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Construction of speed-to-market supply chain management model for garment industry

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Abstract

Purpose – The purpose of this paper is to build and provide a step-by-step methodology to develop a speed-to-market (STM) process model for a fashion garment that can quickly respond to the marketing situation and shorten the cycle time from receiving orders to deliver the finished product. The improved STM process model to contrast the "before" and "after" scenarios in order to induce potential benefits such as reducing production lead-time and keeping low inventory.

Design/methodology/approach – First, collected garment business management systems and garment manufacture operational process. Second, according to the point-line-plane-volume work improvement to list the garment industry up and down stream improvement projects and to reduce the supply chain lead-time. Third, establish the STM model and use information technology to redesign the garment industry supply chain process. Fourth, amend the STM model process. Fifth, compare the supply chain lead-time of finished STM process and normal process.

Findings – After the garment industry implements STM and supply chain re-engineering, the clothing design to sale process can be simplified and reduced time to market. The garment order to buyer lead-time is shortened from 104 to 42 days totally.

Practical implications – This research is a practical business re-engineering process and work improvement. The improvement STM model can half the cycle time from receiving orders to deliver the finished garment product.

Originality/value – This paper provides a process with a step-by-step methodology to develop a successful speed-to-market model for the fashion garment industry and it is able to serve as a reference model for other industrial supply chain management.

Keywords Business process re-engineering, Speed-to-market, Fashion garment, Garment industry supply chain

Paper type Research paper

1. Introduction

By today's high competition, the pressure of global marketplace on organizations finding new ways to create and to deliver value to customers grows ever stronger. The forces of powerful market are demanding manufacturers transform their traditional way to satisfying consumer needs through process of production and delivery of goods. The characteristics of the fashion garment market include short lifecycles, high volatility, low predictability and high impulse purchases. The way to meet this challenge is through lead-time management to reduce the logistical lead-time and capture information simultaneously on actual customer requirements. The garment industry lead-time management established the speed-to-market (STM) model, using

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information technology, work improvement and re-engineering the supply chain process to shorten the garment manufacturing and lead-time of cloths purchasing.

2. Time compression from supply chain management (SCM) perspective

Adrian (1997) highlighted a new tool, "time-based process mapping" that formed part of the time compression programmed standard approach to time compression, as a practical way of establishing the time-based opportunities that exist in the business process. Time compression is a powerful source of competitive advantage. The key to achieving time compression is to remove waste and refocus the sequence of the activities so that time consuming is reduced for the total supply chain system. Juliana (2006) explored one way of reducing time-to-market through process transformation through services globalization and also explored the question: "How can process transformation be performed more effectively, more cheaply, and more quickly" to develop time-to-market supply chain networks, so "streamlining the rules of traditional process, exploring the short-supply list, and coordinating custom procedures" should be amended from the traditional systems (Oh and Kim, 2007). Business success is based on whether the enterprises reacted "faster than competitors," and the enterprises should be responsive to the market change immediately, innovated process effectively and introduced new products or services faster than competitors (Johnson and Busbin, 2000). Antai (2011) evaluated competition from time series data to extent the competition between supply chains by ecological niche theory. Handfield (1993) surveyed 35 American and Canadian companies and suggested that the two major influences on design lead-time are product complexity and manufacturability.

SCM is defined in many ways, and many papers have been focus on the SCM researches (Defee *et al.*, 2010; Schmenner and Swink, 1998; Stock, 1997). The International Center for Competitive Excellence defined it as: "[…] the integration of business processes from end user through original suppliers that provides products, services and information that add value for customers." The supply chain can be regarded as a business process to construct enterprise-wide schemes (Cooper *et al.*, 1997). Hewitt (1994) believed that the supply chain is regarded as core or strategic management within the overall enterprise process. Zachariassen and Liempd (2010) investigate the SCM that implement the symbolic perspective on a dyadic level.

Since normal SCM follows traditional streamline to fulfill garment business, the study introduces a STM model to create an idea to break through streamline and to reshape a sphere point-line-plane-volume (P-L-P-V) model to achieve the target of many literatures argued for time compression from SCM perspective.

