Winter 12-9-2003

B2B E-commerce and BPR for Establishing the Competitive Supply Chain

Hwanyann Su

B2B E-commerce and BPR for Establishing the Competitive Supply Chain

Hwan-Yann Su
Department of Asia-Pacific Industrial and Business Management
National University of Kaohsiung
Kaohsiung, Taiwan
h_su@nuk.edu.tw

Abstract

This paper deals with the problems frequently facing contemporary businesses including the problems of quality, lead times, quantity flexibility, customization, service and cost through supply chain management. To increase the competitiveness of the supply chain, the importance of increasing its velocity, variability visibility and value – 4vs - has been proposed. Understanding the importance of increasing competitive advantages through supply chain management, a referential model based on the 4vs is provided in detail. It is argued that B2B e-commerce and business process reengineering from the perspective of customers to create value are both important for the success of the proposed model and for establishing the competitive supply chain.

Key words: supply chain management, e-commerce, business process reengineering, competitive advantage

1. Introduction

E-commerce can be regarded as to carry out business activities over the informational network. There are four basic categories for these activities: the activities regarding Business to Business (B2B), Business to Consumer (B2C), Consumer to Business (C2B) and Consumer to Consumer (C2C). The B2B e-commerce can achieve for a business and its counterparts the elimination of repetitive data inputting because only one party has to input the needed data. The correctness of the data input is also enhanced for the same reason. The completeness of the data input is also improved because incomplete data will be automatically rejected. With the data regarding the items required being correctly and completely input, a business can strengthen its ability to fulfil the requirements of its customers and improve its quality. As Crosby [1] points out that "[i]nstead of thinking of quality in terms of goodness or desirability we are looking at it as a means of meeting requirements".

The B2B e-commerce can also achieve for a business and its counterparts the reduction of lead times and the improvement of services. Instead of sending related data to each other through post or facsimile and ensuring their reception, they can be transmitted over the informational network in seconds and after office hours. Tremendous lead times can be saved and the service can be improved up to 24 hours a day. The partnership between a business and its counterparts can then be strengthened. The cost of labor and operation cost can also be considerably saved.

Business process reengineering (BPR) that is to re-think and re-design fundamentally and thoroughly the ways in which a corporate conducts its business in order to improve its performance dramatically [2-3], must be considered when implementing B2B e-commerce. To gain the best out of the co-operations from external counterparts such as customers by means of B2B e-commerce, a business should redesign its own business processes to remove unnecessary activities first. In addition, using information technology to facilitate BPR cannot be used in the way to simply speed up how a corporate used to conduct its business. A new way of conducting business must be sought out in advance and the new business processes can then be implemented by information technology.

Under severe global competition, ways of dealing with the problems of quality, lead times, quantity flexibility, customization, service and cost through supply chain management need further investigation. Incorporating B2B e-commerce and BPR, a referential model that intends to deal with these problems, is thus provided for establishing the competitive supply chain.

This paper will proceed as follows: section 2 will discuss the background of the research; section 3 will provide a referential model; section 4 will summarize the paper.

2. Background to the Research

2.1 Supply Chain Management

The Supply Chain Council (SSC) points out that supply chain management includes all the efforts made for transforming materials to finished products and distributing them to end customers and that the members of a supply chain range from suppliers to end customers. Severe global competition has forced the management of the supply chain to focus and compete simultaneously on quality improvement, lead time reduction, higher quantity flexibility, customization enrichment, service enhancement and cost reduction [4-9]. To increase the competitiveness of the supply chain, the importance of increasing its velocity, variability and visibility, has been proposed [10-13]. Velocity refers to the ability to quickly fulfil internal and external customer's demands. Variability refers to the ability to fulfil the fluctuated and changing customer's demands. Visibility refers to the ability to make transparent the status of resources.

To emphasize the customer orientation, this paper argues the importance of value. Each process and activity should be carefully reviewed to ensure that it creates value for customers. As Seybold [14] points out that companies are so concentrated upon fine-tuning their own products that they fail to understand how their products fit into the real lives of their customers and how value can be delivered. Based on the 4vs – velocity, variability, visibility and value – the paper will investigate into the literature and propose a referential model to facilitate the establishment of the competitive supply chain.

2.2 Velocity

Due to the difficulties in accurately predicting the demand in the market and the depreciation of inventory within a short period of time, customers now days stop providing sales forecast for a business in advance. Instead, they give their orders to a business after they have taken orders from their own customers. This has forced a business to increase its ability to quickly fulfil its customers' demands under severe conditions such as "955" and "982". "955" and "982" refer to the severe due date conditions that 95% and 98% of ordered goods must delivered within 5 and 2 days respectively. To fulfil these requirements, all the processes of a business must be redesigned to eliminate unnecessary activities and to reduce all the lead times reducible. These processes include the processes of ordering, designing, procuring, manufacturing and distributing.

