

THE SUPPLY CHAIN AND ITS MANAGEMENT: SHOULD WE BE THINKING LOOPS NOT LINES?

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The authors argue that frequently -- possibly as a matter of convenience--visual illustrations of supply chain flows of goods, services, relationships, information, finances, and human resources are presented linearly. Industry examples clearly show that supply chain relationships are not linear, horizontal, or mechanical by nature. Nevertheless, what other models might be useful to illustrate the dynamics of these activities as they occur in the real world? In this regard, the authors discuss "Loops Not Lines," an organizational diagnostic model popularized by management scientist Gareth Morgan. Through this valuable lens, supply chains are viewed as a combination of loops, where key actors and stakeholders influence relationships and change flows of inputs and outputs dynamically. The authors conclude with recommendations that deserve consideration in the quest toward consensus regarding the scope and domain of supply chain management.

INTRODUCTION

Possibly as a matter of convenience, frequently visual illustrations of supply chains flows of goods, services, relationships, information, finances, and human resources are presented linearly. Industry examples clearly show that supply chain relationships are not linear, horizontal, or mechanical by nature. The authors explore other models that illustrate the dynamics of supply chain activities as they occur in the real world. In this regard, the paper focuses on an organizational diagnostic model, "Loops Not Lines," popularized by management scientist, Gareth Morgan. Through this valuable lens, supply chains are viewed as a combination of loops, where key actors and stakeholders influence relationships and change flows of inputs and outputs dynamically. The "Loops Not Lines" model discussion adds another perspective that is valuable to enhance discussion regarding the scope and domain of supply chain management (SCM).

The development of the paper is as follows:
Discussion of key concepts and definitions that

ground the paper, application of loops and "mutual causalities" (Morgan 1998, p. 274) to supply chains flows, and the implications of the "Loops Not Lines" model to stakeholder interactions and future research. Integrated along the way are strengths and limitations of traditional depictions of supply chain flows, as well as Morgan's "Loops Not Lines" model. The case study provided is based on a large corporation that primarily serves academic and professional training institutions. The conceptual framework for the discussion and the figures that follow were generated in cooperation with one of the corporation's regional offices. The real name of the corporation and specifics regarding the company or its environment are not divulged.

CONCEPTUAL FRAMEWORK

Supply Chain Management Definition

There is an evolving body of literature devoted to the quest for a definitional consensus of SCM (Gibson, Mentzer and Cook 2005; Mentzer et al. 2001). While definitional grounding is important to this paper, a comprehensive review of the literature devoted to defining SCM is beyond the scope of this study. Suffice it to say that we—the authors—frame the understanding of SCM in the

definition developed by the Council of Supply Chain Management Professionals (CSCMP): Supply Chain Management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all Logistics Management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies. (CSCMP 2005).

The above definition, as reported in the Gibson, Mentzer and Cook article and survey (2005), represented input from participant practitioners, academicians, and research and media/publishing interest groups, and was adopted in 2005 by CSCMP.

