

ABSTRACT

XIAN, LU. Touchpoint Mapping of Local Supply Chain in North Carolina. (Under the direction of Dr. Trevor J. Little.)

The goal of this research is to develop a new way of mapping the product pipeline and analyzing the pipeline velocity from inception until reception by the consumer. The major challenge facing the industry is that the textile pipeline requires the same amount of time as it did in the mid 1980's. After 25+ years, there is no substantial reduction in the entire textile supply chain velocity. One of the consequences is the inability to respond quickly to changes in consumer purchase behavior. The recent/ongoing recession is a prime example of the inability of the retail end to adjust inventory according to demand. This resulted in significant markdowns, significant inventory mountains in the upstream textile processes, and the resulting obsolete fabric weights and colors for the next selling period. To meet this challenge, an important step is to clearly understand how product, information and cash flow throughout the pipeline. This thesis research sets out to develop a methodology that can be applied successfully throughout all stages of the product pipeline. The "touch points mapping" methodology is an appropriate place to begin and develop into a common analysis methodology throughout the entire product pipeline.

The study focuses on the mapping of local supply chain in North Carolina and takes Cotton of the Carolina T-shirts as an example to illustrate the complete supply chain activities- Farming, Ginning, Spinning, Knitting, Finishing, Cutting, Sewing, Printing, Dyeing, and Retailing. Companies used for the information collection process were the local farmer, ginner, spinner, knitter/ cutter/ sewer, finisher, printer/ dyer producing

T-shirts made from the Cotton of Carolinas locally grown.

This research finding concludes that there are more than 100 touchpoints in total along this local supply chain in North Carolina. Most of them occur in the information flow outside of the production circles. Process points that have been widely investigated in the literature only take up a small portion of the total. More touchpoints occur with the flow of product from the upstream to the downstream side of the supply chain. The outcome of this research has made this local supply chain more visible and transparent. Consumers get access to the information and activities associated with the product pipeline not only via the label attached to the product, but also from the pervasive social media and company-based websites. Sharing of information and visibility would contribute to the facilitation of supply chain velocity and responsiveness to the market. Future research could apply the touchpoint mapping to industrial use, extend the touchpoint mapping methodology to other textile products that have different processes, use more advanced computer software serving as the mapping platform, and conduct touchpoint analysis on a global basis.

Touchpoint Mapping of Local Supply Chain in North Carolina

by
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DEDICATION

First and foremost, I would like to extend my sincere gratitude to my wonderful advisor, Dr. Trevor J. Little, for his great supervision and guidance during the process in attaining my Masters of Science in Textiles. His profound knowledge and expertise has supported me extraordinarily in my learning process. I would like to thank Dr. Nancy L. Cassill and Dr. Timothy G. Clapp for not only serving as my committee but also providing their precious suggestions and assistance during the course of my thesis study. I'd like to give my thanks to the local textile companies for their cooperation and involvement in my research. I am also grateful to my family and friends whose encouragement and support gives me strength in accomplishing this program. I would not have been able to get through this journey without them.

BIOGRAPHY

Xian Lu was born and grew up in Jiangsu Province, one of the most developed markets for textile and apparel production in China. During her pursuit of the B.S. degree in Textile Engineering from Donghua University of Sciences in Shanghai, China, she realized her interest in the downstream side of textile supply chain such as sourcing, purchasing, marketing and sales. In 2009, she came to the U.S. to attend North Carolina State University, Raleigh, NC, where she began pursuing her M.S. Degree in the Department of Textile and Apparel, Technology and Management (TATM) at College of Textiles. She focused her study in Textile Supply Chain Management. She expects to obtain her M.S. degree in Textile Management Technology (TMT) in May 2011.

TABLE OF CONTENTS

| | |
|--|-----|
| LIST OF TABLES..... | vi |
| LIST OF FIGURES..... | vii |
| CHAPTER ONE | |
| INTRODUCTION | 1 |
| CHAPTER TWO | |
| REVIEW OF LITERATURE | 4 |
| <i>Process Mapping Tools</i> | 4 |
| <i>IDEF</i> | 5 |
| <i>Visio</i> | 10 |
| <i>CA Erwin Process Modeler</i> | 13 |
| <i>Touchpoint Methodology</i> | 14 |
| <i>Supply chain</i> | 15 |
| <i>Supply chain Tools</i> | 17 |
| <i>Supply chain Transparency</i> | 18 |
| <i>Global SC vs. Local SC</i> | 20 |
| <i>Cluster Sourcing</i> | 25 |
| <i>Silk Road</i> | 31 |
| <i>World pattern in textiles</i> | 32 |
| <i>Social Media</i> | 33 |
| History, Evolution and Future..... | 33 |
| Spread and Scale | 35 |
| Social Media Strategy | 37 |
| CHAPTER THREE | |
| METHODOLOGY | 38 |
| <i>Touchpoint Mapping</i> | 38 |
| Case Study- Local supply chain of TSD Carolinas T-shirt..... | 41 |
| <i>Data Sources</i> | 43 |
| CHAPTER FOUR | |
| RESULTS | 45 |
| Farmer& Ginner..... | 46 |
| Spinner | 50 |
| Printer & Dyer..... | 53 |
| Retailer..... | 59 |
| A. <i>Retail Stores- Distribution Center.</i> | 60 |
| B. <i>Consumers- Retailer</i> | 61 |
| C. <i>Retailer- Vendors</i> | 64 |
| Local Supply Chain..... | 65 |
| CHAPTER FIVE | |

| | |
|--|----|
| CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS | 69 |
| Conclusion& Implications | 69 |
| Recommendations..... | 72 |
| CHAPTER SIX | |
| LIMITATIONS AND FUTURE RESEARCH..... | 75 |
| Limitations | 75 |
| Future Research | 75 |
| REFERENCES | 76 |
| APPENDIX..... | 82 |

LIST OF TABLES

| | |
|---|----|
| Table 1 Cluster Benefits from customer, producer and supplier perspectives..... | 26 |
|---|----|

LIST OF FIGURES

CHAPTER TWO

REVIEW OF LITERATURE

| | |
|---|----|
| Figure 1 Consultants and teams working on process improvement | 5 |
| Figure 2 Process-centered schematic IDEF3 | 7 |
| Figure 3 Object-centered schematic IDEF3..... | 8 |
| Figure 4 Symbols used for IDEF3 Process Description Schemes | 9 |
| Figure 5 Screenshot of Microsoft Visio | 12 |
| Figure 6 Screenshot of CA Erwin Process Modeler | 14 |
| Figure 7 Transparency of SCM ethics – a conceptual framework..... | 19 |
| Figure 8 Number of Textile and Apparel clusters in China | 28 |
| Figure 9 Location of Cotton production regions in the U.S. | 30 |
| Figure 10 Locations of South Carolina Textile Mills | 30 |
| Figure 11 Map of Silk Road Trade Routes | 32 |
| Figure 12 The evolution of Social Media | 34 |

CHAPTER THREE

METHODOLOGY

| | |
|---|----|
| Figure 13 Touchpoint Metrics (MCorpConsulting)..... | 39 |
| Figure 14 End-to-end lifecycle services (Touchpoint Experience) | 40 |
| Figure 15 T-shirt tracking of local Supply Chain..... | 41 |

CHAPTER FOUR

RESULTS

| | |
|---|----|
| Figure 16 Cotton prices Jan. 2008- Feb. 2011 (Monthly)..... | 46 |
| Figure 17 Cotton prices 2001- 2011 (Yearly)..... | 47 |
| Figure18 Saw Ginning Touchpoints | 48 |
| Figure19 Spinning Touchpoints..... | 51 |
| Figure 20 Printing and Dyeing Touchpoints..... | 55 |
| Figure 21 Locations of Retailer | 60 |
| Figure 22 Retail Touchpoints..... | 61 |
| Figure 23 Touchpoint Mapping of Local Supply Chain for TSD Carolinas T-shirts. | 66 |
| Figure 24 Simplified Framework of Local Supply Chain for TSD Carolinas T-shirts | 67 |

CHAPTER ONE

INTRODUCTION

Supply chain issues such as forecast accuracy, inventory control, JIT production, and transparency have made supply chain relationship management paramount. Several contemporary supply chain tools have been developed to address these issues. APS, ERP, CPFR, EDI, TXTPERFORM2008 are used by companies to manage orders, forecast sales demand, better distribution and replenishment, coordinate production, optimize inventory, and create visibility throughout the entire supply chain.

A typical supply chain involves information flow, product flow and cash flow. Information as the driving force of all supply chain activities should be accurate and shared in-time among all supply chain members. The external and internal flows should be mapped out for analysis, coordination and rearrangement. Touchpoint mapping is built based on Touchpoint methodology with the common mapping tools- IDEF, Visio, CA Erwin Process Modeler/ BPWin. A Touchpoint takes place each time a person is touched by substantial information before, during or after purchasing a product throughout the supply network. Information flow has the most Touchpoints in the supply network compared with physical product supply or cash flow. Touchpoint analysis methodology is to define, analyze and optimize the Touchpoints. Touchpoint mapping is the first step as well as the primary step to fulfill Touchpoint analysis methodology. A major benefit of

Touchpoint mapping is to identify the information flow and therefore permit automation of information flow.

The textile supply chain generally consists of five main stages- fiber and raw material, textile manufacturing (yarn, fabric, finishing), textile products, distribution and sales. A textile cluster has been defined as a collection of companies in geographic proximity producing products with same raw materials. The supply chain in this research is one example that clusters local textile mills (farmer, ginner, spinner, knitter, finisher, cutter, sewer, printer, and dyer) producing TSD Carolinas T-shirts in North Carolina. TSD Carolinas T-shirts are made from Cotton of the Carolinas grown in North Carolina. Before the T-shirt delivered to the consumers, it should go through the nine stages for processing. Traditionally, these segments operate as independent entities and are geographically separated. However, in response to the trend of supply chain localization, TSD Carolinas T-shirts are made and sold by members of a local supply chain with strong partnership and linkages. With Touchpoint mapping, the textile supply chain in North Carolina could be visualized taking the example of TSD Carolinas T-shirts.

The purpose of this study is to map a sample of U.S. textile and apparel supply chains- the local supply chain for TSD Carolinas T-shirts launched by TS Design, a local printer and dyer in North Carolina with the Touchpoint methodology. Touchpoint methodology in this research was extended into other areas of supply chain besides marketing. The research methodology is built on the on-site visits and personnel

interviews involved in this specific supply chain that have been conducted for information input to the mapping. Microsoft Visio has been selected as the tool for mapping in this research. The primary objective is to collect data from this local supply chain sample, to organize the information into a Touchpoint mapping and to visualize the local supply chain. The map identifies Touchpoints occurring either within a supply chain entity or between supply chain members. There are more than 100 Touchpoints mapped out in the Cotton of the Carolinas supply chain and only a fraction of this amount is in the processing of the product. These Touchpoints bring value to the product process as well as the end market and the methodology differs from the traditional process mapping approaches used to optimize supply networks..

Future Research may extend the research methodology to larger textile clusters or a global level. Touchpoint methodology could also be applied in the supply chain of other textile products that have different processes. Moreover, advanced software is expected to serve as a new platform to visualize the Touchpoint mapping in future research.

CHAPTER TWO

REVIEW OF LITERATURE

Process Mapping Tools

It is very likely that many managers do not really understand their business processes and how to simplify and optimize them. Process mapping is an analytical and communication tool used to describe each step in the business processes in the form of workflow diagrams and supporting texts. A process map usually shows activities with boxes and arrows to represent data and interfaces. Leading process mapping tools are categorized into 1) Simple Flow-Chart Graphic Software such as Visio, 2) Process Mapping Products such as BPwin, 3) IDEF Process Mapping Products, 4) Process Simulation Products, and 5) Process-Mapping ABC Products including OPTIMA, ADC Process Simulator, Prosim, SIMPROCESS, ITHINK, Design/CPN and PROMODEL [Hunt, 1996].

To improve the process mapping, organization process work team (Figure1) starts from developing an overall roadmap, identifying errors and wastes, analyzing the process with evaluation techniques and preparing for redesign and implementation. [Sweet, 2011]

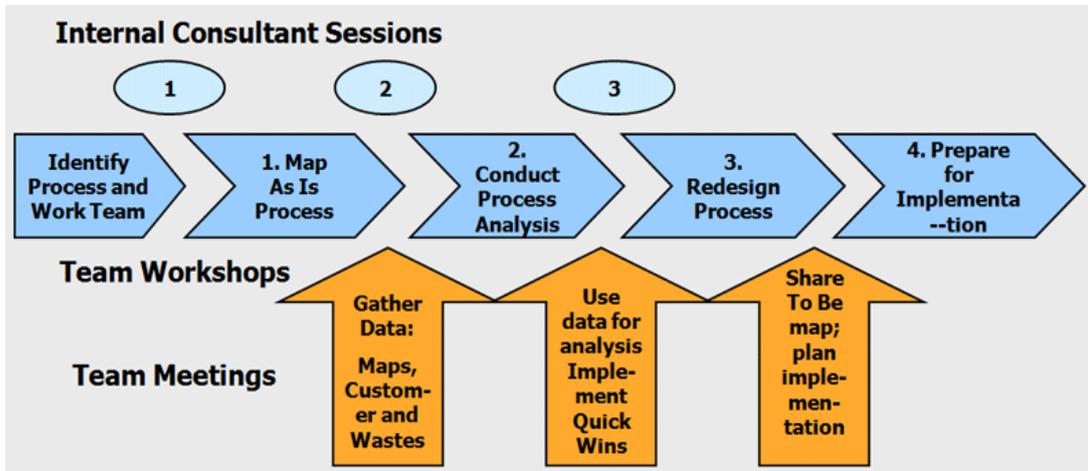


Figure 1 Consultants and teams working on process improvement

Source: Sweet, S. (2011). *Process Improvement with Multiple Teams Using Action Learning*. Retrieved from I4Process, CA.

IDEF

IDEF (the integrated DEFinition methodology), primarily represented for manufacturing systems, has been defined up to IDEF14. It was initially developed as IDEF0, IDEF1, IDEF1X, IDEF3 and IDEF4 for functional modeling, information modeling, data modeling, process description capture and object-oriented design. These different IDEF methods are categorized into “descriptive” and “modeling”. IDEF3 is one of the descriptive techniques that do not provide model for a working system but record or express how a system, process or organization works. [Phillips, 2008] There are maybe thousands of different descriptions but some of them could be summarized and analyzed to produce a model. Description does not involve data analysis but only captures the knowledge about a process. It helps document how a system or process works which accommodate differences or inconsistencies. Unlike models, descriptions do not create analysis data but serve as one form of analyzing data. Description may also be taken to

produce models, or descriptions are the raw material from which models are made. Thus, the utility of descriptions may also be realized through their reuse in constructing multiple models.

