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The Real-Time Global Supply Chain Game: New Educational Tool for Developing Supply Chain Management Professionals

Abstract

Researchers at Delft University and the Robert H. Smith School of Business at the University of Maryland have developed the "Global Supply Chain Game" (GSCG). A specific instance of the game is called the "Distributor Game," centered on globalization and the real-time supply chain. The GSCG differs from many existing business learning games in that, as opposed to being turn-based and locked in on demonstrating a single phenomenon (i.e., the bullwhip effect), it simulates a real-world experience by operating on a continuous clock with ongoing events and responses to individual decisions. The decision-making processes of the distributors in the game are controlled by human players. To confront the human players with a complex and dynamic environment, suppliers, markets, and competing distribution centers are represented by computer-controlled actors. The Distributor Game has been tested at the Robert H. Smith School of Business in seven courses since January 2005. The beta-tests include four MBA classes, two Executive MBA classes, and a single undergraduate class. Each class has been consistent in its approval of the game as a tool in simulating the complexities of a global supply chain and facilitating learning about how to successfully manage this environment.

In today's global environment, companies recognize the strategic importance of well-managed supply chains. Clearly, companies such as Dell, Wal-Mart, Zara, and Li & Fung have built their overall corporate strategy around achieving supply chain superiority over their competitors (Copacino and Anderson). These firms have gained distinct advantages by efficiently managing the complex web of interactions that extend across continents and across enterprises in the process of procuring, assembling, and distributing goods in a global context.

However, achieving supply chain expertise in today's global economy is a complex challenge for corporations. Indeed, excellence in supply chains requires executives who possess a wide range of skills in the following areas: information technology; advanced enterprise software systems; financial planning; relationship building with supply chain partners, wholesalers/distributors and customers;

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systems design engineering; real-time event monitoring; and business intelligence.

This article examines the use of management simulation games in higher education to prepare supply chain leaders to meet the challenge of a global economy. The article introduces a new tool, i.e., an Internet-mediated, real-time Global Supply Chain game, designed to bridge the gap between existing tools for training supply chain leaders and those tools needed to handle the web of global relationships intrinsic to today's supply chains.

The next section of the article presents more detail on the attributes that supply chain managers will need to achieve excellence in performance. This is followed by a general discussion of some simulation games currently used in business education to develop the needed supply chain skills and the limitations of these games. The real-time Global Supply Chain game is presented as an alternative to existing approaches for the education of supply chain professionals. The article concludes with a discussion of how the Global Supply Chain game can be incorporated into a broader curriculum for the management education of supply chain professionals.

Attributes of Supply Chain Leadership

As complexities have increased in the global economy, so too have the skills required to manage supply chains. While a less complex world required supply chain/logistics executives to focus on manufacturing, procurement, and distribution issues, the global supply chain requires executives to additionally have strong financial and accounting skills, highly developed information technology skills, excellent customer relationship management skills, strategic planning expertise, and overall executive skills. Specifically, the Harvard Business School Executive program in Supply Chain Management (Harvard Business School 2006) believes that supply chain leaders should be able to do the following:

- Leverage supply chain innovations for sustainable competitive advantage;
- Respond to competitive challenges throughout the value chain;
- Build supply chain partnerships that manage all the elements for the benefit of every partner;
- Motivate others by addressing individual and organizational behavior issues that pose barriers to supply chain performance;
- Attend to process details and operational execution, while creating strategic plans; and
- Understand the role of information technology in the supply chain.

The challenge to the supply chain executive is enormous and covers all the critical aspects of overall corporate performance. When a company's supply chain is highly efficient, it can give the company a sustainable competitive advantage. When the supply chain breaks down at a critical moment, the very essence of corporate survival can be put at risk.

Supply chain executives have strategic, tactical, and operational performance responsibility. The challenge is to manage and monitor both the physical flow of goods and services and to ensure coordination with associated information and financial flows. Furthermore, supply chain executives must provide strategic and tactical planning for the overall design and structure of the supply chain.

All aspects of the supply chain are in real time and require constant, 24/7 event management and quick response capability to identify problems and relieve bottlenecks. In fact, there has been a growing movement toward anticipatory supply chain management involving the collection of critical data in real time and processing those data against key performance monitoring measures to alert managers about potential problems/bottlenecks, as opposed to waiting until they occur before action is taken.