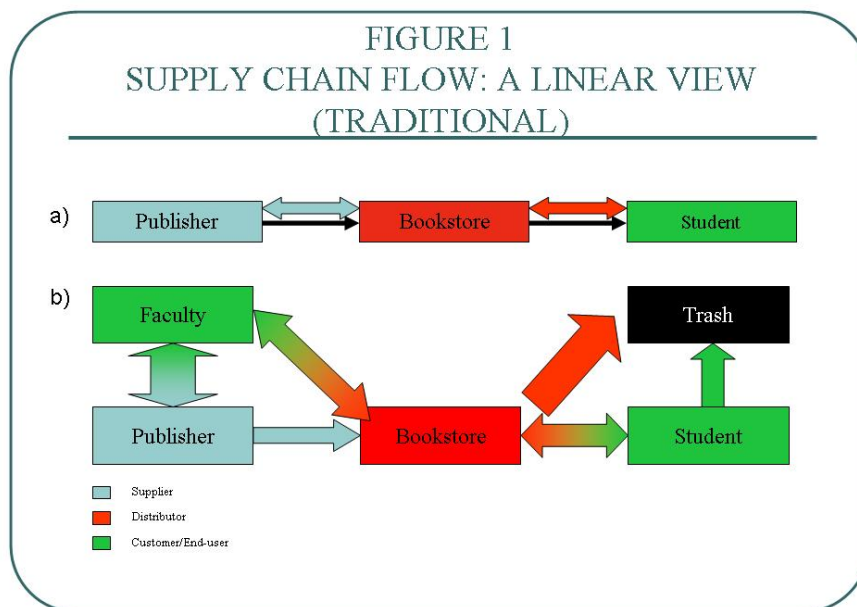
Traditional Depiction of SCM Flows

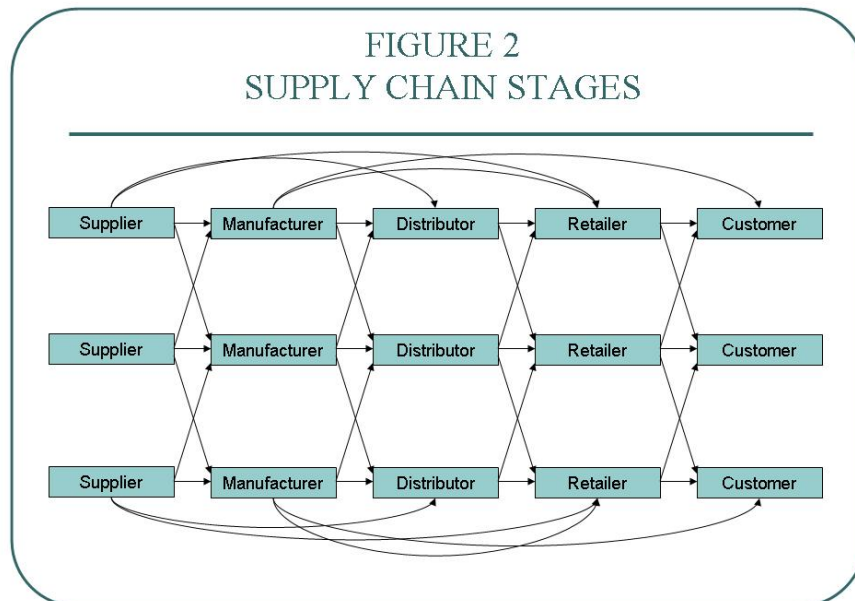
The flows of supply chain activities are frequently depicted in linear fashion. Figure 1 is an example of this linearity. It illustrates the

traditional/generic view of possible upstream, downstream, and reverse flows of goods, services, finances and/or information for a college bookstore.

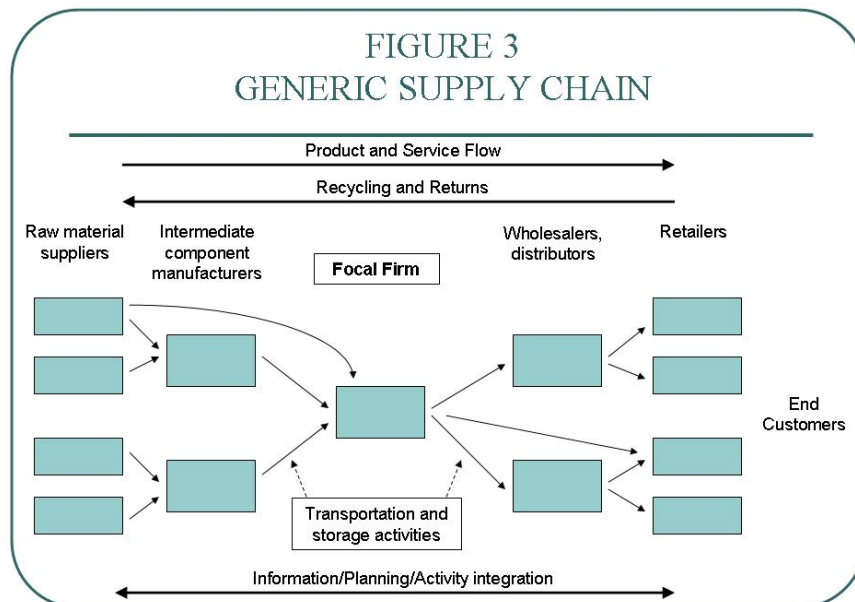
Figure 2 is another illustration of how current SCM textbooks frequently represent supply chain activities. The flow of services and goods pass from one stage to another. Some basic assumptions are made regarding the ordering of activities. With this illustration, the assumption is that suppliers precede manufacturers and distributors. Figure 2 more or less represents the traditional view of interactions between any two stakeholders in a supply chain.

