

The efficacy and value generated from sustainable cotton initiatives in the United States



The Sustainability Consortium, University of Arkansas,
and Wake Forest University



June 2020

Acknowledgments

This research is supported by the Supply Chain Sustainability Research Fund, managed by Meridian Institute with funding from the Gordon and Betty Moore Foundation and the Walmart Foundation. The purpose of the Research Fund is to increase the collective understanding of outcomes associated with market-based approaches to conservation. The Research Fund has supported a series of research efforts designed to increase collective understanding of corporate sustainability commitments in the forests, land use, and food sectors. Learn more at www.supplychainresearch.eco.

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Suggested citation: Atwood, R., Clift, J., Slay, C., Wilcox, A., Garcia-Moore, T., Keehne, K., Odour, A., Kosak, J., Meiburg, S. The efficacy and value generated from sustainable cotton initiatives in the United States. Meridian Institute, Washington, DC.

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Date of publication: June 2020

Executive Summary

The U.S. Cotton Industry has established industry wide sustainability goals to guide supply chain actors who are growing and commercializing sustainable cotton. These targets are ambitious and representative of the dedication and action that has been underway for more than a decade to improve the sustainability performance of U.S. cotton.

Multi-tier sustainability supply chain initiatives are challenging to execute and require collaboration, the use of metrics, the verification of results, and a commercial mechanism to make it all work. This research explores the effectiveness of key actors and the value created from participation in a sustainable cotton supply chain initiative.

The Introduction provides an overview of The U.S. cotton supply chain and some of the key actors: Farmers in pursuit of growing more sustainable cotton, sustainable cotton initiatives with metric frameworks to assess the sustainability performance, and apparel firms that have set corporate targets for procurement of sustainable cotton. This section provides valuable context to better understand the commentary in the rest of the paper.

The second section, Methodology, provides a synopsis of research methods used including in depth-interviews, content analysis, and desktop research to better understand the perspectives and experiences of farmers, companies, and frameworks.

The third section, Research Findings, explores the results from desktop research including a comparison of the framework metrics and their key criteria. A summary of key challenges provides an introduction to the aggregate themes that surfaced, followed by discussion on some of the implications of these aggregate themes. Some of the findings include:

- Farmers are uncertain if sustainable cotton initiatives create value for them
- Sustainable cotton initiatives believe they are creating value for farmers and brands
- Brands and retailers are limited by a lack of traceability in the supply chain
- The adoption of sustainable practices is being driven by farmers
- There is the potential for greater social capital across the supply chain

The fourth section, Conclusion, brings together some of the aggregate themes to connect some of the opportunities for further collaboration across the multi-tier supply chain. Recommendations for future research are also included in this section.

This report's objective is to foster new conversations about the most effective management approaches for multi-tier sustainability initiatives, resulting in more value creation for all actors and the greater adoption of sustainably grown cotton in the United States.

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Introduction

Imagine your favorite t-shirt or jeans. Most likely they are made from cotton. Are they made from sustainable cotton? How does the sustainable cotton value chain work in the US? What role do different actors play in creating value and driving sustainability? This study explores these questions to develop a more nuanced understanding of the sustainable cotton supply chain. We explore the value and efficacy of sustainable cotton programs from three perspectives: farmers, responsible apparel brands and retailers, and sustainability initiatives.

Cotton is the most widely used natural fiber in the world, making it an important cash crop to support farmer livelihood and a common material input for the apparel and home textiles industries.¹ A naturally diverse plant group in the mallow family with around 50 species, cotton is a plant that synthesizes carbon dioxide and respire oxygen into the atmosphere. The success and productivity of a cotton plant are largely dependent on forces of nature- weather patterns, precipitation, pest pressure and competition from other plants (i.e., weeds) are considered regular challenges that farmers have to contend with to bring a cotton crop to market.

A farmer has at their disposal a variety of available technologies and management techniques to increase the productivity and quality of the cotton crop. Techniques and technologies that use key resources such as water, fertilizer, and crop protection chemicals (i.e., pesticides and herbicides)² as well as hormones (to promote boll creation and inhibit plant height) are all regular inputs that farmers invest in to achieve economic viability. On-farm management techniques vary in their ability to safeguard the environment, workers, and communities as agricultural practices have been regularly documented to have an impact locally and globally when the scale of these practices are considered.

The sustainability performance of cotton production has become the responsibility of the entire supply chain, with a variety of key actors working towards creating a systemic shift towards a collaborative sustainable cotton value chain that is able to mitigate the impacts of cotton and make sustainable cotton commercially available in the marketplace.

The remaining subsections of this introduction will summarize the landscape of actors in the US cotton supply chain, with additional context provided for three essential actors in building a sustainable value chain; the US Cotton Farmer, the Sustainable Cotton Initiatives, and Companies that are responsible for adoption. Additional subsections will explore the definition of sustainable cotton and close with an overview for what this study intends to achieve.

The US Cotton Supply Chain

A cotton supply chain is a multi-tiered process that transforms raw cotton grown by farmers into a variety of yarns and fabrics that are constructed into finished apparel and textile products sold by brands and retailers to consumers in the market. In addition to the primary actors managing a material

¹ Khadi, Santhy, and Yadav, "Cotton."

² Daystar et al, "Sustainability trends and natural resource use in U.S. cotton production"

flow of cotton, there is a compendium group of supply chain actors that support the cotton supply chain (e.g., crop consultants, University researchers, equipment suppliers, etc.) in a variety of other related functions. Table 1 describes the various supply chain actors and the roles that they play to support a viable cotton to textile supply chain.

Table 1- Key Actors in the Cotton to Textile Supply Chain

Primary actor	Supporting actor	Value offered
	Seed companies	Create seed varieties with regional specific genetics for optimal yield and quality for cotton growers.
	Seed growers	Grow cotton seed for seed companies to sell to cotton growers each year.
	Crop consultants	Advise growers on best practices pertaining to crop management seeding rates, chemical application rates, and general practices.
	University research	Provide data to growers to improve cotton quality, yield, mitigate pests, and experiment with emerging on-farm practices.
Cotton Grower		Plant cotton seed, grow, and harvest cotton crop.
	Chemical companies	Produce crop protection chemicals and fertilizers for use on cotton farms.
	Ag Sales	Warehouse, sell and distribute seed, chemicals, and equipment.
	Equipment manufacturers	Manufacture equipment for planting, maintaining and harvesting of cotton.
	Financial institutions	Financing the purchase of equipment, chemicals, seed or land purchase.
Gin		Clean raw cotton from seed debris and impurities, coordinate with USDA classing office, package and label with PBID.
	USDA classing office	Test cotton samples and record fiber qualities.
	Warehouse	Store cotton bales in a controlled environment until sold by a merchant.
Merchant		Purchase cotton from farmers, coordinating with warehouse and transport to sell to a spinning mill.
Mill		Clean, card and spin cotton fibers into yarn, dye yarns, and knit or weave into fabrics.
Factories		Cut, sew and finish fabric to produce the final garment or textile product.
	Industry trade groups	Maintain trading rules while offering expertise on advancements in the cotton industry.

Brands		Design, merchandise, and sell products directly to consumers or through retail partners.
Retailers		Design, merchandise, and sell products directly to consumers or source products through brand partners.
Consumers		Purchase apparel and other textiles made from cotton or other materials.

The U.S. Cotton Farmer

As the world's leading cotton exporter and third-largest cotton producing country, the U.S. Department of Agriculture estimates that U.S. cotton growers produced 21.6 million cotton bales during the 2018/2019 season³ from an approximate 14.5 million acres of U.S. farmland. The 2017 Census of Agriculture revealed that there was an 11% decline in the number of cotton farms since 2012, greater than the 3% national decline in US farms overall.⁴ Cotton farms in the U.S. are largely family operated; in 2015, Frisvold reported that 98% of cotton farms were inherited from the previous generation.⁵ This family connection to land and vocation creates a deep and rich history, but can also create a cultural conformity that acts as a significant barrier to the adoption of sustainable practices.

While family tradition and the market price for cotton have undergone little change from year-to-year, the technology used on cotton farms, increased margin constraints and more erratic weather systems have fluctuated greatly. Technological advances allow for greater ease in planting and harvesting, resulting in an annual production increased by 185lbs of yield per acre from 2000 to 2019.⁶

Figure 1 - Map of Cotton Growing Regions in the United States



Source: CottonWorks™

³ ERS USDA, "Cotton Sector at a Glance."
⁴ ERS USDA, "2017 Census of Agriculture."
⁵ Frisvold, "Where Are All Those Corporate Farms."
⁶ ERS USDA, "Crop Production Annual Summary."

Sustainable Cotton Initiatives and Frameworks

There are several sustainable management and marketing frameworks operating in the U.S. with varying approaches to value creation in the cotton supply chain. A management framework specifies actionable requirements for participation, while a marketing framework utilizes existing farmer performance to brand under a set of specific baseline performance indicators. These performance indicators (i.e., metrics) and overall approach create a "framework" of engagement. Frameworks vary in the information that they collect from farmers; required and optional practices and criteria under a binary checklist are most common, while some frameworks will utilize metrics derived from farm data to inform the level of performance respective of a state or national peer group. The organizations that manage the frameworks will often publish programmatic updates on the success of their engagement with farmers, the outcomes and impact they are able to achieve, the marketable claims that can be made by brands and retailers, and the overall social and environmental value created from farmers participating in the framework.

This research evaluated ten key cotton sustainability initiatives that operate in the U.S., using both management and marketing frameworks (Table 2). Each initiative has a different perspective on sustainability, different measurement requirements, and different goals and impacts. Most initiatives detailed in this report include certification with verification protocols. Indeed, several programs work together to achieve certification from farm to textile. Though important differences are detailed here, initiatives have the common aim of continuous improvement on U.S. cotton farms, marketability and profitability of U.S. cotton, and a willingness to collaborate to achieve this common vision.

Table 2 - Overview of the Sustainable Cotton Initiatives

	Certification/ Standard	Assurance/ Verification	Purpose	Areas of operation	How it works
USDA Organic	Yes	2nd and 3rd party	To enforce the USDA Organic seal.	U.S.	Verifies organic production in the U.S.
Organic Content Standard	Yes	3rd party	To increase organic agriculture production and reduce associated impacts.	Global	Utilized with the Content Claim Standard and many organic standards to verify organic cotton in any non-food product containing a specified portion of USDA certified organic material content in final product. The This standard does not cover the certification of the raw material itself.

	Certification/ Standard	Assurance/ Verification	Purpose	Areas of operation	How it works
Content Claim Standard	Yes	3rd party	To certify the content claim for organic, recycled and other content types.	Global	Verifies the presence and amount of a given raw material in a final product. Provides strong chain of custody system from the source to the final product. Used in combination with Organic Content Standard to verify organic content.
Global Organic Textile Standard	Yes	3rd party	To define requirements to ensure organic status of textiles, from harvesting of the raw materials, through environmentally and socially responsible manufacturing up to labeling in order to provide a credible assurance to the end consumer.	Global	Textile processing, manufacturing and trading entities can apply for certification according to the Global Organic Textile Standard to verify organic content.
Field to Market	No	Yes	To convene diverse stakeholders to support multi-sector collaboration, while providing useful measurement tools and educational resources for growers and the value chain that track and create opportunities for continuous improvement at scale.	U.S.	By providing measurement tools and resources that are outcome-based and grounded in science, they help growers and the supply chain benchmark sustainability performance, catalyze continuous improvement and verify sustainability claims.
U.S. Trust Protocol	Yes	1st, 2nd, and 3rd party	To meet U.S. cotton's customers' sustainability goals by validating that U.S. cotton is the most responsibly-produced cotton in the world while striving for continuous improvement to reduce its environmental footprint.	U.S.	Utilizes Field to Market platform as well a farmer self-assessment to verify the sustainability performance of U.S. cotton growers.

	Certification/ Standard	Assurance/ Verification	Purpose	Areas of operation	How it works
e3	Yes	1st, 2nd, and 3rd party	To establish an industry leadership position for cotton sustainability by connecting relationships through the entire farmer-to-retailer channel.	U.S.	Utilizes Field to Market metrics platform in addition to farm management software to measure and verify the sustainability performance of U.S. cotton growers.
Better Cotton Initiative	Yes	1st, 2nd, and 3rd party	To improve livelihoods and economic development in cotton-producing areas and reduce the environmental impact of cotton production.	Global	A holistic approach to sustainable cotton production which covers all three pillars of sustainability: environmental, social and economic. This practice-based standard forms the global definition of Better Cotton. By adhering to these principles, BCI Farmers produce cotton in a way that is measurably better for the environment and farming communities. The system is designed to ensure the exchange of good practices, and to encourage the scaling up of collective action.
Cotton LEADS	No	N/A	To advance sustainable cotton sourcing and production by promoting research and practices that weave sustainability into all aspects. Share resources and best practices to improve cotton production worldwide.	U.S. and Australia	Connect textile manufacturers, brands and retailers with opportunities to support cotton growers' sustainability efforts and to share data, resources and technologies globally for the benefit of improving cotton around the world. Promote the BioPreferred standard for cotton.
Bio Preferred	Yes	2nd and 3rd party	To increase the purchase of biobased products. The program's purpose is to spur economic development, create new jobs and provide new markets for farm commodities.	U.S.	All federal agencies are required by law to purchase biobased products in categories identified by the USDA. To date, USDA has identified 139 categories (including cotton) of biobased products for which agencies and their contractors have purchasing requirements. Each mandatory purchasing category specifies the minimum biobased content for products within the category.

Furthest downstream in the supply chain from the cotton grower are companies that use cotton in their products, retailers that sell cotton products in their distribution channels, and consumers who are making purchasing decisions. While recognizing that home furnishings and home textiles industries are important actors in the cotton supply chain, this research focuses our analysis on apparel companies using cotton in their products. Recent data indicates that the entire apparel market volume in the United States generates approximately \$368 billion dollars, the most revenue compared to any other country and it is anticipated to have a compound annual growth rate of 3.6% from 2020-2025.⁷

Many brands and retailers have made commitments to increasing sustainable product offerings, the use of more responsible materials and/or sourcing from more sustainable manufacturing environments. While some companies have a product type that requires a preference for cotton-rich or synthetic rich fabric (i.e., polyester, nylon, spandex), in many cases there is an opportunity to displace cotton with alternative sustainable fibers such as hemp, recycled polyester, or recycled cotton or wood pulp based rayon which may be derived from sustainable forestry or unsustainable sources. One of our interview subjects best summarized their company's sustainable fiber procurement approach by sharing: *"but still, at the end of the day, cotton is the problem. It's really the problem."* This reflects a perspective that increasingly values an understanding of the social and environmental outcomes that a fiber or material choice has as opposed to supporting an organization or certification (i.e., a framework). As of 2018, 39 apparel companies have committed to source 100% sustainable cotton by 2025.⁸ See Table 3 below for a representation of brands that have public facing statements on their commitments to sustainable cotton adoption.