The supply chain executive can best be viewed as the "orchestra conductor" (Harvard Business School 2006) who is responsible for bringing together everything at the right place and the right time. The "conductor" must have a global perspective and the ability to work across business environments and cultural differences. Indeed, the web of interactions involved in a global supply chain is manifestly complex. The "conductor" must have acute analytical skills in order to judge the "ripple" effects of each individual decision on the entire supply chain. Hence, a simple decision to source from an additional

supplier located on another continent will impact distribution and manufacturing planning as well as the financial flows that will accompany the transactions. Additionally, the information technology challenges of linking transaction level systems with the new supplier have to be addressed. Thus, each decision by the "conductor" requires sophisticated analytics that must be planned for and addressed. Failure to account for these intricate connected activities will result in additional costs, disrupted production schedules, missed sales, and lost market share. Clearly, the conductors need analytic tools to guide their decision processes and strategies. This need comes at a time when the amount of data being presented to the supply chain manager is increasing exponentially. Developments in radio frequency identification (RFID) have resulted in massive increases in real time data being incorporated into the supply chain. Managers need sophisticated tools, like business intelligence, to manage this influx of information.

The expectations for supply chain executives are enormous. Supply chain mangers need a wide range of technical skills covering multiple disciplines. Furthermore, global supply chain managers need strong analytical skills as well. There is a real challenge to the education community to develop an overall program/set of tools that will prepare "best-in-class" orchestra conductors/supply chain managers.

Simulation Games and the Education of Supply Chain Leaders

There is a great challenge in designing educational content to build supply chain leadership skills in executives and managers of global corporations. Traditional methods of lectures from textbooks coupled with a pointed or directed set of case studies do not replicate the dynamic 24/7 environment in which global supply chain leaders must function.

Digital Game-Based Learning (DGBL) has been viewed as a potential new tool to develop skills. For example, the March/April 2006 issue of *Educause Review* is devoted entirely to "serious gaming" in education. But the survey of the field concludes: "We are not likely to see widespread development of these games until we can point to persuasive examples that show games are being used effectively in education (Van Eck)."

The same can be said of the current crop of supply chain games attempting to expose participants to the cognitive challenges and capabilities required to lead supply chains. Until now, approaches to fill this training/education gap have focused on a series of static turn-based business games designed to simulate the environment of a logistics executive and provide participants with a better understanding of the situations they might encounter as well as ways to deal with these situations effectively. However, none of these games replicate the traits of the modern supply chain, which requires multi-tasking in a dynamic, real time and event-driven leadership environment. The next several paragraphs discuss some of the more popular of these simulation approaches and identify some of the gaps associated with them (Billhardt).

The Beer Game is a role-playing simulation of an industrial production and distribution system developed at the Massachusetts Institute of Technology to introduce management participants to the concept of economic dynamics (Sterman). In particular, this concept illustrates the bullwhip effect that causes high variability in orders and inventory levels due to non-linearities and time delays between the actors in a supply chain. The game can be played using a board or as an Internet-mediated version (Ravid and Rafaeli).

The main limitation with the Beer Game is its limited functionality. Its sole design is to reinforce an understanding of the bullwhip effect and its central causal factor, i.e., inadequate information sharing across the supply chain. Furthermore, it is a turn-based game that involves one set of decisions being made and a fixed response to those decisions. It fails to replicate the continuous time aspect of the real world. Its message, while significant and important, does not change from one playing of the game to the next. The message is singular and constant. As such, it does not provide for a rich continuous play environment in which

events are constantly changing and the responses from the managers must filter the events and determine an optimal strategy/approach based on an analysis of the impacts of current events.

More recently, the Harvard Business School has developed an interactive Global Supply Chain Management Simulation to provide participants with a learning environment that replicates the complexities of the real world (Harvard Business School 2004). The game involves participants making decisions regarding the rollout of two models of mobile phones. The participants make decisions about product feature sets, supplier selection, demand planning, and management, as well as pricing and marketing. Specifically, the game is designed to illustrate the following key supply chain concepts, according to the Harvard Business School Web site (Harvard Business School 2004): "creating a balanced supply chain across suppliers with different lead times, building flexibility into the supply chain to avoid stock-outs and excess inventory and evaluating and using demand forecasts."

Participants run the simulation for four simulated years. The simulation is turn-based, with each turn representing an entire calendar year. After each turn, participants are presented with a series of reports documenting their sales, their supply chain performance, and their overall profitability results. These reports provide the participants with information to adjust their strategy and decisions for the second (and subsequent) turn. The Global Supply Chain Simulation from the Harvard Business School does not involve any continuous play features. Clearly, while it has very important learning objectives, the game does not provide a real-world, continuous play environment. As such, the experience given to the future global supply chain managers is limited and fails to replicate the pressures of operating in a 24/7 global supply chain environment.