There are two types of diagrams in IDEF3: (1) process flow diagrams (Figure 2), which capture the knowledge of how things work; and (2) object state transition network diagrams (Figure 3), which summarize the transitions of an object. The process centered strategy organizes process knowledge with a focus on processes and their temporal, causal, and logical relations within a scenario. The second dimension organizes process knowledge with its focus on objects and their state of change behavior. Both the Process Flow Description and Object State Transition Description contain units of information that constitute the description of a system. In summary, an IDEF3 Process Flow Description, which is intended to show how things work in a particular organization, captures a description of a process and the network of relations that exists between processes within the context of the overall scenario in which they occur.

The development of an IDEF3 Process Flow Description consists of five basic descriptive building blocks. (1)Units of Behavior (UOBs); (2) elaboration; (3) referents; (4) junctions; (5) links. The IDEF3 term for elements represented by boxes is a Unit of Behavior (UOB). The arrows (links) tie the boxes (activities) together and define the logical flows. The smaller boxes define junctions that provide a mechanism for

introducing logic to the flows. [Chen, 2009 & Carrie, 1995]

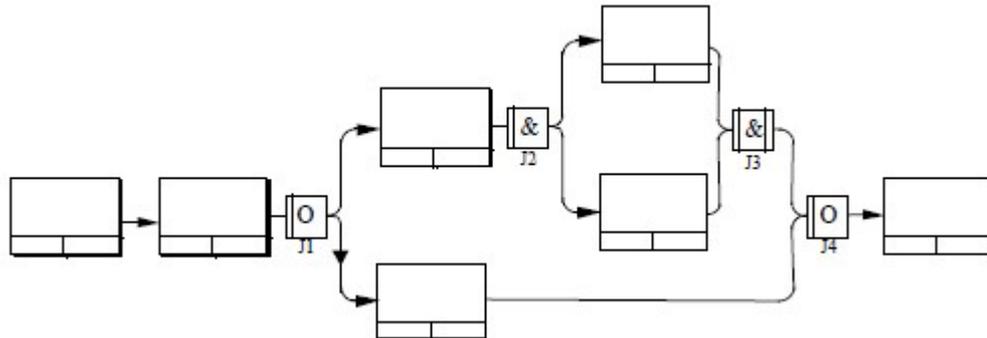


Figure 2 Process-centered schematic IDEF3

Source: Mayer, R., & Menzel, C. (1995). *Information Integration for concurrent engineering(IICE) IDEF3 Method Report*. College Station, TX: Knowledge Based Systems, Inc.

Boxes- **UOBs** ; arrows- **links**; small box containing the “X” denotes a **junction**

Numbering scheme-- explicit traceability between levels of detail in the description

The process description depicted in Figure 3 shows a system from a particular point of view. Each view to be described would be presented in a separate decomposition with a unique label and number.

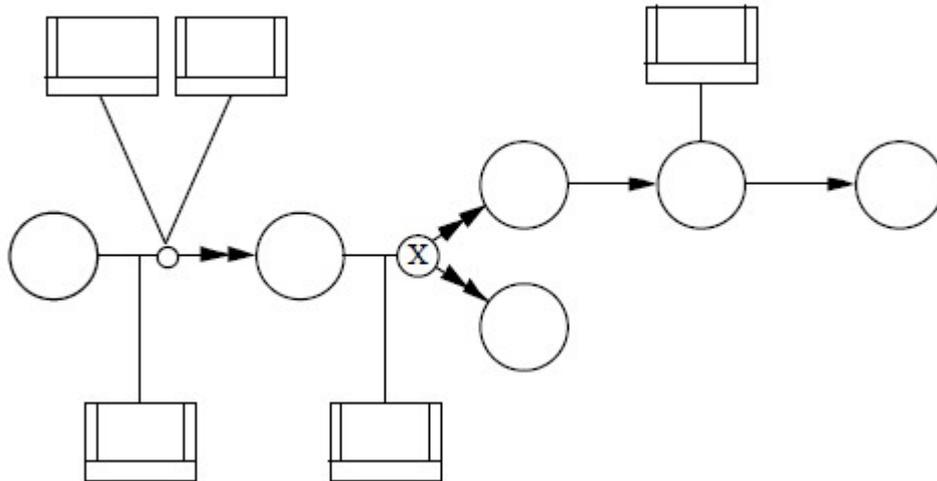


Figure 3 Object-centered schematic IDEF3

Source: Mayer, R., & Menzel, C. (1995). Information Integration for concurrent engineering(IICE) IDEF3 Method Report. College Station, TX: Knowledge Based Systems, Inc.

Circle containing the name of an object represents an object of a certain kind. A certain kind of object in a certain state is represented by a labeled circle that captures both the kind itself and a corresponding state. The banded boxes linked to the arrows are referents which describe the relationships between objects states and UOBs. The symbols used for IDEF3 are concluded in Figure 4.

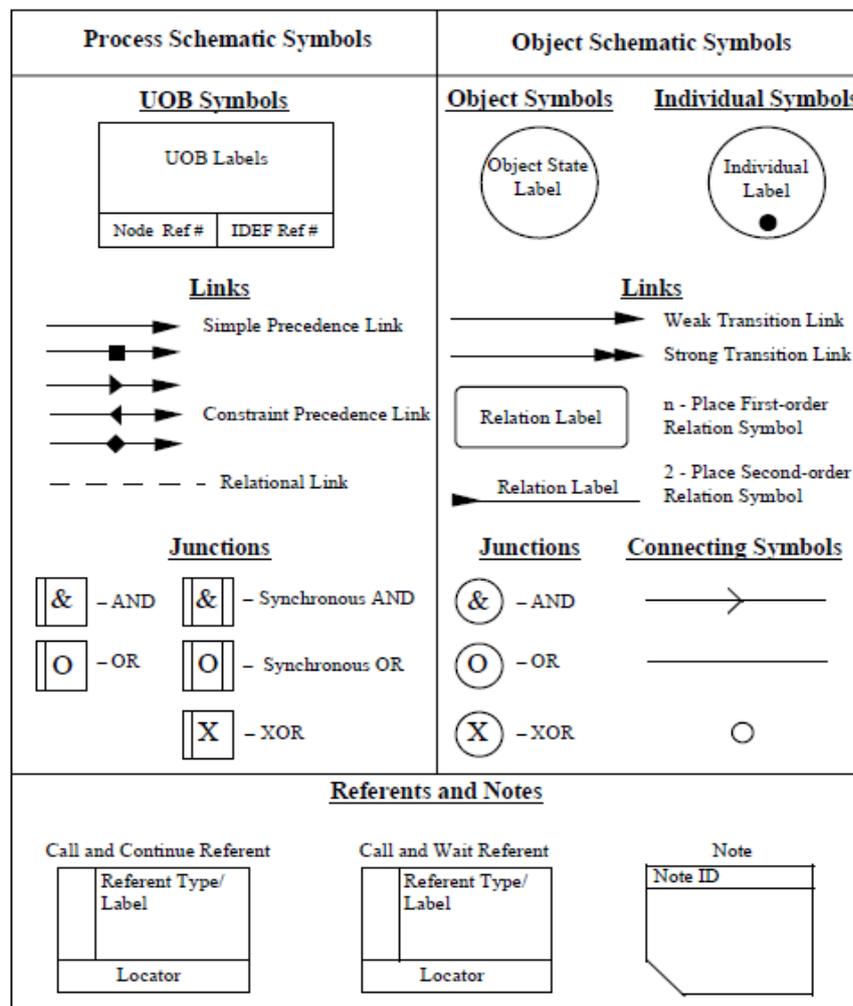


Figure 4 Symbols used for IDEF3 Process Description Schemes

Source: Carrie, Allan (01/01/1995). "Application and assessment of IDEF3-process flow description capture method". *International journal of operations & production management* (0144-3577), 15 (1), p. 63.

The benefit of IDEF3's design is to capture and structure descriptions of how a system works from multiple points of view rather than directing users toward approximate system behavior by model construction. IDEF3 has been used to identify obscure process links between organizations, to highlight redundant or non-value-added activities, and to design new processes. Some main benefits of IDEF3 are:

1. Distribute detailed manufacturing process knowledge among geographically dispersed units;
2. Enhance the analysis of a business system with a structured approach;
3. Facilitate design data life-cycle management;
4. Support the project management process by monitoring and controlling project activities in real-time

Benefits realized through the application of IDEF3 can be measured by cost savings, quality improvements and capability improvements.

Visio

There are two versions of Visio available. The basic standard version (Figure 5) which creates business-related diagrams such as flowcharts, organizational charts, and project schedules, is flexible enough to address most common business needs. The professional version builds on the standard version with shapes and solutions that enable technical professionals to create IT, Web, engineering, and other technical diagrams. [LaFon, 2004] Visio's core strength is seducing users into expressing ideas and relationships of a given process, rather than forcing users to focus on how to use the program. [Doherty, 1999]

First known as an easy tool for diagramming, Visio has been adopted by many enterprises to model a host of processes and systems. Companies using the Visio tool will

have to buy, install and manage it on the desktop. [Caton, 2006]

Business Process Modeling Notation (BPMN) represents multi-dimensional business processes, as it uses the set of graphical elements describing every important aspect of the business process, which can be regarded as the modeling dimension. However, BPMN is only graphical notation and does not support the essence of Business Process Management (BPM) which supports full business process lifecycle from documenting and modeling to execution and monitoring. To accelerate the adoption of BPM, industry has come forward with two BPMN complementing standards – Business Process Execution Language (BPEL) and XML Process Definition Language (XPDL). [Penicina, 2010] These two standards are used for different purposes – BPEL is process execution language and XPDL is process exchange language.

The Visio platform that belongs to Microsoft allows easier use of the mapping software and sharing of electronically stored process across the organization. Process navigator is a process mapping software that enables staff to transfer their knowledge of a process into electronic maps, drawn and stored on PCs. It is a great way to capture and display business processes. It is portable, accessible and environmentally-friendly. [IEE Review, 2003]

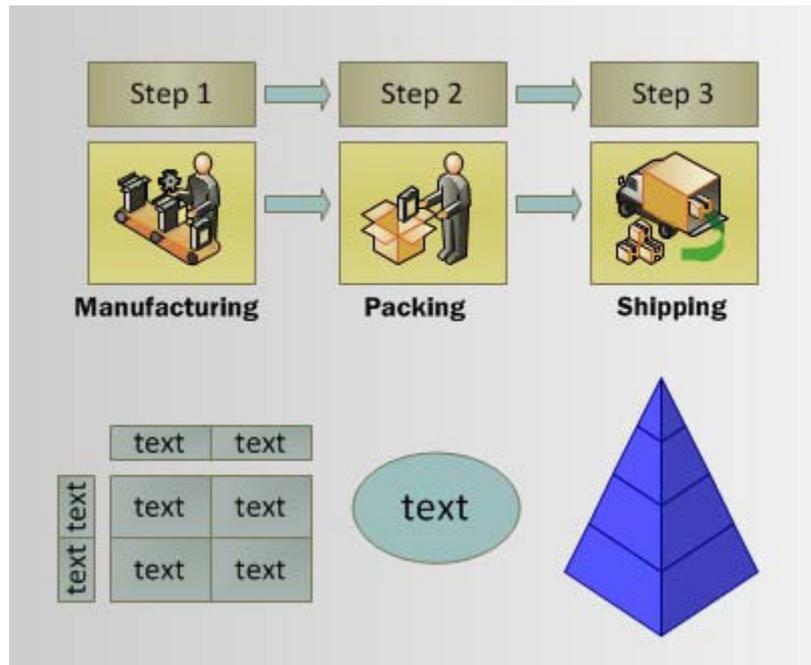


Figure 5 Screenshot of Microsoft Visio

Microsoft Visio makes it easier to communicate information, reach consensus across an organization, optimize business processes, design or configure complex systems, monitor and maintain IT systems. [Microsoft Support, 2011]

1) Visio Standard

Visio Standard 2007 helps visualize, document, communicate, and share ideas by performing tasks such as exporting brainstorming diagrams to Microsoft Office Word documents in outline form, organization charting, scheduling activities or generating calendars for easy review, tracking project progress based on assigned timelines, visualizing business processes.

2) Visio professional

Professionals in IT, engineering, and software development benefit from Visio Professional 2007 that are targeted to specific domain needs. Besides a rack diagram drawing type and updated network shapes, an improved web site mapping solution, software development templates, architectural/ engineering/ facilities management, and database modeling, the features that Visio Professional 2003 offers, Visio Professional 2007 introduces additional technical solutions and advanced functions on the basis of Visio Standard 2007. Some added features are the integration of data and diagrams to combine disparate sources of complex visual, textual, and numeric information, visualization of business data in a hierarchical form, visualization of manufacturing processes based on lean methodology, compliance with ITIL standards, creation of site maps of existing web sites by using templates and predefined shapes, support for incorporating data into a building plan, etc. Visio Professional 2007 even enables to reverse-engineer database models and software solutions.

CA Erwin Process Modeler

CA (Computer Associate) ERwin Process Modeler is formerly BPWIN. [ERWin, 2011] CA ERwin PM, used for general review of resources, planning of major organizational changes and procedures clarification, is a powerful modeling tool that supports process, data flow and work flow modeling in one tool. BPwin offers supports a set of user-defined model information such as purpose, scope, definition, source, status, and time frame. It also offers fully scalable graphics, presentation-quality reports, and

Dynamic Data Exchange reporting. CA ERwin PM provides a mechanism for capturing key enterprise business knowledge, improving collaboration, productivity and quality, and guiding the application development process. A future version of BPwin may include a spreadsheet interface for sophisticated calculations and optimization.

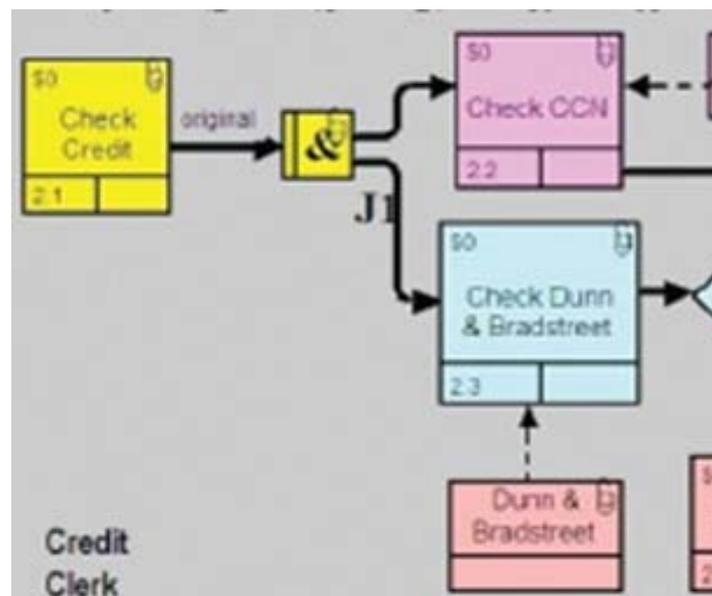


Figure 6 Screenshot of CA Erwin Process Modeler

Source: Product Brief (2011): CA ERwin® Process Modeler.