3. Methodology review

A number of researchers have presented methods for supply chain reengineering, Stevens (1989) addressed a supply chain integration model, Abrahamasson and Brege (1997) focussed on structural changes on supply chain of a single firm, Towill (1997) used systems dynamics modeling, analysis and simulation to develop a methodology for supply chain re-engineering. Kumar *et al.* (2008) redesign the supply chain in the healthcare industry in Singapore. Dev *et al.* (2011) redesign the supply chain network of a manufacturing firm in an industrial city of India, and they focus on SCM issues and concern the organization system in supply side and the distribution side. STM provides the enterprises for their customers for speed their products and service developments and has a positive impact under the competitive market (Akgün and Lynn, 2002).

The objective of this paper is to build and provide a step-by-step methodology to develop a STM process model for a fashion garment that can quickly respond to the marketing situation and shorten the cycle time from receiving orders to deliver the finished product. This paper uses a P-L-P-V work improvement method to carry out company improvement projects and redesign the garment supply chain business process using information technology.

4. STM model to improve traditional process

It is not just in the high technology and fashion markets where timing is paramount. Nowhere the pressure is more evident than in garment's markets governed by fashion. Fashion markets have properties of short lifecycles, high volatility, low predictability and high impulse purchase which risk a challenge to the apparel industry logistics management. The way to achieve successful logistics management is to use lead-time management to build a STM model plan. The objection of STM is to shorten the lead-time in all of the model process, which includes the maintained data module, and market forecast module, design module, purchasing module, manufacturing module and customer service module.

In this paper, we submit a work improvement control method to reduce the supply chain lead-time of the garment industry streaming up and down. Figure 1 shows the garment industry STM model building process.

4.1 Originate definition of the P-L-P-V work improvement

The work improvement of P-L-P-V is an improvement task classification method, based on firms' functional departments and management to their and responsible levels. It allows for easy arrangement and handling of supervisor rights in managing improvement acts. The category levels of point, line, plane and volumetric improvements are defined as follows:

(1) Point work improvement is the improvement for every individual task within the firm ranging from manufacturing to administration. The person in charge of point work improvement is the base-level supervisor in the organization.

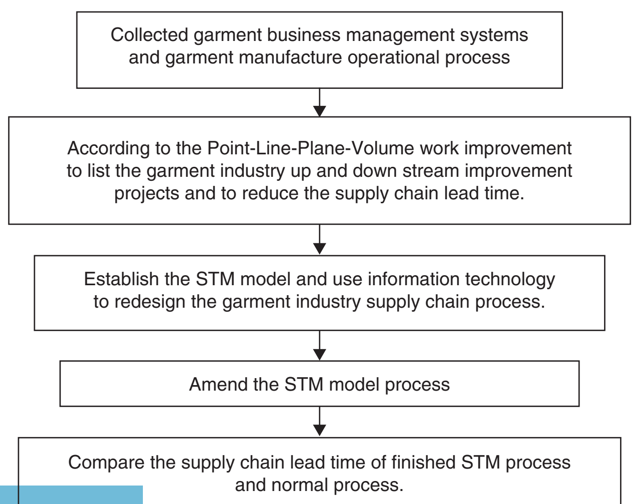

Figure 1.
Flow chart for establishing the STM model

(2) Line work improvement is the improvement of a business function. Such as production line balance, new production line design, pick and pack systems, etc. The middle rank manager or department-level manager is responsible for the improvement of production line.

(3) Plane work improvement is the improvement of the overall factory and business operations such as plant layout redesign, business process re-engineering, etc. The person in charge of improvement is the high level or plant-level manager in the organization.

(4) Volume work improvement is the improvement of collaboration between the company and its suppliers and customers. It is supply chain by streaming up and down and joining together to a virtual enterprise or partnership via the internet.

Clothes manufacturing is used as an example and are shown in Figures 2 and 3.