There has been an attempt to bridge the gap between turn-based and real time games. Responsive Technologies (www.responsive.net) hosts a game on its Web-server called the Supply Chain Game. It is completely Web-based and real time in the sense that there is never a point where the game completely stops and participants receive a report from which to make new decisions. Instead, the game runs at a slow enough pace over the course of a week or two that participants can log in to a Web site, ascertain the status of their team, and make necessary adjustments. There is no need to view the game even hourly. The instructor stops the game after the time period allowed and ranks the teams. The types of decisions that participants can make are limited to a few preset choices, and the goal of the game is to see which team can make the best use of its resources. There is competition in the sense that teams are ranked in the end, but there is not competition for resources or demand.

While there are other management simulation games designed to illustrate supply chain management principles (see Appendix A), there are a few important limitations. Most games are turn-based, meaning that participants make a decision, submit that decision, and then, at a point later in time, they are handed a set of metrics detailing their performance and the consequences of their decisions. With this information and feedback, the participants adjust their strategy/decisions for a second round of play. The second important limitation is the competition for resources. All games have an "unlimited" pool of input resources available to the participant to draw from and most games allow all demand to be fulfilled by all participants. Third and finally, there are no exogenous events that may occur during the game. For example, halfway through the Beer Game, the administrator does not announce that there has been an improvement in the communication order relay technology, thereby reducing the delay from two periods to one period. Such an event would require the rethinking of strategies, which is not the goal of the games. The goal of such games is either to demonstrate a specific principle (i.e., the bullwhip effect) or to help players learn to think about what they would do given certain choices.

The fundamental observation, however, is that the real world is continuous and dynamic (not turn-based), highly competitive, and extremely disruptive to even the best-laid plans. As a consequence, the existing set of supply chain management simulation games does not replicate the real world of a global supply chain

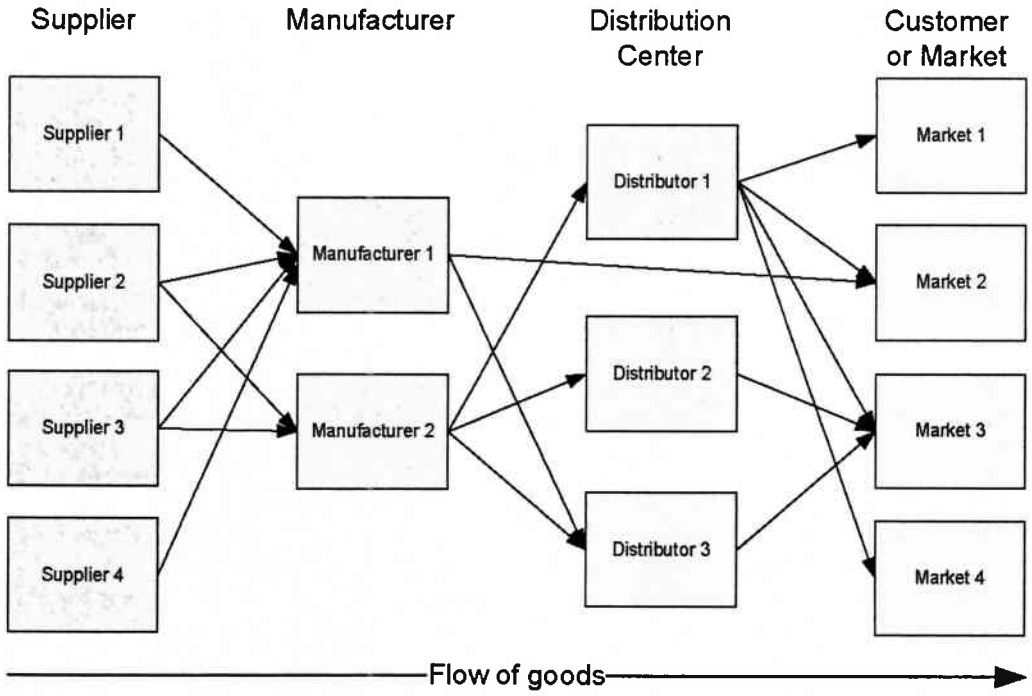
manager. Clearly, this gap represents a significant issue in the training and education of global supply chain managers, whose environment is highly dynamic.