Touchpoint Methodology

Touchpoint methodology has been applied in brand management and consumer relationship management. A brand can be built up from earliest impressions to after-sales service. Touchpoint will have both positive and negative effect on brand equity and it may cause either positive or negative impression that forms the foundation for brand perception. It is important to analyze which Touchpoints have the greatest impact on customer behavior and brand loyalty. [Hogan, 2005] Managers tend to invest more in the

customer Touchpoints that will do most to increase brand equity and resulting profits. They identify the most critical Touchpoints, evaluate the performance of each and monitor them to optimize the interaction between the brand and the consumers.

To figure out the best way for a company to touch its customers, what triggers the intention to purchase and how Touchpoints affect the consumer behavior, process mapping helps in managing Customer Relationship Lifecycle (CRL) which cover 7 stages- Awareness, Knowledge, Consideration, Selection/ Trial, Satisfaction, Loyalty and Advocacy. [**Intervox Group, 2003**] Touchpoints in terms of customer relationship management may include websites, telephone, email, stores, advertisement and social media, or any other channels that a customer comes in contact with the business.

Touchpoint could be managed from different perspectives. [**Marketing Week, 2006**] It could be managed by channel- media, call center, stores, or the product itself, and by type- informational, physical or personal. Information Touchpoints require state-of-the-art IT systems to deliver the most effective information to the customers and get customer view back in an efficient manner.

Supply chain

Supply Chain is a set of three or more organizations linked directly by one or more of the upstream or downstream flows of products, services, finances, and

information from a source to a customer. Supply chain, a systematic process, is composed of interrelated activities that are internal and external to a firm. [Handfield, 2009] Supply chain is transparent only when participants are willing to share information based on trust. Thus, the supply chain relationship management becomes paramount. Organizations are effectively forming new types of relationships that require shared resources.

From a customer's perspective, what really matters is where they could get the best products at the most reasonable price, but supply chains are irrelevant and not so critical. However, a well managed supply chain and a systematic process of internal and external activities will benefit not only the organizations involved but also the customers at the end of the chain.

Supply chain management activities include purchasing, in-bound transportation, quality control, demand and supply planning, materials handling and inventory control, order processing, production planning, scheduling, warehousing, distribution, shipping, outbound transportation, and customer service. [Taylor, 2003] Sourcing as a primary activity in supply chain management includes analyzing the budget, identifying suppliers, requesting quotations, making contract and monitoring the order.

Supply chain Tools

Reflecting on the increasing brand competition, growing supply costs, changing

consumer needs and preferences, and diversification or variation of products, companies are faced with severe supply chain issues such as forecast accuracy, inventory control to maintain service levels, transparency across the extended supply chain, and the gap between production and sales caused by the lack of visibility as to what is actually being sold in real time. The level of transparency and demand visibility could be supported by the improved real-time communication between business partners to be proactive rather than reactive.

The advanced planning system (APS) is used to develop proper production schedules to support the potential orders. Enterprise Resource Planning (ERP) is applied at executive level to integrate the order execution related business process. Linking an APS system to an ERP system is a major integration project. [Hon, 2008] There are overlaps between APS and ERP system in terms of managing order fulfillment, planning, sales demand, distribution, production and purchasing.

Collaborative planning, forecasting, and replenishment (CPFR) has replaced the traditional Electronic Data Interchange (EDI) with the objective to coordinate production, forecasting and replenishment through web-based communication. CPFR benefits both retailer and manufacturers by reducing safety stock and increasing order fill rates. According to the research by KPMG (Klynveld, Peat, Marwick, Goerdeler), a global network of professional firms providing audit, tax, and advisory services, direct material

flow from manufacturers to retailers eliminating distributors is more efficient along the supply chain [Fliedner, 2003].

TXTPERFORM2008 brought up by TXT e-solutions enables greater visibility and control over supply costs, more accurate forecast, better distribution and replenishment planning as well as inventory optimization aligned with sales and production. Based on best-in-class industry practices, TXTPERFORM2008 supports consumer goods companies such as textile and apparel to go for the best demand management and supply planning that delivers an exceptional combination of analytics capabilities and functionality. [Kumar, 2008]

Supply chain Transparency

All activities throughout the supply chain from the point-of-origin to the point-of-consumption should be transparent since stakeholders tend to ask for more information about a company's value chain activities. The conception of transparency is illustrated in Figure7 [Svensson, 2009]. The "arrow" that goes through all levels of the supply chain represents supply chain transparency in the ongoing business operations.

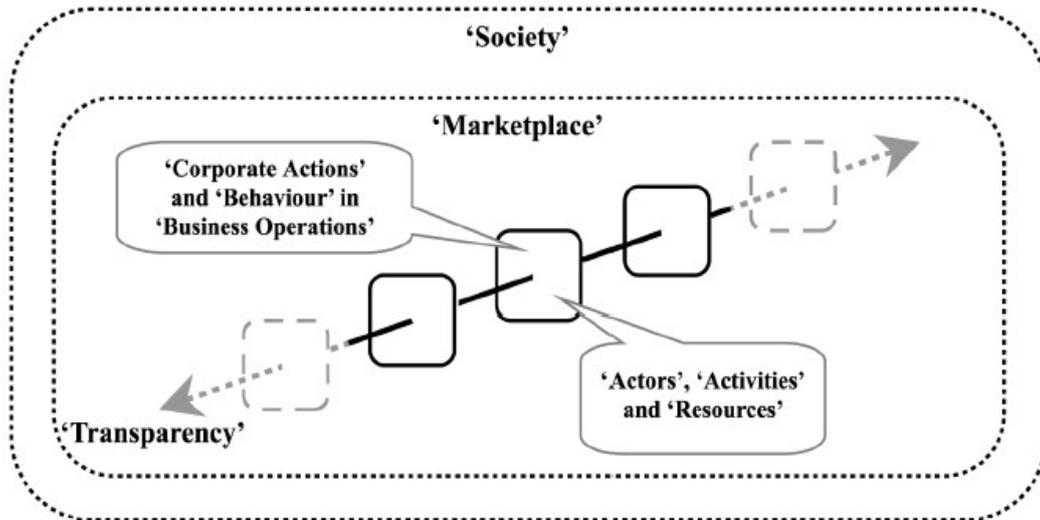


Figure 7 Transparency of SCM ethics – a conceptual framework

Source: Svensson, G (01/01/2009). "The transparency of SCM ethics: conceptual framework and empirical illustrations". *Supply chain management (1359-8546)*, 14 (4), p. 259.

Supply-chain transparency in ordering, inventory and transportation is essential for companies to make better business decisions being proactive rather than reactive to the marketplace and society as a whole. Transparency enables companies to see how the suppliers perform from raw materials sourcing to the store delivery. [Gunasekaran, 2004] It should be noted that information is the driving force of all SC activities and accurate information should be in place in terms of order quantity, delivery date and flow or transition of products to achieve reduced operational cost, expected service levels and customer satisfaction.

Supply chain transparency could benefit from knowledge management systems which involves both internal and external processes and information. Internal knowledge

is applied when the organizational memory or the knowledge from the past is brought to present activities for improvement. External knowledge refers to production, shipping, order schedules, demand and inventory levels that each player in the value chain could see. [Davey, 2005] The “voice of the customer” should be shared throughout the pipeline by allowing the changing customer preferences visible to everyone. Knowledge management systems create opportunities for quicker response to changes and reduced cycle or lead time.

Global SC vs. Local SC

Changes as well as challenges have taken place throughout the textile supply chain. There is higher demand for shorter product lifecycle, more visibility and higher pressure on cost and margins. Distributors tend to expand their supplier base by outsourcing, outbound investment, or joint venture. [Gentry, 2006] Besides purchasing from distribution centers which takes much time and inventory cost, retailers nowadays order directly from third-party logistics (3PL) company which help them better manage their inventory in a timely manner. Some 3PL professionals such as APL and APL Logistics, which manage end-to-end worldwide supply chain and provide optimized logistic operations, have been counted on by many global companies for their different business needs. These two companies, based on 159 years of innovation, help companies design and manage the global supply chain and have been rewarded for their outstanding service by J.C. Penney and Target Corporation respectively.

Global supply chain brings benefits such as lower procurement cost through outsourcing in developing countries, advanced knowledge and technology, as well as diversified talents that play different roles in all supply chain activities such as production, R&D, sourcing, marketing, and sales, etc. Firms need to compare procurement cost on the same basis and Brinbaum advocates that they use the FCVA- Full Value Cost Analysis method. **[Birnbaum, 2000]** The FCVA method separates costs into direct cost, indirect cost, and macro cost. Direct cost associated with the product such as labor cost is insignificant compared to the final price costs. Macro costs such as logistics and communication, tariffs and quotas are more important.

An integrated global supply chain is flexible and efficient. Supply chain globalization helps accelerate the capability to manage global customer base, but adds complexity and risk to the supply chain. In the globalised business world, there are factors more important than price. Different culture and currencies, information flow, trade barriers, availability of resources, government or country specific situations, compliance, etc. all pose challenges on the supply chain management on a global basis. There is also underlying intangible cost from the loss of core technology, longer lead time, lower quality and less flexibility as well as the tangible cost of money accruing interest once the order is placed. **[WEBER, 2007]**

Using suppliers that are inflexible and unresponsive to changes in demand entails

great loss, leading to considerable cost implications along the supply chain network. Offshore sourcing becomes less attractive when the hidden costs such as inflexibility and unresponsiveness outweigh the benefits coming out of low wage, and low production cost [Christopher, 2004]. A domestic supplier that provides quick response and flexibility would be a better choice for adding velocity into the supply chain.

A global supply chain has higher demand on information transfer and relationship management. Companies and their suppliers or business partners share information, rewards as well as risks. To build well-established relationships with both upstream and downstream players along the supply chain becomes even more difficult due to the differences in economic, political, social, infrastructure, cultural and logistical aspects across nations. Economic challenges may include exchange rates, inflation, duties, and taxes. Political factors are considered in terms of law and regulations, labor and capital. Infrastructure differences may have effect on the banking, logistical and transportation systems. Information flow could be accelerated by the advanced technology and information systems; however the transnational physical flow involves more uncertainty in lead time. [Rugman, 2009 & Manuj, 2008]

A key issue facing a company is to decide which activities should be sourced internationally and when to source locally in terms of geographical proximity. Outsourcing of non-critical value chain activities enables a company to focus on aspects

of the product that contribute to the competitive advantage. The first step to address this question is to understand the cost triggered by the geographical distance and the balance between the cost and the benefits. [Levy, 1995] As is discussed, local sourcing brings convenience and flexibility while international sourcing makes JIT production and lean production hard to implement. Inaccurate sales and demand forecast caused improper planning in production and inventory. However, the improvement in sales forecast could be offset by the problems caused by poor management in shipping and transportation. Therefore, besides the potential production problems that can occur in international sourcing, there is a non - ignorable threat of disruption regarding offshore transfer of products.

Immature products, products with frequent engineering changes, products requiring rapid delivery and customized products are locally sourced in most cases. The requirements on quality and close coordination among all business functions also make local sourcing as the first choice. There are some proven situations when local sourcing is applied. For instance, high-tech products are manufactured close to the local R&D center. Generally speaking, high-fashion products are manufactured close to the local market. However, standard products with low cost manufactured locally compete with imports, especially after the lifting of temporary quotas on goods made in China at the end of 2008.

Two main factors are both considered in international sourcing, location-specific factors versus the relational factors. The former represents the attractiveness of a particular region in general. However, the latter disrupt the value chain activities by separating them which may cause delayed shipping, overstock or insufficient inventory, and demand fulfillment problems. The location-specific factors specifically include the local resources, the production cost, the political stability, the economic and social status, and the availability of technology. Meanwhile, the relational factors refer to the flow of physical product, capital and information. International sourcing separates activities along the value chain. The benefits coming out of the low production cost or cheap labor are weakened by the distance from the production center to distribution center or the dynamic consumer markets. Regarding to this, effective communication technology as well as efficient transportation and logistics should be extremely important. [**Kotabe, 1993 & Bartlett, 1989**] It is imperative for the managers to understand the trade-offs entailed in international sourcing in order to make better choice between local sourcing and global sourcing. Moreover, the risk and cost behind each mode could be controlled and minimized concerning the supply chain activities such as the shipping method, choice of suppliers or vendors, and the location of production, R&D facilities, etc.

In summary, global supply chain brings shift in production, reduction in labor and procurement cost, mobility of resources, information, services and talents across national boundaries, tremendous development of information and technology, new opportunities

for business, and thus financial returns as well as profitability. However, the supply chain itself is complicated to coordinate since it involves multiple functions generating substantial information flow and product flow. There are underlying risks and multiple uncertainties for a global supply chain which is more difficult to coordinate, communicate and monitor due to the identified factors such as high transportation cost, technological complexity and product immaturity. Therefore, long-term perspective, patient and careful implementation should be taken towards Global SC footprint which is usually managed by global organizations. MNCs usually control the risk by developing suppliers in a reduced number and establishing long-term partnership with them. Transparency of the supply chain activities and trust in business relationships help offset uncertainty and risks associated with international sourcing.

Cluster Sourcing

Domestic companies that supply products with flexibility and quick response more important than capacity or cost will continue to compete effectively with imports.

Textile clusters are defined as a collection of companies in geographic proximity producing products made from same materials but have distinctive market share in the market at large. The establishment of clusters provides advantages in terms of sharing talents, resources and technology integration, supported infrastructure, efficient information exchanges, better targeting of government programs and specialized products,

service, markets and technologies. [Apex, 2006] Clusters bring benefits to customers, producers and suppliers as is analyzed in Table 1.

Table 1 Cluster Benefits from customer, producer and supplier perspectives

| Customer | Producer | Supplier |
|---|---|---|
| <ul style="list-style-type: none"> - Approachable - Variety of choices - Fast delivery | <ul style="list-style-type: none"> - Availability in resources, land, infrastructure and labor, etc. - Centralized purchasing - Government support | <ul style="list-style-type: none"> - Approachable - Efficient logistics - Bulk order and high consumption - Centralized supplying |

Clusters promote competition as well as co-operation. A cluster will die without competition. However, over competition may cause normalization and inflexibility which has negative effects on the clusters instead. Textile clusters traditionally originated from the vicinity of raw material sources. In today's world, the clusters compete on end-products and production competencies including technology and infrastructure. It is continuous innovation or new product development that makes the clusters more competitive in the long run.