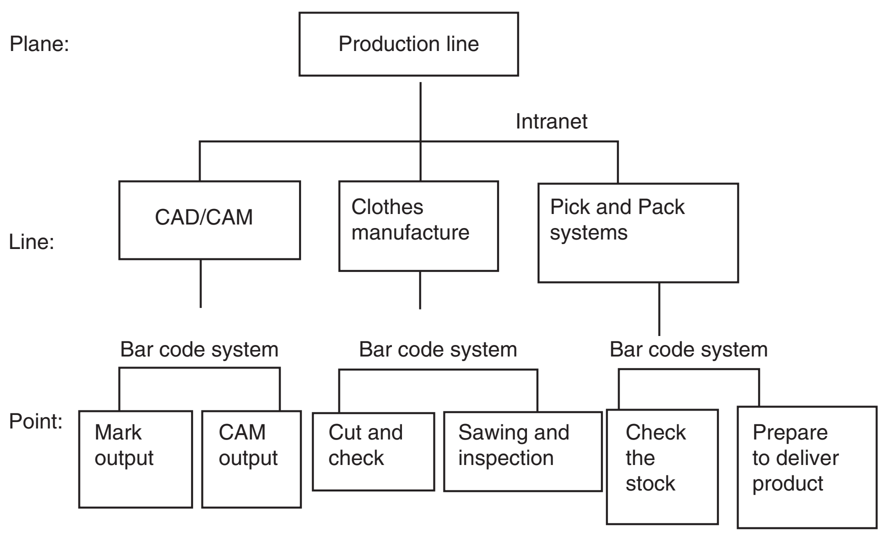

Figure 2. P-L-P-V construction of apparel industry

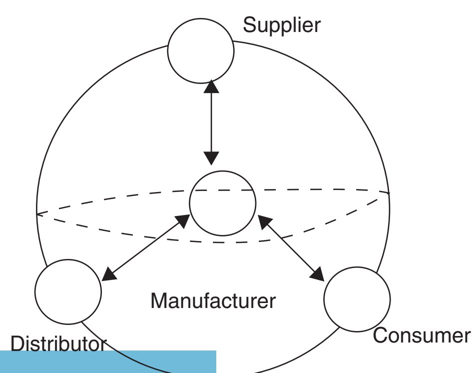

Figure 3. Volume-related communication which center on products manufacturer

4.2 P-L-P-V apparel industry improvement projects

To improve the total service to customers and realistic production systems of garment supply chain, P-L-P-V work improvement project is introduced for a garment manufacturer corporation in Taiwan which shown in Table I and the department improvement projects are shown in Table II. The estimated completion time for the projects in Tables I and II is approximately one year for the garment manufacturer. The execution power of general manager is an important factor for the success of the plan.

4.3 Establish the STM model for garment industry

After implementation of the P-L-P-V improvement actions, we also need to re-establish the traditional garment supply chain process to reach expected STM goal. The garment industry STM flow result is shown in Figure 4.

Figure 4 shows the STM model process, which includes models of maintained data module, market forecast module, design module, purchasing module, manufacturing module and customer service module.

The step-by-step systematized construction makes execution easier for the whole supply chain, and can also provide the integrated concept to the normal operators to increase delivery speed in today's internationally competitive environment. Every module operational process is explained as follows.

Div. annual policy/goal	Task	Applied P-L-P-V ranking	Indication goal
Total service to customers	Supply chain management/inventory management/product development		33 days → 30 days
	Shorten replenishing time of EDI orders	Plane	33 days → 30 days
	Improve the fill rate of EDI orders	Plane	100% fill rate
	Develop the STM with shorter lead-time	Volume	Less 50 days
	Improve the order fill rate	Plane	88% → 96%
	Keep rational inventory in warehouse	Plane	Less 6 weeks
	Multi-length pants project with order in Taiwan	Plane	100% fill rate
	Customer satisfaction/needs survey	Point	Monthly report
	Demand solution for forecast error management	Line	Error less 20%
	On time delivery improvement	Line	95% on time delivery
	Merge enlarged sample making into paper pattern to cope with functional needs		
	Finalize the proposal	Plane	Proposal issued
	Order the facilities	Plane	
	Implementation	Plane	240 to 720 pcs
Realistic production systems	Stock reduction		
	Fabric	Point	Reduce 20%
	Interlining	Point	Reduce 15%
	WIP day improvement	Point	7.5 days
	Rationalize warehouse operation/material handling /space utilization		
	Finalize the proposal	Point	+30% space
	Order the facilities	Point	