Table 3 - Brand and Retailer Initiatives and Commitments to Sustainable Cotton Adoption

Brands	Sustainable Cotton Initiatives and Commitments
Levi Strauss & Co.	100% sustainable cotton from Better Cotton Initiative growers, organic cotton farms or recycled cotton suppliers (2020)
GAP Inc.	Source 100% of cotton from more sustainable sources by 2025
NIKE Inc	Committed to 100% sustainable cotton by 2020
American Eagle	American Eagle primarily sources using the Better Cotton Initiative cotton and has a goal of increasing the total volume of origins from the BCI.
VF	Committed to 100% sustainable cotton by 2025
Patagonia	The company uses a combination of hemp and organic cotton for their apparel
Nordstrom	Clothing is made with at least 50% sustainably sourced organic cotton with Fair Trade certifications
PVH	100 percent of its cotton should be sustainably sourced by 2025

⁷ Statista, "U.S. Apparel Market - Statistics & Facts"

⁸ Textile Exchange, "First Annual 2025 Sustainable Cotton Challenge Report."

Hanes Brands	Utilizes recycled cotton fibers procured from cut fabric waste
Beckons Yoga Clothing	The company uses organic cotton for all its sustainable yoga clothing that is accredited through Control Union Certifications and meets USDA and Organic Trade Association guidelines.
Blue Canoe	Blue Canoe is dedicated to using only organically grown cotton and using US-based fabric mills that follow Global Organic Textile Standards approved textile processing methods.
Retailers	
Walmart	Walmart has a goal of sourcing 100% "more sustainable cotton" by 2022. They plan on sourcing from textile mills that use the Sustainable Apparel Coalition's Higg Index to measure and score a company or product's sustainability performance accurately.
Amazon	Amazon aims to use high-quality sustainable cotton through partnerships with the Better Cotton Initiative (BCI)
Target	Target plans to be sourcing 100 percent sustainable cotton by 2022 for their owned-brand and exclusive national-brand products using a combination of programs including BCI and Cotton LEADS
Macy's	Macy's offers apparel and home textiles that are certified with different types of OEKO-TEX standards, which deals with chemicals in the production process and the final product.
Kohl's	Kohl's plans to achieve 100% sustainably sourced cotton for their proprietary brands by 2025; however, they are only at 5% as of 2019.

While each company recognizes different frameworks or a combination of frameworks to measure their achievements in reaching their goals, these commitments by a variety of apparel companies signals a downstream demand for sustainable cotton. Brands and retailers are motivated by a collective stakeholder critique on the social and environmental impacts of the cotton supply chain, the need to be responsive to consumer demand, and a sense of corporate or personal responsibility to act. Commercially, brands and retailers depend on their upstream actors, supplier mills and factories who purchase cotton to collaborate on achieving sustainable cotton targets.

Defining Sustainable Cotton

Farmers, sustainability initiatives, and companies have not reached a consensus on how to define sustainable cotton. These divergent views are largely predicated on three common and complex factors. First, cotton is a global crop produced in over 100 countries in the world and uses different amounts of resources based upon the climatic conditions and available technology of the geography in which it is grown. This results in a range of possible values for each environmental impact metric (e.g., water, carbon, energy use) even when normalized by a kilogram or ton of cotton fiber lint produced and/or acres or hectares of land from which the cotton was sourced (i.e., yield metric or land use efficiency metric). Comparing the sustainability performance from any one given farmer relative to another farmer's scale of possible values would require a normalization of ranges and

performance, similar periods of observed time, an accounting methodology for abnormal events, and the use of somewhat similar data collection methods.

This difficulty in measurement reflects significant variations in farming practices region-by-region. The most obvious differences are those between heavily mechanized growing areas that use tractors (e.g., U.S., Brazil, and Australia) on large farms of 3,000 or more acres, and operations that harvest cotton by hand on smaller farms of only a few acres (e.g., India, African cotton growing countries). As a consequence, what defines “sustainable cotton” for one region of the world may not be relevant for another region of the world. Even if assessment frameworks recognize that there are two or more varying approaches to achieving “sustainable cotton,” their data may not match up neatly, and it can be difficult for end users to conclude that one version of sustainable cotton is equal to another.

Second, the metrics and methods for collecting farm level data vary greatly framework-by-framework and country-by-country. This creates the possibility that data across metrics and across frameworks will be inconsistent and of varying quality. The process for eliciting farm level management information from farmers and the management of that information once it is collected and recorded creates additional opportunities for data to be compromised. This issue is discussed more in depth later in this report.

Third, as technology in conventional cotton production has evolved to make cotton growing more efficient and reducing its environmental impact, there have also been tradeoffs. The most obvious example is how the combined use of a cotton seed with a GMO trait of herbicide resistance and the use of a universal broadcast spray of herbicide (i.e., glyphosate) has resulted in fewer tractor passes to manage weeds. This technology has freed up available time, reduced overall greenhouse gas emissions, and reduced soil compaction. The tradeoffs that we face, with now more than 15 years of herbicide and GMO seed companion practices, are that these practices can increase chemicals in runoff, human exposure to potentially hazardous substances, and emergent chemical resistance in superweeds (i.e., Palmer Amaranth, Pigweed). In order to address the superweed resistance, seed and chemical companies are promoting controversial chemistries to break weed resistance.

Despite the challenges in defining sustainable cotton, U.S. cotton farmers are making progress in reducing environmental impact. According to Field to Market’s 2016 National Indicators report, U.S. cotton farmers as a collective industry were able to increase cotton yield by 42% while decreasing irrigation water use by 82%, energy use by 38%, and GHG emissions by 30% from 1980 to 2015.⁹ Additionally, the U.S. cotton industry set sustainability performance targets for the industry to guide continued progress through 2025. See Appendix Item #1 for a list of the cotton industry sustainability goals.

While this research did not include a thorough review of different on-farm practices to determine their relative impact when compared against one another, Table 4 provides an overview of some common on-farm practices, how they are measured and the impact that these practices are having to address sustainability issues.

⁹ Cotton Incorporated, “U.S. Cotton Ten Year Sustainability Goals”

Table 4 - A Spectrum of Conventional to Sustainable Practices and their Respective Impact or Benefit in Cotton Growing

Category	On-Farm Practices	Input Metric	Impact (Challenge/Benefit)	Output Metric
Land	1. Conventional Tillage	# of times per year	- Soil erosion, runoff - Kills weeds	- Kg, lbs, tons of soil lost - Clear or cloudy runoff - Infiltration rate - Soak in/Standing water - Soil Conditioning Index
	1A. Conservation Tillage or Reduced	# of acres	Less erosion	
	1A1. Stale seed bed	# of acres	Less erosion	
	1B. Strip-Till/No Till	# of acres	Keeps soil structure intact	
	2. Cover Crops	- # of acres - # of species of cover in rotation - Scouting cover for beneficials/pest	- Keeps soil intact - Builds organic matter	- Termination technique - Soil Conditioning Index
	3. Rotation (cash and cover)	- Rotation internal - # of species of cash crops in rotation	- Disrupts pest pressure - Improves soil microbes	
Water	4. Rain-fed/Dryland	Inches per year	NA	- Estimated Dryland yield
	4A. Irrigated via furrow/flooding/basin	- Soaking in against height of furrow - acre-inches of water applied per acre - # of irrigation events	- Depletion of aquifers or other freshwater resources - Efficiency and delivery of water	- Acre-inches of water applied per additional unit of production - liters per kg of lint - Infiltration rate - Edge of field ratings (WQI)
	4B. Irrigated via pivot/sprinkler			
	4C. Irrigated via drip			
	4D. Cover Crops	See #2	- Water infiltration - Increases effective root zone - Water retention - Build organic matter	Soil moisture sensors (6in,12in,18in)
Chemical Inputs	5. Pesticide Use	- lbs. of active ingredient - grams, oz, lbs. an acre	- Water pollution - Kills beneficial insects - Exposure/human health - Protects crop	Edge of field ratings (WQI)
	5A. Integrated Pest Management	- Scouting - Using land grant university thresholds	- Protects crop - Keeps beneficials intact	<i>Specific to pest:</i> - % of fruit damaged - # of eggs on plant - Estimated yield loss from pests
	5B. Precision applications of pesticide			Edge of field ratings (WQI)
	6. Fertilizer Use	- lbs of fertilizer	- Eutrophication from runoff - GHG derived from nitrogen applications - Soil acidity - Increases crop yields	Edge of field ratings (WQI)
	6A. 4Rs of Fertilizer Use (Rate, Source, Timing,	- Total N application rate	Increases effectiveness of fertilizers	Edge of field ratings (WQI)

Category	On-Farm Practices	Input Metric	Impact (Challenge/Benefit)	Output Metric
	Place)	per season - # of applications in season - Nitrogen source		
	6B. Cover Crops	See #2		Edge of field ratings (WQI)
	6C. Integrated Livestock (small or large ruminants)	- Livestock units per paddock - Rotation frequency	Increases microbe biodiversity	- Edge of field ratings (WQI) - Defecation dispersal
	7. Herbicide Use (with multiple modes of action)	- lbs. of active ingredient - grams, oz, lbs. an acre - # of residuals used in weed management season long (including burndown)	- Exposure/human health - Weed resistance to glyphosate	- Edge of field ratings (WQI) - Estimated yield loss from weed competition

Finally, we cannot leave this discussion of sustainable cotton without noting that environmental concerns are not the only sustainability issues. Some sustainability issues come with deep history that bears understanding. Cotton has a brutal and shameful social legacy in the history of the United States.

The growth in cotton production and demand following the invention of the cotton gin was the foundation of the slavery economy in the South in the first sixty years of the 19th century, as demand increased for slaves to plant, grow, and harvest the crop. According to one source, by the middle of the 1800's, the United States produced over 75% of the world's cotton.¹⁰ Combined with improvements in transportation (e.g., the river steamboat) and industrial machinery for textile mills in New England and abroad, it is fair to say that cotton drove the rapid expansion of slavery and its ever more central role as the pivot point of conflict in the United States.

Though the Civil War led to slavery's abolition, it did not erase the racist underpinnings of slavery or the role cotton had in its expansion. That legacy endures even to the present day, with consequences for inequities in land holdings, capital accumulation, and our broader society. While slave labor is no longer used to pick cotton in the U.S., forced and child labor does continue in other cotton-growing nations. To their credit, some of the management frameworks discussed in this report focus on metrics to make visible this modern-day slavery and support initiatives to eradicate it consistent with the U.N. Sustainable Development Goals.

¹⁰ Kelly, "Historical Significance of the Cotton Gin"

Why is this research important?

The overall goal of this research was to identify how the three key actors (farms, initiatives and firms) that grow, verify, and use sustainable cotton can generate the most value for each other and the entire supply chain. This report looks at activities in U.S. cotton sustainability to provide a resource for those seeking to understand the key issues, initiatives, and perspectives in the value chain. This research shows that key actors have a significant interest in successful sustainable cotton supply chain initiatives and acknowledges the importance of all supply chain actors in their role towards commercialization and supporting the growth of sustainable cotton.

However, many questions remain. What challenges do the frameworks encounter when trying to create a program that works for all? Do the existing frameworks deliver the value needed by growers and companies? If selecting cotton to put in products is a design choice when compared with other fibers, how can sustainable cotton compete with synthetic fibers? How can an efficient and transparent cotton supply chain support the adoption of sustainable practices required to meet the long-term sustainability goals set by the U.S. cotton industry?

Many of these questions and others were examined during the research and will be explored in the Research Findings and Conclusion sections below.

Methodology

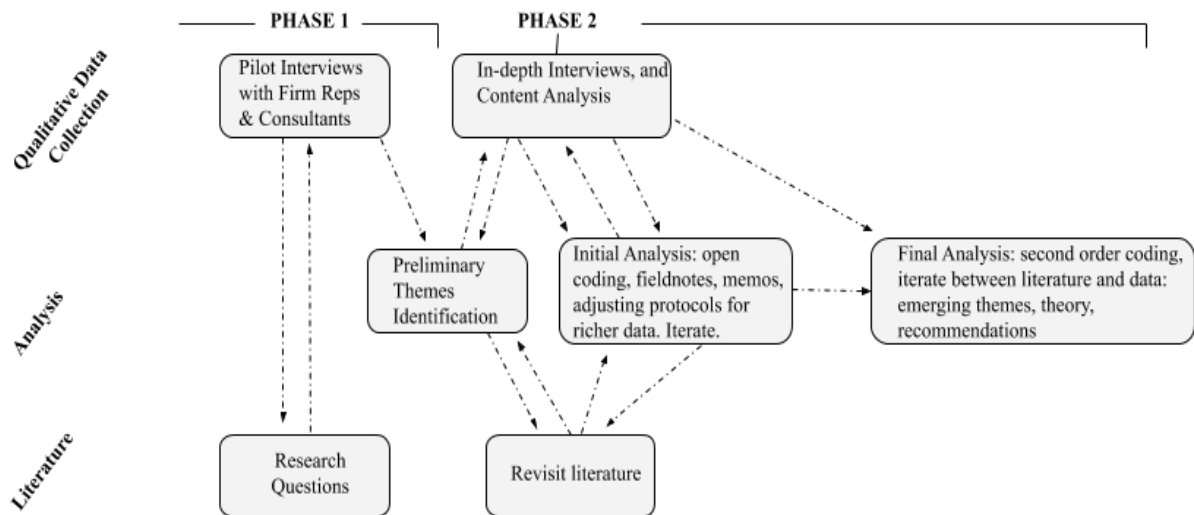
A study like this requires interdisciplinarity, as does sustainability as a whole. Our team included industry experts, biologists, sustainability scholars, management scholars, organizational designers, political scientists, and practitioners that live in the value chain everyday. Our objective was to capture the authentic voices, experiences, perspectives, interactions, stories, and processes of farmers, firms, and frameworks through detailed interviews, content analysis, and case study. We conducted 35 interviews in total: 14 interviews focused on responsible apparel companies and consultants that represent over 20 brands, 15 interviews focused on farmers across diverse geographies, and six interviews focused on industry leading sustainability frameworks.

The initial approach to the research inquiry involved conducting a brief pilot study to hone our questions, sampling, and approaches; we did this by interviewing two firms and two consultants as Phase 1 and using information uncovered in the pilot study to inform our strategy moving into Phase 2. These approaches and samples are targeted at achieving "methodological fit" considering our underspecified understanding and undeveloped theory specific to the sustainable cotton supply chain.¹¹ A visual model of our research approach is shown in Figure 2.

To capture these voices and stories, we designed an inductive, qualitative study using in-depth semi-structured interviews (see Appendices 2,3, and 4 for our interview protocols).

¹¹ Edmondson and McManus, "Methodological Fit in Management Field Research."