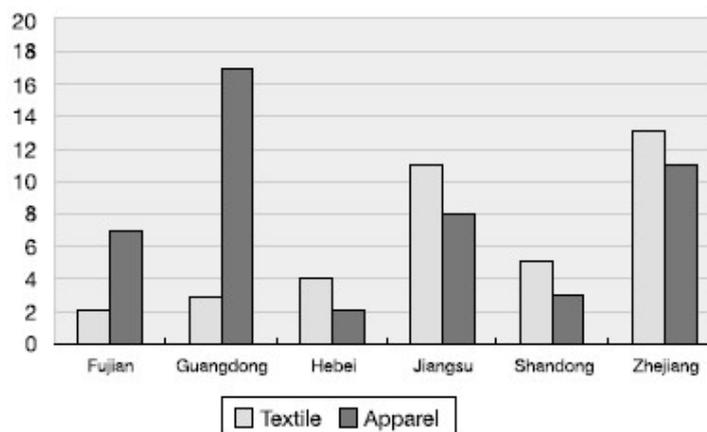
Many countries have their own clusters of textile products. Large clusters in the

hosiery sector are found in Tirupur, Ludhiana and Kolkata. Silk clusters are in Bangalore and Mysore and woolen clusters for shawls in Kullu and Amritsar. China and India are the two developing markets that could best illustrate “cluster” concept in the textile industry. According to United Nations Industrial Development Organization’s (Unido) estimate, India has about 70 textile clusters comprising about 80% of textile production. India’s Budget 2006 stimulates cluster-based development, especially in the textiles and handloom sector. India has the most handicraft clusters nationwide making handicrafts better than any other regions or nations in the world. In 2010, more than 125 clusters participated in the cluster sourcing exhibition representing all major crafts like Embroidery, Cane & Bamboo, Wood, Stone, Block Printing, Metal, etc. **[fiber2fashion, 2010]** The show provides convenient B2B and B2C platforms for the cluster artisans to network nationwide. Handicraft sector in India has contributed to emerging business opportunities, growing employment, larger capacity of production, and increasing export overseas.

Textiles and apparel is one of the leading industries in China in terms of the domestic production, and trade overseas. Industry clusters are prominent in textiles sector in China. They are located mainly in southeastern coastal regions, particularly in the Yangtze River Delta (YRD), the Pearl River Delta (PRD) and the Bohai-rim region where thousands of textile and apparel manufacturers have clustered together. Wholesale markets are also located in these areas to provide platforms for domestic networking or

global trade. In 2004, it was estimated that around 80% of the total sales of all textiles and apparel enterprises above designated size were generated from industrial clusters. According to Figure 8, more than two thirds of the textile clusters are located in Jiangsu and Zhejiang province while Guangdong is the largest apparel producer with 16 more clusters [Li& Fung, 2006]. Jiangsu province, for example, has the strongest clusters nationwide in terms of the output of textile materials such as woolen cloth, yarns, and textile machinery.

The textile and apparel clusters in China are large in scale and well-established all the way from raw materials, yarn and fabric, to final products and brand management. Cluster sourcing in China requires considerable knowledge of the clusters and suppliers due to the large amount of clusters competing in the market thus thousands of choices.

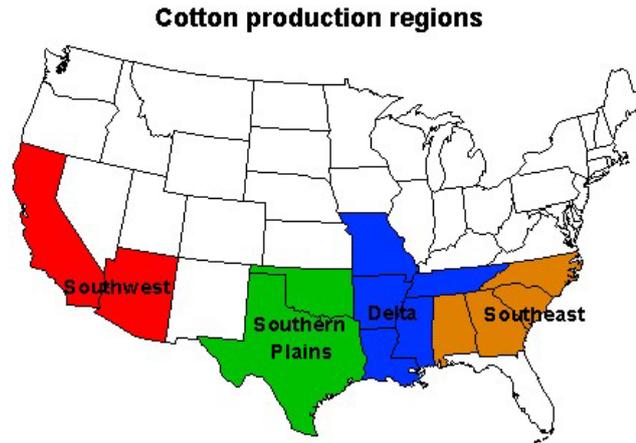


Source: China National Textile & Apparel Council

Figure 8 Number of Textile and Apparel clusters in China

There are also textiles clusters existing in the U.S. It could be seen from Figure 9

[USDA, 2007] that cotton growers are clustered in the southern part of the nation. North Carolina is the 4th largest producer of cotton nationwide. Performance textile companies are clustered in North Carolina, especially the Charlotte area cluster, Triad cluster, Hickory area cluster, and Triangle cluster [Nelson, 2008]. There are approximately 517 companies with 60,000 employees working in the performance textile industry in North Carolina. South Carolina has abundant textile and apparel resources which make it an industry clusters as well. This can be proved by some quantitative facts. There are 16 major textile industry headquarters in SC, 46 out of 46 counties in SC with at least one textile related business, 2,200 US patents generated by Milliken Research since establishment in 1955. Due to the cluster effect, apparel companies in SC could take quick response to the varying consumer tastes and behavior, which makes themselves less vulnerable to the market changes. The SC cluster contains both growing and declining sectors in terms of production output and employment opportunities. Figure 10 illustrates the SC textile mill cluster among other cluster categories. [Eades, 2007] Losses in employment and output in some sectors of the textile cluster are offset by some other well-performed subsectors. Cluster members should be encouraged to work together to improve labor skills, develop new products and maintain local competitive advantages by sharing information to foster future industry growth. Within the South Carolina cluster, headquarter of some companies are located in the state while some are not. Thus, cluster initiative still need to be recognized for further cluster development.



Southeast: Alabama, Georgia, North Carolina and South Carolina
 Delta: Missouri, Arkansas, Louisiana, Mississippi and Tennessee
 Southern Plains: Oklahoma and Texas
 Southwest: Arizona and California

Figure 9 Location of Cotton production regions in the U.S.

Source: Economic Research Service-data Sets- Production Regions (2007)

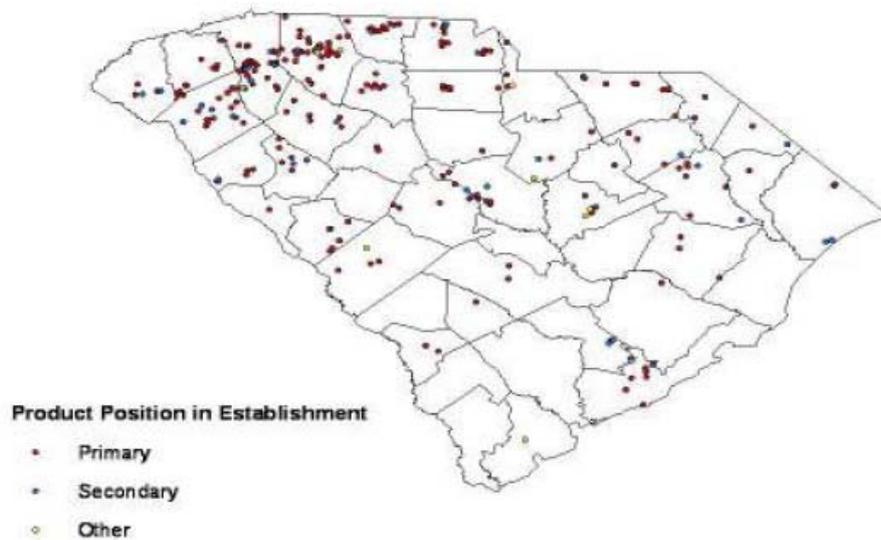


Figure 10 Locations of South Carolina Textile Mills

Source: Eades, D. (2007). South Carolina's Textile and Apparel Industries: An Analysis of Trends in Traditional and Emerging Sectors. UCED Research Report, 12(1), 50-60.

Silk Road

The Silk Road was opened up by Zhang Qian in the Western Han Dynasty (206

BC–24AD), and gradually formed throughout the Han Dynasty (25–220). With the establishment of the Tang Dynasty (618–907), which saw rapid development of economy and society, this famous trade road reached its most prosperous stage in history and during Yuan Dynasty (1271–1368), it experienced its last flourishing period. **[Frank, 1990]** Silk Road could be considered as a prototype of supply chain in today’s world. It played the role of exchanging goods, technologies, information and ideas between nations or regions. More than just a trade route, the Silk Road also witnessed the movement of cultural influences. In pre-history there was the original “Silk Road” linking China to Europe. It is more inclusive in so far as it links the Pacific Ocean to the Atlantic Ocean via rail and road. These modern links will enable faster (and safer) transportation of goods from Europe to the USA and to intermediate points.

Textiles have been part of a global market since the days of the Silk Road, thus Silk Road could be regarded as the first stage of globalization, as the trade routes shown in Figure 11 **[Steve, 2010]**. Transportation modes on Silk Roads include overland, railroad and maritime systems, which are still being used in today’s transportation and logistics. For transactions along the Silk Roads, “fei qian” is traditionally used as credence of payment to exchange for goods, services or intellectual capital which has been replaced by bank notes nowadays. The payment was applied because “fei qian” is easier to carry around and used to avoid robbery along the Silk Road. The most noticeable evolution since then should be the development of IT support network which enables

modern and efficient logistic and supply chain systems nowadays.

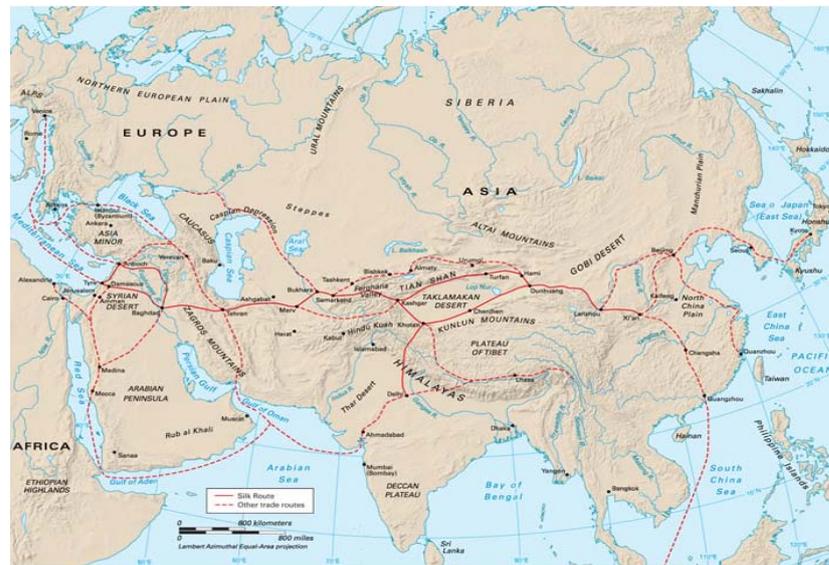


Figure 11 Map of Silk Road Trade Routes

Source: Steve (2010). The Silk Road, Pt. 1: Introduction.

World pattern in textiles

In the early 1800s, cotton was raised in the southern United States and exported to mills in England and the north. After the Civil War (1861–1865), North Carolina built large number of mills which made cotton mills in New England less important. World War I (1914–1918) and War II (1939–1945) emphasized the need for self-sufficiency and new companies emerged. American textile companies thrived with the use of imported machinery and dyestuffs. [Washington Post, 1991] In the 1990s, there was a shift in production from U.S. to lowest cost producers. Textile and apparel sector has seen large-scale downsizing in domestic manufacturing with employment declining from 12.1% in the 1970s to 8.1% in the 1990s. [Malhotra, 2006]

Regional trade arrangements such as NAFTA enforced in 1994 (between the U.S.,

Mexico and Canada), and CBI enforced in 1984 (between the U.S. and the Caribbean basin countries) have reshaped the world pattern and benefited the U.S. textile and apparel industry. The geographical proximity with countries like Mexico, Canada allows U.S. firms to save transportation cost and to ensure JIT delivery, rather than sourcing from distant regions in Asia. Moreover, quota systems help shape the world trade pattern as well. [Franklin, 2004] Worldwide quotas on textiles and apparel expired under WTO rules, and textile and apparel makers in the U.S are threatened by losing numerous job opportunities.

Social Media

History, Evolution and Future

Social media has penetrated into every corner of people's life in the modern society. Dating back to the early 17th century, newspaper and magazine as printed media was invented. Telephone network came to the stage in the 1950's with functions like "bridges" (audio conference call lines) and voice mail. Internet was accessible in the late 1960's as network and after then, social media was fast developed. There are sites for forums, games, blogs, photo or video sharing, clubs and communities. There are also sites that provide social networking with acquaintances or strangers [Borders, 2009]. It could be noticed that there are more types of social media with time and social media functions were further developed. Thus much more Touchpoints were brought about, either the Touchpoints between a variety of information and audiences or person-to-person

Touchpoints.

Figure 12 illustrates the evolution of social media industry, however not all social media invented are presented. Six Degrees, founded in 1997, was the first modern social network. It allowed users to create profiles and to add friends into their network. Some popular social networks that have most visits nowadays would be Facebook, LinkedIn and Flickr. Social media isn't just limited to social networking. It also acts as a platform for users to share personal status, photos, videos, and other information or activities. Youtube, launched in 2005 was the first major video hosting and sharing site.

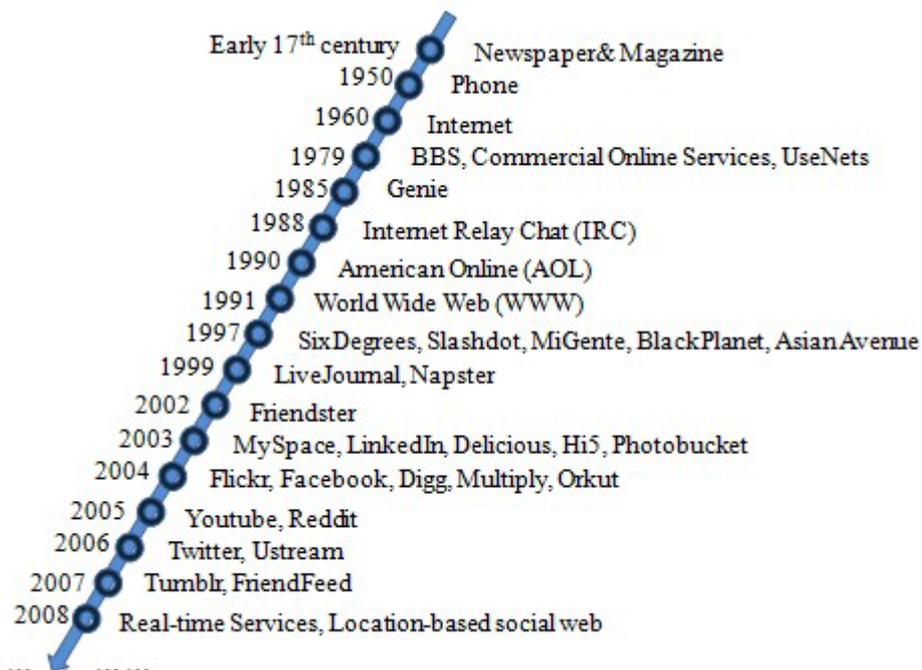


Figure 12 The evolution of Social Media

The future trend for social media will be about location and mobile.