Table I.
P-L-P-V work improvement projects for garment supply chain

Dept. annual policy/goal	Item	Major measures Apply P-L-P-V ranking	Indication goal	Fin. date	Factory/department 1	2	3	PPC	TAC	4	5
A. Customer	A1. Cost reduce										
	(A11. Bandling cost (pick and pack)	Plane	Ontime implemetation		◎			○		○	
	A12. Inventory cost	Plane	40 weeks → 16 weeks		○			◎			
	A2. Lead-time reduce	Plane									
	A3. Speed to market for fancy shirt	Volume	60 days → 45 days		○			◎			◎
	A4. Product quality	Point	AQL4% → AQL2.5%		○				◎		
B. Market	B1. Order source										
	B11. From OEM	Point	100% → 80% → 65%		○			○			◎
	B12. From local sales	Plane	0% → 20% → 35%		○			○			◎
	B2. Buyer source										
	B21. USA market	Plane	100% → 90% → 75%		○			○			◎
	B22. Local/Asian market	Plane	0% → 10% → 25%		○			○			◎
C. Production	C1. Skillful guest workers	Point	Efficiency 30% → 70%		◎	○					
	C2. Equipment automation	Point	Feasibility study		◎		○				
	C3. Productivity	Line	0 → 500 → 3,000DOZ/month		◎			○			
	C4. Improvement	Point	88.7% → 89%		◎			○	○		
	C5. Apply AQL 4% in ironing	Point	Pass rate 0% → 50%		○				◎		
	C6. Goods flow improvement	Line	Efficiency 85% → 95%		◎			○	○		
	C7. Energy saving	Point	2%/annual		◎	○	○	○	○	○	○
D. Organization	D1. Re-organization	Plane	Simplify process → combing department		○	◎	○	○	○	○	○
	D2. Linkage of budget improvement	Plane	Net profit: 4,856Kntd		○	○	◎	○	○	○	○
	D3. Enlarge management term base	Plane	8 Managers → 12 managers		◎	○	○	○	○	○	○
	D4. Reduce traffic free	Point	Down NTS 50,000		○	◎	○	○	○	○	○
	D5. Simplify the reporting	Point	Feasibility study		○	○	○	○	◎	○	○
E. Training	E1. Staff in-house training	Point	Bi-monthly		○	○	○	○	◎	○	○
	E2. Job changing	Point	Rotation frequency: 5 → 10		○	◎	○	○	○	○	○

Notes: PPC, Production plan and control department; TAC, training action control; 1, product department; 2, management department; 3, financial department; 4, project department; 5, customer service department; ◎, responsible department; ○, co-operate department

Table II.
Department improvement projects

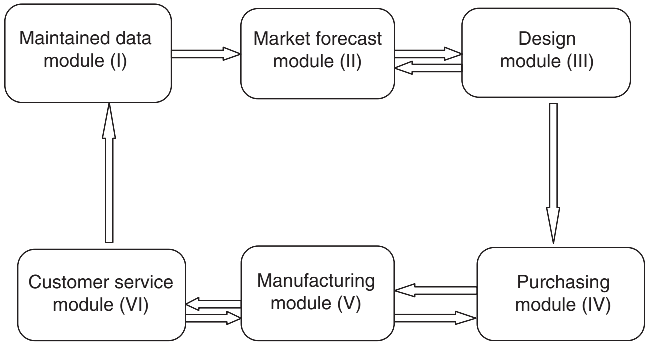

Figure 4.
STM process model

4.3.1 Maintained data module (I). Figure 5 is the flowchart of maintained data module. Through information technology, information from the customer service module (VI) and maintained data module (I) is used by market forecast module to create a market forecast. The forecast information is converged by the messages of customer service module (VI), information of popular style in the market, information of new cloths, and data of popular clothing style in the past. The international popular clothing style and color trend will then be forecasted and integrated with those data transferred to the market forecast module (II) by the design department product engineer.

4.3.2 Market forecast module (II). The market forecast module is shown in Figure 6. The garment fashion specialist can forecast the customer demands and evaluate fashion trends from the maintained data module's PDM database.

4.3.3 Design module (III). If the designed blue-print is accepted by the customer, the designers then make the garment samples and the commercial specialists proceed to negotiate with the supplier, on the purchase price of the cloth, analyze costs and margins, and fix a standard cross-currency price position for the garment. The size of the production run, i.e. the number of garments required, is determined in the process of Figure 7 of design module (III).