Figure 2 - Full Research Model



We respected the anonymity of our participants at the firm and farm level as we sought rich data. We stayed close to the data we uncovered. And we grounded our insights and findings in the authentic experience of our participants. We conducted open coding to identify high-level concepts and key phrases from the interview data, content analysis, and case study. Our second order coding involved identifying relationships and developing conceptual families. Finally, we conducted selective coding to develop aggregate dimensions. As we gathered and analyzed our qualitative data, we continually iterated between academic and practitioner literature to arrive at findings and recommendations grounded in our insights.

Our methodology was crafted to uncover insights and develop recommendations for practitioners across the value chain. We wanted this report to benefit the research community as well—our exploratory approach helped us identify research implications for future studies. This approach enabled us to explore a complex system and add the insights of experience to existing theoretical and empirical academic work.

Research Findings

The research was separated into three groups based on the key actor in the supply chain being evaluated: Farmers, Companies and Frameworks. In this section, each group offers findings from desktop research and in-depth interviews. The identities of our farmer interviewees, company representatives, and framework representatives are kept anonymous with the exception of select quotes attributed to specific remarks.

The US Cotton Farmer

One observed characteristic of cotton farmers interviewed during this research is that there is high connectivity among farmer-peers through sharing of best practices and learning from one another. This may be true for agricultural producers broadly, but it is unique when compared to other actors further downstream in the supply chain that compete for consumer attention and purchase. Also noteworthy is that cotton farmers generally do not farm cotton exclusively, but also raise other crops such as corn, wheat, soy, sorghum, or peanuts. This diversification of crop management has environmental benefits when practiced in rotation (See Table 4) and also helps diversify farm income for greater resilience against market volatility for cotton or any other single commodity crop. While many U.S. cotton farmers desire to accelerate greater adoption and broader commercialization of sustainable cotton, there are several challenges that emerged through our interviews and desktop research. First, cotton farmers are feeling caught between two economic factors that affect their overall profitability. Farmers have introduced and accepted new technologies, from cotton harvesters to modified seed varieties, based on the ability of these technologies to increase yields and improve operational efficiency (i.e., giving time back). These technologies have required significant capital investment and have increased the cost of growing cotton. Yet in recent years, the market price for cotton has dropped to historic lows, sometimes below production cost. This economic dynamic makes farmers hesitant to experiment and implement novel sustainable practices unless there is clear and persuasive evidence that they will save on costs. Second, organizations that provide financing for farm equipment and other inputs (i.e., seed, fertilizer, or crop protection chemicals) tend to -prescribe requirements for on-farm practices. Agricultural retailers, banks and sometimes landowners may follow this practice. Farmers may prefer to manage their farms more independently and resist such prescriptions. If farmers identify the prescriptions of outside organizations as tied to "sustainability", this may contribute to a skepticism of sustainable cotton initiatives.

Third, farmers are managing against weather variability and water scarcity like never before. In some geographies, dryland (i.e., non-irrigated) fields are no longer being planted and the cost of water for irrigated fields has increased as aquifers lower and pumping technology has to work harder to deliver water to the field. In many geographies, late spring rains have delayed the planting window and led to compromises in yield and quality in order to bring a crop to harvest in approximately 145 days.

Despite these three challenges and others, the farmers interviewed for this research were all committed to growing cotton sustainably, and had some experience working with one or more of the sustainable cotton initiatives. The primary focus of the questions used during farmer interviews was to understand the experience and learning process of farmers that are actively pursuing or considering growing cotton sustainably. In addition, we sought to understand how farm-level economic models evaluate sustainable practices, the process for assimilating new sustainable practices, and the perceived or experienced value from participating in sustainable initiatives.

The farmers interviewed for this study had to be operating in the United States, actively growing cotton for the past three consecutive years, and operating a farm size of more than 500 acres. Fifteen in-depth, semi-structured interviews were conducted with cotton farmers in the U.S. Potential research participants were identified through referrals from other researchers. Interview questions for cotton farmers focused on the challenges to the adoption of on-farm sustainability; adoption, implementation, and evaluation of sustainable agricultural practices; sustainable cotton

schemes; farmers' perceptions about downstream commercial partners, gins, co-ops, and brokers; and farmers' perceptions about apparel brands/companies that are trying to adopt sustainable raw materials and set sustainability targets.

The complete aggregate results of these interviews are available in Figure 3. What follows is a brief discussion of key themes and subthemes that emerged during the interviews:

Limited Use of Replicable Accounting Methodologies

All farmer interviewees agreed that there is no greater concern for U.S. cotton growers than on-farm profitability, but we found that growers are using a variety of different accounting methods to understand their profitability. Half of the farmers interviewed stated that they were using the "human microchip," "intuition" or pursuing a strategy of crop diversification "that outweighs the effort required for in depth accounting." One farmer-respondent said:

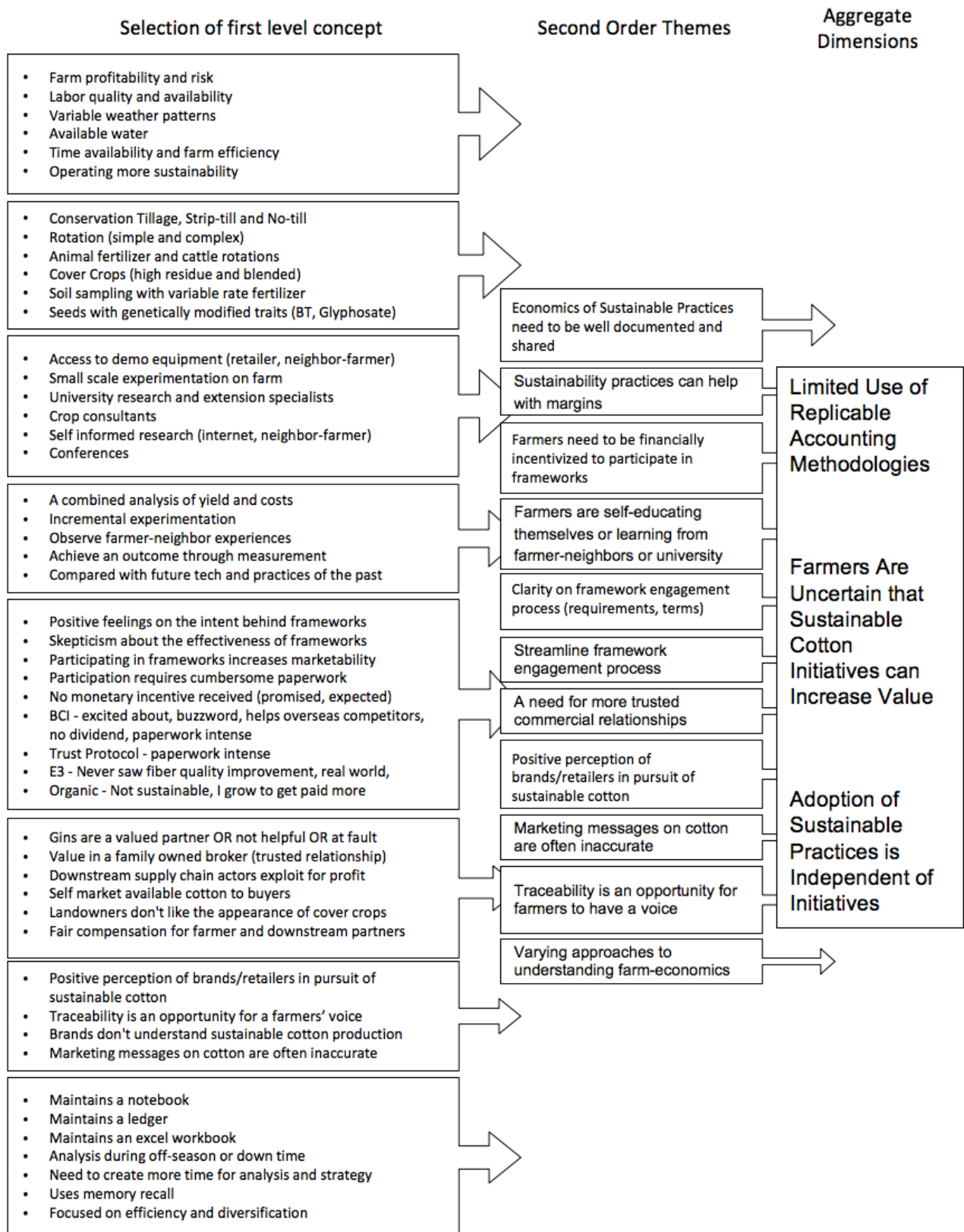
"I memorized it in my mind, right. What are my costs on this. Okay, yeah, study it and just kind of carry it with me in my own... on my own microchip, I guess."

The other half of farmers interviewed were using a detailed accounting methodology, spreadsheets, or regular accounting ledgers. One farmer-respondent used an advanced enterprise level accounting methodology that looked at multi-year times horizons and evaluated the opportunity cost of taking one action over another.¹²

Our research did not attempt to explore the accuracy of intuitive accounting practices, and we did not see a correlation between accounting methodology and the number or robustness of sustainable practices adopted on farms. However, we believe that when growers are evaluating sustainable practices, the clearer and more obvious the financial benefit, the faster the speed of adoption and the more likely that sustainable practice will become a regular on-farm practice over the long term.

¹² Clifford and McKendree, "Economic profitability and enterprise budgets."

Figure 3 - Aggregate Results from Cotton Farmer Interviews



One possible response to this finding would be to develop a series of comprehensive case studies with demonstrable financial results to accelerate the adoption of sustainable farming practices. Another might be to provide willing farmers with a more comprehensive economic analysis of their farm practices to demonstrate the potential of a novel land stewardship technique.

Farmers Are Uncertain That Sustainable Cotton Initiatives Can Increase Value

Farmers enter into a sustainable cotton framework with an expectation that they should be compensated for their time and/or commitment to practices. As uncovered in the farmer interviews, all respondents saw how they spend their time as connected to operational efficiency and overall farm profitability. A few farmer interviews disclosed that they saw the compensation tied to an ongoing commitment to sustainable practices when other farmer interviews credited compensation as allowing them to continue to pursue new sustainable practices. For the farmers that had participated in one of the frameworks, there was an overall disappointment that they had not seen what had been communicated to them as cash payment (i.e. divided) for participation or an increase price for their cotton in the market. In the words of a farmer interviewee:

"Well, I haven't seen personally any dollar result from any of them, so I don't have a great... like BCI, it was supposed to marketing dividend be giving back to us, and improve cost, but I gotta be honest with you, I haven't seen any of it... I don't know who it's is helping, but I want to going to stick with them cause they are not really costing us anything to do. I haven't seen, I haven't seen anything that put anything back in our pocket."

There is some perceived value in the marketability of cotton grown under such frameworks when compared to conventional cotton not grown under a framework.

Adoption of Sustainable Practices is Independent of Initiatives

During the course of the farmer interviews it became obvious that farmers have three main approaches to learning how to adopt sustainable practices. Consistent amongst all interviews, was a farmer's pursuit of new information through a series of different methods including internet research, attending educational seminars, and talking with other neighbors. There was a subset of farmers that described a heightened desire to problem solve through self-discovery and incremental experimentation. University research, research stations and extension specialists were credited with helping to inform new learning, but not once did one of our farmer interviews credit a sustainable cotton initiative for informing how to become more sustainable. On the contrary, there was critique on the relevancy of metrics and the knowledge of the auditors who came to inspect the farm:

"Well, the BCI, it's... I don't know how to be nice here... it's ridiculous, cause a lot of the questions are third world questions, things that we haven't done in years and years, and questions about some of the chemistries that we don't even know what it is because we never used it, and I don't have any... we are already doing most of the things that they are asking without changing anything."

A similar sentiment is expressed by a different farmer-interviewee with an interpretation of how a framework can lose its standing with the farmer-base.

"A global program that can't adapt its program loses credibility and insights frustration and a resistance."

Despite feedback from our farmer interviews that sustainable cotton initiatives are not a part of their trusted network for educational opportunities, the sustainable cotton initiatives are offering specific learning events for farmers on the adoption of sustainable practices in the U.S. in 2020.

Discussion: Farmers are Leading the Pathway to Regenerative Agriculture

While there is no existing research that quantifies the evolution of a U.S. cotton farmers' risk profile over the past 100 years, it is fair to describe the past ten years as challenging ones for cotton growers. One farmer interviewee shared this historical account of the capital equipment requirements of farming.

"Just take equipment costs, this is my 40th crop, since I got out of college and worked on the farm. My daddy died when I was 16 and my mother sold the equipment and we had 600 acres, and she rented it out. So, anyway, when I started... my 2nd or 3rd year I was looking for a cotton picker and a good friend of mine told me where one was, and it was brand new and it was \$42,000. And the price of cotton was \$0.60, and I told him, I would have to be crazy to spend \$42,000 on a cotton picker, and the last picker I bought was \$760,000. And the price of cotton this year is \$0.52."

Despite these challenges, a majority of farmer interviews were positive about the future and committed to not only continuous improvement, but to actively pursuing on-farm sustainable practices and questioning their previous cultural norms. For farmers that have been dedicated to sustainable practices for a decade or more, they are passing on practices to the next generation that look entirely different from what they grew up with. This farmer interview explains:

"I won't say in my early career, but typically worked the ground 12-14 times with the planter and went over it. Well, we pretty much destroyed what soil health we had during those years. It's kinda one of those things, how would you say it? You know, as a farmer you just liked to till the soil."

This account is contrasted by the youngest farmer-interviewee who was unfamiliar with tilling equipment:

"I sit in different position than my dad as, you know, he said he grew up plowing and he grew up with all this water, and he watered every acre out here, and that's the most productive area in the world if you can have water, but we don't have water, so it doesn't matter, right, but I don't ...I don't know plowing like he did. I mean I never grew up plowing, never understood... "What is that?" I don't even know what that is [pointing to a piece of tilling equipment], like, I feel so dumb you know what I mean, I farm for a living and I don't know what that piece of farm equipment is. But it's a blessing."

These farmers are clear about the integral link between improved farm economics and sustainable practice and willing to share with one another the key learnings from these practices. They are seeing financial benefits from using a combination of conservation tillage, cover crops, complex rotations and efficient irrigation systems, practices that have the ability to return carbon to the soil and provide water infiltration to mitigate flooding and improved water retention in times of drought. See Table 5, below for estimated rates of environmental benefit.