2.3 Visibility

The application of electronic commerce through the adoption of information technology to enabling rapid and effective intra-organizational and inter-organizational communication and coordination, to removing intra-organizational and inter-organizational barriers and to achieving customer satisfaction, has also been getting more and more emphasized [15-20]. In the area of intra-organizational communication, the use of information technology enables a business to have a clear picture of the availability of all its inventory resource, machinery resource and human resource in its factories, warehouses and branches around the world. This visibility provides a business with a foundation to calculate its ability to fulfil its customers' demands within due dates set by them and to figure out where the products ordered should be manufactured. This visibility also enables a business to minimize its inventory level, increase inventory turnover, and as a result, sell products with a small margin and lower its demand in capital.

In the area of inter-organizational customer communication, the development of Internet has provided a low-cost and yet rapid and boundaryless option because Internet is an open-structure environment that supports a variety of platforms and is compatible with existent facilities of a business. Internet enables instant information exchange and sharing too. In a traditional supply chain, the information such as product information or order information is exchanged between manufacturers and customers through mails or facsimiles. In addition, the information such as production or inventory status is held by manufacturers and it takes a long process for manufacturers to share this kind of information with their customers. However, through Internet, information exchange and sharing can be instant.

2.4 Variability

In the modern world where customer's demands are getting more and more customized and cost reduction through inventory reduction has become an important consideration, make-to-order (MTO) strategy has been widely adopted. Generally speaking, there are three kinds of production strategies: make-to-stock (MTS), assemble-to-order (ATO) and make-to-order (MTO). MTS production strategy emphasizes on satisfying customer's unified demands through the inventory of finished products. Under this production strategy, finished products have been manufactured and manufacturing process has completed before customer's orders are issued. Therefore, the lead time for order fulfillment under this strategy is the shortest but its success depends on high level of costly finished product inventory. Its success also depends highly on accurate sales forecast because if the forecast goes wrong the inventory left will be costly finished product inventory.

ATO production strategy emphasizes on satisfying customer's differentiated demands through assembling pre-designed differentiated modules to finished products. Under this strategy, pre-designed differentiated modules have been manufactured before customer's orders are issued. Therefore, the lead time for order fulfillment under this strategy is still short (the time needed for assembling) but its success may be less dependent on costly finished product inventory. It success is also less affected by sales forecast because if the forecast goes wrong, the inventory left will be less costly commonly usable modules for many differentiated products rather than costly and single purposed finished products. MTO production strategy emphasizes on satisfying customer's customized demands through designing and manufacturing according to customer's customized orders. In principle, manufacturing under this strategy cannot begin before the issuance of customer's orders. No finished products are stocked despite that sales forecast of finished products is still required for the procurement of materials needed. Therefore, the lead time for order fulfillment under this strategy is the longest but its success depends least on costly finished product inventory. It success is also least affected by sales forecast because if the forecast goes wrong, the inventory left will be least costly materials rather than costly finished products. As a result of the growing importance of MTO for enhancing variability, this paper will particularly address the model proposed under this production strategy.

In addition to the customers' changing demands, their fluctuated demands also challenge a business' ability to manage its supply chain. Modualization and the same materials or components used in differentiated products are two strategies that can be adopted at the product design stage to deal with the challenge. These two strategies enable a business to quickly re-allocate materials previously arranged when its customers change the products ordered because a considerable amount of materials can be used in or taken from other orders.

2.5 Value

Anderson and Narus [21] indicate that a growing number of businesses have drawn their attention to what their customers value to gain marketplace advantages over their less knowledgeable competitors. Lin and Su [22] also argue that transformation of better understanding of customers to long-term and promising customer relationships and formulating CRM strategies in this way can create valuable marketing opportunities, increase customer value and enhance customer satisfaction in the pursuit of business excellence. The value of products come from what customers want from them and why. Therefore, value creation should begin with a business' choice of who their customers are and its understanding of their priority regarding its branding, quality, due dates, quantity flexibility, product variety, service, price and innovation which as whole is the reason for their purchase. In this paper, supply chain management regards the chosen customers and their priority concerning its branding, quality, due dates, quantity flexibility, product variety, service, price and innovation as given from the function of marketing. Under this assumption, the task of supply chain management is then to redesign all the processes by means of BPR to make sure that unnecessary activities are removed and that the redesigned processes create values according to the list of priority as perceived by chosen customers.

