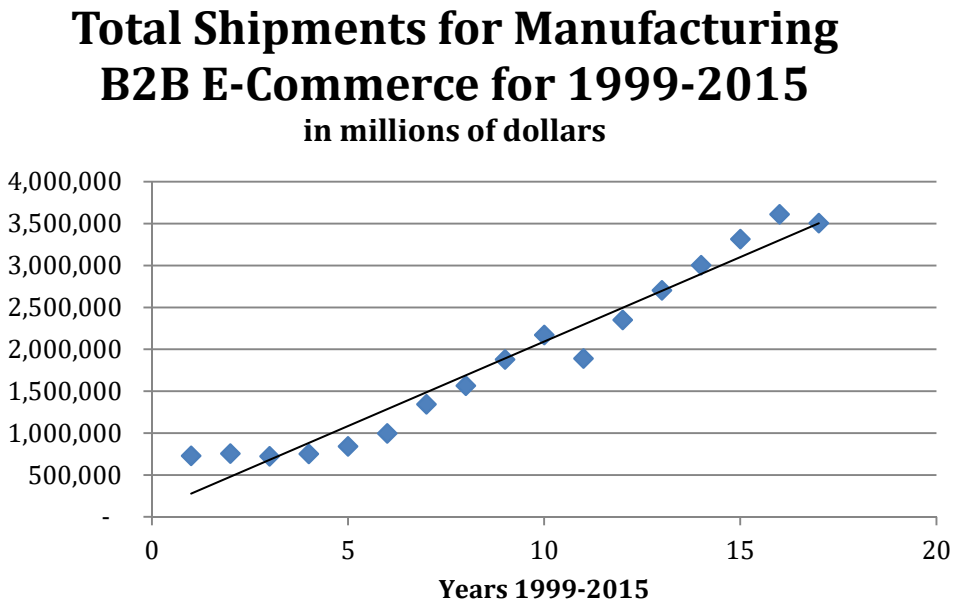

Figure 1. Total Value of Manufacturing E-commerce (E-Shipments) for U.S.

Total Manufacturing Shipments and Total E-Commerce statistics were further evaluated for sixteen years from 2000 through 2015. The data for 1999 was used to calculate the percent change from 1999 to 2000. Year-over-year growth percentages were calculated for both the Total Shipments and the Total E-Commerce and can be seen in Table 2. The mean growth rate for Total Manufacturing Shipments was 2.308% while the mean growth rate for Total Manufacturing E-Commerce (or E-Shipments) was 10.901% for the sixteen-year period (see Table 2).

Table 2. E-Commerce Growth and Total Manufacturing Growth for 2000-2015 (year over year percent)

	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15
Total Mfg Shipments	4.4	-5.7	-1.3	2.4	7.3	10.1	5.8	6.4	2.4	-19	11.0	11.7	4.7	1.3	1.3	-5.8
Total E-Shipments	3.6	-4.2	3.8	12.1	18.2	34.9	16.6	19.9	15.5	-13	24.3	15.0	11.1	10.4	8.9	-2.9

A logical conclusion might be that B2B e-commerce has grown primarily as a result of the overall growth of the U.S. economy in the last two decades. On the other hand, the alternative would be that there are factors other than overall economic growth that are contributing to the growth of B2B e-

commerce. To answer that question and statistically assess whether there is a significant difference in the mean growth rates, the following Hypotheses were evaluated:

$H0 : \mu 1 = \mu 2$

$H1 : \mu 1 \neq \mu 2$

The null hypothesis suggests that Total Manufacturing Shipments and Total E-Commerce Manufacturing Shipments (or E-Shipments) have grown at the same average rate for the sixteen-year period or in other words, the two means are equal. The alternative hypothesis makes the opposite statement, that the mean growth rates are not the same. Table 3 contains the results for the t-test:

Table 3. Difference in the Means t-test Results

	Total Manufacturing Shipments	**Total Manufacturing E-Commerce**
Mean	0.02308	0.10901
Variance	0.005957	0.013685
Observations	16	16
Pearson Correlation	0.879321442	
Hypothesized Mean Difference	0	
df	15	
t Stat	-5.60308	
P(T≤t) two-tail	0.0000503643	
t Critical two-tail	2.1314495	

Comparing the t-statistic with the critical t, the null hypothesis is rejected in favor of the alternative hypothesis. From the P-value, the t-test results are significant at the 0.05 level as established for the hypothesis test. Extending the interpretation of the results, it can be inferred that other factors or dynamics are contributing to the growth of e-commerce, not just the overall economic growth as seen in the growth in Total Manufacturing Shipments.

Such factors can then be investigated to help explain the substantial growth in B2B e-commerce over the sixteen-year period under analysis. In the following sections, several significant factors are discussed that have contributed to the growth of e-commerce and also to the timing of that growth.

Integration of Multiple Systems

To remain competitive and to improve supply chain performance, companies formulate and implement a variety of supply chain strategies. Supply chain integration includes a broad range of supply chain strategies that focus on improving cooperation and coordination with other organisations in the core company's supply chain (Lee & Whang, 2001).

G.C. Stevens (1989) began the discussion about supply chain integration in one of the earliest publications about supply chain management. He proposed that a range of resources need to be coordinated and harmonised as a complete system in order to achieve an integrated supply chain (Stevens, 1989). This statement is an indication of the complexity encountered when working towards the integration of multiple systems and multiple functions that must be synchronized for effective supply chain management.

Lee and Whang (2001, p. 2) assert that "information technology, and in particular, the Internet, play a key role in furthering the goals of supply chain integration. While the most visible manifestation of the Internet has been in the emergence of electronic commerce as a new retail channel, it is likely that the Internet will have an even more profound impact on business-to-business interaction, especially in the area of supply chain integration." IT (information technology) integration has also been described as "an enabling mechanism that positively impacts supply chain flexibility and supply chain agility" (Swafford, Ghosh & Murthy, 2008). The authors further describe their view of integration as a "domino effect" where IT integration "enables a firm to tap its supply chain flexibility which in turn results in higher supply chain agility and ultimately higher competitive business performance" (Swafford, Ghosh & Murthy, 2008). From this perspective, IT integration has a direct impact on responsiveness to customers. This is a factor that is a fundamental objective of high level customer satisfaction that ultimately drives e-commerce sustainment.

Other research has shown a lack of substantial progress for IT-enabled supply chain effectiveness. For example, Singh, Lai and Cheng (2007) quoted a previous study which reported that less than 20% of companies surveyed perceived that SCT [supply chain technology] had provided an acceptable rate of return on the investment (Singh, Lai & Cheng, 2007). The authors suggest that the lack of success might be attributed to "a lack of alignment between SCT and organisational processes" (Singh, Lai & Cheng, 2007).

As mentioned above, the Internet has become the main technology that makes e-commerce possible. Implementing new e-commerce platforms and

other Internet-based applications require significant investments of time and money for large corporations. The following sections delve into the integration of multiple systems and how maturity models are related to these systems for different environments. First, the various systems involved are described.

Systems for the Growth of E-Commerce

Success of any strategy depends on alignment of any number of associated factors and compatible tactical actions. Deployment of the latest information technologies represent such a strategy and requires carefully calibrated alignment of other technology applications where interdependencies exist.

In the late 1990s, as the new century approached, many corporations concentrated their efforts on a variety of technology updates including: enterprise resource planning (ERP), e-procurement, customer relationship management (CRM), supplier relationship management (SRM) and e-commerce. Among those technologies, e-procurement and e-commerce are mirror images of the same digital business transaction (Johnson and Whang, 2002). This corresponds with a similar description of sales and purchasing being mirror images, nominally seen as opposite sides of the desk, for traditional business transactions.