Figure 3 is a more evolved version of Figure 2, and again adapted from a current supply chain textbook. It shows 2-way flows of products, services and information between supply chain stakeholders. The representation of supply chain in Figure 3 is evolved, as it shows forward and reverse information flows along with the service and product flows.





Adapted from: Sunil Chopra, Peter Meindl (2007). Supply Chain Management: Strategy, Planning and Operation 3rd Ed. Upper Saddle River, NJ: Pearson Prentice Hall.



Adapted from: Wisner D., Joel et al. (2005). Principles of Supply Chain Management: A Balanced Approach, Mason, OH: Thomson South-Western

Loops Not Lines and Mutual Causalities

The relevance of mutual causality for understanding the events and processes that shape organizations and their contexts is that it can be used to understand the dynamics of many different kinds of organizational problems (Morgan 1998, p. 236).

The above quotation is stated in the context of organizational development/organizational science and focuses on diagnoses of organizational problems. However, it also provides insight into supply chain flow activities and their management. Specifically, if SCM activities are viewed as a pattern of relationships of loops, this provides a much richer image of the activities and stakeholders involved in the system under consideration. Morgan advocates searching for critical systems patterns, which Figures 1-3 do not show. This is accomplished by identifying those “positive and negative feedback loops that are shaping a situation” (1998, p. 240). “Positive feedback loops” tend to lead to diminishing returns; “negative feedback loops” tend to be cybernetic by nature: or, much like a ship that turns too far in one direction or another, a negative feedback loop counters that activity and turns it back on course. The long-term result of positive and negative feedback is a more balanced and integrated system. In other words, solutions depend on the development of shared understandings of the problem, and an ability to reframe system dynamics so that short-term individual interest and long-term sustainability and development become more balanced and integrated. (1998, p. 241).

Open Systems: Antecedents to the Loops Not Lines Model

Conceptually, there are numerous antecedents to Morgan’s discussion and application of the “Loops Not Lines” concept and mutual causalities to the fields of management science and organizational development. Those include, but are not limited to, extensive literature regarding systems thinking and

systems dynamics. Magorah Maruyama’s work (1963) on mutual causal processes was an important breakthrough to understanding how elements within a system influence each other either simultaneously or alternately. Another was Jay Forrester who pointed to the importance of studying the open, fluid and dynamic nature of feedback systems: “The study of feedback systems deals with the way information is used for the purpose of control. It helps us to understand how the amount of corrective action and the time delays in interconnected systems can lead to unstable fluctuation” (1958, p. 40). Forrester cautioned against functional, mechanical, and “three-dimensional” views of systems (p. 52). C. West Churchman’s discussion of systems argued that any one view of a system is “terribly restricted” (1968, p. 231). This, of course, is an underlying rationale for consideration of the loops and lines model, as its application to SCM provides another way of seeing the dynamics of SCM processes. Morgan’s book, *Images of Organization* (1st ed. 1986 – 2006, latest edition) echoes the Churchman view, arguing that one lens only is both a way of seeing and not seeing. Numerous lenses are essential for viewing dynamic processes—hence, our application of Morgan’s model to SCM.

Peter Senge et al. also addressed feedback systems, control loops and intervention strategies—breaking, adding, and reinforcing links and loops as elements of system thinking and problem-solving (1994). However, Morgan’s discussion of “Loops Not Lines” predates the work of Senge. W. Edwards Deming emphasized the value of systems thinking and visualization of processes throughout his entire career. Deming viewed competition and transactional thinking—as opposed to cooperative, relational thinking, as among the destructive forces that could potentially harm managerial effectiveness and organizational longevity (1994).

In short, while there are antecedents to the concept of mutual causalities, it is Morgan who amplified the application in the realm of

management with thought-provoking visual illustrations--i.e., "Loops Not Lines"--as a way of seeing dynamic systems, countermeasures or intervention strategies.