Table 5 - Measured Carbon and Water Gains

	Soil organic carbon sequestration rates for cotton	Cropland water infiltration (rate at which water enters the soil surface)	Cropland water retention (amount of water absorbed per volume of soil during dry period)
CONVENTIONAL	(baseline for comparison to other practices, typically a net loss of carbon)	2 in at 200 min	18.4 in ³ in ³
NO-TILL	0.39 Mg C ha ¹ yr ¹	4.7 in at 200 min	24.3 in ³ in ³
COVER CROPS	0.45 Mg C ha ¹ yr ¹ (with no-till)	3.9 in at 200 min	20.5 in ³ in ³
CROP ROTATION	0.43 Mg C ha ¹ yr ¹ (with no-till)	Not measured	18.4 in ³ in ³

Source: Wrangler Science & Conservation Series Paper

The idea that farming practices such as those described above can improve outcomes such as soil health, biodiversity and water conservation has become known as "regenerative agriculture". As the regenerative agriculture community becomes more defined, these leading farmers have the opportunity and ability to mitigate climate emissions through agricultural practice. While our farmer interviews suggest that sustainable cotton initiatives and their metric frameworks are not driving education on sustainable practices at this time, leading farmers and their trusted networks offer opportunities for greater innovation and adoption. This insight suggests several critical questions for further research. For example:

- Are the sustainable cotton initiatives able to support this next level of farmer performance?
- What role are the sustainable cotton initiatives playing other than verification?
- Do responsible apparel companies understand the opportunity they have to impact the environment and farmer livelihood in pursuit of their sustainable cotton goals?

A majority of farmers interviewed during this research were committed to on-farm sustainable practices not only because they believed that there was financial gain, but there was a moral undertone to the discussions that is best represented here:

"If you're not doing it for the right reason, you will never be successful. It's just a fact of matter. It's the right thing to do, because I plan on having kids, and I hope they have kids, whether they do or not, somebody is going to have kids, and so we have one earth, we are all environmentalists,

whether we want to be radical or not, it's our responsibility. God gave us that, and he gave us a blessing of being responsible of what we're given, how to take care of that, and how to pass it on to the next person, so they can be the same thing, because if I screw up, it doesn't matter how great the generations for me did, it's my responsibility to ... if I drop the ball, it not only affects me, but everybody after me."

This well-articulated sentiment in favor of conservation is shared among many supply chain actors and embedded in the intent behind sustainable cotton frameworks and the corporate procurement goals of companies. It is a hopeful vision of a world where supply chain actors have an opportunity to galvanize support among farmers to use regenerative agriculture practices, quantify meaningful impacts to the environment, and verify them through a sustainable cotton initiative and its metric framework. The result would be sustainable cotton that is transparently so to consumers and can be used with confidence in apparel and home textiles products.

Sustainable Cotton Initiatives

One of the developments in response to the environmental and social impacts of cotton production has been the establishment of frameworks working with farmers to measure and improve the sustainability of growing cotton. As a result, in recent years there has been an emergence of frameworks aimed at promoting sustainable cotton production to jointly enhance the livelihoods of producers and workers, and to protect the environment.¹³ The development of these frameworks builds on earlier experiences in other industries whereby increased business pressure to conform to best-practice demands about sustainability performance and transparency resulted in the creation of frameworks of metrics by which investors, customers, and consumers could assess sustainability progress by companies in many lines of business.¹⁴

The initiatives we evaluate here have developed out of many years of work and collaboration culminating in both management (i.e., farm activity measurement and chain of custody) and marketing (i.e., U.S. cotton promotion) frameworks. To understand them better, we conducted desktop research and interviewed professionals working with key cotton sustainability initiatives operating in the U.S. While sustainable cotton initiatives endeavor to use these frameworks to accelerate greater adoption and broader commercialization of sustainable cotton, there are several challenges that emerged through our interviews and desktop research.

First, each framework has its own production standards, metrics, and systems to promote the objectives of sustainable farming. Ideally, the indicators of sustainability and the measures by which an industry is assessed should have common definitions in order to provide a basis for evaluation and to establish benchmarks for measuring progress towards becoming more sustainable. However, in the cotton industry, efforts to collaborate on shared or congruent metrics across frameworks have been inconsistent. In addition, environmental advocates have raised concerns about the proliferation of "sustainable" cotton with its various definitions and criteria that may compete with organic markets.¹⁵

¹³ FAO, "Measuring Sustainability in Cotton Farming Systems: Towards a Guidance Framework"

¹⁴ Riisgaard, Lund-Thomsen, and Coe, "Multistakeholder initiatives in global production networks: naturalizing specific understandings of sustainability through the Better Cotton Initiative."

¹⁵ Changing Markets Foundation, "The false promise of certification"

Second, observers have criticized the claim that the United States' farm, labor, and chemical regulations give it the right to be called the "best in class." There are many efforts to measure the continuous improvement of cotton farming in the U.S., and the industry continues to set and meet sustainability goals. Yet, there continues to be a marketing message that U.S. cotton has an inherent sustainability superiority, which downplays the negative impact that individual farms may have in local communities or the impact farms may have in aggregate. Some frameworks have advanced outcomes-based metrics, but these frameworks may limit what information they share out of apprehension that highlighting certain grower accomplishments and implicitly criticizing others that are lower performing will create a backlash and undermine the use of that framework.

Finally, scholars and reporters have criticized some frameworks for their inability to provide annual documentation and impact reports as well as unclear or ambiguous criteria for performance, especially related to pest management and fertilizer use¹⁶ These criticisms create confusion among brands, retailers, and consumers about the objectives of these frameworks and whether they are adequately describing the impacts of initiatives that use them.

The objective of developing more integrated and enhanced management frameworks applicable to cotton is to preserve and enhance the quality of natural resources without compromising the quantity and quality of agricultural products.¹⁷ In this context, this report identified existing frameworks based on the following selection criteria: (1) consideration of one or more elements of sustainability, (2) availability in the U.S., and (3) applicability for cotton. Based on these criteria, the following ten cotton management frameworks were included for analysis during our desktop research, and five were selected for in depth interviews (bolded): **Better Cotton Initiative (BCI)**, **BioPreferred**, **Content Claim Standard**, **Cotton LEADS**, **e3**, **Field to Market**, **Global Organic Textile Standard (GOTS)**, **Organic Content Standard**, **USDA Organic**, and **U.S. Cotton Trust Protocol**.

A comparative overview of the frameworks can be found as Appendix Item #5. Each initiative's impact areas were documented from their published program principles, criteria, and impact reports (Table 6) and their detailed metrics and criteria were documented (Table 7).

Regarding criteria and impact measurement, metrics range in type between qualitative principles that can be answered in a binary fashion to intensive data driven calculations. We found that organic and sustainability initiatives all document data on pesticide use and soil indicators (Table 6). In addition to GMO, pesticide, and fertilizer restrictions, organic initiatives report on proxy benefits to biodiversity, soil, and water quality from organic production methods but do not measure these impacts directly. The GOTS framework includes the same indicators of organic production practices as well as a variety of social and environmental criteria beyond the farm at manufacturing and trading stages, as well as banning certain chemicals from final textile production that are known to have human health risks. The Content Claims and Organic Content Standards track organic content, but not impact from production practices directly. They also do not address environmental aspects of textile production (such as energy, water, or chemical use, labor rights).

The BCI framework includes additional criteria for small and medium sized farms that focus on pesticide, safety, and labor but does not have quantitative measurements for these sizes of farms. For large farms BCI requires collection of quantitative measurements regarding fertilizer and

¹⁶ Partzsch, L., Zander, M., & Robinson, H., "Cotton certification in Sub-Saharan Africa: Promotion of environmental sustainability or greenwashing?"

¹⁷ FAO, "Measuring Sustainability in Cotton Farming Systems: Towards a Guidance Framework."

pesticide application, water use, and yield. Field to Market includes quantitative metrics on the same impacts as BCI but utilizes different metrics for these indicators. Field to Market also includes metrics for biodiversity, energy, greenhouse gas emissions, and water quality on farms. Growers may collect different or additional metrics to the ones required by frameworks in order to make farm management decisions. These decisions can have positive impacts on sustainability and may go unreported in some frameworks (Table 4). Metrics across impact areas vary by program except where collaboration exists to leverage a single measurement platform (Table 6, 7) such as USDA Organic and Field to Market.

Table 6 - Impact areas covered by metrics, criteria, and impact reporting of sustainable cotton initiatives

	Organic Programs				Field to Market ***	U.S. Trust Protocol ***	e3 ***	Better Cotton Initiative	Cotton LEADS*	Bio Preferred*
	USDA Organic**	Organic Content Standard**	Content Claim Standard**	Global Organic Textile Standard**						
Certification	✓	✓	✓	✓		✓	✓	✓		✓
Consumer-facing Label	✓	✓		✓		✓	✓	✓		✓
Biobased									✓	✓
Biodiversity	✓			✓	✓	✓	✓	✓	✓	
Chain of Custody	✓	✓	✓	✓		✓	✓	✓		
Child Labor				✓				✓		
Continuous Improvement					✓	✓	✓	✓	✓	
Energy and Carbon Footprint				✓	✓	✓	✓		✓	
Farm Management	✓			✓	✓	✓		✓	✓	
Fiber Quality						✓		✓	✓	
Forced Labor				✓				✓		
No GMOs	✓			✓						
Labor Rights				✓				✓		
Land Use	✓			✓	✓	✓	✓	✓	✓	
Organic Production	✓	✓	✓	✓						
Pesticide Use	✓			✓		✓	✓	✓	✓	
Soil	✓			✓	✓	✓	✓	✓	✓	
Water Consumption				✓	✓	✓	✓	✓	✓	
Water Quality	✓			✓	✓	✓	✓	✓	✓	
Worker Health and Safety				✓				✓		
Yield					✓	✓	✓	✓	✓	

Legend

- Research investment in this
- Relies on another standard to
- included in standard

*, **, *** programs are used
 ✓ textile manufacturing

Overall, the impact areas that frameworks cover, and the criteria used are similar across organic certifications, though some claims to biodiversity, soil, and water quality extend beyond measurement. Frameworks for conventionally grown cotton cover similar impact areas but vary in how they measure performance. However, there are collaborative efforts underway to harmonize and align performance metrics; we will discuss these below.

Table 7 - Detailed metrics and criteria used by sustainable cotton initiatives

	Global Organic Textile Standard	Field to Market, e3, U.S. Cotton Trust	Better Cotton Initiative (Criterion-small and medium farms)	Better Cotton Initiative (Results Indicators/ Metrics-large farms)	BioBased*	USDA Organic**
Biobased					"new" organic carbon ÷ "new" organic carbon + "old" organic carbon	
Biodiversity		Habitat Potential Index	Biodiversity Management Plan (id and map resources, id and restore degraded areas, enhance beneficial insect populations, crop rotation, protect riparian areas)			
Child Labor	Child labour must not be used. Based on the Minimum Age Convention and Worst Forms of Child Labour Convention		No child labor under ILO Convention 138, No workers under 15 or below minimum age per local law			
Continuous Improvement			Implement a continuous improvement plan, workers receive regular training on best practices, operate a data management system, document and review risks of noncompliance and implement corrective actions, Several criteria across impact areas call for continuous improvement or have time-bound goals			
Energy Use	Wet processing units must keep full records of the energy use per kg of textile output	BTU's per acre or crop production (includes metrics for farm management, chemical application, manure				

	Global Organic Textile Standard	Field to Market, e3, U.S. Cotton Trust	Better Cotton Initiative (Criterion-small and medium farms)	Better Cotton Initiative (Results Indicators/ Metrics-large farms)	BioBased*	USDA Organic**
		loading, seed production, irrigation, post-harvest, transportation)				
Greenhouse Gas Emissions		GHGs per unit of crop production (includes energy use, N ₂ O from soils, methane from flooded fields, residue burning				
Fertilizer Use	Utilize a specific process to identify synthetically derived nitrogen in cotton fiber (ISO 20921:2019)	fertilizer impacts are covered by Water Quality and GHG metrics	kg per hectare for each type of fertilizer	kg per hectare for each type of fertilizer		Soil fertility and crop nutrients will be managed through tillage and cultivation practices, crop rotations, and cover crops, supplemented with animal and crop waste materials and allowed synthetic materials, The use of genetic engineering, ionizing radiation and sewage sludge is prohibited
Fiber Quality			All stages of cotton production and storage must minimize trash, contamination, and damage, implement management practices that maximize fiber quality			
Forced Labor	Employment must be freely chosen. Based on the Forced Labour Convention and the Abolition of		No forced, compulsory work including bonded or trafficked labor			

	Global Organic Textile Standard	Field to Market, e3, U.S. Cotton Trust	Better Cotton Initiative (Criterion-small and medium farms)	Better Cotton Initiative (Results Indicators/ Metrics-large farms)	BioBased*	USDA Organic**
	Forced Labour Convention					
GMOs	Prohibition of genetically modified organisms (GMO) and their enzymes					The use of genetic engineering, ionizing radiation and sewage sludge is prohibited
Labor Rights	Key norms of the International Labour Organisation (ILO) must be met by all processors and manufacturers.		No discrimination that denies or impairs equality, Equal pay for equal work, Access to safe and hygienic facilities, potable and washing water, and medical care (including emergency care), provide regular health and safety training and prevention, record accidents and illness, guarantee right to organize with access to facilities, pay legal minimum or regional norm regularly and on time, worker consent during hiring, keep employment records, ensure temporary, seasonal or contracted workers receive equivalent benefits and conditions, working hours comply with national laws or collective agreements, overtime work is voluntary in accordance with law or collective agreements, no tolerance for corporal punishment, physical or mental coercion, sexual, physical or verbal harassment, transparent disciplinary policy, collaborate on decent work, develop effective producer organization			

	Global Organic Textile Standard	Field to Market, e3, U.S. Cotton Trust	Better Cotton Initiative (Criterion-small and medium farms)	Better Cotton Initiative (Results Indicators/ Metrics-large farms)	BioBased*	USDA Organic**
Land Use		acres per unit of crop production	Adopt High Conservation Value approach when converting land			
Organic Production	A textile product carrying the GOTS label grade 'organic' must contain a minimum of 95% certified organic fibres whereas a product with the label grade 'made with organic' must contain a minimum of 70% certified organic fibres					Operations must use organic seeds and other planting stock when available
Pesticide Use	Hazardous pesticides are banned in organic cotton production.		IPM Program, Registered Pesticides Use, No use of pesticides on Stockholm Convention, Montreal Protocol, or Rotterdam Convention lists, Phase out highly hazardous chemicals by 2021 and 2024, Phase out carcinogenic, mutagenic, and reprotoxic chemicals, Restrictions on those using pesticides, Require PPE, Proper storage, Follow Label use, Proper disposal	kg per hectare of each active ingredient		Land must have had no prohibited substances applied to it for at least 3 years before the harvest of an organic crop, Crop pests, weeds, and diseases will be controlled primarily through management practices including physical, mechanical, and biological controls. When these practices are not sufficient, a biological, botanical, or synthetic substance approved for use on the National List may be used
Soil		USDA NRCS Soil Conditioning Index	Soil Management Plan (includes soil analyses,			Soil fertility and crop nutrients will