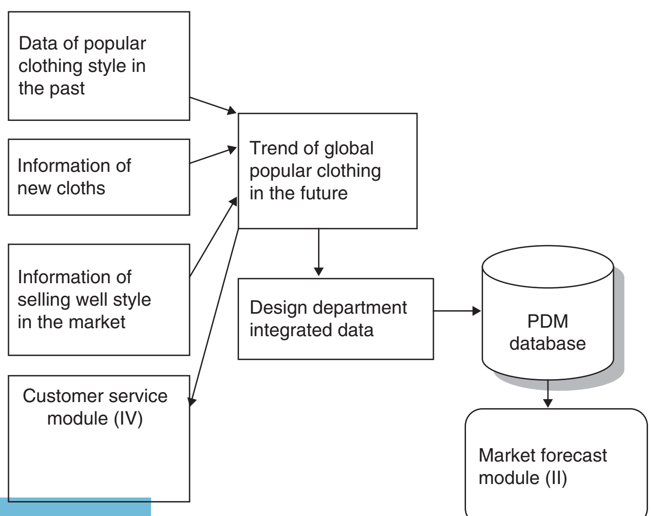

Figure 5.
Flowchart of maintained data module

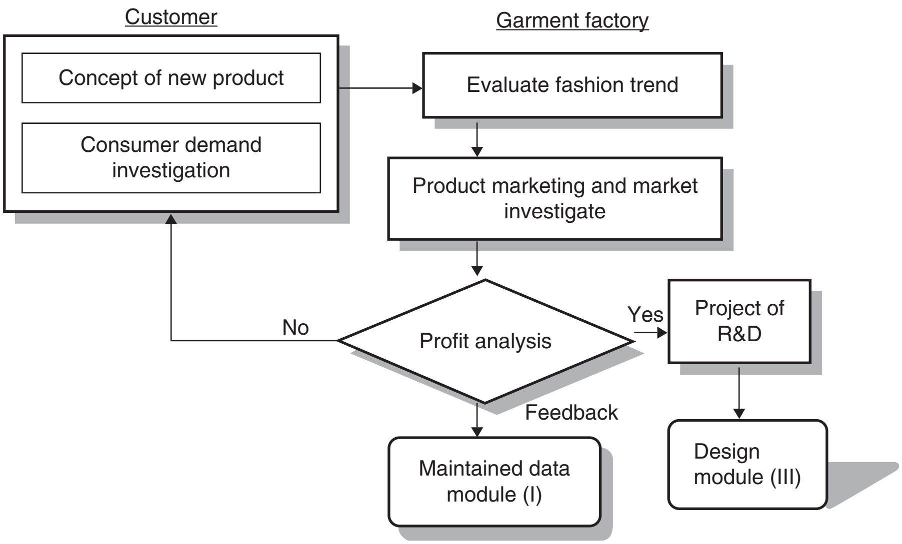

Figure 6.
Flowchart of market forecast module

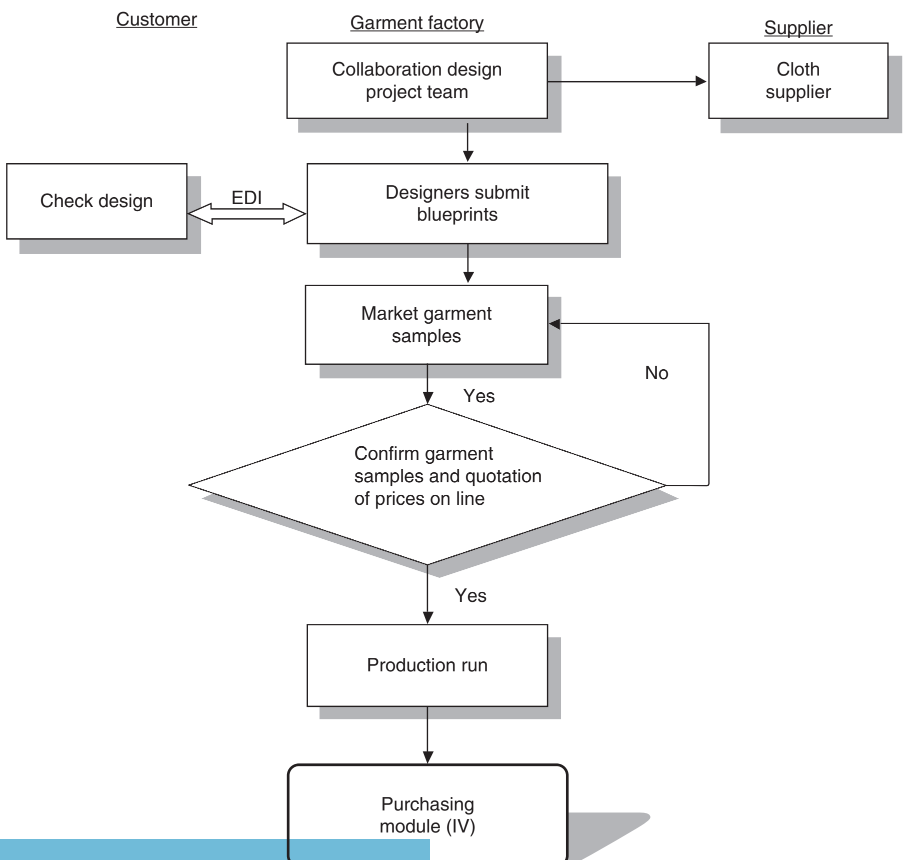

Figure 7.
Flowchart of design module

4.3.4 Purchasing module (IV). Raw materials are procured through the company's purchasing department using the electronic data interchange (EDI) network system, with most of the materials coming from various locations around the world. The global sourcing policy using a broad supplier base provides the widest possible selection of fashion fabrics, while reducing the risk of dependence on any source or supplier. Figure 8 is the business purchase process.

4.3.5 Manufacturing module (V). Figure 9 shows the flow of garments manufacture module. In Figure 9 from the order pack operation system the order is received before production begins. The production control personnel prearranges the order distribution packing schedules according to the different number and kinds of products to reduce the variation of manufacturing process and raise the efficiency of the pick pack works. In addition, computer aided design (CAD)/computer aided manufacturing (CAM) operation system lays out and mark the cloth patterns by calculating cloth yards and total consumption yards. The CAD/CAM system also accelerates the speed of the automated cut out cloth operation. It can reduce the careless operator error and improve the accuracy of clothing sample templates.

4.3.6 Customer service module (VI). This module has been developed to smooth the flow of goods through retail stores. As shown in Figure 10, electronic point of sale

