HIGHLIGHTS FROM THE NATIONAL COTTON COUNCIL'S VISION 21 - COTTON FLOW STUDY

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Abstract

This paper contains excerpts from the Executive Summary and the Final Report that Wilbur Smith Associates (WSA) produced for the National Cotton Council (NCC) in 2010. The WSA study team (see acknowledgements) used several approaches to learn about the U.S. cotton industry and cotton industry issues. WSA concluded its study by reframing a number of hypothesizes in the form of recommendations that were reviewed by the NCC Vision 21 Cotton Flow Study Committee. Several of those recommendations were approved by the study committee and submitted for future consideration by the NCC delegates at the 2011 NCC Annual Meeting.

Introduction and Purpose

In 2009, the NCC initiated a study of the actions necessary to improve and reduce costs associated with the flow of U.S. cotton from cotton bale formation to textile end users. The primary objective of the study was to identify the cotton flow strategies, systems and practices that the U.S. cotton industry may employ to lower costs or improve returns, while meeting the demands of moving cotton into export markets and simultaneously servicing the domestic market.

The WSA team, with input from the cotton industry, identified the following areas of study:

- An examination of the performance gains that can be achieved by improved coordination of bale selection processes, shipment scheduling, and merchandizing.
- An assessment of efficiencies through bale data collection and dissemination methodologies.
- An investigation of innovative practices that result in better infrastructure utilization.
- A critique of bale management systems, beginning with cotton bale formation and ending at the textile mill opening room.
- Recommendations for best management practices at each major stage of bale handling and information flow, with the objective of optimizing cotton flow.

According to the WSA team these are areas where changes or improvements will likely improve the efficiency of cotton flows and reduce industry costs.

The purpose of the cotton flow study was to research and survey the various segments of the cotton and allied industry to comprehend how cotton flows following bale formation until delivered to end-users; to prepare recommendations to improve data systems and merchandizing techniques; to maximize domestic and international sales; and to present strategies and techniques for improving efficiency and lowering warehousing and logistics costs. This study was a component of the Vision 21 initiative, a comprehensive effort of the NCC, Cotton Council International (CCI) and Cotton Incorporated (CI), aimed at gaining critical information about cotton's position and potential in the market place.

The study effort was conducted in four phases including: 1) research and data gathering, 2) conclusions regarding industry status and issues, 3) identification of options to address these issues, and 4) evaluation of options.

Results and Discussion

Industry Survey/Interviews

After the initial formation of hypotheses based on input from a number of cotton industry sources, the study team received feedback from one hundred-eight members of the National Cotton Council, six foreign manufacturers (Table 1) and various industry representatives from trucking firms, logistics firms, ocean carriers, railroads, software providers, and government agencies. A series of phone and web-based survey tools were developed, which were customized for each cotton industry segment, as well as foreign manufacturers.

Table 1: Cotton Flow Survey Respondents

Segment	Producer	Gin	Warehouse	Merchant	Domestic Manufacturer	Foreign Manufacturer
Phone Interview	4	6	12	5	5	6
Online Survey	20	40	16	0	0	0

Source: Prepared by Wilbur Smith Associates

The surveys and interviews focused on two question categories:

- Questions regarding the strengths, weaknesses, opportunities, and threats (SWOT) facing the cotton industry; and
- Questions relevant to the development of methods to improve the cotton flows. In particular, respondents were asked questions aimed at understanding the advantages, disadvantages, and barriers to successful implementation of the hypotheses.

Flow Analysis/Changes in Freight Patterns

Another component of the research was to analyze cotton flows using the Global Insight's Transearch™ database. Transearch is considered the most comprehensive information source for domestic goods flow within the U.S., between North America Free Trade Agreement markets (NAFTA), and between the U.S. and overseas markets. Transearch identified the 2008 historic cotton flows and forecasted the 2018 flows by tonnage and value between the cotton producing states, regions, business economic areas (BEAs), and markets, whether domestic or foreign, that received shipments. The study team also looked at changes in freight patterns that could change the way that cotton flows in the future, such as the expansion of the Panama Canal and the opening of the Port of Prince Rupert.

