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E-commerce and Supply Chain Management: Fitting the Pieces Together

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Abstract

Like the ERP wave a few years ago, the current drive towards e-commerce and the Internet is also making companies look at their way of doing business. One of the areas affected by this is supply chain management (SCM). Several new business models have emerged in the e-commerce space as a result of the "new economy" technologies. Several of these models and technologies have challenged the existing SCM and other business processes, while others have validated or strengthened them. As a business leader as well as a business process analyst, these business models and technologies pose a problem that has no easy answer: "Which of these business models and related technologies married with a specific SCM strategy will be optimal for my business or process?" In this paper, we look at this question more closely in order to develop a methodology to answer it. Several established and/or emerging models such in the business-to-business (B2B) and business-to-consumer (B2C) categories are analyzed closely for their applicability to an industry sector or company. In other independent dimensions, we also look at the SCM issues faced by the industry today as well as how the operating environment affects such decisions. Based on the space defined by these dimensions we chart out the SCM processes affected - or in some cases defined - and describe a methodology to tackle the problem. We also touch upon a few “new economy” technologies that make new e-commerce models possible. Lastly we look at how the ERP systems can be affected by a combined e-commerce and SCM strategy in order to avoid conflicts in corresponding business processes.

Introduction

In recent years, business processes and business management has gone through a phenomenal change as a result of revolutions in two areas—Enterprise Resource Planning and Supply Chain Management. While the concepts in these two areas have been around for a while, in theory and in practice, recent technological and business process changes have made these concepts more feasible to implement.

The tools and technologies in these two areas however were still developed for a rather traditional approach towards business processes. Most of the early versions of these tools

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support rather monolithic organizations interacting with each other in a linear fashion. These tools and concepts served well for organizations that fit that structure and thus the implementations of the ERP systems and SCM process changes for such organizations was quite successful.

The major change that highlighted the inflexibility of these ERP systems and SCM resources was rise of a whole new business medium—the Internet. The invention of the World Wide Web (WWW) around the Internet infrastructure triggered this business medium by making it was easy for people to interact with each other and exchange information. In fact, that is how it was primarily used for the first few years. As the medium matured, it was soon conceived that all the eyeballs attracted to the information could be persuaded to buy related product or the information itself. E-commerce was born.

The very nature of the web brought a change in the way business was conducted on this new medium. The "Click-and-Jump" character of web surfing caused several changes in customer and vendor behavior. Chief among them are:

1. It was easy to go from one *storefront* to the other.
2. The storefront itself didn't give any particular idea about the size, nature and business maturity of the vendor, thus creating a level-playing field for vendors.
3. The "stickiness" of the storefront became much more important than before.
4. A new avenue of making your business' storefront a part of a *sticky* website opened up.
5. Targeted marketing became easier.
6. Comparative shopping became easier.
7. Forging new business relationships became a technically trivial problem of adding appropriate hyperlinks to your partner's site and vice versa.
8. The role of intermediary in traditional sense started diminishing. A new wave of intermediaries started appearing—ones that were not so tightly coupled to a product, product category, company or even an industry, as was the case with their earlier counterparts.

These changes gave rise to a multitude of business relationships and, therefore, business models. These business models were dynamic in nature because of the loose coupling between storefront infrastructures of various vendors through hyperlinks. They also demand a fast turnaround time to respond to the rapidly changing business relationships**.** Models such as auctioning, reverse auctioning, and B2B market exchanges exemplify this. The technical simplicity of forging or breaking a business alliance translated into a new set of business level complexities in which issues such as role of intermediaries, revenue sharing and customer loyalty became tricky. For example, increasingly, the traditional channel partners of manufacturing companies are turning their on-line business into a referral site that takes the visitor to the manufacturer’s site. The manufacturer then splits the revenue for such business in an agreed-upon manner.

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This dynamism in the business environment invariably translates into significant implications for SCM policies of a company as well as the ERP systems used to facilitate the operation of the business. A dynamic business model also means that the upstream and downstream nodes in your supply chain are changing more rapidly than the traditional static relationship. Thus, the SCM policies designed to optimize traditional business relationship are not suitable in the e-commerce world because they cannot respond fast enough. Also, the ERP systems that assume a rather static environment for various resources available to a company can fail to help the e-commerce environment. An example of this would be positioning of mySAP.com vis-à-vis SAP.