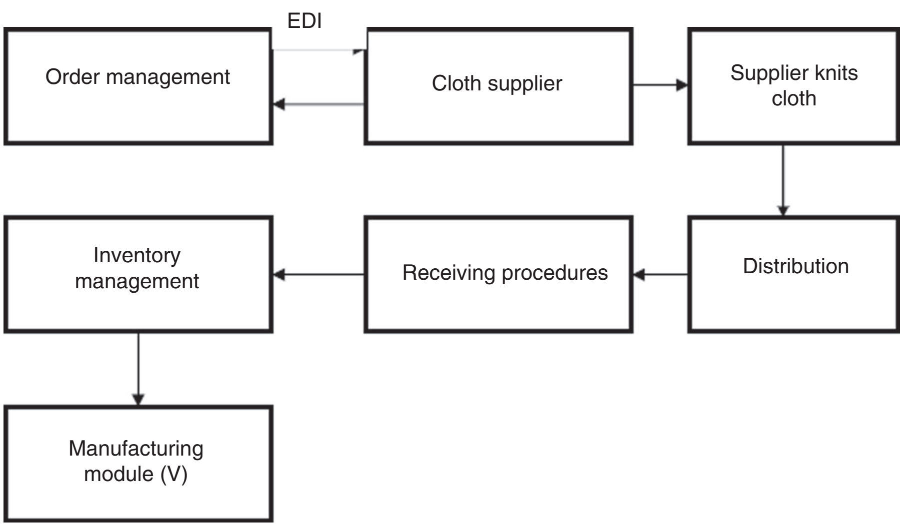

Figure 8.
Flowchart of purchasing module

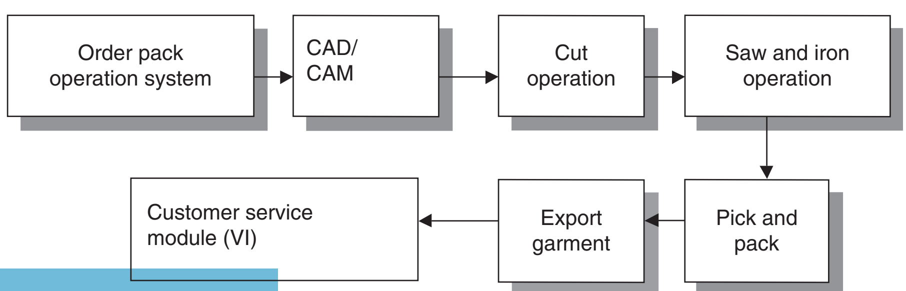

Figure 9.
Flowchart of garment manufacture module

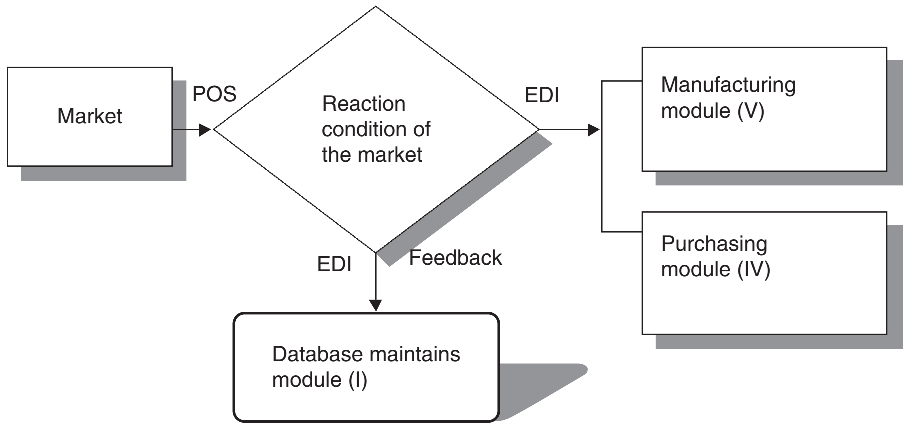

Figure 10.
Flowchart of customer service module

systems automatically capture data about clothing sales as they occurred and then transmit this data to the manufacturing module and purchasing modules using EDI connections. Producers responded with daily shipments of pre-tagged items that could go directly from their trucks to the sales floor. Another important decision rule of the purchasing module is the replenishment agreement which acts as a standing purchase commitment. These allow members of the program to eliminate individual purchase orders altogether, further streamlining the replenishment process.

5. Discussion