Comparison to Other Industries

Components of the U.S. cotton industry were compared to other industries. Some of the key findings are as follows:

- Cotton shippers face many of the same problems as other agricultural exporters. Truck/rail intermodal ramps tend to be in major metropolitan areas, as are the available shipping containers. But agricultural production occurs in rural areas, often distant from large cities. This places all Agricultural shippers, in particular cotton shippers, at a disadvantage, because products must be moved long distances to intermodal facilities.
- The information technology tools used by the cotton industry, reflect the unique systems and constraints of the cotton industry. For example, many of the warehouse management (WMS) and enterprise resource planning (ERP) tools used in other industries are absent from the cotton industry. In part, this reflects the unique operating characteristics of the cotton supply chain (e.g. extensive interaction with the USDA, no replenishment of warehouses, unique quality classing system). To some extent it also reflects the size of the firms within the industry, which tend to be small compared to industries dominated by billion dollar enterprises. However, some technologies used by other industries could be transferable.
- The evolution of rail service presents an interesting potential model for the cotton supply chain. In the 1980s railroads essentially offered a single service that was delivered at a single speed: manifest train carload service. Railcars were treated as individual units that would be sorted into and out of numerous freight trains before they reached their final destination. The typical railcar spent far more time in rail yards than as part of freight trains. The carriers later offered a range of new services; so that railcars could be combined into single unit trains that would not be separated and could travel between origin and destination at much faster cycle times. Carriers now offer a range of intermodal container and trailer services with varying transit times and reliability. This multiplicity of service options, including premium high speed service or inexpensive low speed service, could serve as a model for a multiplicity of cotton supply chain offerings.

Least Cost Modeling

The study team used the Texas A&M least cost model to test a number of "what if" scenarios that may impact the flow of cotton. The model applies a detailed cost minimizing mathematical programming model that was developed by agricultural economists at Texas A&M University to represent the U.S. cotton transportation and logistics system. The model's framework minimizes the total cost of shipping, handling, and storing cotton that originates at 673 gins and flows to more than 443 warehouses across the U.S., over four quarterly periods. The model then ships

and stores cotton every quarter to satisfy the imposed demands, while minimizing specified costs. The results from a number of scenarios were included in the final report. Texas A&M used the study to hone it's least cost model and now that the model has proven its worth, it is expected that the model or its successor will be beneficial when it's time to evaluate the multitude of "what if" scenarios needed to improve cotton flow.

WSA Observations

One preliminary observation of the cotton industry is that it is relatively fragmented. The fragmentation of the cotton industry is apparent both in the low market concentration in some segments of the industry, as well as the fragmented nature of the cotton supply chain.

Industry Concentration

With some notable exceptions, the cotton industry is mostly made up of small to medium sized companies. Several segments have large numbers of industry participants, none of which have a particularly large share of the market. For example, there were 673 active cotton gins in 2008, 443 CCC approved cotton warehouses, and thousands of producers growing cotton. The fragmented nature of the cotton industry increases the importance of the NCC and other industry organizations, because of the need to coordinate investments in innovative practices in order to improve cotton flows. For example, Wal-Mart has used its size and market position to dictate supply chain innovations in the retail sector. No one company has the size or scale to exercise the same power within the cotton industry.

It may be difficult for individual industry participants to take advantage of the economies of scale necessary to justify investments in innovative supply chain practices or make other long-term investments due to tight cash flows, perceived risks or fluctuations in cotton production. Because of these restraints on long-term investment strategies, equipment manufacturers are not inclined to develop innovative applications of their machinery that are cotton bale friendly.

Fragmentation of the Cotton Supply Chain

Different entities handle specific pieces of cotton's supply chain. In some instances, incentives are skewed because participants are compensated for performing only one activity within the supply chain without necessarily being penalized for inefficiencies or rewarded for innovations even when practices would benefit the other parts of the supply chain. Table 2 breaks out the numerous activities performed by industry participants and shows who is impacted even though those other interests do not direct the activities. One can see that there are numerous activities performed by industry participants that impact others who do not direct these activities.