Claycomb, Iyer and Germain (2005) developed and tested a model of B2B e-commerce. Their discussion also addressed the differences of B2B as a "selling technology" or as a "purchasing technology" (Claycomb, Iyer & Germain, 2005). The list of factors in their model that were significant predictors of B2B use included but were not limited to:

- B2B compatibility with current systems
- Cooperative norms with customers
- Size (of company)
- Technocratic specialization (Claycomb, Iyer & Germain, 2005).

Gunasekaran, Marri, McGaughey, and Nebhwani (2002) discussed the e-commerce impact in eight different areas related to Operations Management:

- Marketing
- Purchasing
- Design
- Production
- Sales and Distribution
- Human Resources Management
- Warehousing
- Supplier Development.

Clearly, the impact is viewed as being pervasive throughout all aspects of Operations Management and similar expectations apply for supply chain activities as well.

In another study, Bendoly and Kaefer (2004) found support for their hypothesis that B2B e-commerce initiatives would be more successful when following the successful implementation of ERP systems. This finding is consistent with the "Process re-engineering" factor from Ehie and Madsen (2005) because successful ERP implementations often involve redesign of the process which in turn will make it easier to apply a B2B technology to that process. These assertions are also consistent with the factor identified as "B2B compatibility with current systems" as described by Claycomb, Iyer and Germain (2005). Bendoly and Kaefer (2004) focused very specifically on transactional efficiencies (TE) as the primary benefits of B2B e-commerce. They utilize ten TE dimensions in their survey instrument. Each dimension involved saving time, saving money or improving productivity in a given functional area. The ten dimensions were ultimately extracted as four factors based on the highest factor loadings:

- Communications
- System development
- Personnel
- Capital (Bendoly & Kaefer, 2004).

Along with the multiple systems involved, a new wrinkle has been added to the discussion in the form of cyber security. In fact, researchers have begun to make clear impact statements that organisations of all types are often underinvesting in critical cyber security (Gordon *et al.*, 2015, Fielder, *et al.*, 2016) with potential devastating losses looming. Zafar and Ko (2016) suggested that the rampant information security threats have made the value of the chief technology officer or chief information officer increase significantly for organisations needing to protect their supply chains. The Internet has become the main technology that fuels e-commerce, but significant investments of time and money are required to protect the viability of these systems.

This means that the multiple systems that enable e-procurement and e-commerce need to be successfully integrated in order to grow the volume and value of transactions processed electronically. If ERP is added to the mix that means that three different systems must be integrated which adds to the complexity. As indicated by the research discussion above, successful ERP implementation should precede the implementation of other e-commerce technologies. Attempting to implement multiple systems simultaneously may present significant challenges to the firms that depend on effective functioning of those systems.

Maturity Models

The concept of "maturity model" is primarily attributed to the Software Engineering Institute at Carnegie Mellon University dating back to the 1980s (Larson & Gray, 2018). The Capability Maturity Model (CMM) is intended to evaluate an organization's level of evolution for software project management and the use of best practices for software development projects (Larson & Gray, 2018). Other maturity models have been developed for environments that share some of the common elements of project management but differ significantly from software development. The Project Management Institute introduced their own model in the 1990s and then a second revision of their maturity model in 2004 that is applicable to a broader range of projects rather than software development (Larson & Gray, 2018).

Holland and Light (2001) proposed a stage maturity model that focused specifically on the different levels of adjusting to ERP systems. The three stages begin by continuing to manage with existing legacy systems as the ERP project is initiated. The second stage is notable because the ERP implementation is complete and the capabilities of ERP are beginning to show some reasonable level of effectiveness. In the third stage, ERP has become "normalized" throughout the organization (Holland & Light, 2001). Strategic value can then be derived in the third stage through other extensions of ERP such as "customer relationship management, knowledge management and supply chain planning" (Holland & Light, 2001).

Consulting companies have also made significant contributions based on a firm's actual experiences with a large number of clients. PRTM proposed the supply chain maturity model which consisted of four different levels: Functional Focus, Internal Integration, External Integration and Cross-Enterprise Collaboration (PRTM, 2003).