THE INTERNET-MEDIATED GLOBAL SUPPLY CHAIN GAME

The review of current approaches in the education of supply chain managers demonstrates that there is a need to provide a learning environment that closely approximates the challenges of managing a real-time global supply chain. Such an environment demands that participants experience being besieged with a flood of information, needing to analyze that information or process it in a systematic way, and being aware of the complex interdependencies of each decision that they make. The environment must provide participants with the opportunity to make strategic decisions involving procurement of supplies, the matching of supply and demand, the distribution of goods and services, and the management of financial resources, all in real time.

In order to create this type of environment, researchers at Delft University and the Robert H. Smith School of Business at the University of Maryland have developed the Global Supply Chain Game (GSCG). A specific instance of the game is called the Distributor Game, centered on globalization and the real-time supply chain. The GSCG differs from many existing business learning games in that, as opposed to being turned-based and locked in on demonstrating a single phenomenon (i.e., the bullwhip effect), it simulates a real-world experience by operating on a continuous clock with ongoing events and responses to individual decisions. The decision-making processes of the distributors in the game–the third tier in Figure 1–are controlled by human players. To confront the human players with a complex and dynamic environment, suppliers, markets, and competing distribution centers can be represented by computer-controlled actors.

Figure 1. Structure of a Supply Chain



Thus, in the GSCG, players assume the challenge of playing the role of a distributor. The main tasks of a distributor are to compete through a bidding process to buy products from suppliers, control the inventory levels of the various products in the warehouse based on projections about sales, and sell the products to markets through another bidding process. In the initial instance of the game, which is based on a report on globalization of the personal computer industry (Dedrick and Kraemer 2002), the products are four different types of computer systems: laptops, servers, multimedia computers, and ordinary desktop computers. Players need to manage their inventory carefully, taking into account (dis)advantages of global sourcing and purchasing (for further information see www.gscg.org). An incentive to move inventory quickly has been incorporated using a 2 percent depreciation per week of products in stock, which is a realistic figure given the type of products. To measure players' performances, data are collected for populating balance and equity sheets. These sheets reflect the state of players by taking into account cash balances, the value of inventory, outstanding orders, incoming orders, bills to be paid, and payments to be received. These sheets are presented to player teams on a regular basis, enabling them to see how their strategies perform in comparison to other teams' strategies.

To support the concept of globalization, the world is divided into three regions in the Distributor Game: the U.S., Europe, and Asia, although it is possible to work with any number of regions and any geographic demarcation. An overview of the European region is illustrated in Figure 2. Each region has a number of player-controlled distributors. Furthermore, a number of suppliers and markets are present in each region. The number of players is flexible and can easily be changed. It is possible to buy products globally to allow for global competition both for the distributors buying from global suppliers and for the global markets buying from the global distributor players.

In the Distributor Game, each of the players controls a distribution company in one of the three regions and has to develop and test strategies for global versus local sourcing, global versus local sales, inventory levels to be maintained, and product specialization or differentiation. Due to rapid depreciation, unsold items are almost worthless. In the game setting, profit margins are under pressure due to heavy competition, and making a profit for the distributors is difficult. Customers expect fast service from the distributor, but they cannot tell in advance when they want to purchase items and what they require. Due to the heavy competition, distributors cannot afford to have no inventory on hand. One of the main assignments of the players is managing the trade-off between having as little inventory as possible to decrease the inventory costs and having enough inventory at hand to satisfy their customers' erratic and sudden buying patterns.

The Distributor Game has been implemented in a layered software architecture, which allows the reuse of parts of the application in other games inside or outside the supply chain domain. The software architecture has been described in more detail in van Houten and Jacobs (2004), van Houten et al. (2005), and Verbraeck and van Houten (2005).