Location-based services like Facebook Places and Deals indicate that social media extend beyond the web. Another trend will be social commerce such as group-buying sites and social currencies such as Facebook Credits.

Spread and Scale

Some tools utilized by companies to monitor and analyze social media results are Radian6, uberVU, Argyle Social, Social Mention, Social Radar, Viralheat, Meltwater Buzz, and Flinchline. These tracking tools are used for measuring buzz and the spread of a campaign. The question is that companies might know how many views or Touchpoints of one campaign via one channel of social media like Facebook. However, there is no way for them to know who is watching. **[Howell, 2010]**

Statistics collected from social media, especially Facebook, could illustrate the enormous spread and scale of social media nowadays. **[Lukes, 2010& USAToday, 2009]** The tremendous scale covered by social media could tell how many individuals, groups or organizations have been touched via these social channels. It could be regarded as numbers game.

- Facebook has 500 million or more users at the end of 2010, rising from 300 million the year before
- About 30 million Facebook users get access via mobiles
- Facebook users can interact with 900 million more objects

- More than 10,000 webs use Facebook connect as affiliated sites
- The average user on Facebook has 130 friends and connected to 80 pages, groups and events
- The average user on Facebook creates 90 pieces of information per month (i.e., photos, video, links, and status)
- More than 30 billion pieces of information are shared on Facebook per month
- Twitter has 40 million more users who create a staggering amount of tweets per day
- LinkedIn has over 365,000 company profiles

It is said that only 10% of US online consumers upload videos to public sites like Youtube while one-third of them basically watch that are considered as “lurkers”. **[Social Behavior; Forrester, 2010]** According to Forrester Research, people in the US generate more than 500 billion online impressions regarding products and service, while 16% of online consumers generate 80% of the impressions. **[Ray& Wise, 2010]**

Social Media Strategy

Consumers are publishers, communicators and reviewers on social media. Companies should not only listen but also engage, converse, and participate in real time as voice from social media happens **[Smith, 2009]**. Interactions with consumers via social media contribute to improvement on products and services, brand loyalty as well as consumer satisfaction. Social media however is a double-edged sword. Negative

comments or reactions may destroy the brand and other brands affiliated with it. It is crucial to get the right and positive reaction from the right audiences. Mass views or Touchpoints are not that critical but what really matters are the targeted views. More spread via social media is not necessarily powerful in generating positive reactions that may create return or potential consumers. Thus the effectiveness of social media strategy is not dependant on how many people reached on social media, but how many targeted audiences reached. Mario Sundar, community evangelist at LinkedIn, [Maddox, 2008] points out that company must carefully weigh and measure their social networking strategy. Starting from answering questions like whether there is a need and who is the target audience becomes an effective social media strategy.

CHAPTER THREE

METHODOLOGY

The purpose of this research is to investigate how “touch point analysis” can be used to map the product pipeline. It is focused on the analysis of information flow, physical product flow and cash flow along the textile supply chain in North Carolina. The “touch point analysis” methodology is used to map out the business processes and to identify the value stream. With adequate range of companies and resources involved in all stages of the product pipeline, North Carolina provides a best local platform for this research. The data collected in this research come from a completely local supply chain, from cotton grower all the way to the local retailer. This research uses a case study of T-shirts made from Cotton of the Carolinas locally grown and made.

Touchpoint Mapping

There are many different definitions of Touchpoint in the literature. Teradata, which launched Touchpoint Server (TPS) as part of its customer relationship management (CRM) application defines Touchpoint as “customer interaction channels such as call centers, web sites, automated teller machines and web kiosks.” [Teradata, 2002] Touchpoint Metrics (Figure13) defines Touchpoints as occurred every time audiences come into contact with or "touch" the company [Touchpoint Metrics, 2010], whether static, human or interactive. The quality of Touchpoint experiences drives perceptions,

actions and relationships.



Figure 13 Touchpoint Metrics (MCorpConsulting)

Intervox Group defines it as “all physical, communication, and human interactions that customers experience during their relationship cycle with the company. Increasingly, customer Touchpoints are ‘owned’ and managed by the contact center.” **[Intervox Group, 2010]** Touchpoint Experience, Inc. which helps optimize the total customer experience to drive growth through customer acquisition, retention and penetration (Figure 14) defines Touchpoint as “every point in time the customer ‘touches’ or connects with the company throughout the entire product/service delivery; pre-, during and post-purchase.” **[Touchpoint Experience, 2004].**

| Customer Interaction Management | Assess | Design | Implement | Optimize |
|---------------------------------|----------------------------|-------------------------|----------------------|------------------------------|
| Touchpoint Optimization | Touchpoint Analysis | Touchpoint Mapping® | Touchpoint Alignment | Touchpoint Optimization |
| Customer Value Optimization™ | Customer Experience Audit™ | Customer Value Roadmap™ | Loyalty Blueprint™ | Customer Value Optimization™ |

Figure 14 End-to-end lifecycle services (Touchpoint Experience)

Source: Building Customer Advocacy (2004).

Each Touchpoint has cost and time associated with it and provides critical input to a process. Touchpoint analysis methodology is to define, analyze and optimize the Touchpoints. The first step is Touchpoints identification- how many Touchpoints there are and what they are; the second step is Touchpoint evaluation- whether the Touchpoints work well and add value to the process, whether there are redundant Touchpoints and missing Touchpoints that caused inefficiency. And the final step is optimization by eliminating or adding Touchpoints in a process. Touchpoint mapping helps prioritize and refine the Touchpoints for better analysis and improvement of a process. Touchpoint management allows companies to optimize all the interactions with existing and potential customers, the external and internal communications as well as process management.

Touchpoint Analysis Methodology has been mostly applied in marketing and consumer relationship management. In this research, the Touchpoint concept will be expanded into all activities in the supply chain and all internal and external interactions from a company's perspective. Touchpoints in this study are identified not only between different functions of an organization- Sales, R&D, marketing, finance, sourcing,

production, packing and shipping, quality assurance, and database management, etc. but also in different supply chain roles- farming, ginning, spinning, knitting, finishing, cutting & sewing, printing, dyeing and retailing. Touchpoint mapping in this research is based on the Touchpoint analysis methodology and the platform of Microsoft Visio, which is easy to use and widely applicable.

Case Study- Local supply chain of TSD Carolinas T-shirt

The data collected for this research concentrates on the local supply chain of a T-shirt. The data used were compiled from businesses in making T-shirt and selling T-shirt all within North Carolina. TSD Carolinas by TS Designs is a t-shirt brand that is grown, made, sold fully locally. The complete local supply chain of TSD T-shirt starts from farmer, ginner, spinner, knitter, finisher, cutter, sewer, printer, dyer, to the retailer.

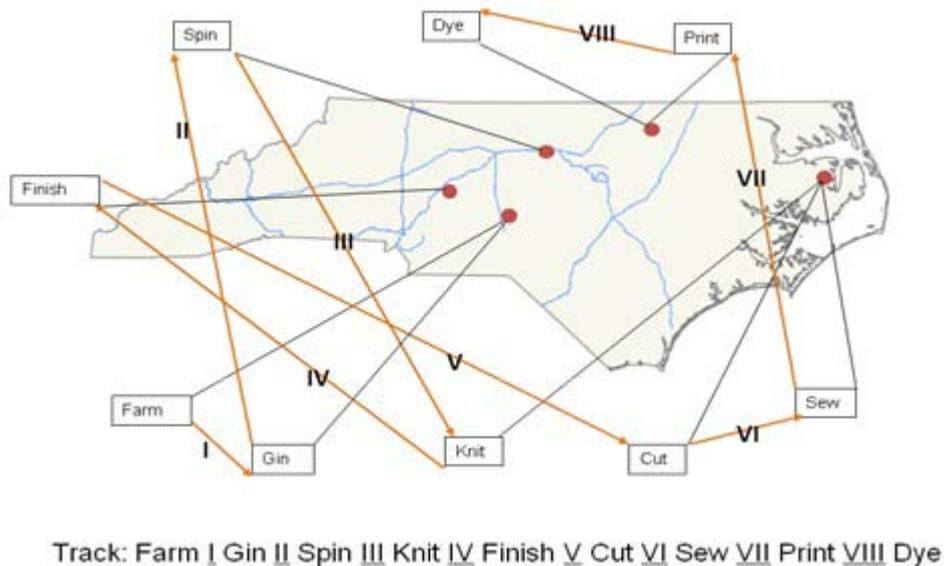


Figure 15 T-shirt tracking of local Supply Chain

In data collection and utilization, the research follows these steps A) Setup visits to each process in the product pipeline B) Setup visits to each transfer point C) Interview the relevant personnel for each supply chain element D) Collect information/data and enter into the framework E) Develop a map characterizing the local supply chain using Touchpoint analysis F) Validate the maps and information collected.

The interviews were set up via email or phone calls at least one week ahead. Two on-site visits were conducted before and after the mapping. Taking TS Design for example, during the first visit, the CEO and CIO provided large pool of information towards interview questions that had already been listed in the pre-research. In the second visit, the CIO had a review of initial map and corrected the information collected. Questions raised during the interview include but not restricted to:

1. What role do you play in the textile supply chain? Could you describe your job title and responsibility?
2. Describe your suppliers and customers.
3. What product information is communicated to your suppliers and customers?
4. What steps and processes are included in this section of the supply chain?
5. What is the time consumed in each process mentioned above? Which step is the most critical and why?
6. How many different products do you produce and market?
7. How many new products do you market each year?

8. How do you decide on which new products to offer?
9. In your work experience, describe the ongoing problems.
10. Describe your plans to improve any parts of the system.
11. How do you achieve the optimal value in each step of product processing within this section of the supply chain?
12. How many employees are there in this section of the supply chain?
13. How does the market influence the working process?
14. Describe the personal contacts within and between the sections of the supply chain.
15. Describe the technology solutions of your section of the supply chain.

Data Sources

The companies involved in this research include Thurman Burleson & Sons Farm (Richfield, NC), Rolling Hills Gin, LLC (New London, NC), Hill Spinning (Thomasville, NC), [Mortex Apparel (Wendell, NC), MoCaro Dyeing and Finishing (Statesville, NC)], TS Designs (Burlington, NC) and Great Outdoor Provision Co. It is estimated that 50% of cotton grown in North Carolina is shipped overseas to be manufactured into finished products, and then shipped back to the local store for sale.

However, T-shirts grown, made and sold in NC only travel less than 750 miles, compared to 17,000 miles from globally-sourced cotton shirts. Partnership with upstream

suppliers and downstream customers to achieve a local supply chain community has contributed to the local economy, higher transparency, and low transportation footprints from field to printed shirt.

CHAPTER FOUR

RESULTS

Farmer& Ginner

Thurman Burleson & Sons Farm is the first step in the Cotton of the Carolinas project. The farm located in Richfield of North Carolina brings cotton back in 1991. The cotton used is grown from conventional, Monsanto Roundup Ready cotton seed.

Rolling Hills Gin, LLC, first established in 1996, has long been involved in the business of ginning for local planted cotton. The gin uses a combination of wire screen, teeth and hooks to pull the cotton through and to filter the debris and short fibers out while brushes help remove the loose cotton lint to prevent jams.

In the past, the ginner received the order from the spinner, the next player down the supply chain. However, for the 2010 cotton harvest, the order for cotton comes directly from TS Designs [the printer and dyer], who purchases cotton of the Carolinas and ships to the spinner. For the 2009 Harvest, a traditional pull system for demand was used. It was found that this traditional method had a stock-out of certain sizes and no opportunity to re-manufacture with Cotton of the Carolinas. Pre-purchasing Cotton of the Carolinas and then processing in batches will help is maintaining an inventory of sizes that are in demand. If Cotton is not pre-purchased, the cotton price is currently fluctuating

almost every 30 minutes which makes quotation for cotton quite difficult and challenging. In order to optimize cotton inventory, to facilitate the cash flow, and to keep waste down, the T-shirt printer and dyer now takes the overall control in the upstream supply chain.

The price of cotton has hit around \$1.72/lb in February 2011 compared with \$0.80/lb in February 2010. Cotton price per 100 lbs has been tracked and the results are shown in Figure16 and Figure17. This increase is not short-term. The surging price of raw materials will lead to the expected increase in the prices of textile products around 30-100% over the next 6 months. According to the yearly trend in Figure16, this year hit the highest price point in the past decade with a dramatic jump in the past year.



Figure 16 Cotton prices Jan. 2008- Feb. 2011 (Monthly)

Source: Barchart- Future Market

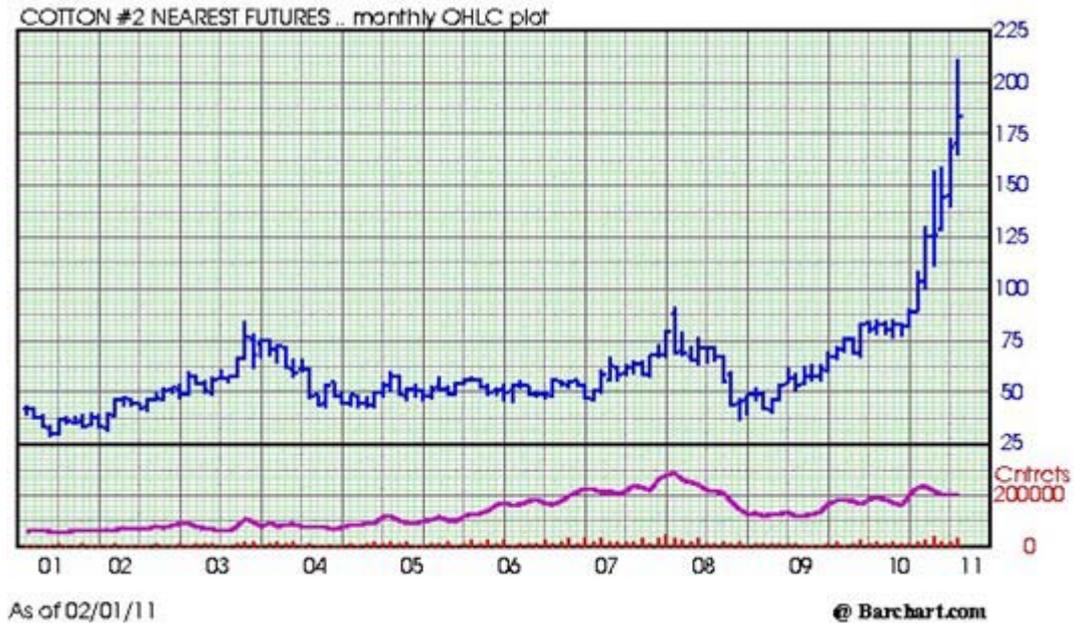


Figure 17 Cotton prices 2001- 2011 (Yearly)

Source: Barchart- Future Market

Cotton in the Carolinas is typically planted in April, and harvested in October each year. In October, the fields are dry enough for picking and cotton plants are defoliated easier for mechanic picking. The stalks break down in winter and decompose into the field. Cotton is planted in evenly spaced rows, perfectly aligned for the picker. For the 2010 harvest, the picker automatically wraps the cotton with yellow wrappers. It is new John Deere equipment introduced in 2010 that makes the new wrapped round bales.