3. The Proposed Supply Chain Integrative Model (SCIM)

Based on the importance of the velocity, visibility, variability and value factors mentioned above to the success of supply chian management, this paper proposes a model which enables the effective communication among the internal functions and external partners of a business for the successful implementation of the competitive supply chain. To reduce complication, this paper assumes the existence of certain management information systems which make visible and provide the following information: order information, customer-related information, production information, and shop floor status. Besides it also assumes that B2B e-commerce and BPR from the perspective of customers has been implemented to ensure the accessibility and acquirement of the above-mentioned information. To understand the model, the ideas of master production scheduling (MPS), material requirements planning (MRP) and capacity requirements planning (CRP) must be introduced.

3.1 MPS, MRP and CRP

Traditionally MPS is to decide what, when and how many end items will be manufactured and this decision is made under the consideration of a business' sales forecast, backorder, production capacity, material resource and production strategy. Material requirements planning (MRP) is to calculate the needed amount of materials and the needed procurement lead times of insufficient materials for master production schedules previously given. Therefore, accurate master production schedules can be used for MRP to calculate the right quantity of materials needed and coordinate the arrival of materials in order to reduce the material inventory level and procurement lead times. As American Production and Inventory Control Society (APICS) defines MPS as a representation of sales forecast, backorder, other demands, the quantity projected available and the quantity available to promise (ATP) and a representation of the planned production of different products of each product group and their quantity and schedule and how the facilities are arranged.

Accurate master production schedules can also dampen the utilization oscillation of production capacity. Inaccurate master production schedules may cause many problems. Without knowing exactly what, when and how many end items will be manufactured, production will be in chaos and production capacity will frequently swing between redundancy and insufficiency. Capacity requirements planning (CRP) is to decide and allocate the needed production capacity for master production schedules previously given. When production does not proceed according to schedule, MRP will be neglected because it will not matter so much if materials will arrive with the right quantity and at the scheduled time. When MRP is neglected, inventory levels of some items of materials or work-in-process (WIP) will go up on the one hand. However, on the other hand, inventory levels of some items of materials or WIP will be insufficient before production and chaotic production will be further postponed and procurement lead times will be increased. Inventory level of finished products will have to increase to deal with the immediate market demand because no one can estimate exactly what, when and how many finished products will be manufactured. Therefore, MPS is important for dampening the utilization oscillation of production capacity, reducing lead times, inventory levels of materials, WIP and finished products and coordinating the arrival of materials.

More importantly, a clear consideration of MRP and CRP is also very important before MPS can be finalized. Traditionally MPS, MRP and CRP are decided separately. Traditionally MPS is considered first and the decision regarding what, when and how many end items will be manufactured is made. Then MPS is taken as an input for MRP explosion. However, if the exploded MRP shows that materials will be unable to arrive with the right quantity or at the scheduled time or that production capacity will not be available for the time scheduled for production, there is no clear defined channel for modifying the MPS already made.

Therefore, this paper argues that it is necessary to integrate MPS with MRP and CRP. From the perspective of lead times and inventory level reduction and efficient utilization of production capacity for enhancing velocity, visibility, variability and value, a well-defined model for clearly integrating MPS with MRP and CRP is very important too. Thus, this paper will propose a model considering MPS, MRP and CRP together with BPR from the perspective of customers implemented and certain management information systems already existent which provides the information mentioned above. The proposed internet-based Supply Chain Integrative Model (e-SCIM), as shown below in Figure 1, will be discussed in further detail in the following section.

