Cotton value chain in Pakistan: A preliminary assessment of climate vulnerabilities

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1. Introduction

Agriculture remains the largest employment generating sector of Pakistan[i] and contributes substantially to the national income. The importance of this sector cannot be emphasized enough as it provides inputs to various industrial units. However, recent global changes in climate has threatened the output of this sector and Pakistan is no exception to this. Pakistan has been a victim of climate catastrophes for the last two decades. Major climate extreme events include floods and droughts whereas change in rainfall pattern and increase in temperature are some of the gradual changes that the country is experiencing.

Cotton value chain[ii] is by far the largest source of export earnings for Pakistan. Cotton and textile products combined contribute around 10.5 percent to the GDP.[iii] However, cotton being the lifeline of this value chain, is under continuous threat by the changing climate. Analysis of historical climate events and scientific studies available on the subject reveal high sensitivity of cotton crop to changes in climatic parameters.

More recently, a decline of 33% has been observed in the cotton production this year. This shortfall has caused a loss of Rs. 0.6 trillion to the national exchequer.[iv] Keeping this situation in view, Sustainable Development Policy Institute has initiated a research study titled ‘Climate Change Impacts, Adaptation and Opportunities for Cotton Supply Chains’. It is a three phase study that aims to analyse existing data on the
cotton and textile sectors in Pakistan and to generate knowledge on ways to promote resilience of the actors and institutions involved in the cotton value chain, against climate change. Each research phase will focus on one question at a time. We aim to:

1. Identify direct and indirect linkages in cotton value chain in Pakistan.
2. Identify current and future climate risks within the value chain; and vulnerable groups and current adaptive practices.
3. Explore potential adaptation options for communities, business and private sector investment opportunities in responding to climate change.

Furthermore, this analysis will be carried out from the lens of a semi-arid setting of the region. There exists sufficient evidence to support the notion that semi-arid regions, in particular, are more exposed to climate induced vulnerabilities (Lemma et al, 2015) and for this reason semi-arid cotton producing districts would be our focus regions for step 2 and 3 research phases. This article summarizes the detailed report prepared on step 1.[v] The detailed report takes note of the current situation of the cotton and textile sectors in Pakistan; maps the cotton value chain in Pakistan; reviews the historical data on climate extreme events in Pakistan and existing literature on climate vulnerabilities for cotton value chain; analyses the relationship between actors involved in the value chain; and lays ground for step 2 research.

2. Why cotton and textiles matter for Pakistan?

Almost 14 percent of the cropped area in Pakistan is held by cotton crop (PBS, 1981-2015). Almost 1.3 million farmers are associated with cotton production[1] in Pakistan and for most families, cotton production is the primary source of income. That said, the cotton sector has huge implications for socio-economic outcomes like food security, poverty, employment, etc.

Punjab contributes around 80 percent to the total cotton production of the country whereas Sindh’s total contribution is almost 20 percent. Figure 1 presents a historical overview of cotton production in Punjab and Sindh and compares it with the total production of the country. National cotton production has increased two-folds during the last three decades.

Figure 1: Province wise yearly raw cotton production in Pakistan (000 Bales)

![Figure 1](image.png)


The textile sector is the largest industrial sector in Pakistan and accounts for about 40 percent of the industrial labor force and employs 10 million people (Government of Pakistan, 2014). This sector utilizes 40 per cent of banking credit to manufacturing sector, provides one-fourth of industrial value addition and makes up 55 per cent of the exports of Pakistan (Government of Pakistan, 2013). Cotton and textile products combined makes up 55.4 per cent of the total exports of Pakistan whereas imports of these products amount to nearly 2.3 per cent of the total imports. Pakistan imports huge bulks of cotton and
textile products from Bangladesh, China and India whereas US, UK and Germany are major destinations for the cotton exports of Pakistan. Moreover, Pakistan imports most of the cotton products from India and China and textile products from China and Korea.

Figure 2: Comparison of cotton and textile exports with total exports of Pakistan (2003-2014)

![Graph showing comparison of cotton and textile exports with total exports of Pakistan](image)

*Source: Trade Map, International Trade Centre (2016)*

3. Mapping of cotton value chain in Pakistan

Cotton value chain is one of the largest value chains in Pakistan, extending from cotton production to readymade garments and then to exports. It takes many actors, industrial units and processes to convert cotton lint to a final product. The various processes and actors involved in the cotton value chain is given below:

3.1 Cotton Production

*Seed, fertilizer, pesticide, machinery, extension services and credit are major inputs to the cotton production.* Fertilizer and pesticides companies are largely owned by the private sector whereas credit and extension services are provided by public institutions like agriculture banks, district/provincial level agriculture departments and agriculture universities.