There are 6 Touchpoints in the ginning process, regardless of production details on the machine such as moisture control, cleaning and bales pressing. The compressed cotton is wrapped into modules which are sent for ginning. After ginning, the bales are shipped and stored in the warehouse. Trash or seeds are not wasted but sent to the oil mill or

processed to feed cows or cattle.

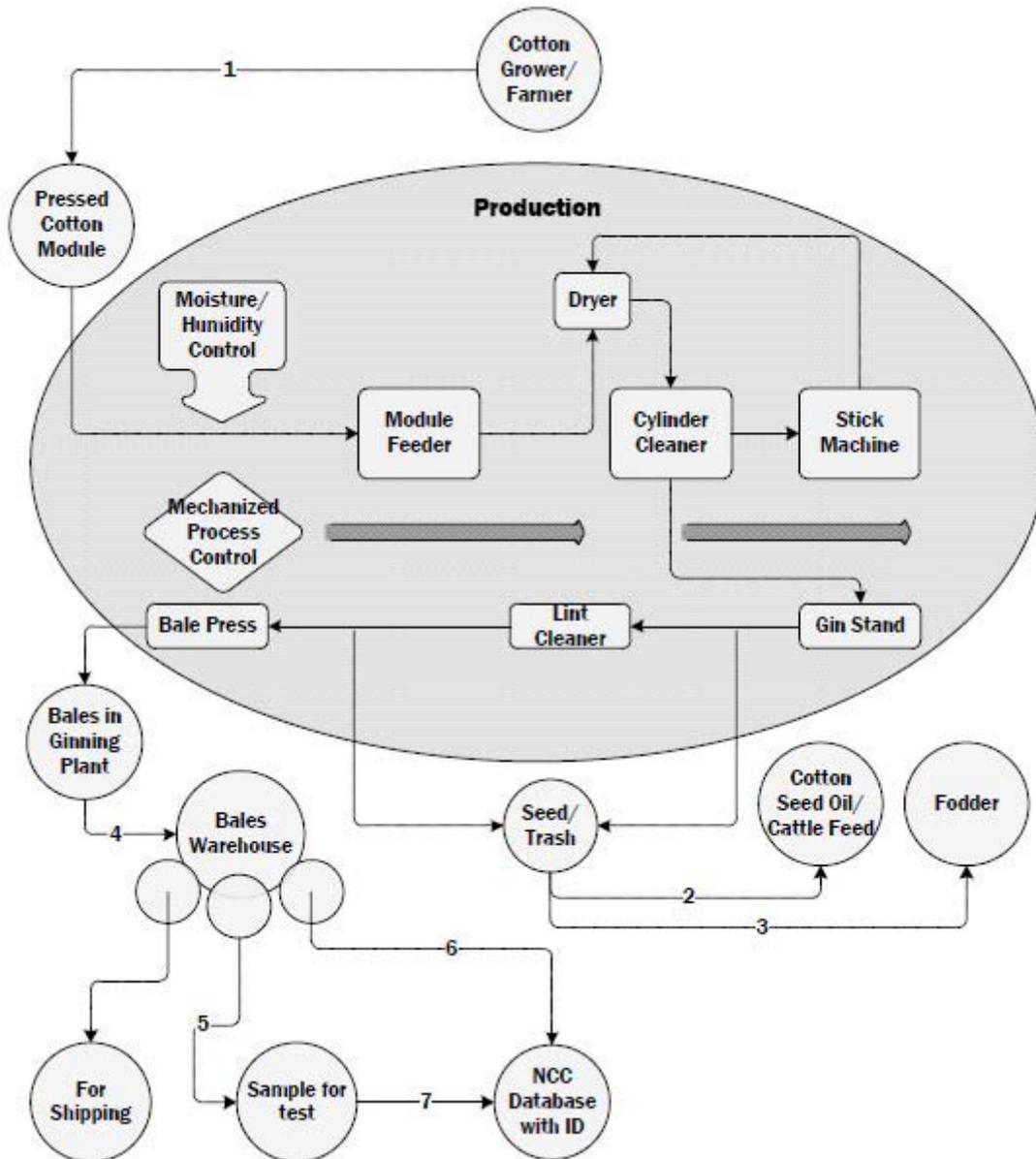


Figure 18 Saw Ginning Touchpoints

1. Cotton Gower/ Farmer → Pressed cotton Module

Cotton picked and wrapped into pressed modules;

Modules are transported from fields to the ginning plant

2. Seed/ Trash → Cotton Seed Oil/ Cattle Feed

The seeds and trash during ginning process are used to feed cattle or to produce cotton seed oil

3. Seed/ Trash → Fodder

The seeds and trash are also used by farmers for fodder

4. Bales in Ginning Plant → Bales Warehouse

The bales are shipped from the plant to the nearby warehouse for distribution to different buyers

5. Bales Warehouse → Samples for test

Samples are selected from the bales warehouse for characterization

6. Bales Warehouse → NCC database with IDs

Each bale is labeled with ID and the IDs are entered into the database of the National Cotton Council

7. Samples after testing → NCC database

After tested, the bales are characterized into different categories based on parameters such as fiber length, strength, etc. The information is then sent to NCC database.

The compacted cotton modules full of seeds and plant matter are transported from fields by truck to the ginner. Saw Ginning [**Pavendhan, 1993**] here is basically mechanized with several machines controlling the process illustrated in Figure18.

Approximately 40 bales are processed per hour. Modules are sent to the module feeder and mixed with hot air which makes cotton moisture, loose, unstuck and ready to be cleaned. Further down the line, fibers are pulled from the seeds and taken onto extra cleaning process which keeps the fibers more aligned. The seeds separated from the fibers fall into the bottom. The cleaned cotton is then compressed into bales by the automated machinery. A sample of each bale is taken and tested for staple length and quality before the bale is packaged for storage and shipping. The bales are labeled to differentiate the cotton and shipped to the warehouse and offered for sale.

Spinner

Hill Spinning Mill, established in 1941 is a private cotton processing company incorporated in North Carolina. The technique for processing in this mill is basically ring spinning which differs from mule spinning or rotor spinning. The mill offers Ring Spun Carded Yarn, Ring Spun Combed Yarn, Ring Spun Slub Yarn made from organic cotton, cottina cotton and cotton of the Carolinas. Yarns are available on cones or dye tubes in a knitting twist, weaving twist, or reverse twist.

There are 8 Touchpoints in the spinning process, regardless of the details in production that turns the compacted ginned cotton fibers into yarns. Spinning activities involves cleaning, carding, and draw frame blending to combing, roving, and finishing. First, the compacted bale is beaten to loosen the cotton into manageable fibers for the

cleaning process. After then, the carding process is to straighten and smooth the cotton fibers breaking up any fiber locks, and to make fibers aligned. Carded fibers are blended to create slivers of consistent thickness for the next combing process which removes the short fibers to make quality fabrics. The carded or combed slivers are drawn and twisted to create roving. The roving is finished up as yarn that is then wound around bobbins prepared for shipping.

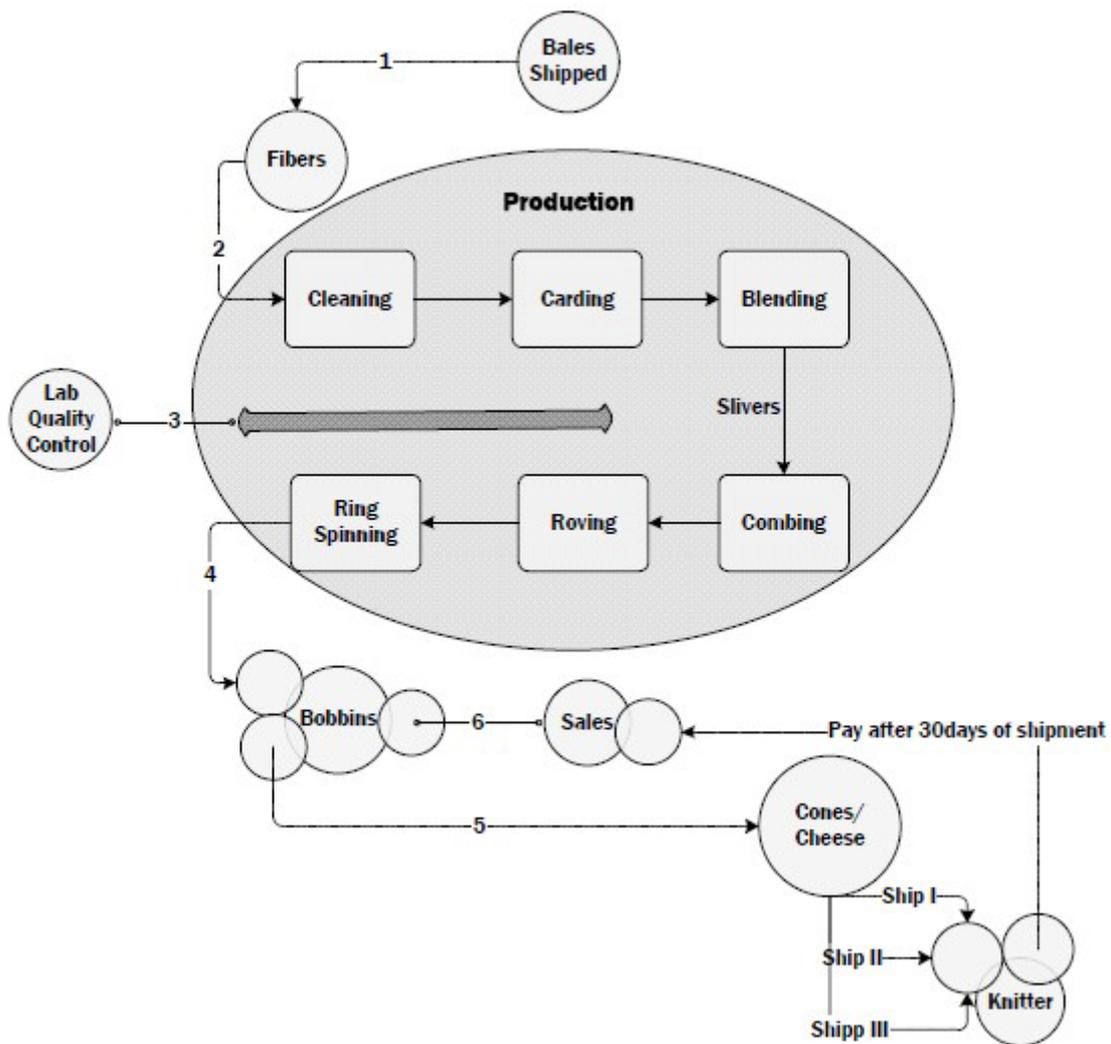


Figure 19 Spinning Touchpoints

1. Bales Shipped → Fibers

The bales are open and loosened into fibers

2. Fibers → Cleaning

Fibers are cleaned before production

3. Lab Quality Control ↔ Production

Lab technician controls the quality of fiber processing and yarn production

4. Ring spinning → Bobbins

The roving are spun to create yarns on bobbins

5. Bobbins → Cones on new Murata Winder

Yarns are wound on the cone of various angles for storage and shipping but the CoC goes to Mortex and is picked up by the Mortex truck

6. Bobbins ↔ Sales

Sales makes connects and relationships with the market to develop new yarns or to market the existent yarns and slivers. The Cotton of the Carolinas yarn is collected by Mortex truck and transported to Mortex in Wendell for knitting.

In the production, lab technician controls fiber and yarn processing by evaluating facility parts, testing on fiber or yarn physical parameters such as weight, fineness, yarn count, and number of twist, etc. to ensure consistent quality. After fibers made into yarns, yarns are wound on the bobbins prepared for shipment. There is an important Touchpoint

connection between yarn and sales because sales help bring in orders as well as new market trend or new materials.

During the visit to the mill, the manager introduced cationic cotton which is a technology when cotton is modified in order to be dyed differently from regular cotton. Cottina Cotton absorbs dyes easier and quicker with less water and dyes without any chemicals. Cottina Cotton also has superior wash fastness which enables good appearance of fabrics after wash and wash again. The shorter dye cycle not only means less energy used and higher efficiency, but also more color offerings, inventory savings, and flexibility for the retailers moving fashion forward. Cottina cotton is made in the U.S. with small manufacturing footprint which makes quality control easier than outsourcing. This technique will be applied in denim jeans, denim shirts, socks, hosiery, and T-shirts but not for Cotton of the Carolinas at this time.

Printer & Dyer

Founded in 1977, TS Designs went through several transformations in business models. It grew from a small, manual screen printer, to a fully automated manufacturing company, printing shirts for big brands like Nike, Tommy, Polo, GAP, etc. After the 1993 implementation of NAFTA, however, TS Designs built its new business model based on three equally important bottom lines: People, the Planet, and Profits. Today, TS Designs makes custom print designs on sustainable t-shirts which contribute to reducing

environmental footprint.

TS Designs offers three types of T-shirts: TSD-Organic, TSD-Carolinas (Cotton of the Carolinas), and TSD-Recycled. In this research, the focus is on the best and most expensive line-- TSD-Carolinas T-shirts made from 100% cotton locally grown and made.

The local idea helps reduce the footprint generated by unnecessary consumption and waste of resources like, transportation, land, and manpower. Besides the positive environmental and social impact coming out of the local movement, there is also more transparency that offers consumers a way to track their shirts throughout the entire supply chain.

Each circle with arrow on it stands for one Touchpoint. There are 42 circles in the map, thus 42 Touchpoints. The arrows linking the Touchpoints could be either one-way or two-way.