In this paper, we look at these inter-relationships between e-commerce business models with supply chain management and ERP system implementations. Specifically we analyze how choice of an e-commerce business model can affect SCM issues and how can that knowledge be used to make informed choice between competing e-commerce models. We also take into account, the role of *business sensitivities* that result from being in a particular industry sector, geographic region etc.

We use the following three main dimension to scope the problem space and boundaries for the analysis:

1. e-commerce business models,
2. supply chain issues faced by a business and the
3. business environment sensitivities.

In the following discussion, we look at each of these dimensions. We define these dimensions independently first and then look at the co-relations among them to identify the problem and the solution space.

E-commerce Business Models

As Michael Rappa has noted, the purpose of a business model is to identify the revenue potential of a company and to position its business in a value chain[1]. In other terms, a business model really specifies what gap in some value chain a company hopes to fill and thus generate revenue that is necessary for its sustenance.

Before the advent of the Internet and the web based "new economy", business models were relatively simple. Products would reach the *end customer* through a set of tiered intermediaries, each less and less bound to the manufacturer of the product. Each intermediary would collect its share of the pie from the sale. The business model for each of these intermediaries was based on their relative position in this tiered business relationship model.

[1] Rappa, Michael, *http://ecommerce.ncsu.edu/business_models.html*

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As noted previously, the role of these intermediaries was diminished with the Internet since it provided a low cost medium of outreach for the manufacturer. However, there were newer gaps in this type of commercial activity**.** For example:

- Manufacturers now need to stock inventory that used to be stocked by the intermediaries. Demand forecasting becomes more important.
- Manufacturers would need additional marketing activity and efforts to create co-campaigning programs.
- Manufacturers need to provide value-added services.

As a result, the e-commerce world discovered new business models to fill these gaps. In some cases, it also reinvented the old business models, such as auctioning.

The study of the evolution of the business models in the e-commerce world is outside the purview of this paper. Interested readers are referred to the following sources for more details.

- *.Com to .Profit Inventing Business Models that Deliver Value and Profit*
- *http://ecommerce.ncsu.edu/business_models.html*
- *http://hotwired.lycos.com/webmonkey/e-business/building/index.html*
- *http://www.strategy-business.com/research/99202/chart1.html*

We use Rappa's identified e-commerce business models.[2] We have classified these models into four major categories - B2B, primarily B2B but potentially B2C/B2E, B2C/B2E and primarily B2C/B2E but potentially B2B. These categories are depicted in Figure 1. The highlighted business models are used in the example illustrating the methodology.

Identifying Supply Chain Management (SCM) Issues

The process of producing a good or providing a service has also evolved over the past several years with business process changes and technological advancements. Business managers first answered the question of how to automate production and reduce costs of labor. While efforts were underway with the "production line", total quality management brought not only a fast and efficient but high quality method to producing goods. Increasing demand on manufacturers forced many business managers to stock inventory to be ready to meet unpredictable and fluctuating demand on a moment's notice. Business managers realized from the *bull whip effect*, the fine line they had to walk between adequate inventory levels and inventory obsolescence. The actions of the upstream suppliers and downstream customers had a strong effect on a business' ability to make and move products and provide service. By thinking of the upstream and downstream businesses as an integrated supply chain, business managers could meet demand while improving revenue growth, asset utilization, and cost reduction through

[2] Rappa, Michael, *http://ecommerce.ncsu.edu/business_models.html*

optimal inventory levels maintained at various nodes in the supply chain. Handfield and Nichols have termed this as *Logistics Renaissance.*[3]

Figure 1 Degree of E-Commerce Model Focus

The logistics renaissance brought with it information technologies and logistics networks that allow for business' to manage the supply chain. Handfield and Nichols define Supply Chain Management to be "…the integration of these activities [activities associated with the flow and transformation of goods from the raw material stage, through to the end use, as well as the associated information flows] through improved supply chain relationships, to achieve a sustainable competitive advantage."[4]