*A few multinational companies have monopolized the pesticide and fertilizer market.* This has resulted in high price inputs for the farmers. Moreover, the fertilizer use efficiency has significantly declined (i.e. more fertilizer required per unit of yield) for cotton during the last decade which points toward the poor regulation of inputs industry in Pakistan which has resulted in low returns for cotton growers and high profit margins for the private sector.

*Almost 99 per cent of the land used for cotton is privately owned.* Within privately owned farms, three prominent ownership systems can be observed i.e. private ownership, sharecropping (harvest is shared between landlord and tenants) and contractors (pay annual rent for land).

*Seed cotton (also known as phutti) is the major output of cotton crop.* The waste of cotton plants (stems and sticks) are often used by other manufacturers to produce clip boards and artificial furniture, and by households as firewood. Cotton waste is also exported to France, Italy, Korea, Thailand, USA and others (COTISTICS, 2015).

*A major issue facing Pakistani cotton industry is low quality cotton production.* Quality of cotton is determined majorly by picking, transportation and ginning processes. While cotton is mostly hand-picked
in Pakistan, trash content in raw cotton is almost around 9% as compared to trash content of 3.5% of machine-picked cotton in other cotton producing countries.

Female laborers make up 24 per cent of the labor force working in the cotton growing region of Pakistan (Dawn, 2014). Almost 600,000 women cotton laborers are engaged in activities related to cotton in major cotton producing districts in Punjab and Sindh (Ibid). Despite the large number of female laborers, per month average wage for female unskilled workers in Pakistan is just Rs. 3753 as compared to the wage earned by male unskilled workers i.e. Rs. 6166 (Labor Force Survey, 2013-14). In addition, 59.9 per cent of the female laborers in agriculture work more than 50 hours per week while only 26.6 per cent of male laborers worked above 50 hours a week (Pakistan Bureau of Statistics, 2014). The excessive working of women indicates low wages per hour which forces them to contribute more hours to work.

3.2. Ginning and Spinning

Ginning is the process of separating cotton fiber from its seed. Pakistan currently has 1100 ginning units. Both small and large ginning units exist in Pakistan.

This industry produces two by-products i.e. cotton lint and cotton seed. Ginned cotton (lint) is a cleaner form of raw cotton which is transferred to the spinning units for further processing. Cotton seed, remaining part of the cotton boll, is used both as animal feed and to produce cottonseed oil, seed cake, soap etc. The spinning industry is a major part of CVC as it is the primary step in adding value to raw cotton fiber.

Yarn is the output of spinning units. It is a major input for the textile made-up sector, which includes ready-made garments, knitwear, dyeing and printing etc. Yarn is exported as well as sent to weaving (to produce gray cloth), knitting units and garment manufacturing units. Some large textile manufacturers have in-house spinning facilities, combined weaving and knitting as well as dyeing and stitching.

Lack of modern and efficient technology, poor marketing skills, non-standardized ginning practices and lack of government support price are some of the major issues facing the ginning sector of Pakistan (Aslam and Rasool, 2013).

3.3. Manufacturing: Weaving/knitting, Made-ups

Manufacturing units are mostly clustered in Faisalabad, Karachi, Lahore and Multan. The weaving and knitting sector is dominated by small and medium enterprises and are mostly clustered in Faisalabad and Karachi. There are 400 textile mills, 7 million spindles, 30,000 automatic looms and 0.25 million small (home-based) looms, 4000 garment units with 0.2 million sewing machines, 650 printing and dyeing units, 300 large scale banola oil units and 20,000 small oil expellers in Pakistan.

Weak linkage between upstream cotton industry and downstream textile industry ends up in low quality and high production cost. There is a limited flow of knowledge from textile industries to cotton producers. This hinders the spread of innovation and creates difference in demand and supply between the two parts. Moreover, weak linkages between actors in a value chain is a major reason of skewed growth of the value chain, in which few actors become competitive, compelling small and weak units to eventually leave.

The textile sector enjoys a conducive policy environment as compared to the cotton production sector. The textile policy (2014-19) lays out a perspective development plan for the textile sector through tariff rationalization, product diversification, technology up gradation, development of SMEs and vocational training of man power. As ambitious as it is, this policy has serious drawbacks on the implementation side. While this policy exclusively caters to the interests of the industrialists, there exists no policy to safeguard the interests of the cotton producers in Pakistan.