Table 2: Supply Chain Activity

Activity (Cotton Bales)	Directs the Activity	Impacted by Activity
Shipping from Gin to Warehouse	Gin	Farmer, Gin, Warehouse, Shipper
Slotting in warehouse	Warehouse	Warehouse, Shipper
Buying and selling cotton in warehouse	Shipper	Farmer, Warehouse, Shipper, Mill Customer
Selecting bales for a shipping order	Shipper, Mill Customer	Warehouse, Shipper, Financial Institutions, USDA, Mill Customer
Assembling (picking, sorting and staging) of shipping order at warehouse	Warehouse	Warehouse, Shipper, Logistics Firm, Financial Institution, Mill Customer
Picking up orders (load out) at warehouse	Shipper	Warehouse, Shipper, Financial Institution, Logistics Firm, Mill Customer

Source: Prepared by Wilbur Smith Associates

Uniqueness of Cotton

The uniqueness of the underlying commodity, baled cotton lint, in terms of how merchandising, warehousing, data and transportation systems are integrated is significant. These unique systems make baled cotton difficult to categorize. A cotton bale shares some common aspects with other agricultural commodities, some with other break bulk items such as paper or wood products, but in the end a bale is easily distinguished from other commodities. This uniqueness complicates the development of solutions to cotton supply chain issues as well as the applicability

of other industry's solutions to the cotton supply chain. Some aspects that impact its logistics and handling are as follows:

- Like many other agricultural commodities, cotton is harvested during a single short season, but sold throughout the year and as a result:
  - Most cotton must be stored for an unknown number of months before it is processed by the end-user; and
  - A majority of the initial storage facilities that house cotton bales will not be replenished after the harvest and ginning season and will turn their inventory only a single time per season;
- Baled cotton is not handled or merchandized in bulk like grain. It is not stored in an elevator, and it is virtually impossible to merchandize and ship baled cotton like a bulk (comingled) commodity;
- Cotton bales are not readily fungible. Each bale carries a unique title. Warehouses typically hold roughly equivalent cotton bales for multiple entities, but the bales cannot be substituted for each other. Cotton cannot be pulled out of storage facilities at random, as is the case with most types of grain;
- Unlike many other agricultural commodities, cotton lint is classified using high volume, precisely calibrated inspection equipment that gives specific technical measurements, so that each bale is assigned multiple quality characteristics;
- Unlike commodities such as lumber or paper, the quality of cotton varies from year to year by growing area and environment. Because much of the variation is caused by weather, etc., a producer can do little to guarantee a consistent product;
- Baled cotton has a high value per ton compared to other field crops and requires large amounts of financing through the merchandizing process. For example, while grain exports typically sell at somewhere between $100 to $250 per ton, cotton sells for between $1,000 to $2,000 per ton;
- Cotton is a cash crop for many small producers around the world. Since it is a non-perishable good and not grown for self-consumption, it can be stored in small lots to be sold when local prices are at an appropriate level or cash is needed.

Cotton Industry Bottlenecks

Logistics bottlenecks can take one of two primary forms. Either the bottleneck slows the average shipment beyond what would be preferable, or the bottleneck creates a level of uncertainty. Bottlenecks reduce the desirability of the shipper's entire supply chain to the ultimate customer, based upon the extent to which the customer values speedy and reliable deliveries. In the latter case, the shipper and consignee must build the uncertainty into their planning and scheduling through ordering more safety stock, which increases their annualized inventory holding cost. A number of steps within the cotton supply chain create long lead times, particularly for international shipments. However, the greatest source of inconsistency within the cotton supply chain appears to be the warehouse shipping function.

Merchandising Issues

The perceived priorities for merchandising U.S. cotton depend upon one's perception of cotton and whether it is truly a commodity or a differentiated product. On the one hand, some industry interviewees consider cotton to be a commodity, not too different from other agricultural commodities such as grain. Price is the primary element in selling cotton, and most other considerations are of lesser importance. Like other agricultural commodities, the priorities for cotton flow will lie in cost reductions or improving margins. The cost of bringing cotton to market should be minimized. Some contend that in order to achieve a reduction in cotton logistics cost, the industry should move away from sorting cotton by 500 lb bales and instead work with larger increments, or groupings of bales, such as 88 bale case lots or groups of four bales. By grouping bales, the industry can lower the cost of handling bales.

Another perspective holds that cotton is not entirely a commodity. After all, mills go to great pains to sort, inspect, and prepare cotton for spinning. The quality of cotton impacts the speed at which mills can operate. Mills value the detailed classing data that accompanies U.S. cotton. They value the reliability and lack of contamination of U.S. cotton and are willing to pay a premium for this. Shippers value the ability to sort and provide shipments of bales that meet the specific criteria of a customer's order.