Essentially the supply chain includes internal and external process and information flows. In general, a company or a business unit has control only over the internal processes and the external processes can only be influenced to certain extent. In this analysis, we concentrate only on internal processes and inter-organization information flows. The methodology developed is still applicable for an integrated supply chain but requires significant work to achieve consensus across all the nodes that are being integrated to agree upon the results. In Figure 2, we divide the internal supply chain by product life cycle (only the SCM categories are depicted). At every level of the internal

[3] Handfield and Nichols, pg.1
[4] Handfield and Nichols, pg.2

supply chain there is an opportunity to participate in inter-organization information flow. However, many businesses would not share information during the product/service generation phase.

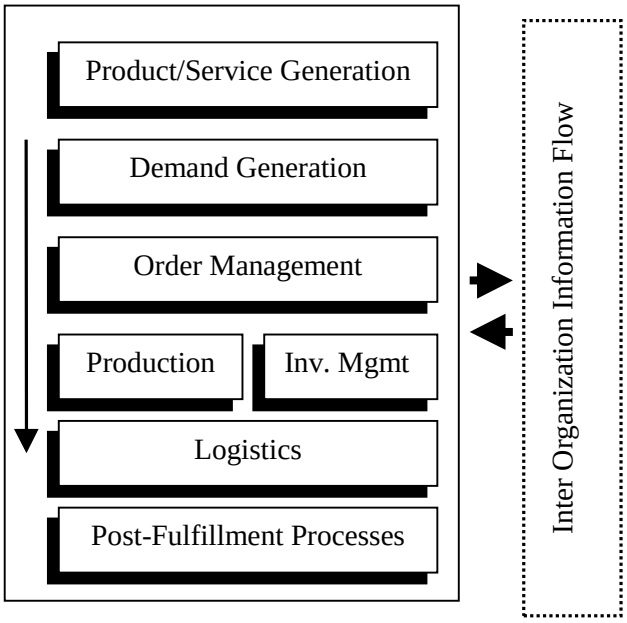

Figure 2 Supply Chain Categorization by Product Life Cycle

In this discussion we limit our attention to only the categories of SCM issues. The table in Figure 3 below describes some of the categories and potential SCM issues in them. This list is not intended to be exhaustive but rather exemplary. In a real-world business specific SCM issues could be perceived in a category or the categorization could be done based on some other criteria altogether. Irrespective of such a classification, the methodology that follows remain applicable. We use this classification for rest of the discussion.

Product/ Service Intro	Demand Generation	Order Mgmt	Production	Inventory Management	Logistics	Post-fulfillments	Inter-organizational Information Flow
market research	sales force automation	returns	production scheduling efficiency	inventory efficiency	cycle times	after sales support	collaborative demand forecasting
	customizing	nexus issues		shelf life	solid waste management	localization	vendor managed inventory
				service parts inventory	reverse logistics	customer satisfaction	supplier tracking
					refurbishment processes	product/service warranty tracking	supply chain sophistication

Figure 3 Potential Supply Chain Issues

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Business sensitivities for a general business

The third important dimension of the problem space is the business sensitivities faced by a business. To achieve this, one could look at an industry sector of interest and look at the specific issues, policies and events that can impact the sector's performance. In order to create a general methodology, however, it was important to represent this in a more abstract manner. Thus, instead of concentrating on an industry sector or a business model we focus on *business sensitivities*. We define business sensitivity as an issue, policy or event that can materially impact, positively or negatively, the business environment a business is operating in. Listed below are some of the sensitivities we considered for our methodology. This list is indicative of the issues that should be included in the sensitivities of a business when working on the problem. The issues are broadly classified in two categories: manageable and indeterministic. Manageable sensitivities can be controlled effectively by business planning and good governance. By contrast, indeterministic business sensitivities are out of management control. Their effect can either help or hinder a business.