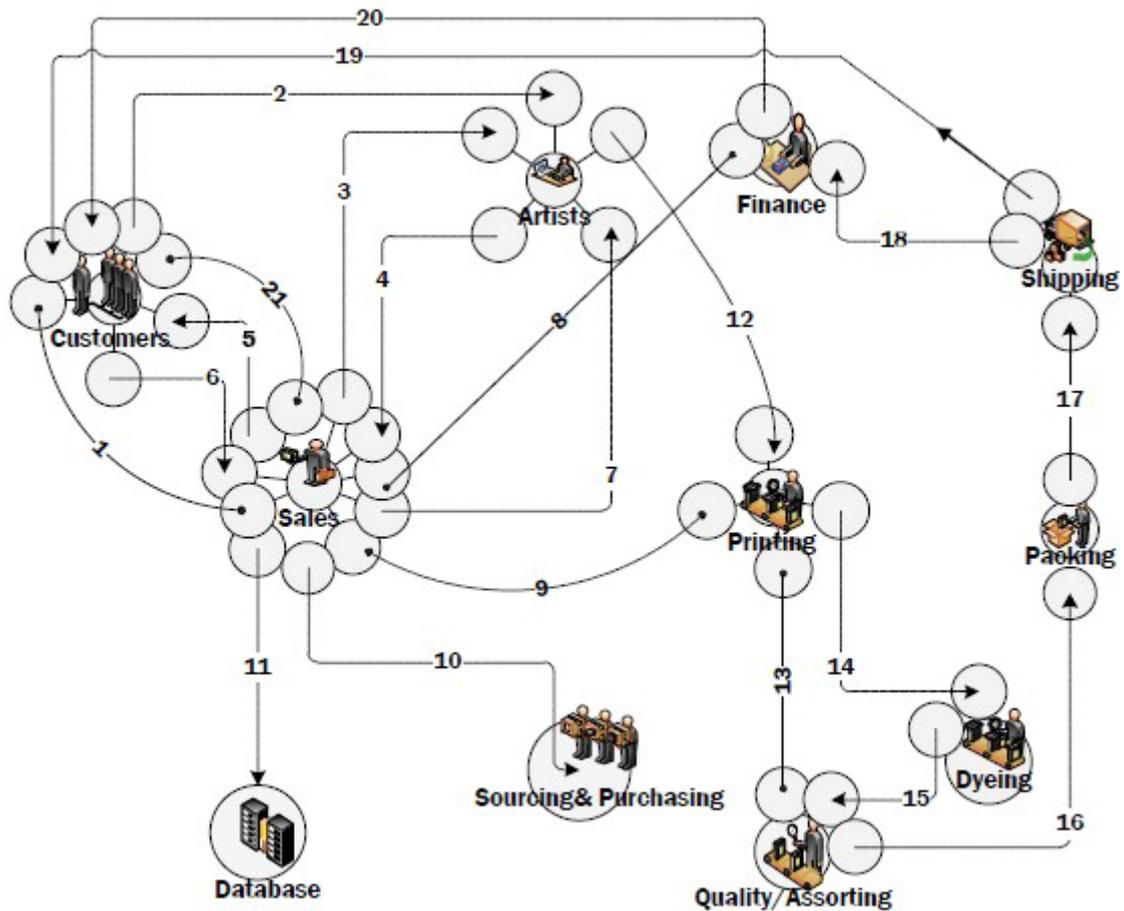


Figure 20 Printing and Dyeing Touchpoints

1. Customers ↔ Sales

Customers and sales make initial contacts by phone call or email;

Customers place the order including T-shirt style, color, and size.

2. Customers → Artists

Customers request quote and upload the artwork online

3. Sales → Artists

Salesperson asks artists to make layouts

4. Artists → Sales

Artists send layouts to salesperson

5. Sales → Customers

Salesperson sends layouts to the customers and quote for the orders

6. Customers → Sales

Customers approve the layouts and order the price

7. Sales → Artists

Salesperson sends the customer's approval to artists for production

8. Sales ↔ Finance

Salesperson communicates with the accountants to invoice 50% deposit for orders

9. Sales ↔ Printing

Salesperson reserves inventory space;

Printing manager works out all schedules (printing/ dyeing/ inspection schedule) and gets back with the salesperson

10. Sales → Sourcing & Purchasing

Salesperson informs sourcing department to purchase solid colored/ white T-shirts

11. Sales → Database

Salesperson enter orders in the computer database to generate paperwork to run orders and to distribute them to each department

12. Artist → Printing

Artists put specifications in bags and make films to production

13. Printing ↔ Quality

After printing, t-shirts are inspected for consistent quality

14. Printing → Dyeing

After quality inspection, t-shirts are sent to the dye house for dyeing

15. Dyeing → Quality/ Assorting

Dyed T-shirts are sent back for quality inspection and assorting based on different colors, styles or sizes.

16. Quality/ Assortment → Packing

After production and assortment, T-shirts are packed in stock and prepared for shipping

17. Packing ↔ Shipping

Packaged T-shirts are shipped

18. Shipping → Finance

The shipping information is automatically shown in the database and Finance department is informed

19. Shipping → Customers

T-shirts are delivered to the customers

20. Finance → Customers

Accountants issue the bill to the customer for payment

21. Sales ↔ Customers Feedback

Sales follow up with the customers and customers provide feedback

The sales department is involved in the most Touchpoint activities associated with such roles as customers, artists, finance and production. Before any orders come in, sales

is responsible for researching the target and potential buyers, especially those companies interested in “green and sustainable” product. Usually sales check out company websites and email or make phone calls to the marketing director or the owner who make decisions in the company. It is always important for sales to know the buying cycle of each buyer. Typically sales put buyer information into the database and call three months in advance before the buying season of the potential buyer. If any company shows interest, sales would set up meetings with the local buyers and display T-shirts in all categories. Sales would also mail the T-shirts samples in package to the buyers either within or outside the state.

When an order comes in, buyers upload the artwork to the art director with basic questions about styles and colors and place the order specifying style, color and size to the sales. Receiving the order, sales ask the artists to make layouts. With the layouts and schedule, sales get back with the buyer and quote for the T-shirts. In this process, the buyer could negotiate with sales and make changes on the style, color as well as order quantity.

After the conformation of the order, sales send the customer's approval to the artists for production preparation. Meanwhile, sales ask the accountants to invoice 50% deposit for the order and inform the sourcing department to purchase T-shirts for printing. Inks and dyes or finishes are purchased on a regular basis based on estimation and

previous orders quantity, and only T-shirts are purchased on order basis. Sales also reserve inventory space and receive the production schedule from the production manager. At this point, sales enter order information and production schedules into the computer database to generate order paperwork distributed to each department. Artists put specifications in one bag and make films for production. With inventory, inks and bags all ready and the copy of order put on board, the order runs and production begins.

After printing, T-shirts are inspected to ensure consistent quality and sent to the dye house for dyeing. Sometimes the T-shirts are only printed but not dyed according to the customer request. The dyed T-shirts are sent back for quality inspection and then assorted based on colors, sizes or styles and packaged for shipping. When T-shirts are shipped out, accountants invoice to the customers for order payment. Sales confirm order with the buyer by sending out the automated tracking information and follow up with the customers for feedback to make sure the order is fully entertained.

Retailer

Founded in 1972, Great Outdoor Provision Co. deals with outdoor apparel, footwear, and outdoor-gear merchandise such as camping equipment--tents, packs, and gear, etc. The company offers opportunities for consumers to paddle, cast, tread, feel and taste the products, as well as paddling sessions, boat demos & fishing classes in the field and on the water. In addition, Great Outdoor Provision Co. supports local land trusts

which acquire land for protection thus preserving open space for adventure, and Scout Troops which provides the leadership and skills that enable young people to safely enjoy the wilderness.

Touch points in the retail environment can be grouped into three main categories based on the interfaces: consumers-retailer, retailer-vendors, retail stores-distribution center.

A. Retail Stores- Distribution Center.

There are seven retail stores located in different cities in North Carolina- Raleigh, Wilmington, Greenville, Charlotte, Winston-Salem, Greensboro and Chapel Hill. Among them, the one in Raleigh also provides as the distribution center that delivers products to other stores in the distance range of 26.6 miles to 170 miles.

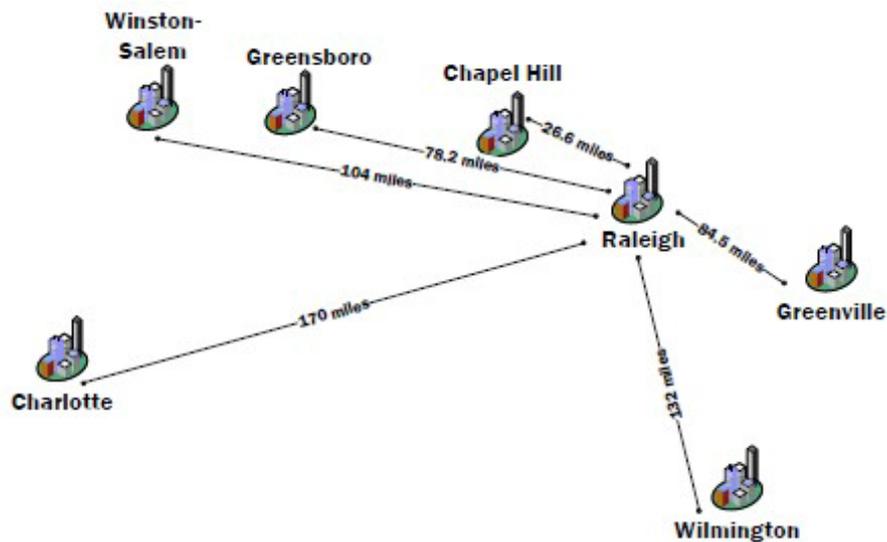


Figure 21 Locations of Retailer

B. Consumers- Retailer

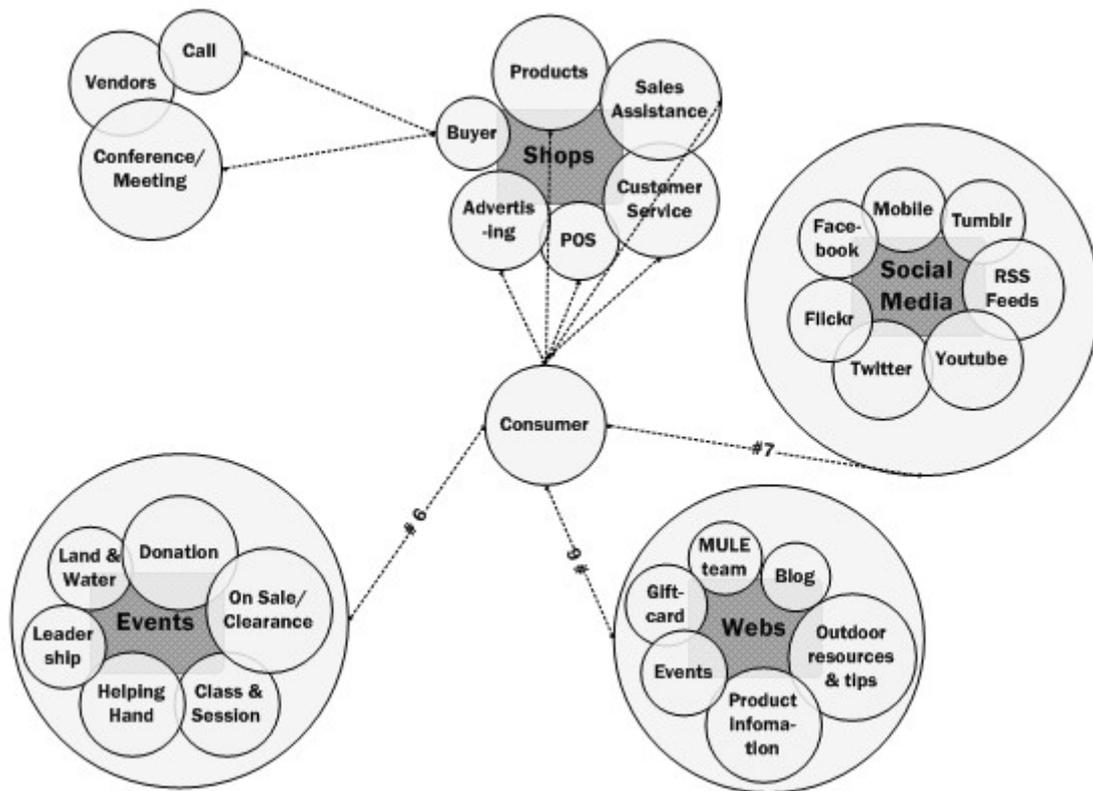


Figure 22 Retail Touchpoints

Each time when a consumer touches the physical product, information, or service is one touch point. Webs, events, social media and stores are the main channels that bridge consumers with the products and retailer. To quantify the touch points, consumers have 6 touch points with “events”, “webs” and “social media” each related with the products and the company.

Consumers get access to the websites learning more about the brand and products. They can search the database of items in the virtual shop in a variety of ways based on

their preferences. By registering online, consumers could get year-round benefits and exclusive deals for shopping. Newsletters and emails are sent regularly to keep them updated and to reinforce the consumer relationship, thus triggering additional touch points. Unlike companies which operate web-based transaction as well as offline shops, this company only sells gift cards online which avoids traffic and other problems associated with online commerce. However, detailed product information is all provided and consumers could contact a local shop for product availability. In this case, the retailer specialized in outdoor equipment or wearing and the target consumers are supposed to be interested in outdoor activities. The website then builds a convenient and useful platform for them to seek guides and tips for outdoors, and to dig more about the products behind the scene such as the suppliers and the manufacturers.

Social media is recognized as today's word-of-mouth, which has accelerated the consumer adoption cycle or decision process from the initial stage of information gathering, to selection and purchasing, and to the post-consumption stage. **[Patti& Chen, 2009]** When consumers are searching for information and messages, they could rely on what other people talk about the product, service or the brand. Social media such as Facebook, Twitter, Tumblr, Flickr, and mobiles is effective for the company in retaining consumers and tapping new consumers based on input from satisfied customers. Therefore, social media benefits not only the consumers by disclosing public speech and

comments but also the companies that offer the products or service by connecting with existent and new consumers in the future.

Companies also seek to engage consumers in relationships and take actions to show that they are reliable and trustworthy by coming up with these events- “Land& Water”, “Leadership”, “Helping Hand”, “Donations to Charity”, “Sales or Clearance” and “Classes& Sessions”. Sometimes consumers get access to these events by getting tickets from social media or company websites. The events or promotions touch the consumers by showing that the company is not only caring about them but also all human beings, environment and the planet. When consumers become comfortable with the company, more Touchpoints and contacts will be cultivated. Additionally, through direct interaction with the consumers, companies could research their needs and wants to provide them with tailored products and services to their satisfaction or even beyond their expectations.

Through the webs, social media and events, consumers may or may not touch the real products. However, the Touchpoints that take place in these channels affect the consumers’ attitude and purchasing behavior in the real store. On the other hand, the original plans before buying may change with the influence of in-store experience and touch points with the real product. In the store, Touchpoints occur between the consumer and the salesperson or customer services. Touchpoints also take place when the consumer absorbs information from in-store advertisement or promotion. The retailer adopts “graphical visual solutions” to make labels and paper prints for advertising use.

Consumers bring coupons that are received from webs, events or social media to the retail store and get discounts on their purchase.