CASE APPLICATION OF THE LOOPS NOT LINES MODEL

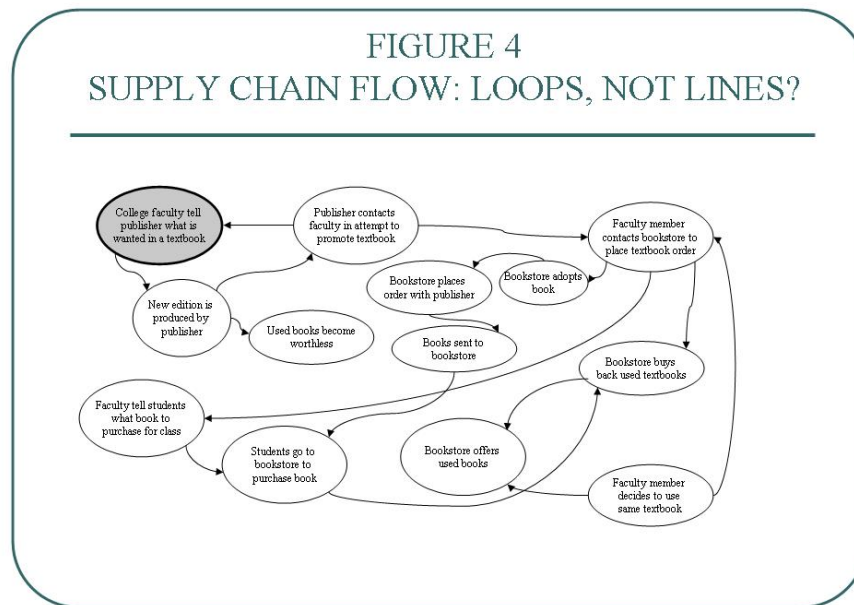
Let's apply the "Loops Not Lines" approach to the case of the corporation under consideration--a corporation that is increasingly concerned with dwindling profits and loss in market share. As background to the examples that generated Figures 1 - 7, a pilot study was conducted over the Spring and Summer of 2005 in cooperation with this corporation. The purpose of the study was merely to support, refute or update perceived trends in the industry that were already extensively reported in secondary sources. A convenience sample of twenty-five northeast region university and off-campus bookstore managers volunteered to respond to a survey regarding textbook purchases in their respective locations. Additionally, sixty-three surveys were distributed to faculty members serviced by a college bookstore located in the same region. The faculty response rate was 25 percent. Findings confirmed the trends reported in secondary sources. Additionally, two phone interviews with two different publishers' sales representatives, and one personal interview with the general editor of a major higher education textbook publishing company further confirmed generally acknowledged industry trends and practices. The interviews were done to triangulate the information gathered from the other sources. In short, the information gathered from interviews, secondary sources, and surveys provided situational examples that formed the basis of the figure-related discussion in this paper.

Linear views of supply chains have their own strengths and limitations. One such strength is that they give the reader a quick overview of interactions between any two connected supply chain stakeholders and are easy to understand. As stated previously, Figure 1 shows two linear views of the corporation's direct and extended

supply chain. Yet, these views of their supply chain are far too simple and mechanistic. In fact, they present the customer base too narrowly, and do not provide necessary deeper understandings of the relationships and the positive and negative feedback loops that potentially influence the end user and the entire supply chain system. Figures 2 and 3 representations are also linear ones, although they show two-way interactions. They do not help to uncover the complexities of possible upstream and downstream changes affecting the entire supply chain. This, inherently, becomes the limitation of the linear views. As argued by Morgan, using a "cause and effect" method of analysis is a straight line approach that does not necessarily look at destructive patterns within the supply chain (1998, p. 239).

Figure 4 illustrates the scenarios where all actors--members of the supply chain--follow simple steps based on assumptions made by other SC members. In this idealistic situation, a textbook is published--either due to faculty requests or publisher plans--and promotions and telemarketing target faculty members as key actors influencing sales. The book is then adopted by the college bookstore and purchased from the publisher for sale to students. Students are advised of what text to purchase by the faculty member, and they visit the bookstore to buy the book. If a book is used for a second semester, the bookstore offers used books for sale. To counteract the sale of used books, the publisher prints a new edition of the text, and so the cycle continues.