Manageable Business Sensitivities	Indeterministic Business Sensitivities
Product-centric	Regulation sensitivity
Service-centric	Economic/Government policy
Inventory sensitivity (demand fluctuation)	Natural disaster sensitivity
IP Creation and Management	Global labor sensitivity
Quality	Environmental friendly-ness
Data integrity	
Data Accuracy	
Global Natural Resource levels	
Access Control	
Customer Identity	
Security	
Fraud	
Market Trends	
Preference Trends	
Market Profile Information	
Competitor sensitivity	
Location sensitivity	

Figure 4 Potential Business Sensitivities

As can be seen from the discussion above, the three dimensions—e-commerce business models, SCM issues associated with a business and the business sensitivities—form the problem space for this discussion. To define a solution, any approach needs to take into account how these three dimensions affect each other. Once these co-relations between these dimensions are defined, we can identify the optimal data points (3-tuples) in the problem space. If a data point works well in just one or two dimensions but fails to optimize the remaining, the co-relation functions point to that fact and we can eliminate that data point. The three dimensions of the problem space are described in Figure 5 below.

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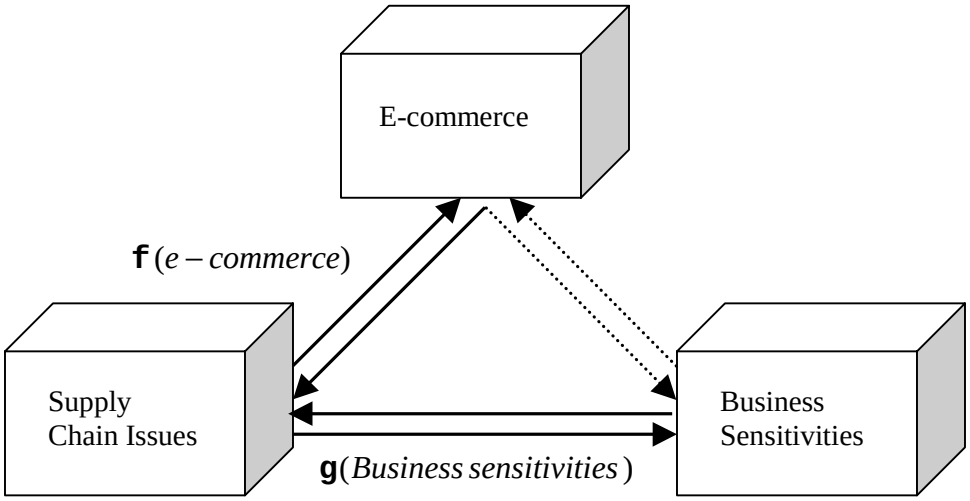

Figure 5 E-Commerce Problem Space

Our approach here is to identify natural or obvious relationships that exist between these dimensions and then deduce the others from them. It can be seen that such natural relationships exist between (1) an e-commerce model and SCM issues and (2) SCM issues and business sensitivities.

An e-commerce model defines how a business is conducted with the Internet as the medium of communication between vendor and customer. Regardless of which method of order generation or revenue sharing is followed (which is what an e-commerce model typically defines), associated product or service must be delivered to the customer just as in non-e-commerce models. This means that from the supply chain standpoint, there will still be an impact no matter which e-commerce model we choose. What needs to be determined is how an e-commerce model helps or hinders a supply chain issue.

A similar case can be made for the co-relation between SCM issues and business sensitivities. By a natural cause-effect relationship, SCM policies determine the supplier or customer satisfaction in the business-to-business interactions. Thus, an SCM policy that fails to minimize roadblocks between suppliers and customers is likely to be disregarded. A business, however, will be sensitive to a plethora of other issues that might force the business to choose a sub-optimal SCM policy. Thus an SCM policy could be in a counterbalancing position vis-à-vis the sensitivities dimension.