For garment industry to implement STM, enterprises need to integrate three operations which are product development, supply chain re-engineering and shortened cycle time to reduce inventory.

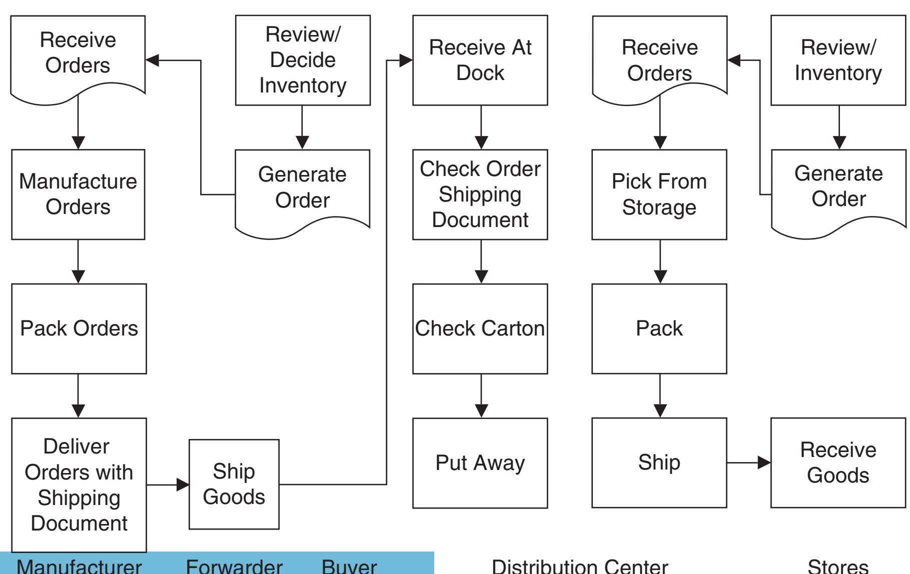

Figure 11.
Normal supply chain processes

In product development, we need to improve communication, promote concurrency and eliminate barriers that currently exist between the project participants from various company cultures, organization behavior and bureaucratic institutions. We must learn to collaborate in design ideas, reduce development time and engineer the final product to reduce manufacturing cost.

The second operation is supply chain re-engineering is manipulated by using EDI informational technology and advanced shipping notification to turn all documents into electronic data transmitted between suppliers and buyers that helps upgrading commercial model.