Although a cycle, this course of events is deeply rooted in the belief that the supply chain follows a linear path. In reality, the cycle rarely follows the same path. The cycle, as well as relationships between supply chain members, can be drastically altered by the actions of an individual member of the supply chain. One destructive pattern (among potential others) within this supply chain might include failure to recognize diminishing loyalty to the college bookstore due to price advantages gained through e-tail or Internet book stores. Order processes might continue



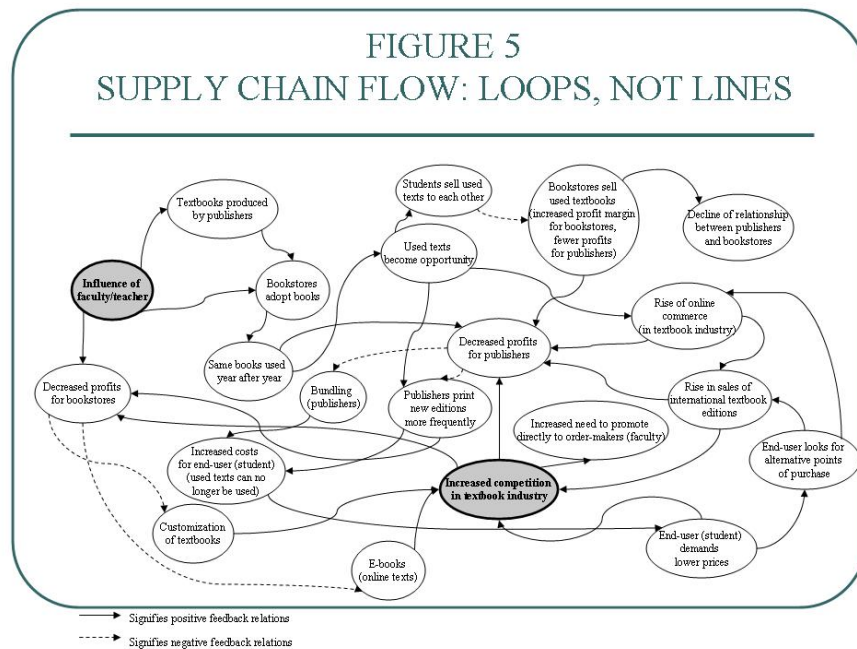
with retail supply exceeding demand, and so the cycle continues, destructively. In other words, positive feedback “takes over”. The system obviously needs stabilization; and to accomplish that, negative feedback loops need to be introduced into the system and/or strengthened.

Prior to the twenty-first century, corporate and bookstore management typically looked for cause-and-effect type relationships influencing dwindling profits. Their actions recall Morgan’s discussion. In short, they were “searching for simple causes that lie at the root of the problem” (Morgan 1998, p. 236). By attributing declining market share to factors such as the rise in e-commerce, the increase in publishing frequency of new editions, and the presence of international editions, management did not recognize that evolving relationships between supply chain members significantly influenced their situation. No one causal factor can be blamed for what turns out to be numerous effects. There are, indeed, mutual causalities.

Figure 5 presents a clearer picture of the system in which our case study bookstore exists. Shown are positive and negative feedback

loops that, over time, have contributed to the bookstore’s loss of market share. Positive feedback loops outweigh negative, and therefore, balance cannot be achieved and sustained. The diagram briefly illustrates the “used book” phenomenon that began with students selling used textbooks to each other; then it moved on to bookstores selling used books to students, and the results led to the financial woes that plague the retail outlets and the corporation as a whole.

In the mid-twentieth century, college students became aware of faculty decisions to use the same text semester after semester. New editions were published less frequently at that time--about every 8-10 years (Roediger 2005). College students began selling textbooks to each other, and bookstores realized that an opportunity existed to sell used books. The sale of used textbooks created a higher profit margin for bookstores (NACS 2005), but meant a lower profit margin for publishers. In an attempt to correct this action, publishers reacted by publishing new editions at a faster pace (CALPRIG 2004). By doing this, professors were forced to reevaluate whether older editions would be used from year to year or if new editions would replace older editions.



Publishers began to target professors directly by developing relationships, generally through telemarketing representatives. New editions were used more frequently at an increased cost to students (CALPRIG 2004). Students rebelled and found alternatives to purchasing new editions at the college bookstore. E-commerce gained momentum and offered opportunities for texts to be bought at lower costs and international editions to be purchased (Lewin 2003; US Census Bureau 2004, p. 4). Additionally, competition increased in the textbook industry. Reacting to the increased number of players in the industry, publishers developed “bundling” techniques, where several materials to be used in a class were packaged and sold together (CALPRIG 2004); bookstores pushed for textbook “customization” and electronic versions of printed text. The intermediary publishing business emerged and continues to grow as a result of this trend. The business of these intermediaries is that of “bundling” and customization of materials--often from multiple publishing houses. Frequently, antagonistic relationships develop between one or more of these supply chain members as they find themselves competing against one another. For example, the sale of bundled chapters by an

intermediary potentially cannibalizes the sales of entire textbooks by a publisher.