A direct relationship between the business sensitivities and e-commerce business models is difficult to ascertain. Thus, in this paper we took the approach of expressing that relationship as a functional composition of the other two co-relations discussed above. In mathematical terms,

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(1) A functional relationship exists between SCM issues and an e-commerce business model

$$SCM\ Issues = \mathbf{f}(e-commerce\ business\ model)$$

(2) A functional relationship exists between SCM issues and business sensitivities

$$SCM\ Issues = \mathbf{g}(Business\ sensitivities)$$

(3) Thus a functional relationship between business sensitivities and e-commerce business model can be deduced.

$$e-commerce\ business\ model = \mathbf{f}^{-1}(\mathbf{g}^{-1}(Business\ sensitivities))$$

or

$$Business\ sensitivities = \mathbf{g}^{-1}(\mathbf{f}(e-commerce\ business\ models))$$

The methodology we develop is based on this principle. Specifically it is based on the ability to answer the following questions that act as the foundation of the analysis for a suitable e-commerce business model:

- What SCM issues are affected, positively or negatively, by a specific e-commerce business model?
- What SCM issues can be affected by or are a result of a set of business sensitivities?
- What e-commerce business models can lend themselves as suitable for a given set of business sensitivities?
- What business sensitivities would be affected, positively or negatively, by the choice of a specific e-commerce business model?

Once such a co-relation between all the three dimensions is defined, effects of a change in one dimension on others can be assessed and thus an optimal set combinations among the three can be found.

Illustrating the Methodology

A clear understanding of the e-commerce models in question, the pertinent SCM issues faced by the business and the business sensitivities is a perquisite for applying the methodology illustrated below. In this paper, the methodology is exemplified using a business that manufactures a highly configurable analytical instrument that is used primarily in environmental, pharmaceutical, and research industries. The product mix consists of the main product—analytical instrument—and the supplies. We assume the following operating conditions for this business and its industry. The table in Figure 6 describes the SCM issues facing this business, categorized using our product life cycle classification.

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Product/ Service Intro	Demand Generation	Order Management	Production	Inventory Management	Logistics	Post-fulfillment	Inter-organizational Information Flow
Complex new product intro	Requires field sales engineers and/or distributors	Complex configuration	Production line expertise	Highly commoditized but expensive	Competitive pressures require "ship next day" ability	Warranties	Auto replenishment of raw materials
Long innovation cycle	Demand can be forecasted	Intricate order information flow through ERP systems	Expensive mfg equipment		Special Delivery processes to preserve precision	Training and education programs	Order status
	Supplies required on periodic basis	*Supplies are easy to buy* *Usually repeat orders (similar qty, etc)*	Quality sensitive because of precision		Multi-site bundling (coordinated delivery)	*Supplies* Field Service	*Auto replenishment for supplies*

Figure 6 E-Commerce Problem Space

The first step in our methodology is defining the co-relation functions explained above. However, it must be noted that this problem is analytical and not that of algebra. Hence we define these co-relations in empirical form rather than in any closed form equation. These empirical relationships are explained below.

SCM issue - E-commerce model co-relation

As explained in the earlier section, no matter which e-commerce business model is chosen, the SCM issues are impacted positively or negatively. Thus the relationship between the SCM issues and the e-commerce models is of qualitative nature. With a particular choice of e-commerce business models, the quality of a supply chain with respect to a given SCM issue will improve, deteriorate, or stay constant. We took the approach of relative ordering in which, for a particular business model under analysis, the SCM issues that favor it are ranked higher than the ones that do not. Two special ranks need explanation. It is possible that an e-commerce model has no effect on or hinders an SCM issue. We give the lowest rank of *1* for models that are neutral with respect to an SCM issue. A model that hinders improving an SCM issue is given a rank of *0* with respect to that SCM issue. Such a relative ordering saves us from giving exact score for a business model with respect to an SCM issue that might require significant work and can be resource-consuming.

It must be noted that such a relative ordering of SCM issues is for a particular e-commerce business model and hence must be repeated for all the e-commerce models of interest for a business. The table in Figure 7 shows an example in which the SCM categories have been ordered in relative fashion for the e-commerce business models of interest in the analytical instruments industry. Note the ranking of 1 for the utility model

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with respect to all the SCM issues except demand generation. On the other hand auctioning, which can hinder logistics and post fulfillment issues, has a rank of 0 with respect to those issues. The real-world rankings will be specific to a specific company or business and may not be in agreement with those for other companies or businesses. Note that higher the relative order rank of an SCM issue, the better it is with respect to an e-commerce model.