BearingPoint applied the maturity model concept to business processes and utilized a five-stage model very similar to the CMM (Fisher, 2004). The five states of process maturity for the business process maturity model are: siloed, tactically integrated, process driven, optimized enterprise and intelligent operating network (Fisher, 2004). Notably, the authors emphasize that progressing from one state to the next state is not a simple "linear path" and that many "hurdles" must be overcome to reach the next level (Fisher, 2004). De Bruin and Rosemann (2005) and Rosemann and vom Brocke (2010) extended and built upon the work by Fisher and other models that are business process oriented.

Lockamy and McCormack (2004) looked at supply chain maturity through the lens of business process maturity since the main functions in supply chain management are in fact business processes. Their model is similar to the CMM and includes the following five levels from low maturity to high maturity: ad hoc, defined, linked, integrated and extended.

From the wide spectrum of maturity models, we prefer the one proposed by PRTM (2003) as it matches our perspective very closely. It also matches the integration process that is described in the seminal work by Johnson and Whang (2002). The four different levels of the model make the direct connection between maturity level and integration. Figure 2 is an adapted version of the PRTM model.

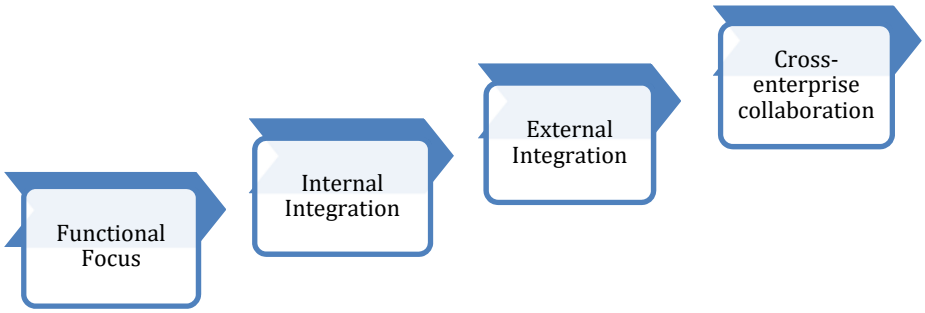

Figure 2. Four Stages of Supply Chain and Systems Maturity Model

Note: Adapted from PRTM (2003); Johnson & Whang (2002)

The first stage is "Functional Focus" which consists of the very basic use of newly implemented technologies. Relative to the future stages, this stage is very immature. The second stage is "Internal Integration" which means that maturity has improved but only inside the focal company. Integration within the company means that communication, cooperation and information sharing has improved substantially compared to the Function Focus level. At the third stage, "External Integration" is now the focus. Drawing upon the success with Internal Integration, the company now extends the initiative outward into the supply chain. Customers and suppliers will be induced to work with the focal company to integrate systems and business processes. The fourth stage, "Cross-enterprise collaboration," represents the ultimate goal in integration, moving beyond the fundamental "External Integration" to engage suppliers and customers in a manner that suggests that there is no boundary separating the central company and the supply chain partners. From the discussion, a gradual progression of an organization's maturity in systems integration is evident. Instant integration is not possible.

If we refer back to Table 2, we notice that the largest year-over-year increase occurred from 2004 to 2005 for E-Shipments in the Manufacturing sector at 34.9%. This is the largest single year increase in E-Shipments by a wide margin. From the maturity model perspective, this significant increase suggests that strategic alignment and the maturity of multiple systems had begun to gain traction in 2003 and 2004 and then surged ahead in 2005.

By the same logic, the lackluster performance for 1999, 2000, 2001 and 2002 can be partially attributed to a lack of maturity in systems integration. In particular, those companies with a need to integrate two or more systems encountered many setbacks and found the systems integration to be more challenging than expected.

Beyond 2005

Gartner conducted a Survey of CIOs which was published in January 2005 and the number one priority cited by CIOs was Business Process Improvement (Gartner, 2005). This indicates that business processes that were being designed into the technology systems could be further improved. As with any process, there is always room for improvement.