The cycle time to reduce inventory is induced by collaborated information sharing which gets rid of whip effect existed in traditional supply chain.

Figure 11 shows the normal business process for garment supply chain, the interactive relationship between buyer, distribution center and retail stores.

The re-engineering of combining EDI and pick and packing to reduce lead-time streamlines process and eliminates processes of receiving, put away, storage and delivery. Business process re-engineering for supply chain is resulted as Figure 12.

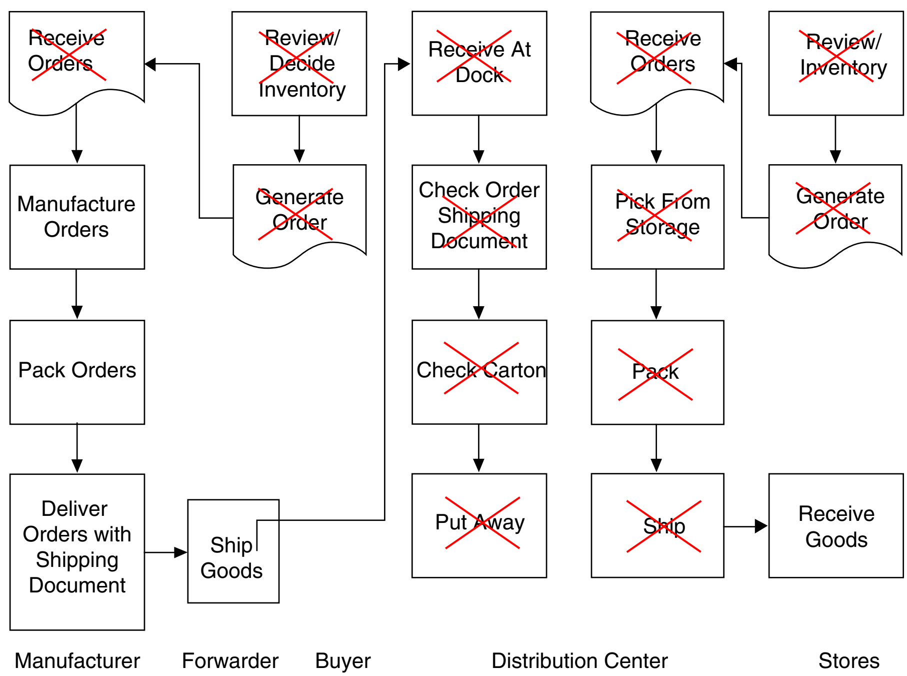

Figure 12.
Supply chain process re-engineering: using EDI, ASN, cross-docking and pick and packing

Table III.
Average performance after implements improvements

Supply procedure	Average days required Normal	STM
From order to fabric factory deliver goods to garment manufacturer	64	20
From fabric factory delivery goods to garment manufacturer ship garment to buyer	40	22
Total	104	42

The improvement benefits reduce distribution cost, inventory cost, warehouse fixed cost and pick/pack cost.

By comparison of the "before" and "after" scenarios, the process from clothing design to sale, in normal and STM individually, Table III shows the average performance of one corporation of garment manufacturer in Taiwan after implementing P-L-P-V improvement, STM and supply chain re-engineering. The average required days from order to fabric factory deliver goods to garment manufacturer can be enormously reduced from 64 to 20 days, and it also performs well from fabric factory deliver goods to garment manufacturer ship garment to buyer by reduction from 40 to 22 days. The garment order to buyer lead-time is shortened from 104 to 42 days totally.

6. Conclusion and future implementation

After the garment industry implements STM and supply chain re-engineering, the clothing design to sale process can be simplified and reduced time to market. The garment order to buyer lead-time is shortened from 104 to 42 days totally.

By viewing the demands worldwide, like continuously shortening product lifecycles, volatile demand and constant competitive pressure, the ability to move quickly is critical and that is not just a question of speeding up the process it takes to get new products to market, but rather the time it takes to replenish existing demand. Time compression in the pipeline has the potential to speed up response times. The key to achieving these dual goals is through focussing on the reduction of non-value added time and particularly time spent as inventory.

This paper provides a process with a step-by-step methodology to develop a successful speed-to-market model for the fashion garment industry and it is able to serve as a reference model for other industrial SCM. Future research work will concentrate on transforming the garment supply chain into an integrated value system.

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