	Global Organic Textile Standard	Field to Market, e3, U.S. Cotton Trust	Better Cotton Initiative (Criterion-small and medium farms)	Better Cotton Initiative (Results Indicators/ Metrics-large farms)	BioBased*	USDA Organic**
		and Integrated Erosion Tool	maintaining and enhancing soil structure and fertility, continuously improve nutrient cycling)			be managed through tillage and cultivation practices, crop rotations, and cover crops, supplemented with animal and crop waste materials and allowed synthetic materials.
Water Consumption		applied water ÷ (irrigated yield - non-irrigated yield)		cubic meters per hectare		
Water Quality		USDA NRCS Water Quality Index				
Worker Health and Safety	Freedom of association and the right to collective bargaining are respected (Freedom of Association and Protection of the Right to Organise Convention; Right to Organise and Collective Bargaining Convention; Workers' Representatives Convention; Collective Bargaining Convention). Working conditions must be safe and hygienic (Occupational Safety and Health Convention). Child labour must		No hazardous work by workers under 18			

	Global Organic Textile Standard	Field to Market, e3, U.S. Cotton Trust	Better Cotton Initiative (Criterion-small and medium farms)	Better Cotton Initiative (Results Indicators/ Metrics-large farms)	BioBased*	USDA Organic**
	not be used (Minimum Age Convention; Worst Forms of Child Labour Convention). Living wages (Protection of Wages Convention; Minimum Wage Fixing Convention). Working hours are not excessive (Hours of Work Convention; Weekly Rest (Industry) Convention).					
Yield		lbs total cotton ÷ total acres cotton production area	kg total cotton lint ÷ total ha cotton production area	kg total cotton lint ÷ total ha cotton production area		

The primary focus of our management framework interview questions was to understand the goal of their framework, their main users, success stories, challenges, expected benefits to farmers and companies, and their relationship with other frameworks. The following key themes and subthemes emerged during the interviews:

Achieving Sustainability Goals and Success Stories

All representatives of the management frameworks interviewed in this report reported that the goal of their framework is to promote sustainability and continuous improvement in the cotton supply chain. However, each of the frameworks have different mechanisms in place to achieve that broad goal. For example, the e3 Sustainable Cotton Program aims at achieving sustainability by "providing traceability,"¹⁸ whereas BCI is "triple-bottom line driven,"¹⁹ aiming at addressing the environmental, social, and economic impacts of cotton production to achieve sustainability. The U.S. Cotton Trust Protocol works closely with Field to Market, driving "continuous improvement through a science-based approach,"²⁰ while the Trust Protocol commits to intentionally engage farmers to document

¹⁸ E3 representative interview, p. 02.

¹⁹ BCI representative interview, p. 02.

²⁰ Field to Market representative interview, p. 02.

their farm-level data and provide them with information and educational resources. The representative of Textile Exchange views the Organic Content Standard as a tool to drive long-term sustainability by strengthening the integrity of the chain of custody and protecting "the intrinsic value of the product."²¹

All of the initiatives sought to achieve their goals through a variety of mechanisms including farmer education, increasing yield and profitability, improving outcomes, and creating a market solution for sustainable cotton. Success stories were an important indicator of progress. The following quotes illustrate this point.

"Companies will be able to report to their shareholders, their customers, their stakeholders that their cotton is being sourced through a sustainability program that actually works directly with farmers on the ground... Increasingly, they were also seeing an interest in science-based targets and scope 3 emissions and things like this, where companies would actually set reduction targets for their own value chains, around things like climate and water. It's very difficult to access on-farm data and information. It's not something that historically would have been available to these companies. So, having a framework...would give them an ability to begin to assess their progress against things like science-based targets."

"Only more recently have we actually seen more downstream participants within the apparel side begin to take hold... We hope that there's going to be more, but cotton has been a bit unique in that they used it as a research tool, as well as a grower engagement tool to try to just better the industry. . . . the cotton industry has [also] set continuous improvement goals for all U.S. cotton and others as well. And they're using the Fields to Market metrics as the way to evaluate success and progress against those continuous improvement objectives. So, then it becomes sort of like the industry standard..."

"And after the years we've been able to strengthen a lot of things. We have on the ground ambassadors for every growing region, and we've been able to root out fraudulent certification bodies, we've been able to root out fraudulent producer groups, we take action all along the line in order to strengthen integrity of the system and work with the really good programs and projects that are there on the ground."

Barriers for Adoption

Nearly all initiatives cited financial incentives as a key barrier for growers to adopt frameworks. Organic and e3 programs provide direct price premiums to growers, while others focus on marketability and efficiency gains as grower benefits. Several initiatives cited the costs of traceability of the cotton fibers from farms to different parts of the cotton supply chain as a key reason for a chain of custody model called mass balance.

"We use mass balance as a way to take costs out of the system and to enable a rapid growth in the supply of better cotton and not slow down the gears of procurement and exchange. (...) So it doesn't slow down on the transactions, it gives people what they

²¹Textile Exchange representative interview, p. 01.

need, it doesn't add much if any extra price, but the traceability system is like an accounting system and ensure that value is still accrued because of that farmer's adherence to the system and no credits in excess of what was produced by participating farmers is ever created."

Rather than tracing the cotton fiber from farm to product through physical segregation of material, the mass balance approach is a volume-tracking system that allows "sustainable" cotton to be substituted or mixed with conventional cotton, while ensuring that credit is given to a brand or retailer for the purchase of "sustainable" cotton.²² For instance, BCI's mass balance model uses Better Cotton Claim Units (BCCUs) as a designated unit to track the volumes of physical cotton or cotton-containing products associated with a Better Cotton claim. 1 BCCU represents 1Kg of physical Better Cotton lint procured from a gin processing Better Cotton by a merchant or a spinning mill. The post-gin mass-balance system does not require that the BCCUs remain associated with the original physical Better Cotton from licensed BCI Farmers. As a result, cotton products can be sold with a Better Cotton claim without containing any physical Better Cotton.²³ The e3 Sustainable Cotton program was the only initiative analyzed in this report that provides full traceability in the cotton supply chain through physical segregation.

Initiative sponsors also explained that collecting data was a burden for growers and that providing value back to growers was important to overcome survey fatigue. Linking sustainability to profitability was also a challenge mentioned by initiative managers, as metrics without a link to dollars earned or saved are not as compelling to growers. As one framework staff member noted:

"You want price parity? Current price parity has created the pollution and the problems, and the poverty. Tell me again why you want price parity with conventional?...if you're talking about sustainability it's more than measuring the chemicals, it's more than measuring the water, it's about people, and, you know what that whole third leg on that stool is... it's about economic sustainability...So, the whole price paradigm is really getting into true cost accounting, natural capital accounting and really...shifting from a price paradigm to a value paradigm...Our brands need to be courageous."

Benefits to Farmers and Brands

Professionals who work with management frameworks say they provide many benefits to farmers and brands including education on best practices to improve sustainability and input efficiency, in addition to market access. Managers of these frameworks said they provide a valuable platform for storytelling that is important for brands and growers.

"I would say most growers, probably 75% or more, typically have some assistance, either from a university, or from a local agronomist, or from USDA, or a supply chain partner that's helping with the data collection and entry into the platform. And then, when the results are shared back with the farmer, thinking through, if they are lagging in any of

²² Marchyshyn, "From Farm to Fabric: Tracing Brand and Retailer Needs for Sustainable Materials Through the Supply Chain."

²³ Better Cotton Initiative, "Chain of Custody."

the indicators like, let's say, their irrigation water score is very poor. Then what can be done to make improvements in that particular area. What are some technologies or systems that they might put in place to drive and improve that score? So, we want the results to have just as much meaning for the farmer as for the supply chain."

"A lot of companies have sustainability goals and I think this is a program that really allows them to help reach that goal. In other ways it benefits, it allows them a unique storytelling message. And I think, in the last year, and probably the next two, three years moving forward, it's very much, at least in the U.S., it's the American made, made in America. And I think this is an opportunity for those guys to kind of have that storytelling ability and to really put a face to cotton and put a face to the raw materials that maybe they haven't in the past."

Cross-Framework Collaboration

In this context, all representatives of the frameworks interviewed for this report expressed that rather than competition, there is collaboration among the five different frameworks analyzed in the interviews. A common theme among all interviewees was a strong sense of a shared goal of driving sustainability in the cotton supply chain, as well as opportunities to collaborate. For instance, even though BCI was not designed to be used with other frameworks or dependent upon another framework in some aspect, one sustainability professional interviewed for this report highlighted BCI's collaboration efforts with other frameworks in the U.S. and in other countries as well, such as Cotton Australia's myBMP (My Best Management Practice) and Brazil's ABRAPA (Responsible Brazilian Cotton Program). In addition, BCI is currently working closely with the U.S. Cotton Trust Protocol: "We have every hope and expectation that [U.S. Cotton Trust Protocol] will culminate in a standard system that can be benchmarked in the same way that Brazil's and Australia's have."²⁴

Another commonality among the five frameworks was their main users. All representatives of the five different frameworks reported that the main users of their framework were farmers and brands/retailers.

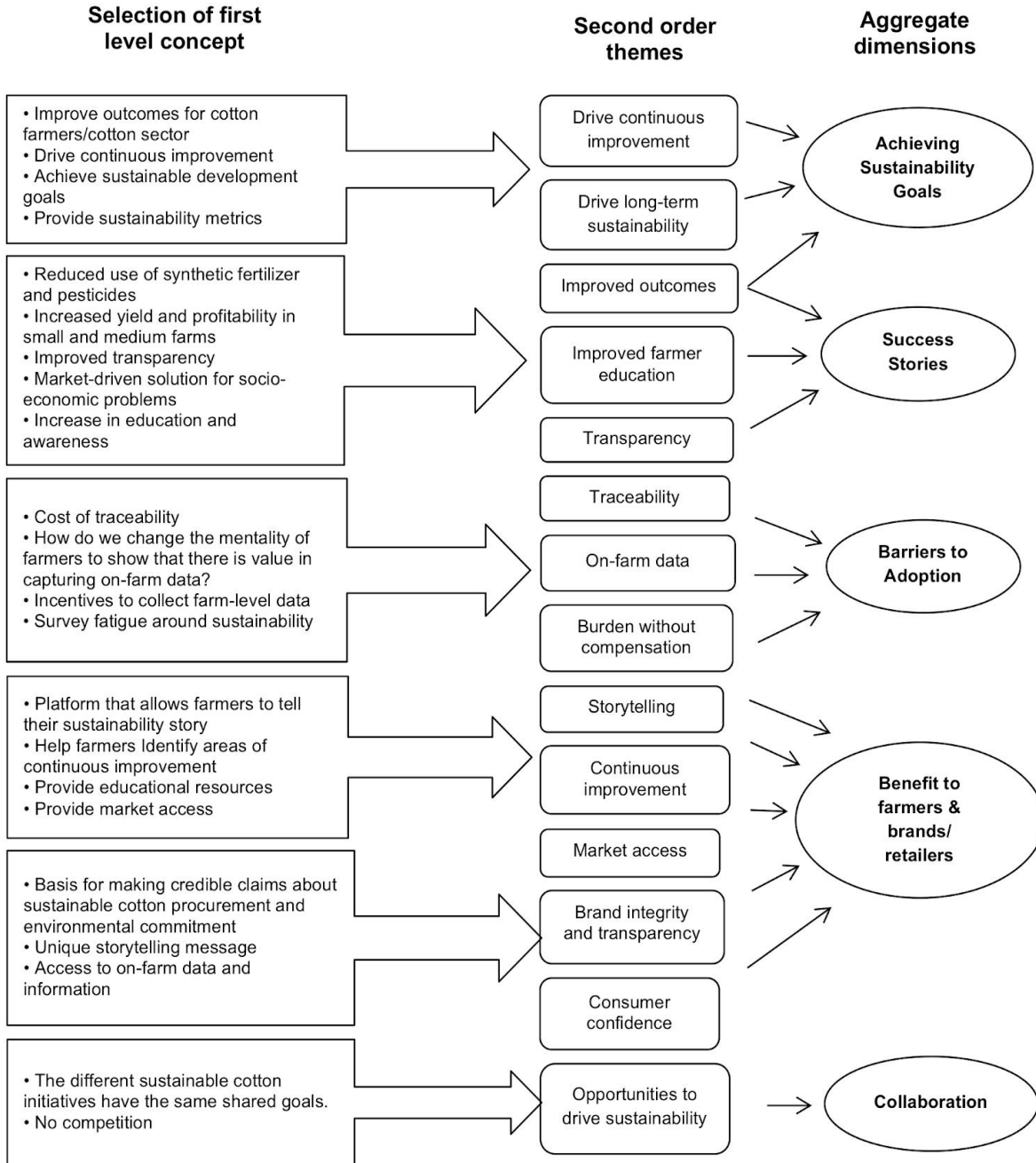
"National Cotton Council and Cotton Incorporated have been such active and founding members of Field to Market. In many cases we're gonna follow their lead in terms of the frameworks that are most important for the grower community to align with in the US. So, when the Trust Protocol was being stood up, it was a clear opportunity for us to work directly with the Protocol....in full transparency, we haven't gotten a similar sort of request or signal that we needed to go align with BCI. No one from the cotton or apparel sector has sort of urged or asked us to do that. So, I'm certain we could if it was a priority, but that has not been identified at this point. So, the Cotton Trust Protocol will, I think, increasingly be a priority. E3 was sort of baked in from the beginning and the Textile Exchange just because I think they're trying to just keep track from a global scale of everything that's happening."

"We continue to have a lot of good collaboration with the Better Cotton Initiative; we're not seeing ourselves as competitors. In fact, we continue to have a lot of I think very

²⁴BCI representative interview, p. 10.

positive dialogue, because they've really...become the model for a farm level type program... We don't see that as a competitive arrangement...the farmer looks at BCI or they're looking at the US Cotton Trust Protocol, we see those as both opportunities to drive a positive message about the sustainability of cotton and ... that, I think becomes an overarching objective."

Figure 4 - Aggregate Results from Interviews with Sustainable Cotton Initiatives



Discussion: Frameworks of the Future

Cotton sustainability frameworks in the U.S. see themselves as mechanisms for driving and documenting continuous improvement, expanding market access for U.S. cotton, and showcasing success stories. However, they do not all do this in the same way. Because they use differing economic and impact models, different frameworks provide different ways for farmers and brands to demonstrate their commitment to growing and sourcing sustainable cotton.

For example, the Bio-preferred and Cotton LEADS frameworks promote cotton as a renewable resource. Organic cotton frameworks leverage their environmental benefits to create market value for growers and brands. Sustainable cotton frameworks for conventional cotton provide a means for growers to communicate their performance to brands and consumers through e3 and the U.S. Cotton Trust Protocol through program criteria, self assessments, and by leveraging Field to Market quantitative metrics. Growers participating in BCI can verify performance by providing farm data to this flexible framework that scales across farm size and geography. The main concern about BCI from other frameworks is the comparability of sustainability practices across nations and the promotion of cotton that may be grown under very different or less sustainable conditions than U.S. cotton.