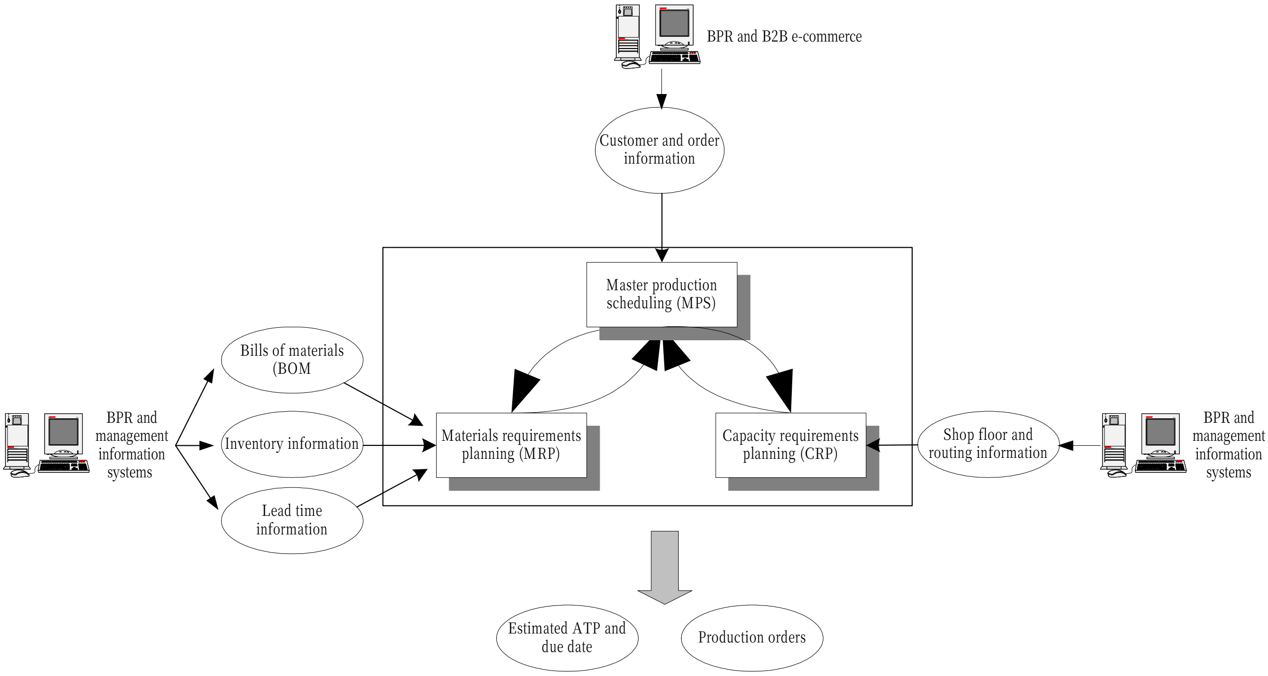

Figure 1: The informational inputs and the thorough consideration of MPS, MRP and CRP of the e-SCIM with BPR, B2B e-commerce and management information systems being implemented.

3.2 e-Supply Chain Integrative Model (e-SCIM)

In the proposed e-SCIM, the model needs the inputs of order information, customer-related information, production information, and shop floor status in order to determine the estimated due date and the quantity available to promise (ATP) and to generate production orders. Adopting the MTO strategy because of its growing importance, the e-SCIM considers the basic functions of MPS, MRP and CRP as a whole as depicted in Figure 2. The variables of the model are shown below in Table 1.

As shown below in Figure 2, the operating process of the model begin with customer's issuance of an order of a specific product that determines net demand N(t) under MTO production strategy. Other products in the order may be processed later on in the same way. It is assumed here that the procurement of materials has been done according to sales forecast of that product. MPS is initiated and M(t) is set to be equivalent to N(t). That is, M(t) = N(t). In addition, the net demand achievable $N_a(t)$ is also set to be equivalent to N(t), i.e., $N_a(t) = N(t)$, assuming in the beginning that all the net demand can actually be satisfied at the interval t. Then Gross demand of item I_{mn} is determined by the explosion of M(t) of finished product to the needed quantity of the nth item at level m according to the BOM. The value of I_{mn} projected available at interval t, P(t), is the sum of I_{mn} projected available at the previous interval, P(t-1), and the planned quantity of I_{mn} to be manufactured or received at this interval, S(t), and the reduction of the gross demand of I_{mn} at interval t, G(t). That is, P(t) = P(t-1) + S(t) - G(t). If the P(t) of item I_{mn} is no less than zero, which means the quantity of item I_{mn} is sufficient, there will be no arrangement of manufacturing or procurement of item I_{mn}. If all the items at level m are not fully exploded, the next item I_{mn+1} at level m is exploded and its G(t) calculated. However, if all the items at level m are fully exploded and yet all the items at all levels are still not fully exploded, the first item at the next level Im+1n is exploded and its G(t) calculated. If all the items at level m are fully exploded and all the items at all levels are also fully exploded, the e-SCIM is arranged and completed. Then ATP A(t) = M(t) = $N_a(t)$ = N(t) and the estimated due date is the end of the interval t.

Table 1: Variables of the e-SCIM.