What makes a Touchpoint in store different from other channels is the dimension associated with it. Touch points in store are three dimensional- informational, personal and physical. Physical touch point refers to the one between consumers and physical products. Informational and personal dimensions indicate that consumers are informed and have the opportunity to communicate or to interact with people, the dimensions that could also be obtained through webs, events and social media. Regarding to the product availability in each 7 retail stores, there are basically 2-3 color options and 250 items of each color.

Both consumers and companies benefit from Touchpoints. Touch points bring consumers and companies closer and develop relationships between them. Through touch points, consumers make good choices and obtain what they want and need more efficiently. For the companies, they benefit by having a pool of consumers that may generate repeat purchases and positive word-of-mouth which brings in more potential consumers.

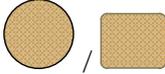
C. Retailer- Vendors

In the vendor-buyer relationship, there are Touchpoints that are different from consumer touch points discussed above. For the retail buyers, the first step in purchasing

is to identify vendors. For Great Outdoor Provision Co. the company selects vendors defensively such as The North Face, Columbia Sportswear, and TS Design. The company emphasizes on the vendors' capabilities in distribution, reliable delivery and the profit margin that could be brought to the retail side.

Local Supply Chain

The mapping of a complete supply chain for TSD Carolina T-shirts is depicted in Figure 23. It is drawn on the platform of Microsoft Visio. Some symbols used in mapping are explained as following:

 : Farming, Ginning, Spinning, Knitting, Finishing, Cutting& Sewing, Printing& Dyeing, Retailing, the eight primary stages aligned with the pipeline

 : One-way flow of information, payment or products

 : Two-way flow of information, payment or products

 : Each step involved in making or selling the product, which is considered to be a Touchpoint

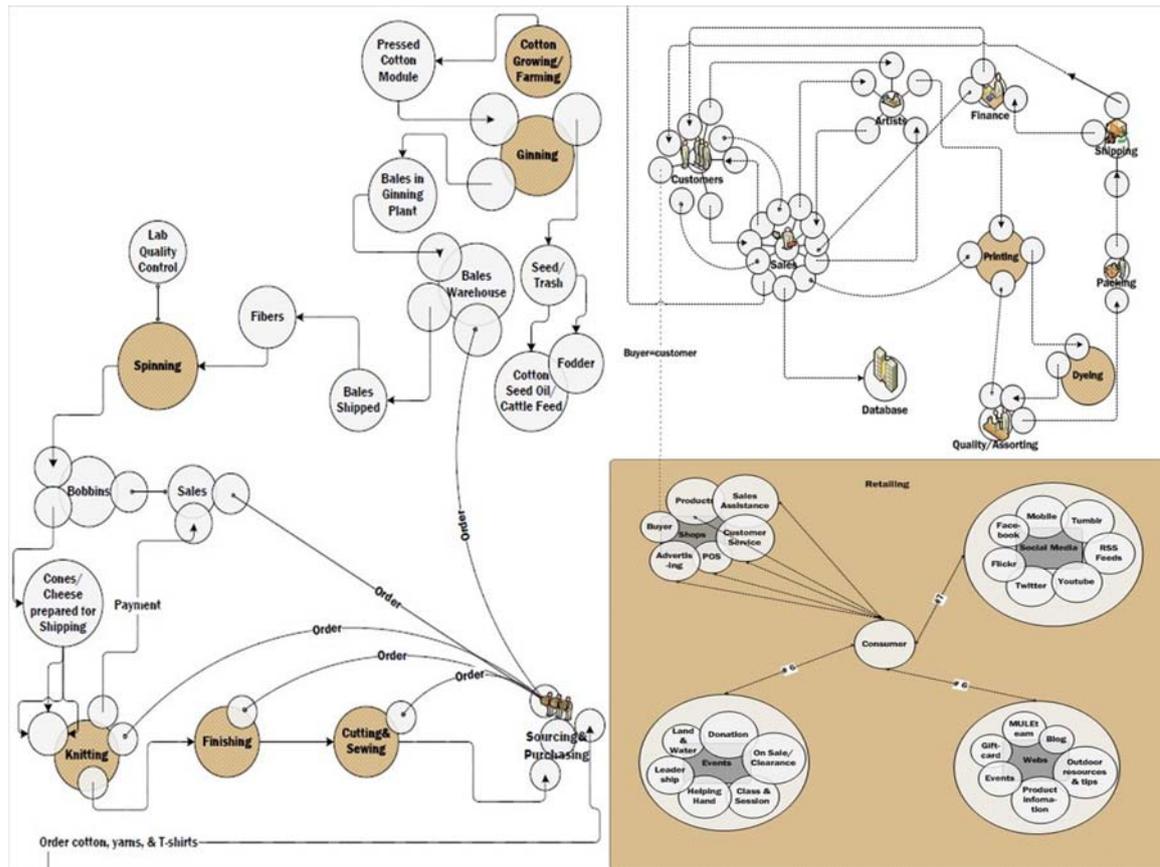


Figure 23 Touchpoint Mapping of Local Supply Chain for TSD Carolinas T-shirts

There are more than 100 internal and external Touchpoints mapped out in total, 45 of which are created from the sector of printing/ dyeing. Knitting, Cutting, Sewing, and Finishing are considered as the black box in which first-hand data was not collected in this research. However, Touchpoints involved in the black box can be referred to the Appendix. On the retail side, the actual Touchpoints are countless because of the complexity embedded in social media. For easier estimation, Mobile, Tumblr, RSS Feeds, Youtube, Twitter, Flickr and Facebook are counted as the seven Touchpoints as social media tools that the retailer has used, however, it doesn't mean that there are only seven

Touchpoints via social media. For example, one piece of content on Facebook or one video published on Youtube would be touched by hundreds and thousands of audiences who may or may not be the target consumers.

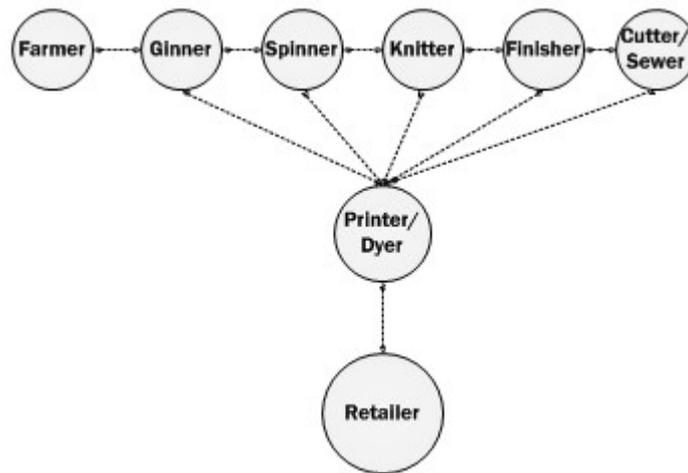


Figure 24 Simplified Framework of Local Supply Chain for TSD Carolinas T-shirts

In the simplified framework (Figure 24), it could be concluded that the printer/dyer is associated with the most Touchpoints compared with other players. The printer/dyer plays the role of Chief Supply Chain Officer if the complete supply chain is regarded as an organization. It is the important linkage between the upper and the lower side of the supply chain.

Internal Touchpoints are introduced and explained in the previous sessions of this chapter. By getting all stages of the chain together, more Touchpoints could be identified due to the external linkages of each stage. It could be seen in Figure 23 that a single point critical for the linkage is “Sourcing& Purchasing” which has connections with all the players in the supply chain. The buyer on the retail side orders from the printer/dyer and

specifies the artwork, size and color. After confirmation of the order, sales notify the sourcing& purchasing department to order blank T-shirts for custom printing and dyeing. It is the printer/dyer who directly orders cotton from the bale warehouse. After ginned, cotton is delivered to the next steps for spinning, knitting, finishing, cutting and sewing. The blank T-shirts are then sent to the printer/dyer to finish up the production processes and to be packaged for shipping to the retailer.

CHAPTER FIVE

CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

Conclusion& Implications

This paper has mapped the local supply chain for TS Designs' Carolinas T-shirts in North Carolina by applying the "Touchpoints mapping" methodology. In the second chapter, topics related with supply chain and mapping tools were discussed. To better understand the philosophy behind the ongoing operations of a supply chain, it is critical to map the chain out for further analysis and improvement. "Touchpoints mapping" methodology is identified as a place to start. Local supply chain for TS Designs' Carolinas T-shirts was selected as a case study conducted to apply this methodology to a specific situation. To investigate the TS Designs' Carolinas T-shirts pipeline, the first step was to identify local supply chain players in the Carolinas, and second is to setup visits to the companies and interviews with the relevant personnel for each supply chain element. Next is to collect information/data and enter into the framework. After all information collected, a framework was developed and validated for characterizing the supply chain with Touchpoint analysis. The final process is to expand the Touchpoint methodology to the supply chains in a broader sense by analyzing the map or framework of the local supply chain that has been studied in this research.

The local supply chain studied in this research could be characterized as an industry cluster within 750 miles in North Carolina. All parties involved in the supply chain share the common goal of local, sustainable products. This goal has brought them on one table driving the local business through integrated efforts.

There are over 100 Touchpoints mapped out for a local supply chain of TSD Carolinas T-shirts. Process points have been discussed a lot in the literature however they only take up a small portion of the total Touchpoints in this research. The most Touchpoints take place in the stage of the printer/dyer, which indicates that the printer/dyer controls or manages the local supply chain for integration. The printer/dyer is the leader of the local supply chain organization for TS Designs' Carolinas T-shirts. It touches the upstream suppliers as well as the downstream retailers. Most of the Touchpoints on the retail side are associated with consumers. Only the T-shirt printer has direct connections with the retailer. The ginner, spinner and knitter are not fully aware of who is selling the T-shirts made from their cotton or fabric. This disconnection may lead to longer response time to the market and thus the reduced pipeline velocity.

To establish a single supply chain organization that manages the supply chain across all geographical regions may be tougher to accomplish. It is much more difficult to manage a global supply chain as an organization. Each Touchpoint is associated with two dimensions- cost and time. There should be much more Touchpoints for a global supply

chain compared with a local one. The additional Touchpoints may come from tangling with the problems such as the remote control of quality, high training cost, inventory inefficiencies, longer lead time, complicated payment method, cultural or language differences, and delays in logistics or delivery variables. A local supply chain outperforms a global one when labor cost in some developing countries has increased. For a specialised line of business, e.g. the green and sustainable TSD Carolinas T-shirts manufactured locally in this research, an integrated local supply chain should be the right choice.

The printer/dyer is aware of both the internal and external information for knowledge management. External knowledge is based on the relationship and connections with other partners along the supply chain. Internal knowledge refers to the order quantity for ginned cotton and dyes, which is determined based on the sales of T-shirts in previous years and an estimated increased demand. By doing this, the company has better control of the T-shirts availability while maintaining effective inventory of blank T-shirts. In previous years, the company ordered all the shirts up front which led to overstock of blank shirts and inadequate offerings of shirt sizes catering to the dynamic consumer's market. Since 2010, the company orders ginned cotton themselves instead of passing the order all the way backward to the ginner. The blank shirts maker hold the yarn inventory for the printer as to reduce waste when extra yarns are left after a production cycle, and to ensure in-time availability of shirts if the demand

varies. The shift in the purchasing power of cotton is also influenced by the surging cotton prices. Cotton price is so volatile that it would change, most likely increase when the order of cotton comes from the spinner. Therefore, the printer/dyer orders cotton all the way to the end against short-term price jumps.

In a typical supply chain, the retail either outsources external distributors or operates its own distribution center internally. In this case, the retailer has seven retail stores, one of which is the distribution center. The distributor determines order quantities from the different vendors or production facilities for multiple products and SKUs. The retailer in this case has a specialized line of business only dealing with outdoor related products. Therefore, it is not necessary for them to rely on an external distributor for purchasing products on highly diversified basis. The roles of retail buyer and distributor have overlapped in this local supply chain studied. The retailer decides on order quantities of products served on the store shelf and holds the inventory in its own warehouse. The Touchpoints in distribution in this case has been reduced, which adds velocity to the supply chain.

Recommendations

The local supply chain in this research could be regarded as a single organization with manufacturing, wholesaling and retailing functions all in place. The printer/dyer is the Chief Supply Chain Officer that is connecting all functions throughout the value chain.

It is recommended to add a Logistics Manager in the organization to integrate interrelated supply chain activities. The Logistics Manager is a single entity who is responsible for product flow from one place to another in a timely manner. Shipping notice and order status are automatically sent to the logistics manager who arranges shipping and delivery instantly. Any possible delays during transition traditionally could be more or less prevented, thus adding velocity to the chain. What's more, the logistic information and order status are elevated to a higher level so that everyone in the organization could track the order from end to end.

It has been summarised that retail Touchpoints are connected with the consumers and the printer/dyer, but not other upstream suppliers. To address this problem, integration effort is needed to optimize the Touchpoints in the supply chain. Retailers and their suppliers need to be more closely connected through shared information such as Point-of-Sale data from stores. By doing this, there should not be delays caused by hand-offs or buffers between the different stages from upstream to downstream supply chain. For example, it would be better for the cotton ginner to know how the end market performs and what is the demand of the retailer so as to start production in an instant manner.

The integrated supply chain does not include the retailer, who is an important player closely linked to the consumers and the end market. In order to link all the

Touchpoints together and to achieve a real integrated supply chain, all the players in making T-shirts should touch the retailer, not only the printer/dyer. Co-ordinating and integrating the flow of information and material is critical if quick response to changing fashion is to be achieved. To build an agile and responsive supply chain, all supply chain players should be more engaged and connected through shared information on real demand to make sure that there is no gap between what the retailer plans to sell and what the manufacturers plan to produce. It is recommended that the retailer shares POS data and information with the suppliers for them to plan replenishments on a regular basis. The order quantity and supplier quantity are usually the minimum information that the players may share throughout the chain. Cost and capacity related information is considered to be private and not revealed typically. However, all players should get together to have a collaborative plan towards production, supply and replenishment based on the shared historical data and forecasts. By joint planning, suppliers and retailers benefit from higher productivity and profits, rapid financial flow, quick response and customer satisfaction. Network system could be relied on by all parties to link their business processes and to transfer information including order and inventory status, product features and designs, demand and forecast.

CHAPTER SIX

LIMITATIONS AND FUTURE RESEARCH

Limitations

1. This research was focused on a case study of the local supply chain in North Carolinas. It may not be generalized to include other types of supply chains.
2. The product studied in this research is TS Designs' Carolinas T-shirt. The supply chain configuration or mapping may vary on the product basis.
3. Results and data collected are based on on-site visit and personal interviews. Therefore, the information is specific to the product being made. Other products may use different processes.

Future Research

1. Future research could include more textile products to extend the applications of Touchpoint methodology to other situations and supply chains.
2. Touchpoint mapping methodology could be further developed on a more advanced platform or software
3. Conduct Touchpoint analysis upon a global supply chain for better understanding of the difference of the supply chain under local versus global senario.

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APPENDIX

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