Efforts to collaborate on shared or congruent metrics across frameworks have not always been a top level concern for most sustainable cotton initiatives. However, our research found that in the U.S. there is growing convergence around utilizing the Field to Market methodology as BCI works to establish equivalencies with the U.S. Cotton Trust Protocol (which leverages Field to Market). The developing convergence on one measurement methodology (Field to Market) eases the burden of reporting and allows for consistent measurement and reporting in the U.S. across cotton farms and enables the methodology to be used on a larger scale.

These variations in frameworks, while providing flexibility to growers and brands, does not resolve all the outstanding issues with their application. At the most basic level, how do you communicate to the consumer the difference between "organic" cotton and "sustainable" cotton? Assuming that farmers and brands know the differences and the value of these different programs, how can the consumer understand them? Although concerns exist about confusion within the market between "sustainable" cotton, with its various definitions and criteria, and "organic" cotton, our research found that frameworks perceive themselves as collaborators and not competitors with a common goal of making cotton more sustainable through a variety of mechanisms and programs. The focus on both the value for the grower and for the brand and in the end promoting cotton as a sustainable, preferred material to synthetics is a major convergence point. It is unclear how this convergence addresses the critique that U.S cotton is marketed as superior without having impact results over time to support this assertion. Frameworks willingness and ability to tell authentic stories about continuous improvement with honest reflection of the challenges to sustainability on the farm would create more trust with brands and consumers. In the case of organic, claiming proxy benefits to biodiversity, soil, and water quality from organic practices needs evaluation and consideration of quantitative metrics to support claims.

As for the criticism that frameworks lack the ability to provide annual documentation and impact reports creating confusion with brands, retailers, and consumers our research found frameworks provide impact reports at various intervals and could benefit from the metrics harmonization across sustainable cotton frameworks. Additionally, looking to add quantitative metrics in areas where gaps

exist is important for driving on farm measurement improvements. Even with farm level verification the accuracy of farm metric reporting is hard to determine. Frameworks that put forth efforts to understand how growers interpret metrics and input data will gain important insights to improve data quality and accuracy. Acknowledging that growers take conservation actions and collect data that is not reported to sustainability frameworks is important to understanding the claims and outcomes of initiatives and should be explored for inclusion in future versions of frameworks. Lastly, scaling sustainable cotton initiatives remains a challenge in the U.S. and addressing the value to the grower is key to expanding these efforts to measure and drive continuous improvement.

Responsible Apparel Companies

The third component of our research focused on capturing the voices and experiences of responsible apparel brands in the sustainable cotton supply chain. The majority of people interviewed in this study noted that consumers, institutional investors, NGOs, and other stakeholders are putting increasing pressures on apparel brands and demanding more sustainable practices and products. Our central goal concerning apparel brands was to understand the barriers and opportunities these firms face. More specifically, *what are the things that facilitate and hinder the process of apparel brands procuring sustainable cotton?*

The 14 interviews with sustainability managers, directors, and consultants with various apparel firms across the US and Europe represented over 20 brands that work to procure sustainable cotton. We used mixed sampling methods including, theoretical sampling, opportunistic sampling, and snowball sampling.²⁵ Our interview protocols were developed to explore the landscape of sustainable cotton and firms, and to integrate with the full research approach including farms and frameworks (See Appendix 2,3,4 for the interview protocol).

Our first and second-order analysis of the data provided insights that informed our final themes and overall recommendation centered on social capital [presented in the discussion section below]. Firstly, we began to uncover challenges with tracing cotton through the supply chain, chains of custody, fraud, and frustrations with the supply chain. Secondly, we began to recognize another challenge as we asked firms to describe their commitments to sustainability and to define sustainable cotton. Unexpectedly, we received a diverse array of responses. Some firms expressed that US cotton in general was the most sustainable, other firms noted that organic or recycled cotton is how they defined sustainable cotton. Thirdly, we began to uncover interesting insights into how important firms were finding building relationships or "getting to know people" was proving to be. We expected to hear about relationships with farmers, but we began to see that relationships across the supply chain can be valuable. Finally, we used these granular insights to build broader themes.

Our firm level findings coalesce around 4 key aggregate themes. 1) *Opacity & Traceability*, 2) *Networks & Social Capital*, 3) *a Continuum of Definitions*, 4) *Emerging Narrative of Soil Health and Regenerative Agriculture*. See Figure 5 for a model of our insights; first order codes, second order themes, and aggregate dimensions at the firm level.

In the narrative below, we use quotes from our interview respondents to tell their story in their own words.

²⁵ Charmaz, "Constructing Grounded Theory"

Opacity & Traceability

Many of our interviews with responsible apparel companies indicated transparency throughout the production process should be more visible from the cotton farmers to the final product. In particular, there was recurring commentary around the opacity in the supply chain: *"There is intense opacity."* Many people interviewed in this section of the study noted that it has been difficult to respond quickly to rapidly changing competitive supply environments, while at the same time retaining confidence that they can trace the sustainability attributes of the products that the firm is procuring back to their origin. We heard words like "opaque," "grey," and "antiquated." We also found fraud to be a concern for firms: *"if you wanna market that you have organic cotton, it has to be, you know, certified or OSC. [...] those standards are under fire right now for fraud."*²⁶

We realize that the concept of the supply chain is clear, as we present in the beginning of this paper. However, the nuances, actors, diversity in values, and processes collectively create the perception of opacity. The following quotes are illustrative concerning these issues. They also highlight the interest in, and challenges with traceability.

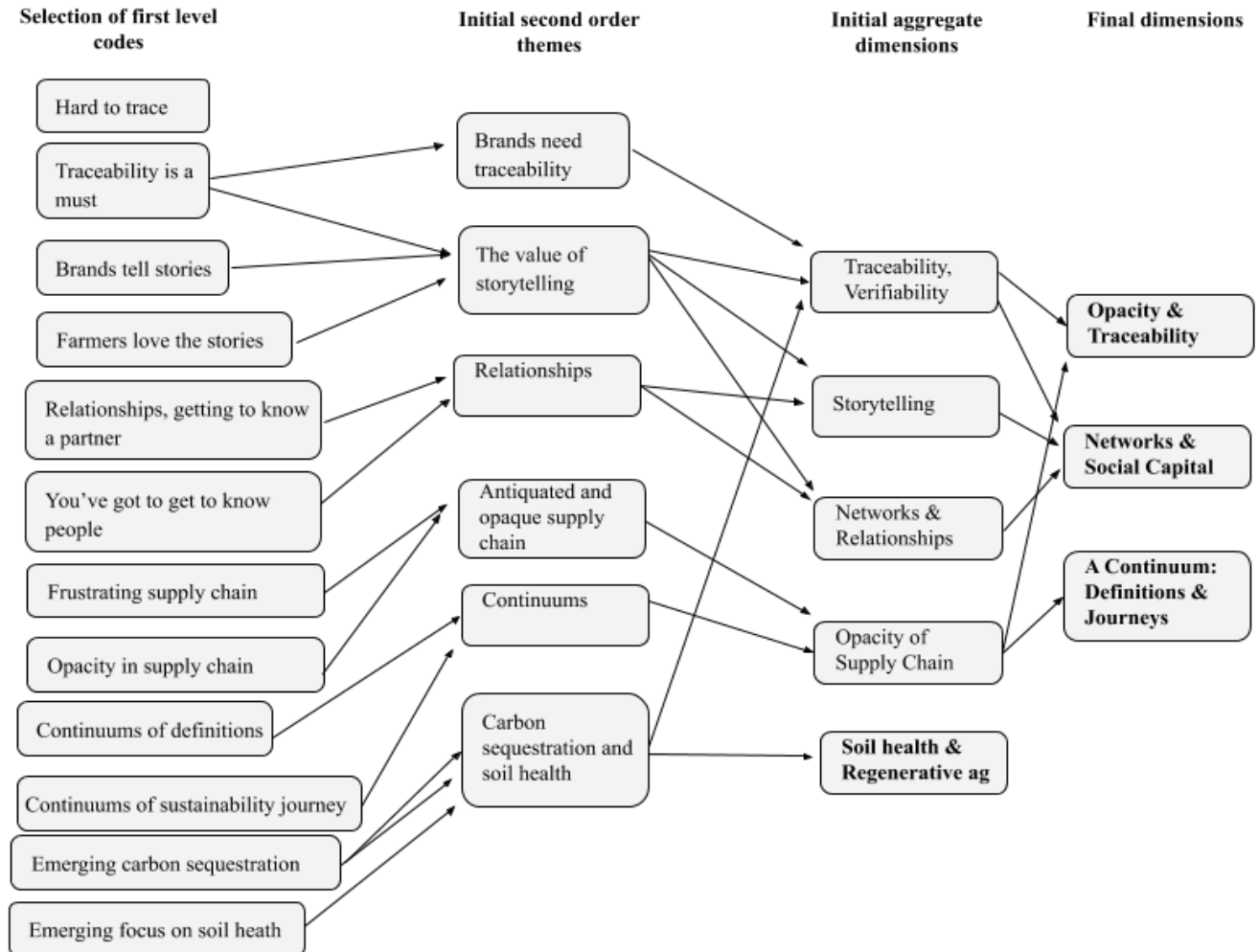
"One of the reasons that we as a company had held off for so long, is because we were concerned about that lack of chain of custody."

"But I think the gray zone we have on the supply chain is really what's happening from the farm perspective to the spinning."

"It's good to have organic cotton, but it's also- or even more important to be able to verify that cotton fiber and it's origin."

²⁶ Company Representative interview, p.02

Figure 5 - Aggregate Results from Interviews with Responsible Apparel Companies



"Well, in any cotton, no matter where you are on the spectrum, and especially with regenerative, you do need visibility and traceability all the way back to the farms"

"...if you wanna market that you have organic cotton, it has to be, you know, certified or OSC. [...] those standards are under fire right now for fraud"

"The BCI brands that are buying BCI cotton don't know where that cotton comes from."

"You're just paying a fee and you're contributing to a bigger system that is trying to make the whole system better, which in theory sounds really good, but what that does is, the cotton you're actually selling to your consumers might not be sustainable at all."

In our interviews, we found that firms see technology as a way to address the issues of opacity, traceability, and fraud. Technological advancements in agribusinesses such as blockchain are enabling more comprehensive traceability and the elimination of fraud. Although blockchain is predominantly used now for cyber-currency transactions, many other industries are starting to use it as a platform for traceability and transparency throughout the supply chain. Trade organizations such as the National Cotton Council of America are forming partnerships with companies to develop a blockchain-based tracking system. By having a decentralized network, actors in the supply chain are less vulnerable to hacking or exploiting the permanent bale identification system. However, technology is still in its nascent phase when it comes to sustainable US cotton:

"We're a top 10 fashion company and we still haven't gotten technology down"

"DNA will take the place of certification, because it's so much more accurate"

Networks & Stronger Social Ties

Our second major theme to emerge among firms we interviewed was the importance of networks and trust for sustainability success. Our interview respondents commented frequently about the importance of networks, partnerships and good relationships. We found that social ties with partners in the supply chain are critical to achieving sustainability targets and addressing the demands placed on brands in making material purchasing decisions. These quotes highlight the importance of relationships for successful sustainability practices.

"There needs to exist a good knowledge of the whole supply chain and a good cooperation with your suppliers, which become partners. Otherwise, it would be very, very difficult to make sure you have a fully-traceable and full visibility of the whole process."

"Partnerships not numbers or contracts are how sustainability gets done."

"You've got to get to know people."

"We need more... communications, along the chain"

"We're on a new frontier, you just have to dig deeper into your supply chain. Putting solar panels on your roof isn't enough."

These findings point to the importance of relationships between diverse actors in the supply chain.

Continuum of Definitions

Across this study, we found that interviewees used the concept of "sustainable cotton" to refer to a continuum of definitions. Firm representatives offered a range of definitions from "anything other than conventional cotton," to regenerative cotton, to U.S. based cotton. Many of the firms with advanced sustainability programs noted that to them, sustainable cotton is "more sustainable cotton" because the target is moving. The definition and understanding of "sustainable cotton" advances as leading organizations redefine what they mean by these words.

When exploring the underspecified question of how brands manage their sustainable cotton procurement we asked for firms to clarify their commitment to sustainable cotton. How do you define sustainable cotton? A majority of the firm interviewees did not immediately mention a specific sustainable cotton framework or metric as part of their concept as we expected. We balanced a refrain from leading respondents and uncovering insights about perceptions of frameworks and the concept of sustainable cotton. Could this mean that brands do not see frameworks as part of their strategy? Were they responding from a marketing perspective to own their sustainable cotton goals and sustainability story? Future research in this space might address how frameworks and certifications are leveraged in strategy making.

"To define what sustainable cotton is, it's not just a simple one size fits all. It is a continuum of progression from, moving from just traditional conventional and GMO cotton, to maybe the next step is BCI. And then maybe the next step after that is transitional to organic. And then organic and then regenerative organic or biodynamic."

"That has been a big challenge for a lot of us, is to really define what it means to be sustainable."

"The most sustainable cotton in the world is U.S. cotton"

Emerging Narrative Around Regenerative Cotton

Our final key theme from interviews with apparel firms revolves around an emerging conversation about regenerative agriculture. Some of our respondents mentioned regenerative agriculture as the next frontier of sustainable cotton. Firms we spoke with reflected this in the vocabulary they used in describing sustainability. Interestingly, some firms noted the importance of soil health—a key tenant in regenerative agriculture. Further, other firms noted the ability for healthy soils to sequester carbon. These are exciting findings as they convey an interest in continually improving the sustainability of fiber choices.

"since industrial ag started in the turn of the century, you know, early 1900's, we forgot that soil is gold. It is actually the foundation of civilization and of surviving and thriving. And that the interrelationship between soil and plant and animals and insects and man and climate and everything works together in this beautiful way."

"And so they're looking for a climate mitigation plan and obviously there's only so much you can do at your factory. You can put solar on them. Textile mills, same thing. That's a big part of apparel's footprint. But farm is a big one where you could actually sequester carbon into the ground and remove carbon from the atmosphere. And that's really exciting to people."

"Not to get too far off track, but in fact, We can show you some organic farmers that in my mind are not sustainable, particularly related to soil health, because the only way they can control weeds is to plow. And that's really detrimental to the soil health in the long run."

"Well, in any cotton, no matter where you are on the spectrum, and especially with regenerative, you do need visibility and traceability all the way back to the farms. So farms, the ginner, spinner, weaver, knitter."

Discussion: Focus on Social Capital to Enhance the Value and Efficacy of Sustainability Initiatives

To improve the environmental outcomes of products, organizations must reach out to suppliers deeper and more distant in their supply chains.²⁷ This is a key managerial implication of our work and an approach to overcoming issues identified in our broader research, such as:

- an opaque and antiquated supply chain,
- a lack of a shared definition sustainable cotton,
- fraud in certain certifications,
- a lack of understanding of the burdens placed on suppliers,
- the inability to demonstrate to farmers the value of their on-farm data,
- the need to leverage storytelling opportunities across the value chain,
- challenges in achieving targets set by firms and the cotton industry at large,
- enabling technology in tracing, and
- perceptions held of each value chain actor.