Notation	Variable	Detail description
$N(t)$	: Net demand	In principle, the net demand is determined mainly by customer's orders under the MTO production strategy. However, net demand may be modified according the policy of a business. This variable is denoted by $N(t)$ in this model where t refers to the interval t.
$N_a(t)$	: Net demand achievable	The net demand achievable refers to the demand that can actually be satisfied at the interval t.
$M(t)$	: MPS	$M(t)$ here refers to the quantity of finished product to be manufactured at the interval t. Under the MTO strategy, $M(t) = N(t)$ in principle.
I_{mn}	: The nth item at level m	The nth item at level m (a material or WIP) according to the BOM of a particular finished product
$G(t)$	: Gross demand of item	Gross demand of item I_{mn} is determined by the explosion of $M(t)$ of finished product to the needed quantity of the nth item at level m according to the BOM.
$S(t)$	: Planned quantity of item to be manufactured or received	The originally planned quantity of item I_{mn} to be manufactured or received through procurement. When the quantity of item I_{mn} is not sufficient, this value needs to be adjusted.
$\triangle S(t)$	: Insufficient quantity of item to be manufactured or received	When the quantity of item I_{mn} is not sufficient, additional quantity to be manufactured or received needs to be arranged.
$P(t)$	: Item projected available	Item projected available refers to the projected quantity of I_{mn} available at a particular interval.
$PdL(t)$	: Production lead time available for item	Production lead time available refers to the available manufacturing quantity (transformed from production lead time including queue, setup and run time) for I_{mn} at a particular interval.
$\triangle PdL_i(t)$	: Production lead time unavailable for item	Production lead time unavailable for item refers to the insufficient manufacturing quantity (transformed from production lead time including queue, setup and run time) for I_{mn} at a particular interval.
$\triangle PdL_f(t)$	: Production lead time unavailable for finished product	Production lead time unavailable for finished product refers to the transformed insufficient quantity of finished product $\triangle PdL_f(t)$ from the insufficient quantity of item $\triangle PdL_i(t)$ at a particular interval due to the unavailability of production lead time.
$C(t)$	: Capacity available for item	Capacity available refers to the available manufacturing quantity (transformed from capacity) for I_{mn} at a particular interval.
$\triangle C_i(t)$	: Capacity unavailable for item	Capacity unavailable for item refers to the insufficient manufacturing quantity (transformed from capacity) for I_{mn} at a particular interval.
$\triangle C_f(t)$	: Capacity unavailable for finished product	Capacity unavailable for finished product refers to the transformed insufficient quantity of finished product $\triangle C_f(t)$ from the insufficient quantity of item $\triangle C_i(t)$ at a particular interval due to the unavailability of product capacity.
$\triangle PcL_i(t)$	: Procurement lead time unavailable for item	Procurement lead time unavailable for item refers to the insufficient quantity that cannot be procured in time for item I_{mn} to be received at a particular interval.
$\triangle PcL_f(t)$	: Procurement lead time unavailable for finished product	Procurement lead time unavailable for finished product refers to the transformed insufficient quantity of finished product $\triangle PcL_f(t)$ from the insufficient quantity of item $\triangle PcL_i(t)$ at a particular interval due to the unavailability of procurement lead time.
$A(t)$	: Available to promise	Available to promise (ATP) here refers to the accumulative quantity of finished product that is stocked or is planed to be manufactured and that has not been promised to any customer.

However, if the $P(t)$ of item I_{mn} is less than zero, which means the quantity of item I_{mn} is not sufficient, the insufficient quantity of item I_{mn} to be manufactured or received through purchasing $\triangle S(t)$ needs to be arranged. Ideally $\triangle S(t)$ should be set to the value to make $P(t)$ equal zero. That is, ideally $\triangle S(t) = G(t) - P(t-1) - S(t)$. On the one hand, if item I_{mn} needs to be manufactured, the production lead time has to be considered. If the production lead time available $PdC(t) - \triangle S(t) > 0$, the production lead time is sufficient for additional production of item I_{mn}.

The production capacity has to be considered next. If the capacity available $C(t) - \triangle S(t) > 0$, which means the production capacity is sufficient for additional production of item I_{mn}, the question regarding if all the level m items are fully exploded is similarly considered and the rest processes are process 8, 9, 10 or 11 (see the numbered arrow in Figure 2) as mentioned above. On the other hand, if item I_{mn} needs to be procured, the lead time for procurement has to be considered. If the latest date when procurement must be done is later than the date when planning is made, which means time is still sufficient for additional procurement of item I_{mn}, the question regarding if all the items at level m are fully exploded is similarly considered. The rest processes are process 8, 9, 10 or 11 (see the numbered arrow in Figure 2) as mentioned above. If production lead time unavailability, capacity unavailability or procurement lead time unavailability does not happen after all the items at all levels are fully exploded, the e-SCIM is arranged and completed. Then ATP $A(t) = M(t) = N_a(t) = N(t)$ and the estimated due date is the end of the interval t.

However, if the $P(t)$ of item I_{mn} is less than zero, which means the quantity of item I_{mn} is not sufficient, the insufficient quantity of item I_{mn} to be manufactured or received through purchasing $\triangle S(t)$ needs to be arranged. Ideally $\triangle S(t)$ should be set to the value to make $P(t)$ equal zero. That is, ideally $\triangle S(t) = G(t) - P(t-1) - S(t)$. On the one hand, if item I_{mn} needs to be manufactured, the production lead time has to be considered. If the production lead time available $PdC(t) - \triangle S(t) > 0$, the production lead time is sufficient for additional production of item I_{mn}.