It appears that factors contributing to loss of market share can be traced back to the rise of used book sales, but, again, there are many factors involved. While supply chain members tried to outdo each other, they caused the system to evolve, which, in turn, had a negative effect on their own sales. These events recall Morgan’s view of the destructive processes that are often self-perpetuating: “team members may be so competitive that in trying to outperform each other they end up eroding each other’s success” (1998, p.240).

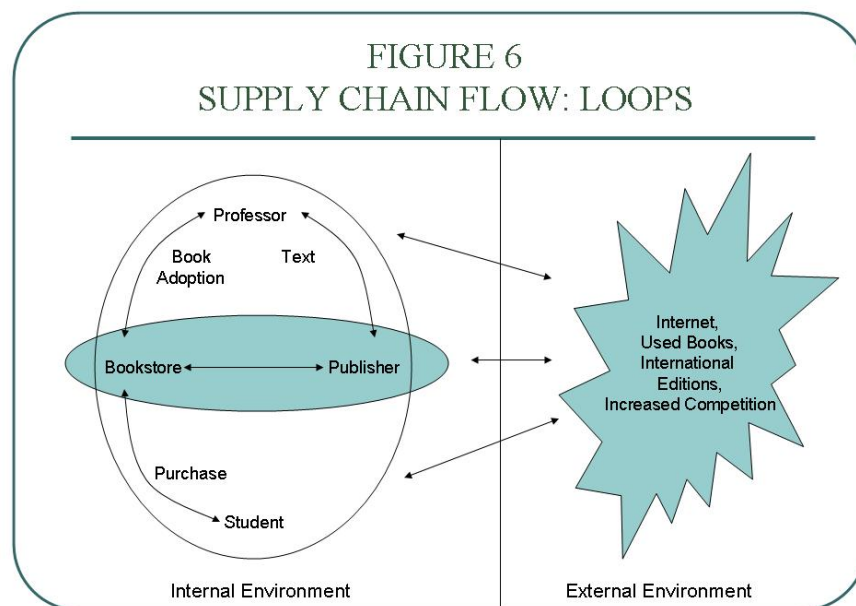
In failing to recognize the scope of their environment and the relationships between the supply chain members, corporations encounter many problems. Indeed, all companies must “recognize how they are part of their environment”—they are an open system, and must not underplay “the significance of the wider system of relations in which they exist” (Morgan, 1998, p. 219), as “...in the long run, survival can only be survival with, never survival against, the environment or context in which one is operating” (1998, p. 221).

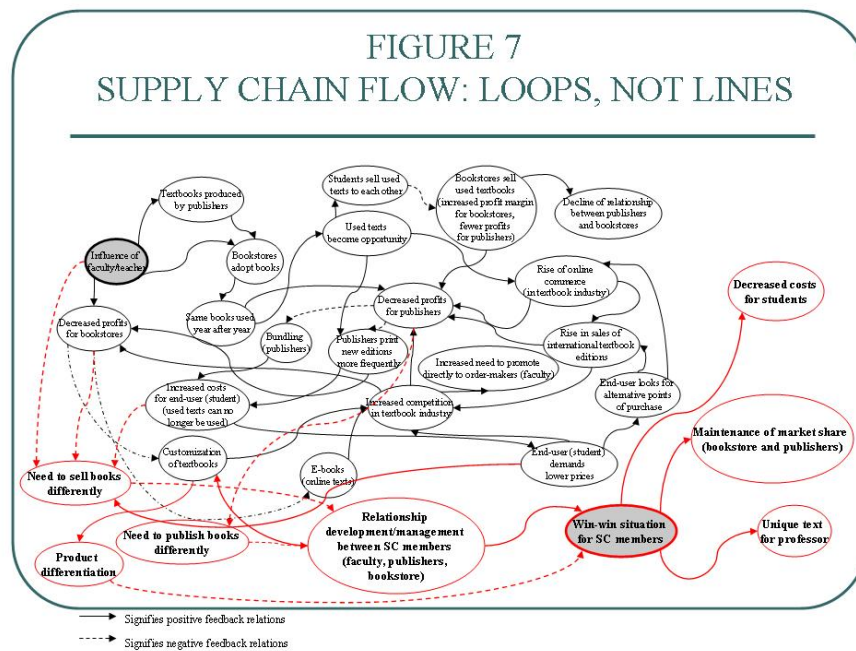
Another view that helps appreciate Morgan’s model is Figure 6, which illustrates the scenario where all the stakeholders interact with one another, and at the same time react to the changes happening in the external environment. The bookstore and publisher are part of one network, while the student and the professor are part of another network. The interaction between the four stakeholders is part of the internal environment. The external environment consists of external factors like internet book stores, second hand books, international editions, and other influences which provide positive feedback to the internal environment. As a result, the publisher and the bookstore feel reduced profits and customer loyalty for their products and services.