Data System Issues

The cotton industry generally uses a different set of supply chain software and data applications than what is used in other industries. The industry has developed a series of cotton-specific applications through organizations such as

Cotton Incorporated, EWR Inc. and others that can be used by members of the industry. In this manner, a single industry-wide series of investments can be shared across a range of organizations. Due to the management of electronic warehouse receipts, the EWR system provides much of the electronic "glue" that links the disparate elements of the cotton industry together.

Warehouse Issues

According to a NCC survey, the typical crew of one or two employees in a cotton warehouse may assemble as little as one container or trailer load of cotton per day. A recent study by Georgia Southern University and Supply Chain Visions found that the typical caseload distribution center can assemble the equivalent trailer or container of freight in about one seventh of the time. There are a number of valid reasons why cotton warehouse shipping is slower. As a starting matter, the typical distribution center is under a single roof using putaway and retrieval systems that allow vertical stacking, whereas traditional cotton warehouses are usually laid out in compartments or in a campus-style with numerous structures using putaway and retrieval systems that do not accommodate vertical stacking. Furthermore, distribution centers typically follow the 80/20 rule where 80 percent of the orders are for 20 percent of the stock keeping units (SKUs), which are clustered into one part of the distribution center. Conversely, traditional cotton warehouses operate in an environment where an 80/20 order rule is not easily accommodated and inventory is typically turned once in a twelve month period. The layout of cotton warehouses, by necessity, is less efficient. On the other hand, warehouse shipping is cotton's largest bottleneck and a top priority for improving cotton flows.

Transportation Issues

Like other agricultural commodities, cotton faces several product delivery challenges due to the rural location of the industry's production, gin processing and storage facilities. In addition, over the past decade, mills in Asia have become the primary consumers of U.S. cotton and this has changed the cotton supply chain from domestic truck-based to international containerized transportation. Since agricultural commodities are essentially low margin products, containing or reducing transportation costs on the longer international journeys will have a large impact on profitability. The transportation infrastructures for truck, rail and ocean vessel shipments are in place and there is no "silver bullet" that will dramatically improve the cost structure for cotton transportation. Instead, coordinated process improvements can provide incremental reductions in transportation that could reduce the overall supply chain costs associated with cotton flows. The NCC can play a vital role in this as many of the supply chain process improvements need to be converted into industry-wide best practices.

During the Cotton Flow Study, the WSA study team did not find a single solution that would radically lower costs and increase revenues associated with cotton flows. Rather, the study team identified a variety of incremental solutions that, taken collectively, could significantly improve cotton flows and reduces costs. The recommendations proposed in the WSA study fall into the following categories:

- Short term recommendations that could be accomplished as part of the NCC's ongoing activities;
- Medium term recommendations that could be accomplished by the NCC and its members in a relatively straight-forward manner. Medium term recommendations would require the buy-in of stakeholders such as USDA, NCC members, and members of allied industries;
- Long-term projects that have significant potential to improve cotton flows. The identified long-term projects would require additional study along with buy-in from stakeholders; and
- Long-term projects that are worth considering, but would best be monitored rather than acted-upon in the short-term.

A brief description of some of the projects WSA included in their recommendations to the NCC Vision 21 Cotton Flow study committee follow. These recommendations are listed in order the WSA study team's presented them to the committee. An example of a WSA short term recommendation is: *"Data Systems 3:* Encourage better use of existing e-commerce tools (and) to offer classes and seminars similar to the gin schools for personnel involved in cotton flow data management." This is a case where an industry consensus exists and only minimal modification of existing NCC policy would be required to implement the recommendation in Data Systems 3. An example of the other type of short term recommendation is *"Warehousing 6:* Recommend changes to trade rules so that warehouses can be rewarded for exceptional (expedited) service." This is an example of a recommendation that could be implemented in a relatively short time frame because both NCC and stakeholder buy-in are required.

An example of a medium-term recommendation requiring NCC and stakeholder buy-in is: "*Data Systems 1:* Continue efforts with Cotton Incorporated, shippers, warehousers, mills, and others to better coordinate warehouse

bale locations with shipping orders that include mill quality needs; consider use of incentives or disincentives to shippers to minimize locations from which bales are pulled." While this medium-term project appears to have significant potential, it is a project where additional study would be necessary before NCC and stakeholder buy-in could be pursued.