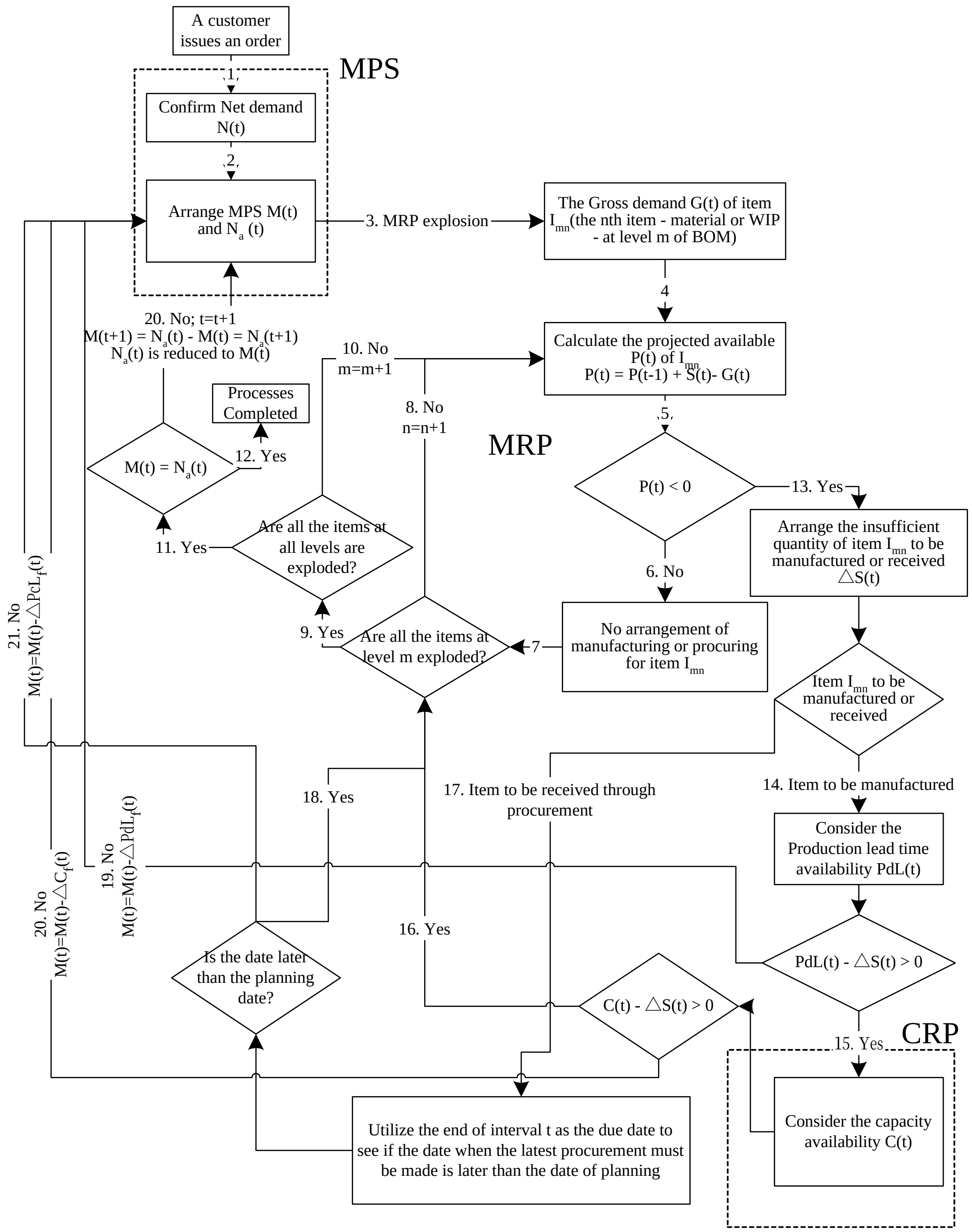

Figure 2: Variables and processes of the e-SCIM.

The production capacity has to be considered next. If the capacity available C(t) - △S(t) > 0, which means the production capacity is sufficient for additional production of item I_{mn}, the question regarding if all the level m items are fully exploded is similarly considered and the rest processes are process 8, 9, 10 or 11 (see the numbered arrow in Figure 2) as mentioned above. On the other hand, if item I_{mn} needs to be procured, the lead time for procurement has to be considered. If the latest date when procurement must be done is later than the date when planning is made, which means time is still sufficient for additional procurement of item I_{mn}, the question regarding if all the items at level m are fully exploded is similarly considered. The rest processes are process 8, 9, 10 or 11 (see the numbered arrow in Figure 2) as mentioned above. If production lead time unavailability, capacity unavailability or procurement lead time unavailability does not happen after all the items at all levels are fully exploded, the e-SCIM is arranged and completed. Then ATP A(t) = M(t) = N_a(t) = N(t) and the estimated due date is the end of the interval t.