It is important to recall that the business of textbook selling today is somewhat complex. Decisions to order a particular textbook are not made by the end user. This decision is made by a faculty member. Publishers have little reason to target the end-user--the student, directly, if a textbook order comes from another source. Communication between publisher and professor, therefore, is vital. It was and still is necessary to cultivate these relationships to sell

newer editions of books. While the time dedicated to developing this relationship between publisher and professor is beneficial, it is generally acknowledged that relationships must be nurtured throughout the supply chain. An action made by one member will affect the entire system in which the supply chain exists. Figure 7 illustrates that a balance between positive and negative feedback needs to be achieved within any system of relations. This can be optimized if actions/reactions are seen as loops and in the context of mutual causalities.

Figure 7 revisits Figure 5, but demonstrates the effect that additional negative feedback loops may have on the system. This is illustrative of a more balanced system where win-win situations are created. In this way, it could be argued that the “Loops Not Lines” archetype also is a way of seeing the importance of integration within the supply chain. As V.G. Narayanan and Ananth Raman (2004) argue, in SCM, “win-win” situations often depend on agility and alignment of incentives among businesses and stakeholders. Instead of letting the positive feedback loops get to the point where both bookstore and publisher lose





significant market share, negative feedback, in the form of collaboration, is illustrated in the visual. This figure is based on real world experiences as observed in this corporation. In this example, the need for this negative feedback is primarily due to actions, such as purchasing decisions, that are made by the end-user in the supply chain--the student.

Strong relationships between supply chain members allow the additional negative feedback shown in Figure 6 to evolve further. In this situation, decreased profits experienced by the bookstore and publisher, as well as end-users' (students') demand for lower prices, lead to a realization that books need to be sold and published differently. With a strong relationship infrastructure between supply chain members, these two needs are approached with one common solution. As an example, one solution is to develop a customized text. Adding this negative feedback has the potential to offer benefits to all stakeholders who are involved in its development. Faculty members still play a decision-making role by choosing what to put in this customized text. The customized text contains excerpts from several sources. Both the bookstore and publisher face less

competition if such an approach is adopted. The product is then differentiated. The inherent uniqueness of a customized text makes purchase at the bookstore necessary. The student no longer needs to purchase multiple textbooks for one class, as these customized texts often offer more value at less cost to the student. As an example: a textbook is required for a class but not used extensively in the course, or only a few chapters are addressed in class. The buying behavior of the student also changes. It is valid to say that the supply chain members surrounding the end-user play a very important role in the purchase decision (Morrison 2004, p. 135). Yet, it is also important to note that the end-user plays an equally important role in determining who, ultimately, will be the seller. All of these issues and decisions ultimately affect purchase and flows of raw materials, information and other resources within the SC system.

Strengths and Limitations of the “Loops Not Lines” Model

Strengths

- The model lends itself to computer simulations of supply chains. Organizations

can investigate the multiple effects of introducing changes into a supply chain. The advantage of a simulation is that it enables a “player” to react and explore preventive measures to minimize the positive feedback loops that destabilize the supply chain. Computer simulations using the “Loops Not Lines” model could potentially provide a way of predicting how the supply chain will react to external and internal stimuli.

- The model optimizes the development of intervention strategies if positive feedback is likely to destabilize the system. These intervention strategies range from simple ones like changing inventory levels and modes of transportation, to more advanced strategies. An example of the latter includes Dell’s direct distribution model. Other examples include strategic alliances such as IBM and Sony for the development of the PS3 microprocessor (Prospero 2006), and strategic information sharing as with FedEx and USPS for carrying mail through FedEx air network (Traffic World 2006).
- The model also sparks opportunities for brainstorming between supply chain members for purposes of innovations and improvements aimed for success and competitiveness of SC stakeholders.