The sustainability of supply chains depends on collaborative relationships between actors and across tiers.²⁸ At the heart of this idea is "social capital"—networks of relationships that are valuable business resources and which facilitate collective action.²⁹

"You need to identify someone in the supply chain that will be able to work in a collaborative manner. If that doesn't work, if the work they're trying to do or the partnership they're trying to do is based on numbers and contracts, it will be very, very difficult to have a sustainable supply chain."

Our research points to the importance of trusting relationships in the cotton supply chain. Building social capital is critical. We believe that these social capital needs apply across the supply chain.

For example, we heard how important it was that firms meet their suppliers "where they are"—that farmers welcome approaches seen as collaborative but resist and resent approaches that they perceive to be judgmental or condescending. On the other hand, the resources and capabilities that can develop through genuine supply chain wide collaboration from farm to firm can become sustained competitive advantages because they are hard to imitate.³⁰ Further, high levels of social capital also lead organizations to perform better than their competitors.³¹ Building social capital can lead to reduction of conflicts, increases in resilience, the promotion of cooperative behavior, development of shared visions and understanding, reductions in opportunistic behavior, and can generate trust in relationships.³² Responsible apparel brands that desire to build strategies to achieve their sustainability goals should focus on cultivating strong and authentic relationships and strategically build social capital across their entire supply chain.

²⁷ Choi and Linton, "Don't Let Your Supply Chain Control Your Business"

²⁸ Gold, Seuring, and Beske, "Sustainable Supply Chain Management and Inter-Organizational Resources."

²⁹ Adler and Kwon, "Social Capital: Prospects for a New Concept."

³⁰ Gold, Seuring, and Beske, "Sustainable Supply Chain Management and Inter-Organizational Resources."

³¹ Tipu and Fantazy, "Exploring the Relationships of Strategic Entrepreneurship and Social Capital to Sustainable Supply Chain Management and Organizational Performance."

³² Villena, Revilla, and Choi, "The Dark Side of Buyer-Supplier Relationships."

Building stronger individual and organizational collaborative ties with partners across the supply chain should focus on three areas: relational, cognitive, and structural. Relational social capital is the goodwill that develops overtime and includes respect, friendship and trust.³³ Cognitive capital provides shared perceptions, interpretations, and systems of meaning through aligning business philosophies, and vision.³⁴ Finally, structural capital includes the presence, frequency and strength of social interactions.³⁵

Expanding on the importance of building social capital, researchers who focus on social sustainability issues note that solely focusing on working with third parties—frameworks, certifications, auditing—can limit the achievement of sustainability outcomes [firms and suppliers lack direct interaction].³⁶ Relying solely on third parties to promote sustainable supply chain management can impede the creation of strong social ties and long term trusting relationships, the essentials for authentic supply chain collaboration.³⁷ New research suggests that combining strong social ties and networks with assessments, certifications, and working with third parties, leads to enhanced outcomes.³⁸

Is this a silver bullet? Most likely, no. However, we see it as a key tool for diverse stakeholders in the journey to make the cotton supply chain continually "more sustainable." We suggest organizations across the value chain not only work with third parties but develop concerted efforts to build strong relationships with diverse actors. Reinforcing collaboration practices builds suppliers' capabilities and subsequently drives improved collective sustainability performance.³⁹

³³ Alghababsheh and Gallear, "Socially Sustainable Supply Chain Management and Suppliers' Social Performance."

³⁴ Alghababsheh and Gallear.

³⁵ Alghababsheh and Gallear.

³⁶ Sauer and Seuring, "A Three-Dimensional Framework for Multi-Tier Sustainable Supply Chain Management."

³⁷ Sauer and Seuring.

³⁸ Alghababsheh and Gallear, "Socially Sustainable Supply Chain Management and Suppliers' Social Performance."

³⁹ Alghababsheh and Gallear.

Conclusion

Our research provides a resource for those looking to understand the activities, issues, actors, and initiatives involved in the sustainable cotton value chain. We captured the stories and voices and experiences of diverse actors from farms, to frameworks, to firms. We leveraged insights from our data and findings in other work to provide a nuanced understanding of the current state of the sustainable cotton supply chain in the US. We recognize that stakeholders across sectors have a significant interest in successful sustainable cotton supply chain initiatives, and acknowledge the importance of all supply chain actors in their role towards commercialization and supporting the growth of sustainable cotton.

The most prevalent observation across the three main supply chain actors interviewed for this research was clearly the willingness and desire to collaborate for a sustainable U.S. cotton supply chain. At the same time, these multi-tiered supply chain interviews also demonstrated a certain amount of disconnect between the experience and perceptions that each group has about one another's value proposition. How do we reconcile that?

That experience and perception of another actor's value is compounded by the commercial challenges that each sector faces. The landscape is dynamic. Similar to a farmer investing in inputs and capital equipment to enhance the yield and quality of their product, a brand and retailer have to invest in infrastructure, marketing, consumer insights, and administrative functions to bring their product to market. Some of the frameworks require brand membership dues, while others are free, or are an expense to the farmer. Farmers want an incentive, and a majority of the company interviewees responded with an understanding that there is some cost that would need to be incurred for adopting sustainable cotton.

We also identified challenges with how "sustainable cotton" is conceptualized by actors across the value chain. "Sustainable Cotton" becomes difficult to define for multiple tiers in the supply chain because of several factors identified during our desktop review and interviews:

- The sustainable cotton initiatives all use different metrics in their frameworks
- The metrics in the frameworks can be either binary or data driven
- The cadence and quality of reporting on programmatic or farm level improvements is not always consistent
- Benefit claims being made by frameworks that are not measured but assumed or superimposed with surrogate data
- Limited understanding (companies, stakeholders) of how farm level practices influence sustainability metrics
- Various stakeholders using different numerical values to speak about the impacts of cotton

Collaboration is necessary to address the issues we identified in this work. We explained the value of firms focusing on building social capital. This applies across the supply chain for diverse organizations. With this kind of alignment, the challenge for sustainable cotton initiatives and other

supply chain actors is to find the greatest programmatic and economic efficiency. Initiatives must frame the question as not either sustainability or financial success, but how sustainability can contribute to financial success.

This research delivered insights with implications for actors across the supply chain. We also exposed new questions that future research that both academics and practitioners should explore. Considering the urgency and responsibility that the U.S. cotton industry has established with the creation of sustainably performance targets, how can we find new opportunities for supply chains to collaborate to reach these targets? How can we build social capital between organizations and individuals? As shared in the Findings section of this report, some organizations are pursuing efforts to harmonize metrics and find greater collaboration between frameworks. Will this be enough to reach a definition of sustainable cotton? How are frameworks and metrics used in strategy making?

Many of these questions that we pose throughout our research can best be surmised in Table 8, Opportunities for Future Research.

Table 8 - Opportunities for Future Research

To understand how various sustainable cotton initiatives and their metric frameworks drive or don't drive progress to reaching the U.S. cotton industry's sustainability targets.
What is the opportunity to have a harmonized system of metrics that can be shared universally between and across, sustainable cotton frameworks, farmers and companies?
How might on-farm technology automate more seamless data sharing to alleviate farmer survey fatigue?
Which emerging sustainable practices need further economic analysis to support a farmers decision to implement or adopt?
If economics is the biggest barrier to adoption, what alternative economic models exist to reward farmers for data and or practices in a non-traditional supply chain configuration?
Are sustainable cotton frameworks efficient in their program management, resource allocation and accuracy with reporting real world outcomes? How frequent is surrogate data and benefit claims without measurement taking place across the sustainable cotton frameworks?

We hope that this research fosters new conversations about the most effective management approaches for multi-tier sustainability initiatives, resulting in more value creation for all actors and the greater adoption of sustainably grown cotton in the United States.

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Appendices

Item #1 - US Cotton Industry Goals

1. Increase Soil Carbon by 30%
2. Increase Land Use Efficiency by 13%
3. Decrease Greenhouse Gas Emissions by 39%
4. Decrease Soil Loss by 50%
5. Decrease Water Use by 18%
6. Decrease Energy Use by 15%

Source: <https://www.cottoninc.com/about-cotton/sustainability/cotton-sustainability/>

Item #2 - Farmer Questions Interview Instrument

1. What type of issues need to be solved for that would make your farm more sustainable for your family? And the environment?
2. What types of things do you do in order to make your farm more sustainable today? What actions do you take?
3. How do you feel about the public opinion that farmers are good or bad stewards of the land? (i.e., read an example of an article that speaks to runoff in local waterways).
4. How do you learn and or make a decision to implement sustainable practices?
5. How does the learning of a sustainable farm practice become something that you actually do? Do you have a process or approach to deciding to implement something new for the first time?
6. Once you have started a new sustainable process, what type of evaluation would you do to understand if those practices were successful or not, and how would you readjust or determine whether or not to continue with it?
7. How would a sustainable practice go from a trial and experiment to an ongoing regular daily practice? What needs to be true for a sustainable practice to be commonplace and a part of regular everyday business?
8. What is your opinion of the success of market certification schemes like BCI, BASF's E3, Cotton LEADS, Certified Organic or this new NCC Cotton Trust Protocol?
9. What is your opinion of your downstream commercial partners, gins, COOPs, brokers in helping you be successful in the marketplace?
10. What is your opinion of apparel brands/companies that are trying to adopt more sustainable raw materials, and in some cases they have set targets and market on the sustainability of their raw materials?

Item #3 - Firm Questions Interview Instrument

1. Introduction to the study and the researchers.
2. Can you tell me about your role?
3. Can you tell us about how sustainability fits into your firm's overall strategy?
4. Does your firm source sustainable cotton?
5. Can you tell us about how your firm defines sustainable cotton?
6. How does the process look?
7. How do those relationships look?
8. What has been your experience with frameworks?
9. Where does sourcing sustainable cotton present the biggest impacts for your firm? The biggest opportunities? The biggest challenges?
10. IF REGENERATIVE:
 - a. What are the biggest challenges and opportunities?
 - b. What is it like working with farmers?
 - c. How do other actors in the supply chain respond when brands work directly with farmers?
11. OPTIONAL: What is the value proposition to customers?
 - a. Suppliers?
 - b. Other stakeholders?
12. What elements of the cotton supply chain are you most interested in improving?
13. What other interesting elements of engaging in the sustainable cotton supply chain might you want to share?
14. Who else should we speak with at the firm level to understand the sustainable cotton supply chain?
15. What would you say to firms in the initial stages of sourcing sustainable cotton that say it's not possible? Or scalable?

Item #4 - Sustainable Cotton Initiatives Questions Interview Instrument

1. What is the goal of your framework?
2. How was your framework developed? How long did it take?
3. Who uses your framework? Who is the main user group?
4. How do they use it?
5. What are some success stories of improved sustainability from the use of your framework?
6. What are the biggest challenges or downfalls of your framework?
7. Do you feel other frameworks provide synergy or are complementary to yours or is there competition?
8. How do you feel farmers benefit from your framework?
9. How do you feel companies benefit from your framework?
10. Does anyone else benefit from your framework (countries, industry more broadly, specific segments-women, etc)?

Item #5 - Overview of Sustainable Cotton Initiatives

Here we provide overviews of the sustainable cotton initiatives evaluated and interviewed for this report. We found that groups of initiatives rely on one another and include one farm level measurement partner along with additional frameworks with criteria and verification processes to accomplish farm to textile certification (Table 2). These collaborations and dependencies include Field to Market, e3, and U.S. Cotton Trust Protocol; USDA Organic, Organic Content Standard, Content Claim Standard, and GOTS; and Cotton LEADS and BioPreferred. The Better Cotton Initiative is an independent certification framework that does not leverage other initiatives for measurement. We summarize the content of each framework in the context of these groupings here. Recognizing that many of these frameworks are detailed and complex we also recommend reading the framework documents directly, using this overview as a high level guide.

Sustainable Cotton Certification Programs

[BASF's e3 Sustainable Cotton Program and U.S. Cotton Trust Protocol in collaboration with Field to Market](#)

The first programs we will describe are the initiatives utilizing Field to Market Fieldprint Platform as their farm level measurement tool for tracking data in order to certify sustainable cotton. Field to Market is the measurement platform supporting both e3 and the U.S. Cotton Trust Protocol. Field to Market is a multi-stakeholder collaboration of companies, academics, and ngo's across the value chain working to create productive and profitable opportunities for continuous improvement in environmental outcomes. Field to Market developed a framework for sustainability measurement that farmers and the supply chain can use to assess performance at the field level compared to state and national benchmarks. To this end, the organization provides a free, online tool called Fieldprint Calculator to help farmers analyze how their management choices impact natural resources and operational efficiency. The Fieldprint Calculator estimates field level performance of key sustainability indicators (Table 6, 7). The Fieldprint Platform is a robust tool for analyzing and communicating farm-level management activities and outcomes.⁴⁰ It measures a variety of farm level inputs and calculates a series of impact metrics that a grower can use to manage continuous improvement.

The calculator was developed for row crops including cotton, soybean, corn, wheat, and rice. Currently, Field to Market has 2 million acres enrolled in more than 50 Fieldprint projects across 32 states.⁴¹ Field to Market has developed protocols and processes that aggregate field-level data while protecting individual farmers' data privacy, enabling downstream companies to characterize the sustainability of their sourcing regions and make supply chain sustainability claims. Any claim of sustainability improvement must go through the Field to Market claims process based on three levels of activity- Participation, Measurement, and Impact. The claims process verifies the process for data collection and analysis but does not conduct farm audits or visits. There are three environmental and socioeconomic indicators reports (2009, 2012, and 2016),⁴² divided by crop and sustainability outcome, as well as independent case studies.⁴³ Based on our interviews the majority of farmers

⁴⁰Field to Market Fieldprint Platform

⁴¹Field to Market Fieldprint Platform

⁴²Field to Market, "Reports Downloads"

⁴³Field to Market, "2016 National Indicators Report Fact Sheet"

utilize crop consultants or other resources to input data into the calculator. Both e3 and the U.S. Cotton Trust Protocol have integration made possible through Field to Market's Fieldprint® Application Programming Interface such that the calculator is embedded in their software interface to maximize data input efficiency and maintain initiative branding.

The strength of programs utilizing Field to Market is it is a *de facto* standard for U.S. sustainability measurement in commodity crops. The tool provides a rigorous claims process and is free for growers to use. Yet, growers may need incentives to participate in the program and need support to enter data and interpret results to improve performance and receive value. While there is a rigorous claims procedure covering processes there are no farm audits conducted to verify performance. Certifying cotton performance is the responsibility of the frameworks leveraging this tool.