While 2005 wins the medal for the highest growth percentage for e-commerce, the growth of e-commerce did not plateau from that point onward. Seven out of ten years saw double-digit percentage increases in e-commerce from 2006 through 2015. Despite the economic downturn in 2009 with a setback of nearly -13% for e-commerce and another setback of -2.9% in 2015, e-commerce growth averaged 10.6% per year during the period from 2006 through 2015. Total Manufacturing Shipments grew at a rate of only 1.97% during those same years. It is also notable that the decline in e-commerce in 2009 and 2015 was less severe than the decline in Total Manufacturing Shipments for those years.

The continued double-digit growth is partially explained by the business process improvement focus as identified by the CIOs in Gartner's survey (Gartner, 2005). Late starters also translated to later maturity and later integration for some companies and some industries. Other companies experienced difficulties or very modest growth prior to 2005 and then began to gain momentum with e-commerce during the subsequent period from 2006 onward.

Company Examples

This study has relied on aggregated data for the U.S. manufacturing sector to evaluate the growth of e-commerce. To provide further confirming evidence, a brief discussion of company examples follows. General Electric (GE), Dow Chemical, and Cisco Systems will serve as snapshots of specific company e-commerce initiatives during the timeframe of our analysis.

GE Polymerland is a plastic resins operation which became a GE division after it was acquired from Borg-Warner Chemicals in 1988 (Handfield & Nichols, 2002). GE Polymerland entered the e-commerce age with their site launch in 1997 and is hailed as one of the few early successes by multiple accounts (Handfield & Nichols, 2002; Kurtzman & Rifkin, 2001). From 1999 to

2000, the division increased e-commerce sales by "twelvefold" and reached sales of $1.2 billion in 2000 which also amounted to 25% of GE's total sales for resins (Handfield & Nichols, 2002). One key factor for the success is noted as the involvement of long-term, existing customers when GE planned the e-commerce site (Handfield & Nichols, 2002).

The story of Dow Chemical is another example of focusing on the customer. The e-commerce initiatives at Dow began with the planning of the "Customer Interface Initiative" as publicised in 1999 (Dow Press Release, 1999). Dow selected Ariba as the provider to implement their B2B infrastructure. They announced plans to invest $100 million in e-commerce programs in 2000 (Dow Press Release, 2000) and subsequently signed a five-year deal with IBM to support all of the Dow Chemical e-commerce systems (Dow Press Release, 2001). From the Dow Customer Service Solutions Fast Facts, the company processed approximately "3 million order items last year with a 98.2% accuracy rate" and "eBusiness services enable the automation of close to 20% of our orders and invoices – providing almost 5,000 customers globally with 24/7 web access to their order and invoice details" (Dow Customer Service Solutions, 2011).

In the case of Cisco Systems, the e-commerce narrative tells the story of a recovery from a supply chain disaster. In 2000, distorted information in the company's internal systems led Cisco to expand capacity, hire additional workers and place massive orders with their key suppliers (Handfield & Nichols, 2002). The internal planning information did not match what was happening in the marketplace and in fact demand data was distorted because customers had been double and triple ordering Cisco products in an effort to get those products despite waiting two or three months for the most popular Cisco items (Handfield & Nichols, 2002). Ultimately in 2001, had to write off $2.5 billion in excess inventory and announced a company-wide layoff of more than 8,500 employees (Handfield & Nichols, 2002). Subsequently, Cisco took control of their supply chain and did so through extensive use of technology. Cisco's efforts are viewed as an outstanding example of "business transformation … using Internet technology to integrate its core processes and culture." The following list highlights some of the results that indicate Cisco's leadership in supply chain management and their ability to leverage the Internet:

- "90 percent of orders [are] taken online.
- Monthly online sales exceed $1 billion.
- 82 percent of support calls [are] now resolved over the Internet.
- Customer satisfaction has increased significantly" (Schroeder, 2008).

These company examples provide a description of the great potential benefits that can be derived from e-commerce and successful supply chain system integration. The examples also suggest the need to consider the systems integration and maturity model to guide company efforts. These are just three individual companies or divisions out of many thousands making the transition to B2B e-commerce. From the growth percentages of the aggregated data for e-commerce, we can infer that thousands of other companies have achieved similar positive results in the long-run with their e-commerce initiatives.