An example of a long-term recommendation requiring NCC and stakeholder buy-in is: "*Merchandizing 2, 3 and 4:* Develop pilot program to investigate feasibility of various short ton (ST) units." This WSA recommendation recognizes attempts to use the width of the cotton bale, approximately twenty-one inches and the weight of four cotton bales two-thousand pounds or a short ton, to increase marketing efficiency and minimize bale storage and handling costs. In this case the up-stream consumers of cotton would need to embrace a new merchandizing concept before the recommendation could be implemented.

An example of a project to be monitored is: "*Shipping 1 – 4, 5 and 7:* Various programs to ensure that trucking and container equipment is available when needed and utilized with maximized efficiency." Even though the NCC has policy that addressed this subject, making sure equipment is available and utilized to the max is the type of program that will usually be implemented on a local or regional basis. The role of the NCC in this case is to work with federal and other authorities to make sure the spirit of the recommendation is not violated.

Conclusion and Summary

Given innovations in harvesting and ginning practices, as well as strides in textile technology, why have we not seen similar advances in bale handling, warehousing and cotton flow in recent years? Consider the following observations from the WSA study. The "Conclusions Regarding the Status of the Industry" section of the study included the following observations concerning the cotton industry's limited vertical integration: "With some notable exceptions, the cotton industry is made up of small to medium sized companies (in WSA's opinion) increases the importance of the NCC and other (cotton) industry organizations, because of the need to coordinate investments in innovative practices to improve cotton flows." WSA then went on to discuss what their team referred to as the "Fragmentation of Supply Chain where they commented that… "Different entities handle specific pieces of cotton's supply chain... (leading to) skewed (incentives) because participants are compensated for performing only one activity within the supply chain without necessarily being penalized for inefficiencies or rewarded for innovations even when practices would benefit the other parts of the supply chain…(or stated another way) numerous activities are performed by industry participants that impact others who do not direct these activities."

As previously noted, the study then focused on the uniqueness of the underlying commodity, baled cotton lint, in terms of how merchandising, warehousing, data and transportation systems are un-integrated. Their conclusion is that in most cases the industry's uniqueness dictates the need for industry specific solutions. A similar understanding (and in some cases frustration) is reflected both in the way the committee prioritized the recommendations and in the comments committee members included on their score sheets.

Staff contends that one industry challenge is to find ways to encourage niche equipment and software specialists to scale innovative product offerings so that those enhancements can provide new flow efficiencies and reduce costs for all links of the cotton flow chain. This has been and will remain a challenge because as WSA concluded even the largest raw cotton operations are relatively small when compared to major distribution center (DC) warehouses. Those DC operations and intermodal/container hubs are the target markets for innovative practices and equipment. However, those same innovative technologies could be applied if properly modified and scaled in cotton industry flow system.

At the conclusion of the study, the NCC vision 21 cotton flow study committee reviewed, ranked and prioritized thirty-two WSA cotton flow recommendations. Before the committee took any action on the recommendations, they were asked to review the final report and executive summary. Then they were asked to "rank" all of them then "prioritize" them as high, medium or low priority recommendations. Finally the committee was asked to identify their "high priority" recommendations. This exercise became the basis for the final sort of the WSA recommendations.

Nine of the recommendations were singled out for additional scrutiny by the committee. Of those nine recommendations six were adopted as committee recommendations which have been included among the revisions

to the current NCC policy. Those six policy statements will be considered by the NCC delegate body during the Council's next annual meeting. In each case NCC policy must be revised or amended or the proposed policy will not be implemented. Three of the WSA recommendations acted on by the committee add emphasis to current policy so no additional policy is necessary. It should be noted that fifteen of the remaining twenty-three recommendations are addressed by the current NCC policy.

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Staff also acknowledges the work of the subcontractors, Dr. John Robinson, Professor & Extension Economist-Cotton Marketing and his associates at Texas A&M University. The Texas A&M group was actively engaged in the study as the sole WSA sub-contractor from start to finish. The WSA team was able to use advanced analytical approaches to gain an understanding of the cotton industry, its issues and potential solutions that address many of those issues with the assistance of the Texas A&M team.

Finally, the efforts of former NCC Senior Economist Dale Cougot must also be acknowledged. Cougot and his associates assembled "An Overview of the U.S. Cotton Industry," a comprehensive collection of cotton industry reference material. This compendium of cotton knowledge was assembled before the contract for the cotton flow study was rewarded. He and other NCC staff provided project oversight from the study's beginning to its end.