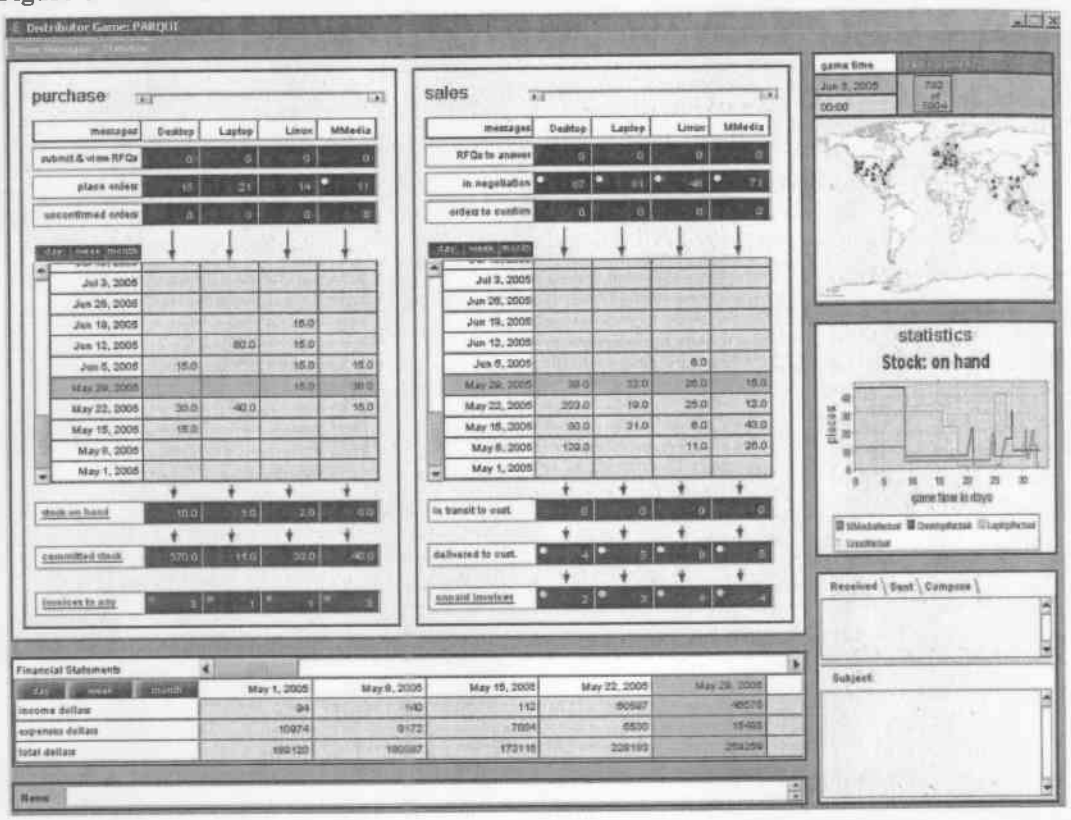
In order to participate in the Distributor Game, the players download a Java application from the game's Web site. Installation of special software by the players is not needed. The player application (Figure 3) provides the players with an overview of the state of their distributor company and allows them to enter their decisions. Through the application, the players get updates about purchases, sales, finance, and inventory. They can also communicate electronically with other players via a built-in chat functionality, which is especially useful when the players are not all in the same room.

The Distributor Game supports the learning of a number of skills that are critical to managing global supply chains in real time. These skills include strategic leadership, operations management, financial management, and information technology. The following paragraphs discuss the link between the Distributor Game and each of these critical skills for supply chain managers. The discussion is summarized in Table 1.

In the game, the distributor, using a sophisticated electronics trading network, is constantly struggling to align supply with demand. Internet-based customer inquiries/orders are flooding into the distributor in real time. Simultaneously, orders to suppliers are streaming

Figure 2. Example of the Players in One of the Regions in the Distributor Game

Figure 3. Structure of the Distributor Game User Interface for the Player



out to procure necessary components to meet demand. Every now and then, unexpectedly, an external event triggers a disruption in the supply chain. Despite this massive overload of real-time information, the distributor cannot just be reactive. The Distributor Game helps participants understand the need in modern business "to know earlier," to scan the horizon, and to learn to master the complexity of balancing a portfolio of product and management risks as a senior supply chain executive.

The distributor must constantly manage the inventory and transportation of its multiple product lines. To be efficient and productive, the distributor must maintain as little inventory as possible to serve total customer demand and yet not miss major sales opportunities due to lack of on-hand inventory, or product stockouts. The participant must constantly manage a range of potential trade-offs. There is the trade-off between costs in maintaining local in-house stocks of inventory versus higher transport costs to express ship inventory over greater distances from suppliers as needed. There is the trade-off between keeping safety stock in an industry with such rapid depreciation of product and components. There is the trade-off between using more reliable suppliers who charge higher prices versus lower-cost but less reliable suppliers. The participant begins to appreciate the power of real-time information in tracking operational performance and in helping to manage these trade-offs more efficiently.