The BASF's e3 Sustainable Cotton Program is the only farm to textile, full traceability initiative with end to end identity preservation.⁴⁴ It is available to farmers in the U.S. who grow FiberMax® or Stoneville® cotton seed sold by BASF, originated by Bayer CropScience. The e3 certification means that the cotton meets all three E's: socially equitable, economically viable and environmentally responsible. The e3 program makes it possible for buyers to identify where their cotton was grown using a certification database maintained by the BASF company. The identity of e3 certified cotton is preserved through to the final product. Thus, the cotton can be traced from the farmers to the gin and through the merchant, mills and retailers in the U.S. Growers have an incentive of \$2.50 per bale to enroll in the e3 Sustainable Cotton Program.⁴⁵ More than 500 U.S. growers enrolled in the e3 Sustainable Cotton Program across every cotton growing state contribute more than 700,000 bales produced during the 2019 growing season. The full traceability model of this initiative enables unique branding opportunities and price premiums for apparel lines. The e3 Sustainable Cotton Program is third-party verified by independent auditors, Wakefield Inspections and STEP. In addition, the criteria cover the key issues in global cotton production, including both environmental and social issues. Yet, only growers who purchase BASF's FiberMax® or Stoneville® cotton seed can enroll in the e3 Sustainable Cotton Program. Although there are plans to implement training on practices related to the criteria of this framework to encourage sustainable improvement on the farm, the training has not yet been implemented.⁴⁶ Therefore, data are being tracked but improved performance is not being encouraged through the program.

The U.S. Cotton Trust Protocol is a new cotton production assessment system established by U.S. cotton producers and industry organizations. The Protocol provides a mechanism by which U.S. cotton producers can assess and verify their current production practices and measure their progress toward long-term sustainability goals. The goal of the U.S. Cotton Trust Protocol is to increase the recognition of U.S. cotton as being responsibly produced and to ensure that U.S. cotton does not lose market access due to a perceived lack of sustainability. The Protocol has a grower self-assessment that is audited through third party verification and encourages the use of Field to Market for farm level sustainability measurement and continuous improvement. Nearly 150 U.S. cotton producers have either started the enrollment process or have become U.S. Cotton Trust Protocol participants. The goal of the Protocol is to have 750 to 1,000 producers enrolled by October 2020.⁴⁷ Cotton produced on operations enrolled in the U.S. Cotton Trust Protocol may be certified and marketed as

⁴⁴ e3, "Sustainable Cotton Program"

⁴⁵ e3, "Sustainable Cotton Program"

⁴⁶ e3, "Sustainable Cotton Program"

⁴⁷ Delta Farm Press, "U.S. Cotton Trust Protocol moving forward"

“Protocol Cotton.” This new initiative is in its pilot stages but is looking to scale over time. This framework takes a mass balance credit approach which allows it to expand more rapidly than a full traceability system.

Better Cotton Initiative

In this section, we will examine the Better Cotton Initiative (BCI), which is the only cotton management framework analyzed in this report that is not designed to be used with other frameworks or dependent upon another framework in some aspect. BCI is the largest initiative in terms of scale, representing 19% global cotton production with 5.1 million metric tons on 5.3 million hectares in 2017-2018. BCI involves 2 million farmers in 21 countries. However, its presence in the U.S. is comparatively small considering its main focus is on improving the livelihoods and sustainability performance of smallholder farmers in developing nations.

The World Wide Fund for Nature (WWF) launched the BCI in 2005 to promote measurable improvements in cotton cultivation, and to make it more economically, environmentally, and socially sustainable.⁴⁸ The standard covers key issues in cotton production with varying levels of rigor based on the farm size (Table 6, 7). It focuses on a continuous improvement model where farmers are encouraged to self-assess regularly. The Better Cotton Standard System focuses on 6 elements - principles and criteria (standards), capacity building, assurance program, chain of custody, claims framework, and results & impact.

According to a representative of BCI, the goal of the framework is “to improve outcomes for cotton farmers, for cotton farming communities, and for the sector as a whole, and the way we endeavor to do that, BCI, is to create what we refer to as a mainstream choice for the cotton supply chain.”⁴⁹ The mainstream choice, in this context, is designed to establish Better Cotton as a responsible mainstream commodity.⁵⁰ BCI Claims are available to BCI members who meet criteria including having paid a volume-based fee, meeting sourcing threshold requirements to increase BCI content, and publicly declare time-bound goals to increase sustainable cotton sourcing. Training is required to utilize the claims framework and is limited to business to consumer messaging only.⁵¹ Impacts are tracked annually through sample data and through independent case studies and commissioned research.⁵²

This framework focuses on training and continuous improvement for farms of all sizes. The system mandates training on practices related to the principles and criteria and emphasizes record keeping in small and medium sized farmers. While large farms can be covered under BCI they are not the main users of the framework. The system promotes scaling the volume of BCI certified cotton and conforms to ISEAL standards. All 3rd party certifiers are selected and trained by a standard setting organization.⁵³ There is substantial global recognition and marketability due to BCI’s volume and scale. This framework takes a mass balance credit approach which allows for BCI cotton to expand more rapidly than a full traceability system. Growers receive the benefit of marketability and in the case of small and medium sized farms they receive training, but no price premium. This framework

⁴⁸ WWF, “Championing Sustainable Solutions”

⁴⁹ BCI representative interview, p. 01.

⁵⁰ Textile Exchange, “Preferred Fiber Market Report 2016”

⁵¹ Better Cotton Initiative, “Claims Framework v2.0”

⁵² Better Cotton Initiative, “Results and Impact”

⁵³ Evidensia, “Evaluation of the early impacts of the Better Cotton Initiative on smallholder cotton producers in Kurnool District, India”

aggregates large numbers of small and medium sized farmers into groups (PU's) for assurance. All farmers do receive training in small groups on practices related to the principles and criteria, yet their assessment of performance is unclear. PU managers are expected to monitor all farms which seems a challenging task with 3500-4000 small farms for PU. Only a small portion of small and medium sized farms are assessed externally. Only large farmers complete the self-assessment for verification regularly.

Organic Chain of Custody Standards and Certifications

USDA, Organic Content Standard, Content Claim Standard, Global Organic Textile Standard (GOTS)

As of 2018, organic cotton was grown in New Mexico, North Carolina, and Texas (with Texas producing the majority) by 58 farmers producing 4% of global organic cotton. Production trends for organic cotton in the U.S. show steady annual increases since 2014.⁵⁴ Organic cotton is still a small percentage of global cotton production representing around 1% of global cotton harvested. The standard covers farm management, pesticide, and soil issues in addition prohibiting use of GMO seed in cotton production (Table 6, 7).

In this section we will describe the initiatives utilizing USDA Organic as their farm level measurement and verification to certify sustainable cotton. There are numerous organic standards throughout the world that are also leveraged by these frameworks, but we will focus on USDA Organic for this report. The Organic Content Standard (OCS) and Content Claim Standard are utilized together to certify an organic cotton chain of custody from farm to textile. Even though the Content Claim Standard (CCS) is not directly related to organic product claims, it is also included in this section because the OCS relies on the chain of custody requirements of the CCS to track material from the farm to the final product. Similarly, we will describe the Global Organic Textile Standard (GOTS) which utilizes USDA Organic for farm level verification in addition to its framework for organic textile content verification.

USDA Organic certification allows a farm to represent their crop as meeting a set of standards and regulations developed by the National Organic Program (NOP). The standards and regulations (The USDA Organic Regulations) "describe organic agriculture as the application of a set of cultural, biological, and mechanical practices that support the cycling of on-farm resources, promote ecological balance, and conserve biodiversity." The standard requires that no prohibited substances be used on the land for three consecutive years prior to harvesting the organic crop, and that organic seeds and planting stock be used when available. Soil fertility and pest control must be managed using tillage/cultivation practices, crop rotations, cover crops, animal/crop waste, and a small number of approved synthetic materials. Genetic engineering, ionizing radiation, and sewage sludge fertilizers are prohibited. To maintain certification, the farm/business must be reviewed and inspected annually.

In cotton products labeled organic, all additives must be within the National List of Allowed and Prohibited Substances, and the final product must be made using 95% organic materials. Products labeled "made with organic cotton" must be made using at least 70% organic materials. Farms/businesses pay a fee to be certified USDA Organic. The amount of the fee varies depending

⁵⁴ Textile Exchange, "Organic Content Standard 2013"

on the certifying agent and the size/complexity of the operation. Science-backed performance outcomes of organic production are recognized and make organic cotton a price premium crop however, organic seeds are often more expensive than conventional seed adding costs to the grower. Consumer demand for organic cotton has increased and production in the U.S. USDA Organic does not address social or safety aspects of the supply chain. It can also be somewhat misleading to a customer who interprets organic as "chemical free", when the final textile product is labeled organic but may contain dyes and/or sizing agents made from synthetic chemicals that are harmful both to human health and the environment.

The Content Claims Standard (CCS) is a voluntary, international standard which acts as a business to business tool to "verify the presence and amount of a given raw material in a final product. It provides a strong chain of custody system from the source to the final product, certified by an accredited third party certification body." Businesses can use this certification to substantiate content claims made about products- both claims made through third party certifications as well as unique material claims. The Content Claims Standard is run by Textile Exchange- a global non-profit. According to a representative of Textile Exchange, there are currently 16,000 different sites that use the Content Claim Standard. The CCS verifies the accuracy of content claims and enables supply chain verification of organic content in textiles for the purposes of making claims. It enables supply chain segregation of organic cotton in textiles. The CCS is clearly meant to be an accompaniment to other certifications. The certification does not address processing inputs, environmental aspects of processing, social issues, or safety issues- only the presence of a given raw material.⁵⁵ Thus, it does not address possible hazards in textile production originated from the dyeing and finishing stages. Finally, CCS does not cover the certification of the raw material itself.

The Organic Content Standard (OCS) is an international standard that applies to any non-food product containing 5-100% organic material. It verifies the presence and amount of organic material in a final product. It tracks the flow of a raw material from the source to the final product and this process is certified by an accredited third party.⁵⁶ The Standard does not cover the certification of the raw material itself which is verified independently of the production process certification. The OCS uses the chain of custody requirements of the Content Claim Standard (CCS), combined with clear requirements for the use of certified organic inputs and rules regarding logo use and labelling claims. In addition, the standard follows the ISEAL Codes of Good Practice for standard-setting bodies. The goal of the Organic Content Standard (OCS) is to increase organic agriculture production. The OCS aims to deliver this goal through three key objectives by providing the industry with a tool to verify the organically grown content of the products they purchase, companies with a trusted tool to communicate organically grown content claims to the industry, and organic farmers with broad access to the global organic market for their products. Like the CCS, the Organic Content Standard (OCS) is funded by Textile Exchange Members. Organic claims made on final products can be fully backed up through this third-party certification.⁵⁷ Therefore, transparency is increased, and consumer trust is improved. The OCS has a common set of requirements across different standards, such as the OCS, Recycled Content Standard (RCS) and Global Recycle Standard (GRS), thus, contributing to the consistency and efficiency of the certification process.

⁵⁵ Textile Exchange, "Organic Content Claims Standard v2.0"

⁵⁶ Textile Exchange, "Organic Content Standard 2013"

⁵⁷ Textile Exchange, "Organic Content Standard 2013"

Renewable, Bio-based Content Certification

In this section, we will analyze the BioPreferred program and the Cotton LEADS program. These two programs will be analyzed in conjunction because the Cotton LEADS program promotes the BioPreferred standard for cotton though Cotton LEADS is primarily a marketing initiative to promote U.S. and Australian cotton as sustainable by tracking progress on national sustainability goals in addition to sharing research findings and technologies globally.

The BioPreferred is a U.S. federal marketing program created to increase the development, purchase, and use of biobased products through a Federal procurement program and a voluntary certification and labeling program to prefer cotton over synthetic products such as polyester or nylon. The program was created by the 2002 Farm Bill and reauthorized and expanded as part of the Agriculture Improvement Act of 2018 (2018 Farm Bill), and the program is currently managed by the U.S. Department of Agriculture (USDA). The two parts of the BioPreferred Program are the mandatory purchasing requirements for federal agencies and their contractors, and a voluntary labeling initiative for biobased products. Biobased products are commercial, industrial, or consumer goods (other than food, animal feed, or fuel) that are composed, in whole or in significant part, from plants and other agricultural, marine, and forestry materials. The biobased products industry includes the following seven major sectors of the U.S. economy: agriculture and forestry, biorefining, biobased chemicals, enzymes, biobased plastic bottles and packaging, forest products, and textiles. All products in the agriculture and forestry subsector of crop production, including cotton, are of paramount to the biobased industry since all products in this subsector are 100% biobased.⁵⁸

The Program's purpose is to spur economic development, create new jobs and provide new markets for U.S. farm commodities. Of cotton produced in the U.S. 100% meets minimum levels of biobased content and is eligible to display the USDA Certified Biobased Product label.⁵⁹ Through this standard, materials are lab-tested to verify no synthetic materials are present. This label assures consumers that the product contains a verified amount of renewable biological ingredients (referred to as biobased content). Economic impact studies and reports of the U.S. biobased products industry are conducted annually.⁶⁰ This framework focuses on the increased development, purchase, and use of biobased products to reduce reliance on petroleum. It also increases the use of renewable agricultural resources and contributes to reducing adverse environmental and health impacts caused by the use of fossil fuels. Trade-offs exist between biobased and petroleum-based products and impact measurement or production process data are not included in this framework. The BioPreferred® program certification program does not measure or address impact of cotton production but enables marketing.

Cotton LEADS is a marketing program born out of partnership between the Australian and U.S. cotton industries creating a traceability program to track the origins of its cotton into global markets. The goal of Cotton LEADS is to engage and connect businesses across the global supply chain with the leading efforts in sustainable cotton sourcing and production. Cotton LEADS connects textile manufacturers, brands, and retailers with opportunities to support cotton growers' sustainability efforts and to share data, resources and technologies globally for the benefit of improving cotton around the world. By supporting research and best practices through the Cotton LEADS program, companies help expand the global supply of sustainably produced cotton. Cotton

⁵⁸ Daystar et al, "An Economic Impact Analysis of the U.S. Biobased Products Industry"

⁵⁹ BioPreferred, "Fact Sheet"

⁶⁰ Agricultural Act of 2014

LEADS currently has 503 partners, with representation across brands, retailers and manufacturers extending to 29 countries around the world. Cotton LEADS cottons are 100% biobased certified by the United States Department of Agriculture's (USDA) BioPreferred® program. This framework focuses on investments in research of sustainable cotton production with intent to share results globally. The goal of this program is to maintain the sustainability of U.S. and Australian cotton. It leverages an existing BioPreferred® program certification program to promote U.S. Cotton. Impacts of Cotton LEADS are tracked annually however the last impact report is from 2017.⁶¹

⁶¹ Cotton Leads, "Annual Report 2017"