	PSG	DG	OM	P	IM	L	PF	IOIF
Specialized Portal	4	7	5	1	1	1	8	1
Auctioning	1	8	6	5	7	0	0	1
Utility Model	1	8	1	1	1	1	1	1
Market Exchange	1	7	8	4	6	3	2	5
Business Trading Community	3	7	8	1	4	2	6	5
Manufacturer Model	0	7	8	0	6	5	0	0

Figure 7 Analytical Instruments industry E-commerce Model and SCM issues co-relation

Business Sensitivity - SCM issue co-relation

The business sensitivities and the SCM issues have a similar cause-effect relationship as in the SCM issues - e-commerce business model co-relation defined earlier. The nature of this relationship, however, is different. While some of the SCM issues could be direct result of a (set of) business sensitivities, some could be indirectly related. For example, the analytical instruments industry is not particularly sensitive to government regulations but can find that it is having *coordinated delivery* issues because of restrictions on doing business with a particular country that can act as a good base for a merging center. Also, by the nature of this relationship, once a sensitivity impacts an SCM issue in certain way it is likely to impact other SCM issues in a similar way. Thus for this analytical instruments business, the government regulation will cause inventory management issues in neighboring countries or corresponding sales area, cycle time measures and inventory efficiency. This phenomenon would make the relative ordering approach difficult.

We used a rather judgmental approach to define this co-relation. In this, an SCM issue is judged vis-à-vis the business sensitivities and then deemed *aligned to, unrelated to* or *counterbalancing* to that. We define the scale of co-relation as follows:

- Aligned to – Addressing the SCM issue will be directly aligned with your business sensitivities.
- Unrelated to – Addressing the SCM issue will not have positive or negative impact on the business sensitivities.
- Counterbalancing to – Improving on the SCM issue will negatively impact the business sensitivity.

Naturally, an SCM issue that is aligned with more of the business sensitivities is likely to be addressed as opposed to one that is not. Conversely, the more business sensitivities an

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SCM issue is aligned to, the better are the chances are that it will be addressed in a timely and optimal manner. And as a result, any SCM issue that has goals not aligned to the business sensitivities is unlikely to be addressed. Intuitively, it is unlikely that an SCM issue is counterbalancing to a lot of business sensitivities because an efficient SCM policy is one the business sensitivities and a business goal itself! Nevertheless, it is possible that some sensitivities could hinder or limit properly addressing an SCM issue. For example, a defense supplier might be limited by government on the kind of data it is allowed to share up and down its supply chain or a pharmaceutical company may not share some data it considers part of intellectual property with its suppliers and customers. In both these cases, the business environment limits the success of inter-organizational information flow—one of the SCM issues.

Rather than analyzing the effects of a business sensitivity to an SCM issue individually, we use the *net* effect to concisely and effectively put the SCM issue—business sensitivity co-relation in perspective. We enumerate the number of business sensitivities that an SCM issue is aligned to, unrelated to and counterbalancing to. Figure 8 outlines the business sensitivities for the analytical instrument industry in our example. As in the previous section, the numbers are exemplary, while the real-world data would be subjective to a business and its environment.

Manageable Business Sensitivities	Indeterministic Business Sensitivities
Product-centric	Regulation sensitivity
Inventory sensitivity (demand fluctuation)	Economic/Government policy
IP Creation and Management	Global labor sensitivity
Quality	Technological capital sensitivity
Data Accuracy	
Market Preference	
Market Profile Information	
Competitor sensitivity	

Figure 8 Analytical Instruments Industry Business Sensitivities

Once the co-relation between an SCM issue and the business sensitivities is defined, an *overall score* for that issue can be calculated as weighted average. We assign the weights as follows: *Aligned to* (+1), *Unrelated to* (0) and *Counterbalancing to* (-1). For our example, the SCM issue—business sensitivities co-relation is defined in Figure 9. Thus for the Product/Service Generation issue the overall score is 8(1) + 1(0) + 0(-1) = 8. The overall score depicts how closely it is addressing a specific SCM issue is aligned with the business sensitivities for a business or company. The higher the score, the better is the alignment.