The electronics industry is a fast-moving one, with constantly shifting pricing and profit margin schemes. On the sell side, it is standard practice among this industry's enterprises to "dump" products and slash pricing to quickly shed excess inventory of an active product line or to close out and discontinue product lines. Thus, supply chains must be extremely responsive in terms of price. Participants in the Distributor Game have to deal with this phenome-

Table 1. Link between Supply Chain Leadership Skills and Learning Points in the Distributor Game

SC Leadership Attribute	SC Game Attribute
SC leaders have understanding of a SC as a business ecosystem spanning the enterprise, its customers, and its suppliers, with best of breed SC performers often out-performing laggards in ROI/Profitability, Inventory Turns, and Customer Satisfaction matrices.	Distributor corporation is a SC-based enterprise where its global operating performance in supply chain has enterprise-wide effects and determines financial performance.
SC leaders understand that rapid globalization increases the strategic complexity of the operating environment.	The Distributor Game is global in scope, with teams choosing to focus sales and supply sourcing strategies on regional, trans-regional, or fully globalized markets and spread of suppliers.
SC leaders must deal with increasing volatility due to heightened exposure to international market and supply risk conditions.	The game is characterized by volatility of supply and demand and is subject to massive external events that dramatically shift customer and supplier conditions.
The Internet and Corporate IT Systems create data overload on SC leaders; leaders must access/filter data, apply critical judgement, and make timely decisions based on most relevant data.	Game participants are constantly bombarded with real-time data. They must instantly evaluate potential customer requests for quotes; match market demand patterns against on hand and/or available supply; prepare bids based on internal or external pricing imperatives or anticipated revenue targets; and organize transport/shipping to comply with customer lead time requirements.
Corporate SC decision structures involve the blending of CFO, CIO, and Chief SC Officer executive perspectives, as well as other horizontally-oriented enterprise management teams.	The game is played by small teams where management skills and analytic capabilities are blended in the minute-by-minute operations of the distributor company to which they belong.
Companies engage in external long-term supply chain partnership building with customers and suppliers.	Distributor companies vie for longer-term agreements and bigger sales volumes than originally solicited in customer RFQs.
Individual SC leaders go through a complex learning curve to incorporate expertise and judgment over time and to demonstrate intuitive supply chain decision-making mastery in a process of developing "Cognitive Agility" (Dibello 2005).	Game participants are constantly balancing and rebalancing factors of decision making and are testing capabilities against competitive realities. Participants often exhibit enhanced confidence in their own mastery and a desire to play the game again and test out new and improved strategems.

non many times during the play session and come to better understand the competitive pricing dynamics at work in the industry. On the buy side, a major learning point relates to order size quantities. What will be the optimal grouping of orders into a specific buy from a supplier to meet aggregate customer demands? Order size is an important determinant of other supply chain costs, such as transportation. Finally, the participants experience the powerful imperative to compress the cash-to-cash cycle and to effectively manage accounts receivable and accounts payable.

Virtual collaboration with customers and suppliers over the Internet can often lead to confusion and dissatisfaction, yet it remains a highly significant managerial innovation. The Distributor Game demonstrates to participants the web of relationships that technology can help bring together quickly to solve supply chain dilemmas. Customer requirements can spark a dramatic "raying out" of messaging and process actions across a web of inter-related enterprises to meet those requirements. Suppliers from other regions and the whole world can be mobilized on an ad-hoc basis using Internet technology to serve the distributor's customers. The participants appreciate the technology infrastructure that supports this supply chain "ecosystem."

These learning points help align game skill development attributes with core supply chain

Table 2. Survey Results: Game Helped in Understanding Basic Concepts in Supply Chain Management

	Questionnaire UMD / January 30th 2005 / 32 mba students / Distributor Game Demand Surge				Questionnaire UMD / May 21st 2005 / 25 Emba students / Distributor Game - Local Global				Questionnaire UMD / Sept 14th 2005 / 43 mba students / Distributor Game Local Global				Questionnaire UMD / Nov 11th 2005 /37 undergraduate students / Distributor Game Local Global				Questionnaire UMD / Dec 3rd 2005 / 21 Emba students / Distributor Game - Local Global				Questionnaire UMD / Feb 1st 2006 / 8 mba students / Distributor Game Local Global				Questionnaire UMD / Feb 19 2006 / 18 mba students / Distributor Game Local Global			
	# NA	n	AVERAGE	STDEV	# NA	n	AVERAGE	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV
The game helped me better understand the illustrated basic concepts in supply chain management.	0	32	4.22	0.75	0	25	4.16	1.07	0	43	4.14	0.60	0	37	4.00	0.71	0	21	4.38	0.67	0	8	4.33	0.52	0	18	4.44	0.51