Limitations

- The idea of SC as single functional unit is still in its infancy stage and most SC out there are still very fragmented and not functionally connected as the “Loops Not Lines” model is suggesting. The supply chain of many organizations are spread across the globe; these supply chains are connected end to end physically with the different modes of transportation, but the supply chain is not connected in terms of information flows as effectively. For the “Loops Not Lines” to be effective, there must be a willingness to exchange information; failing that, the model might not work as well as intended. A potential unwillingness to share information might be related to factors involving cultural

preferences, distance, and/or organizational structure. Indeed, organizational structure can also be influenced by cultural differences that tend to keep individuals in their own functional silos.

CONCLUSIONS

In conclusion, viewing the supply chain as a system of loops does not necessarily exclude the traditional linear representations as depicted in Figures 1-3 . Rather, each enhances understanding of the dimensions of the supply chain. The “Loops Not Lines” model enriches the archetype of the supply chain, making it more visible and representative of the pattern of relationships that interact and affect entire courses of events. “An archetype is nothing more than a mental model made visible” (Senge et al. 1994, p. 164). As the case example illustrates, those visibility and feedback loops are essential to make the supply chain more robust and competitive in the long run: A strong relationship infrastructure -- where stability is maintained through cooperative negative feedback intervention --is vital to supply chain management effectiveness. The supply chain is, in fact, a dynamic and open system, and should be managed as such.

RECOMMENDATIONS FOR FURTHER RESEARCH

“Establishing the Scope and Domain of Supply Chain Management” (JBL 2006)
 ...when one is considering systems it’s always wise to raise questions about the most obvious and simple assumptions (Churchman 1968, p. ix).

One of the interesting outgrowths from the research on this paper was how clearly Morgan’s model pointed to the importance of relationship marketing in the practice of SCM. “Relationship marketing” is defined as “the development and maintenance of long-term, cost effective relationships with individual customers, suppliers, employees, and other partners for mutual benefit (Boone and Kurtz

2008, p. 10.) This prompted the authors to follow Churchman's advice from the initial quote above this section and reexamine basic assumptions regarding the scope and domain of supply chain management.

The current definition of "marketing" adopted by the AMA is as follows: "Marketing is an organizational function and a set of processes for creating, communicating and delivering value to customers and for managing customer relationships in ways that benefit the organization and its stakeholders" (Keefe 2004). Grounding this perspective is the recognition that a relationship with customers and suppliers is vital throughout the marketing process. This is the "relationship" view of contemporary marketing activities. Given the discussion of loops and lines and the application of this concept to SCM, it is easy to see that effective SCM is very relational, indeed. Further, while SCM has evolved into a field of study of its own, it is not to be forgotten that SCM is a marketing activity; as it addresses those important utilities that fall under the rubric of marketing's concerns — namely, that of time and place. Yet, in the survey which generated the current CSCMP definition, marketing was defined as demand creation and fulfillment (Gibson, Mentzer and Cook 2005), and did not receive strong support as a survey choice as an important activity of SCM—only 39.9 percent.

As noted by Potoker (2000), in the last decade "marketing" has evolved from being equated with "sales"—or, away from the view that marketing's activities begin (only) once goods and services are produced. This is a "transactional" view of marketing. Rather, the contemporary view, as supported by the American Marketing Association definition, is quite relational indeed, and involving "supplier and customer collaboration." It is recommended, therefore, that future research regarding definitional consensus of SCM consider how and if "marketing" and the many activities it encompasses are different from (or exclusive of) those of "Supplier and Customer Collaboration"—a choice by 80.8 percent of

the respondents in the Gibson, Mentzer and Cook survey. We would argue they are not. Reaching a consensus view of the definition of SCM may be more attainable if this point is resolved in accordance with contemporary views of marketing's activities.

Another possible future research avenue relates to the diminishing returns faced by organizations when they introduce many innovations and/or changes into a supply chain. For example the mandate by Wal-Mart to introduce RFID's in its supply chain did not produce the same amount of results as anticipated. In 2004, the retailer expected all of its 120 distribution centers to be up and running with RFID eventually, but to date only five are RFID capable (Anderson 2007). There might be many reasons for RFID not attaining the level of usage initially predicted, and testing the "Loops Not Lines" model through computer simulations or other simulation activities may provide answers to this end. In short, the advantages of the "Loops Not Lines" model far outweigh its limitations, and are worth the value they might add to the future of the supply chain and its management, as the title of this paper suggests.

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