In the final stage of analysis, the effects of these two co-relations are combined to get the effect of the e-commerce business model on the business sensitivities or to assess which e-commerce model is favored by the current business sensitivities. To combine the co-relations we multiply the SCM issue's overall score (with respect to the business

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sensitivities) with the relative ordering of that issue with respect to a e-commerce business model. Note again the interpretation of these two numbers:

- The higher the relative ranking is for an SCM issue with respect to a specific e-commerce model, the better is the e-commerce model to improve that SCM issue.
- The higher the overall score is for an SCM issue with respect to the business sensitivities, the better aligned it is with them and thus improving upon that will be more aligned with the business goals.

	Aligned to	Unrelated to	Counter balancing to	Overall Score
PSG	1,3,4,5,6,7,8,9	2		**8(1) + 1(0)+0(-1) = 8**
DG	1, 2, 4, 6, 8, 9	3, 5, 7		**6**
OM	6, 9	1,2,3,4,5,7,8		**2**
P	1,2,6	3,4,5,7,8,9		**3**
IM	2,7,8,9	1,3,4,5,	6	**4**
L	1, 2, 6	3,4,5,7,8,9		**3**
PFP	1, 4, 6, 7, 8	2, 3, 5, 9		**5**
IOIF	2, 6	1,3,4,5,7,8,9		**2**

Figure 9 Example SCM and Business Sensitivities Co-Relation

Due to these properties, the net result of the product of these two numbers is *relative ranking of e-commerce business models with respect to the business sensitivities*. Again as is the case earlier, the higher the product, the better aligned is the e-commerce model with the business sensitivities. This relative ranking number, derived separately for each e-commerce model of interest, can be used to choose an e-commerce model based on current business environment realities. The table in figure 10 depicts the ranking of e-commerce models for our example.

E-commerce Model	Score
Specialized Portal	136
Auctioning	113
Utility Model	75
Market Exchange	131
Business Trading Community	147
Manufacturer Model	97

Figure 10 Example e-commerce model

As can be seen from the scores, the analysis favors business trading community model. A business trading community model is a vertical market which is an "essential, comprehensive source of information and dialogue for a particular vertical market."[5] The lower rankings for market exchange and specialized portal models are result of lack of

[5] Rappa, Michael, *http://ecommerce.ncsu.edu/business_models.html*

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features present in the trading community model. Though the specialized portal provides product information and helps in the post-fulfillment processes, it lacks features to facilitate the order management function. Note that this model fares lower in the overall ranking despite having high scores on product/service generation and post-fulfillment categories – the two categories that are highly aligned with the business sensitivities.

The manufacturer model—the most intuitive model for businesses—scored very low suggesting that having ability to directly reach the customer for this business is not as beneficial as other models such as trading community or market exchange.

Application of the Methodology

Some relevant facts must be noted about this methodology for its effective application. This methodology is based primarily on the SCM issues that are faced by a business. While it is true that, to a good extent, this tends to be one of the most important areas, it is likely that at times other priorities might supercede the SCM issues and policies. Decisions that are based on financial reasons (e.g. layoffs, discontinuing products, plant shutdowns), legal reasons (e.g. patents, product features, areas of product availability, plant locations), or strategic reasons (divestitures, mergers and acquisitions) can mandate a certain business policy be implemented that could include e-commerce business models as well.

The role of the methodology in such a case is changed from suggesting suitable e-commerce models to identifying the SCM issues or business sensitivities that might be affected due to the implementation of a mandated e-commerce model. This fact has been noted in equation (3) discussed earlier. While the first part brings out the suitable e-commerce models given the business sensitivities, the second part highlights the business sensitivities and thus SCM issues affected by choosing a certain (set of) e-commerce business models.

We want to point out that even though the discussion is concentrated mainly on a company or a business unit within, it could be applied at a more granular level such as a product line or a specific product. In such cases, the problem statement should be amended to assess if the product line or the product should participate in the e-commerce initiative being implemented at the company level. Based on this assessment, the product (line) managers can conclude if their product(s) can benefit—in SCM terms—by choosing the corporate e-commerce model (s).