Table 3. Survey Results: Participants Liked Playing the Game

	Questionnaire UMD / January 30th 2005 / 32 mba students / Distributor Game - Demand Surge				Questionnaire UMD / May 21st 2005 / 25 Emba students / Distributor Game - Local Global				Questionnaire UMD / Sept 14th 2005 / 43 mba students / Distributor Game Local Global				Questionnaire UMD / Nov 11th 2005 /37 undergraduate students / Distributor Game - Local Global				Questionnaire UMD / Dec 3rd 2005 / 21 Emba students / Distributor Game Local Global				Questionnaire UMD / Feb 1st 2006 / 8 mba students / Distributor Game Local Global				Questionnaire UMD / Feb 19 2006 / 18 mba students / Distributor Game Local Global			
	# NA	n	AVERAGE	STDEV	# NA	n	AVERAGE	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV
Overall I liked playing the game	0	32	4.34	0.55	0	25	4.48	0.51	0	43	4.53	0.59	0	37	4.25	0.69	0	21	4.62	0.59	0	8	4.67	0.52	0	18	4.61	0.50

Table 4. Survey Results: Game Has Positive Contribution to Curriculum

	Questionnaire UMD / January 30th 2005 / 32 mba students / Distributor Game Demand Surge				Questionnaire UMD / May 21st 2005 / 25 Emba students / Distributor Game Local Global				Questionnaire UMD / Sept 14th 2005 / 43 mba students / Distributor Game Local Global				Questionnaire UMD / Nov 11th 2005 /37 undergraduate students / Distributor Game Local Global				Questionnaire UMD / Dec 3rd 2005 / 21 Emba students / Distributor Game Local Global				Questionnaire UMD / Feb 1st 2006 / 8 mba students / Distributor Game Local Global				Questionnaire UMD / Feb 19 2006 / 18 mba students / Distributor Game Local Global			
	# NA	n	AVERAGE	STDEV	# NA	n	AVERAGE	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV	# NA	n	AVERA	STDEV
Games have a positive contribution to the curriculum.	0	32	4.56	0.50	0	25	4.60	0.50	0	43	4.47	0.63	0	37	4.24	0.55	0	21	4.86	0.48	0	8	4.50	0.55	0	18	4.44	0.70

leadership development attributes, as shown in Table 1.

The Supply Chain Game targets these leadership skills and, by its real-time nature, provides a platform for real-world learning. The Distributor Game has been tested at the Robert H. Smith School of Business in seven courses since January 2005. The beta-tests include four MBA classes, two Executive MBA classes, and a single undergraduate class. During each of these sessions, participants initially played the game for fifteen to thirty minutes to gain familiarity with the environment. This was followed by the official start of the game and its continuous play for approximately two to two and one-half hours. Each class participated in a detailed post-game survey to evaluate the gaming experience. As the results shown in Tables 2 through 4 demonstrate, participants are very positive about the Distributor Game. The questionnaire asked participants to rate various aspects of the experience on a five-point Likert scale, with 1 indicating strong disagreement with a particular statement and 5 indicating strong agreement.

Table 2 reports on results on the question of whether the Distributor Game helped the participants "better understand the illustrated basic concepts in supply chain management." Scores on this question ranged from an average of 4.00 for the undergraduate players to a high of 4.44 among the MBA class who participated in the February 2006 event.

Table 3 shows the responses to the question of whether the participants "liked" playing the game. Scores on this question ranged from 4.25 among the undergraduates to 4.62 among the Executive MBA participants who participated in the December 2005 game. It is probable that the Executive MBA student group liked the game more than other student groups because the game closely mirrored the participants' actual corporate working environment and was regarded as a realistic tool for executive training. This is important given that the Executive MBA student group has significant near-term career potential to attain supply chain executive leadership positions and is the priority target group for the game. Table 4 shifts the focus to the contribution of the Dis-

tributor Game to the overall supply chain management curriculum. These scores were quite high as well and ranged from an average of 4.24 to an average of 4.86.

Incorporating the Distributor Game into a Curriculum for Supply Chain Leaders

The Distributor Game can be incorporated into an overall supply chain management curriculum as a consequence of its continuous play features and its ability to re-create the dynamic 24/7 world of a real-time global supply chain manager. The following paragraphs provide a road map for achieving the integration of the Distributor Game into a broader supply chain management curriculum.