However, if the item I_{mn} needs to be manufactured and its PdL(t) (Production lead time available) - △S(t) < 0, which means the production lead time is insufficient for additional production of item I_{mn}, Production lead time unavailable for item △PdL_i(t) = △S(t) - PdL(t). Thus, Production lead time unavailable for finished product △PdL_f(t) may be obtained through transforming the insufficient quantity of item △PdL_i(t) via calculating how many finished products cannot be manufactured at the particular interval t due to the unavailability of production lead time. Then MPS is rearranged and M(t) is reduced to M(t) - △PdL_f(t) and the whole processes restarts.

If production lead time is sufficient but C(t) (capacity available) - △S(t) < 0, which means the production capacity is insufficient for additional production of item I_{mn}, Capacity unavailable for item △C_i(t) = △S(t) - C(t). Thus, Capacity unavailable for finished product △C_f(t) may be obtained through transforming the insufficient quantity of item △C_i(t) via calculating how many finished products cannot be manufactured at the particular interval t due to the unavailability of production capacity. Then MPS is rearranged and M(t) is reduced to M(t) - △C_f(t) and the whole processes restarts.

If item I_{mn} needs to be procured and the latest date when procurement must be done is earlier than the date when planning is made, which means time is insufficient for additional procurement of item I_{mn}, △PcL_i(t) = △S(t). Thus, Procurement lead time unavailable for finished product △PcL_f(t) may be obtained through transforming the insufficient quantity of item △PcL_i(t) via calculating how many finished products cannot be manufactured at the particular interval t due to the unavailability of procurement lead time. Then MPS is rearranged and M(t) is reduced to M(t) - △L_f(t) and the whole processes restarts.

When production lead time unavailability, capacity unavailability or procurement lead time unavailability happen(s), the finalized M(t) will be less than net demand available N_a(t) after all the items at all levels are fully exploded. The difference between N_a(t) and M(t) will be arranged for MPS at the next interval t+1. That is, M(t+1) = N_a(t) – M(t) = N_a(t+1). In addition, N_a(t) is reduced to M(t). The whole processes begin again until at a particular interval t+x the arranged MPS M(t+x) equals N_a(t+x). Then the e-SCIM is arranged and completed. As can be seen in Table 2 below, the estimated due date is the end of the interval t+x. Assuming the due date required by the customer is at interval t+y. In this situation, if t+y1 ≧ t+x, ATP A(t+y) = N(t) = A(t+x) and due date is the end of interval t+x. If t+y2 < t+x, ATP A(t+y) = N(t) - Σ N_a(t+y+1) + N_a(t+y+2) + … + N_a(t+x) = A(t+y2) and due date is the end of interval t +y2. When this happens, the order will undergo a different process. Manual intervention as to consider working overtime, partial shipment, alternative materials and processes, or outsourcing and to negotiate with customers, will take place to ensure that the order can be fulfil as negotiated.

Table 2: The related intervals, net demand, MPS, net demand achievable, due date and ATP in a planning horizon T.

Planning horizon T	z intervals									
Interval	t	t +1	…	t +y_2	…	t +x	…	t +y_1	…	t +z-1
Net demand N(t)	N(t)									
MPS M(t)	M(t)	M(t+1)		M(t+ y_2)		M(t+x)				
Net demand achievable N_a(t)	N_a(t)	N_a(t+1)		N_a(t+ y_2)		N_a(t+x)				
Due date				Customer's due date t+ y_2		Estimated due date t+x		Estimated due date t+x		
ATP A(t)				A(t+ y_2)		A(t+x)		A(t+x)		

4. Discussion and Concluding Remarks

B2B e-commerce and BPR from the perspective of customers will reduce the manual and iterative operations and improve communication among the customers and the sales department and the production department of a business. This is done through the elimination of repetitive data input, the correctness and completeness of data input, and as a result a business will have a stronger ability of to fulfil the requirements of its customers and improve its quality. B2B e-commerce and BPR from the perspective of customers can also achieve for a business and its counterparts the reduction of lead times and the improvement of services and thus contribute to its velocity, visibility and value regarding quality. Through the proposed e-SCIM and the corresponding BPR and information systems needed to implement the model, it is expected that the manufacturing lead times can be reduced. The reason for manufacturing lead times reduction is that unnecessary queuing for production capacity availability can be eliminated when production schedules became accurate. In the situation when production schedules is not accurate, it is very likely that production capacity is still not available when all the materials, components, assemblies or WIP needed for production are ready. This will contribute to a business' ability to enhance its velocity. Through the adoption of MTO, modulization and multiple-purpose materials and components strategies, it is expected the variability of a business can be improved. Variability is also improved when a business is able to communicate quickly with its customers and its internal functions can communicate quickly among themselves through the enhancement of its velocity. It is also expected that the procurement lead times, on-time shipping rate and inventory cost can be reduced. The procurement lead times can be reduced because all the materials needed will arrive at the specified dates when production schedules become accurate, material requirements can be well planned and the production process will not postpone for the lack of few materials. On-time shipping rate can be increased because of accurate production schedules and due date estimation. The material, WIP and finished product inventory cost can be reduced because all kinds of the inventory can be less stocked when production schedules and estimated due date become accurate. These can contribute to the enhancement of a business' velocity and value regarding due dates and cost. It has also been considered to adopt the advantage of customization and inventory level reduction of the MTO strategy and to improve its difficulties in inaccurate due date estimation, long due dates, the calculation of ATP, the management of production capacity constraints and no finished products stocked for dealing with production uncertainty.