Discussion

Based on the results from this study, a prescriptive recommendation emerges that can guide the actions of supply chain managers and information systems managers. Requisite e-commerce, e-procurement and ERP are not the patent relief for all corporate challenges. Managers should strive to set reasonable expectations and timelines based on available capital and other resources. The maturity model and its different stages of integration form a very useful set of tools for planning the implementation of new technology systems and processes involving infrastructure and other dynamic interconnected systems integration. Managers who are resolved to plan and execute a maturity model under a closed-loop repetitive cycle of the scientific method that facilitates theorizing, implementing, assessing and improving will see their organisations progress through the stages of the model successfully. Reaching the fourth level of the model, cross-enterprise collaboration, is achievable as a long-term goal. With advanced training and information sharing about the maturity model, other managers, system users and supply chain partners can be developed as important supporters in the long-term efforts that are needed to achieve the benefits of e-commerce.

Limitations

The data in this study are aggregated data for the entire U.S. Manufacturing sector. The data are also secondary historical data as collected and processed by the U.S. Census Bureau by utilising multiple reports related to the manufacturing sector. This limits the granularity of the analyses. Consequently, the analyses are primarily deductive in nature and are based on the conceptual application of a maturity model. The model is intuitively appealing and has been utilized in practice by various consultants with ensuing effective results in several actual e-commerce applications.

Conclusion

This study informs both theory and practice by examining the growth data of B2B e-commerce for the U.S. Manufacturing sector in a longitudinal

manner for a sixteen-year period. Statistical analysis indicated that other factors contributed to the growth of e-commerce, not just the overall growth of business activity. A maturity model provides a framework for discussing stages of integration and the progression over an extended timespan. The maturity of an organisation relative to systems integration is strongly suggested as a significant factor that determines the success and therefore the growth of e-commerce and related Internet-based business applications. Synchronising the maturity of multiple systems is also discussed as a key factor that affects the growth rate. The overall slow growth rate of e-commerce in its early years can be partially explained by the lack of systems integration maturity. The slow growth of e-commerce in the first few years of the recent digital onslaught, and the lag prior to the start of a growth spurt provide evidence that the advancement from one level to a higher level of maturity requires a substantial amount of time. Based on this understanding, the deductive arguments in this study can serve to inform managers who are planning new or enhanced e-commerce systems so that they engage their plans amidst realistic expectations for future e-commerce and related systems implementation.

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About the Author

Richard W. Monroe*
Visiting Professor, Supply Chain Management
Longwood University
College of Business and Economics
201 High Street
Farmville, VA 23909, USA
Phone: 434-395-4938
Email: monroerw@longwood.edu

Paul T. Barrett
Professor of Business
Longwood University
College of Business and Economics
201 High Street
Farmville, VA 23909, USA
Phone: 434-395-2142
Email: barrettpt@longwood.edu

*Corresponding author

Richard W. Monroe (Ph.D., Old Dominion University) is Visiting Professor of Supply Chain Management at Longwood University in Farmville, Virginia, USA. Previously he held faculty positions at East Carolina University and Coastal Carolina University. His industry experience includes positions with several manufacturing firms as Project Engineer and Chief Industrial Engineer. He has published more than a dozen peer-reviewed journal articles. His research interests include supply chain risk management, intermodal shipping and sustainability initiatives. He is an active member of DSI, INFORMS and APICS.

Paul Barrett (Ph.D., Regent University) is a CPA and Professor at Longwood University in Farmville, Virginia, USA. He was an important leader in successful technology start-up companies, including one that evolved into a Securities Exchange Commission publicly traded corporation. In addition to his academic commitments, he remains engaged since 1992 in coaching executives in the profit and non-profit worlds. He is consistently an invited speaker at national and global conferences. His research agenda includes leadership development, organizational development, and technology threat assessment and prevention.

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