First, global supply chain leaders are more and more likely to reach out globally to an extended set of suppliers for product/component sourcing. The setup of the Distributor Game can be adopted to provide a teaching point around either a rapid demand acceleration or, alternatively, a rapid demand deceleration. In the former case, the tempo of the demand order generator can be doubled during game play or, in the latter case, the demand order generator tempo can be halved, to create very different but real experiences for the participants to deal with as supply chain managers. In the case of demand expansion, supply chain managers must figure out ways to quickly enhance their suppliers, while in the case of demand contraction, supply chain managers must find ways to ramp down quickly. The Distributor Game is an effective way to experience both situations, develop strategies to deal with each situation, then step back and discuss the results and strategies used as teaching points. It can be played with each situation, followed by an instructor-guided discussion to emphasize what strategies worked, which ones were unsuccessful, and what factors contributed to the success or failure of a particular strategy. Through playing the game, participants better understand how to deal with demand surges or tailspins than they would through a simple discussion of the issues.

The Distributor Game can serve in a similar way for a variety of other important challenges for supply chain leaders. For example, recently there has been a trend for enterprises to develop extended partnerships with a few key suppliers. The Distributor Game could be set up initially with the requirement that each distributor allocates half of total orders to two suppliers. After an initial time period has passed in game play, the game administrator can cancel one supplier for each distributor. This will challenge each supply chain manager to adapt to a major supply chain disruption. Again, discussion about the impact of losing a core supplier will be much more effective after participants have experienced the situation than after viewing a set of slides delineating the pros and cons of having core suppliers.

These are just two examples of how the Distributor Game can be adopted to create situations that supply chain managers must address in a dynamic environment. The Distributor Game settings can be adjusted to create transportation bottlenecks/late deliveries due to a country-based crisis that impacts all shipments into and out of the country. In each case, the Distributor Game provides the participants with the opportunity to deal with the situation in a dynamic environment. Once the situation has been experienced, it is much easier for the instructors to generate discussion and to develop a set of learning points that stay with participants.

Conclusions

The supply chain executive operates in a dynamic, 24/7 global world. Training supply chain leaders in such an environment requires tools that simulate this experience. The Distributor Game is a step in this direction. It enables instructors to change the environment based on likely events/scenarios. The participants must rapidly respond to each situation and they can immediately see the impact of their decisions on supply chain and financial performance. Once the game has ended, the participants are much more receptive and knowledgeable about what has happened and why the results have occurred. This environment leads to a powerful experience for both instructors and participants. Ultimately, it leads to supply chain leaders who are highly skilled and capable of dealing with the dynamic, real-time world of global supply chains.

Appendix A. A Breakdown of Key Attributes and their Use in Relevant Educational Games

Game Attributes	Global Supply Chain Game – The Distributor Game[a]	Beer Game[b]	LOGA Logistics Game[c]	Littlefield Technologies[d]	Supply Chain Game[e]	TAC – Supply Chain Management Scenario[f]	Harvard Global Supply Chain Management Simulation[g]
Real time (RT), turn-based (TB), or simulation (SIM)	RT	TB	TB	RT	RT	SIM	TB
Global perspective	Yes	No	No	No	No	No	Yes
Player interaction during play	Yes	No	No	No	No	No	No
Web-based	Yes	Yes	No	Yes	Yes	No	No
Players per team	2	4	1	4	2-6	2	2
# of teams possible	18	Class size	4	Class size	Class size	6 agents	Class size
Echelon focus within supply chain	Distributor	All	Factory / Whse	Factory	Factory / Whse	Factory	Factory / Whse
Events occurring in game that are exogenous to player control	Yes	No	No	No	No	No	No
Demand pre-planned or computer randomized	Random	Pre - planned	Random	Pre - planned	Pre - planned	Random	Pre-planned
Pricing static or dynamic	Dynamic	Static	Static	Static	Static	Dynamic	Dynamic
Products involved in game	4	1	4	1	1	4	2

a. Global Supply Chain Game – The Distributor Game www.gscg.org
b. Beer Game http://web.mit.edu/jsterman/www/SDG/beergame.html
c. LOGA Logistics Game Found in. Bowersox, Closs, and Helferich (1986) *Logistical Management*, (pp. 554-569). New York. Macmillan Publishing Company
d. Littlefield Technologies. http://responsive.net/littlefield.html
e. Supply Chain: http://responsive.net/scgame.html
f. TAC – Supply Chain Management Scenario http://www.sics.se/tac/page.php?id=13
g. Harvard Global Supply Chain Management Simulation http://harvardbusinessonline.hbsp.harvard.edu/b01/en/common/item_detail.jhtml?referral=9794&id=6107

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