Therefore, the proposed e-SCIM enables a business to compete on quality improvement, lead time reduction, higher quantity flexibility, customization enrichment, service enhancement and cost reduction. It is demonstrated that the ability to improve velocity, visibility, variability and value of the supply chain can be enhanced effectively by means of the e-SCIM, which considers the basic functions of MPS, MRP and CRP as a whole, and through the deployment of the modern IT via connecting the business with the information systems of its internal functions and with its customers over B2B e-commerce. The author has been involved in many e-business projects and the proposed model has been being implemented in a real world environment. The initial result demonstrates B2B e-commerce and BPR from the perspective of customers to create value are both important for the success of the proposed model and for establishing the competitive supply chain.

References

[1] Crosby, P. (1979). *Quality is free*. New York: McGraw-Hill.

[2] Hammer, M. & Champy, J. (1993). *Reengineering the corporation*. New York: HarperCollins.

[3] Hammer, M. & Stanton, S. (1995). *The reengineering revolution*. New York: HarperCollins.

[4] Ellram, L. (1991). Supply chain management: the industrial organization perspective. *International Journal of Physical Distribution and Logistics Management*, *21*(1), 13-22.

[5] Harland, C., Williams, D. & Fitzgerald, L. (1993). Supply chain methodology. *Human Systems Management*, *12*(1), 17-23.

[6] Harland, C. (1996). Supply chain management: Relationships, chains, networks. *British Journal of Management*, *7*, S63-S80.

[7] Scott, C. & Westbrook, R. (1991). New strategic tools for supply chain management. *International Journal of Physical Distribution and Logistics Management*, *21*(1), 23-33.

[8] Thomas, D. & Griffin, P. (1996). Coordinated supply chain management. *European Journal of Operational Research*, *94*(1), 1-15.

[9] Handfield, R. & Nichols, E. (1999). *Introduction to supply chain management*. New York: Prentice-Hall.

[10] Cooke, J. (1998). A look into the supply chain's future. *Logistics Management and Distribution Report*, *37*(5), 45-48.

[11] Bindra, P. (1999). e-Business in the chemical processing industry. *World Refining*, *9*(2), 45-49.

[12] Langabeer II, J. & Joshi, A. (2001). Margin and performance improvement: Using supply chain excellence to improve competitiveness. *Chemical Market Reporter*, *260*(21), 29-31.

[13] Graham, D. (2003). Warehouse of the future. *Frontline Solutions*, *4*(4), 20-26.

[14] Seybold, P. (2001). Get inside the lives of your customers. *Harvard Business Review*, *May*, 80-89.

[15] Cookburn, C. & Wilson, T. (1996). Business use of the World Wide Web. *International Journal of Information Management*, *16*(2), 83-102.

[16] Kalakota, R. & Whinston, A. (1996). Electronic commerce: a manager's guide. Reading, MA: Addison Wesley.

[17] Wachter, R. & Gupta, J. (1997). The establishment and management of corporate intranets. *International Journal of Information Management*, *17*(6), 393-404.

[18] Detlor, B. (2000). The corporate portal as information infrastructure: Towards a framework for portal design. *International Journal of Information Management*, *20*(2), 91-101.

[19] El-Sawy, O. (2001). Redesigning enterprise processes for e-business. New York: McGraw-Hill.

[20] Lim, D. & Palvia, P. (2001). EDI in strategic supply chain: Impact on customer service. *International Journal of Information Management*, *21*(3), 193-211.

[21] Anderson, J. & Narus, J. (1998). Business marketing: Understand what customers value. *Harvard Business Review*, *Nov/Dec*, 53-61.

[22] Lin, Y. & Su, H. (2003). Strategic analysis of Customer Relationship Management – a field study on hotel enterprises. *TQM & Business Excellence, 14*(6), 721-737.