Because the methodology takes a comprehensive approach to the business environment, it favors the most suitable models. However, that result should not be applied in an exclusionary manner. Other models that fare well may be beneficial in limited ways. In our example, the manufacturing model maybe the first simple step to achieving the final goal of participating in a complex trading community environment. Also, the utility model which aids only the demand generation can be implemented for a narrow market segment to offer such an expensive product to a financially constrained market segment.

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Effects on ERP Systems

The effects on ERP systems, as a result of the analysis above, are significant. Because ERP systems are affected by all three dimensions—business sensitivities, SCM issues and e-commerce business models. The impact of the e-commerce business models is rather subtle and may not be noticed at first glance.

An ERP system's primary goal is to effectively manage the resources within an organization. The supply chain policies thus directly affect the capabilities required in an ERP system. The e-commerce business model as such should not affect ERP systems directly, but the impact is felt due to its co-relation with the supply chain issues. In our example, an order configured incorrectly making its way to the assembly line can cost a lot to correct at that stage. To avoid configuration problems, while choosing the e-commerce model, the company might choose manufacturer model for pre-configured bundles of the product, while participating in the business trading community model it can provide custom configured versions. Also, assume that for cost reasons, the manufacturing of the pre-configured bundles is outsourced and only the custom configured products are manufactured within the company's own plant. Eventually, the orders from both the channels will flow to the same order management component of the ERP system. It needs to take separate actions for these two orders. For example, level of configuration checking will be different in both cases, automatic configuration correction could be much simpler for pre-configured bundles, the two orders will need to be routed differently etc. Thus the ERP system will need to provide the supply chain functionalities as necessitated by the choice of e-commerce business model.

The business practices and policies in e-commerce business models change at a faster pace than conventional business models. Moreover, there are several new business models that are being invented continually[6]. An ERP system, that supports an e-commerce business model needs to be more nimble to adapt to these changes compared to the one that supports traditional business models. If the business realities mandate an inflexible ERP system, it could have an impact on the chosen e-commerce business model. However, this impact should be assessed during the implementation and not during the analysis. Since this paper concentrates only on the investigation/analysis phase for choice of the e-commerce business model, we have disregarded the impact of ERP realities.

[6] Earle, Nick .*Com to .Profit*

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E-commerce Technologies

It is worth noting some relevant technological advancement in this context as it affects the applicability and acceptance of e-commerce and related business models. Moreover, some of the technologies also *define* new e-commerce business models.

As discussed earlier, the purpose of Internet and WWW, as they originally developed, was information sharing. Today the WWW tools are the common mechanisms for not only information sharing but commerce activity. However, most of them are optimized for information sharing purpose. But, information tends to have a more static nature compared to business transactions. Thus technologies that provide business level semantic meaning to the data or information exchange must be defined.

Several vendors are providing such technologies. The vertical market software created by VerticalNet, CommerceOne's eCo and Hewlett-Packard's e-speak are some of the examples that provide the platform on which business interactions can be facilitated. A specific set of such interactions eventually defines the core of a business model. Besides these technologies, a variety of business transaction protocols are also emerging in the market. These include, for market exchanges, Rosattanet's PIP's, Microsoft BizTalk and HP's Service Framework Specification (SFS). These specifications with corresponding interactions complete the rules of an e-commerce model. Due to availability of several such specifications, the implementation platform for a business model must be chosen judiciously with current general acceptance and future potential in mind.

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References and Internet Sources

Keen, Peter G.W and Earle, Nick .*Com to .Profit Inventing Business Models that Deliver Value and Profit* (San Francisco: Jossey Bass, in press).

Handfield, Robert B. and Nichols, Ernest L., *Introduction to Supply Chain Management* (New Jersey: Prentice Hall, 1999).

Rappa, Michael, *http://ecommerce.ncsu.edu/business_models.html*

http://www.hoovers.com/sector/0,2187,73,00.htm

http://hotwired.lycos.com/webmonkey/e-business/building/index.html

http://www.strategy-business.com/research/99202/chart1.html