The textile sector also has a number of representative bodies but cotton farmers lack formal representation. The textile sector is represented through All Pakistan Textile Mills Association
Field visit to various industries also reveal difficult working environment for female workers in the manufacturing sector. Women are mostly engaged in the trash removing units. Some units also do not provide masks which makes them vulnerable to allergies from cotton fibers.

3.4. Associated industries

Transport and credit are major supporting industries for the cotton value chain in Pakistan. There exist a huge network of agricultural credit banks which support cotton farmers for production activities. This however has a minimal role in times of climate induced disaster. Cotton farmers are usually unable to repay high interest loans after a loss of crop from climate change. In case of transport, the vulnerability links are quite unclear at this stage.

Some of the secondary industries associated with the cotton value chain is Banola oil, cardboard, firewood, soap and seedcake industries. The waste of the cotton crop is supplied to these industries as well as used for domestic use in the form of firewood, etc. These industries being solely dependent on cotton, any adverse impact of climate on the crop is likely to affect the performance of these secondary industries.

4. Potential climate risks to the cotton value chain

Pakistan is considered to be one of the climate change hotspots. According to the German Watch’s global climate risk index, Pakistan stands at 8th position in terms of number of climate catastrophes witnessed so far. These calamities have not only grown in number but also in intensity since the start of the century.

Cotton crop shows extreme sensitivity to climate change. There exist a huge reserve of literature stating that the growth of cotton crop is usually hampered by changes in CO2 concentration, low water availability, high atmospheric evaporation rate and heat stress, which are likely induced by climate change.

Flood, an imminent threat to cotton production in Pakistan. Most of the cotton production in Punjab and Sindh is cultivated along the River Indus, which is also a major source of floods. Analysis of various episodes of floods experienced in the last two decades reveals excessive damages to the cotton crop. Almost 21% of the cotton cultivated was destroyed during the 2010 flood (ADB and World Bank, 2010). Losses worth Rs. 11 billion to the farming community were also reported from the 2012 floods (SUPARCO and FAO, 2012).

Rising temperature is gradually affecting growth of the cotton plant. Cotton sowing usually takes place during summers and mostly in those area where the average temperature in summers is above 43°C, as a result of which the productivity of the crops gets affected (Rahman, 2006). A study by Siddique et al. (2012) finds that cotton production may decline by 42.33 thousand bales, per 1°C if temperature exceed 32°C (a maximum level of temperature required by cotton crop) in cotton producing districts in Pakistan. Crop models applied by Iqbal (2011) and Yu et al. (2013), predict yield decline between 2 to 42 percent.

Changes in rainfall pattern affects the quality of cotton crop. Cotton farmers report issues of low quality cotton boll and pesticide attack in the aftermath of changes in rainfall patterns. Cotton plants mostly start to develop in the monsoon season and excessive rainfall at this stage slows down the growth of the plant. In addition, in areas where the water table is high, salinization is also observed which completely destroys the crop.
Cotton value chain in Pakistan spreads across borders which provides a pathway for disseminating adverse impacts of climate change. Thorpe and Fennel (2012) take note of quality issues with the cotton exported by Pakistan to international companies after the 2010 floods. This caused the importing companies to incorporate climate risk models in their business models.

Ownership of land is an important factor of resilience. Cotton producers who own land are more resilient to climate impacts (as they have access to agricultural loans etc.) and are less likely to be affected than daily wage laborers who lack land ownership and often face loss of employment in the aftermath of a climate extreme event.

Climate impacts are stronger for upstream units (cotton production, ginning etc.) as compared to downstream units (textile processing units). Cotton production is a direct entry point for climate impact and is more vulnerable to climate extreme events. Dependence of processing sector on imported cotton makes it more resilient to climate impacts.

A secondary entry point for climate impacts exists at the processing stage. Changes in temperature, in particular, deteriorates the working environment for the workers resulting in health hazards.

5. Gaps in the literature and the way forward

Literature on value chain in Pakistan only focused on the vertical linkages in the value chain and there was a need to explore the horizontal linkages also. A vertical linkage is a process through which raw inputs reach the final stage of production and horizontal linkage maps the relationship between actors at a similar stage of production and associated markets. We have already catered for this gap and mapped an extensive value chain system in the detailed report. This would guide step 2 of our research in which we would try to fill in the following gaps in the literature:

Existing literatures on the subject presents skewed evidence of climate risks. Not even a single research study has been carried out to assess the climate vulnerabilities for the whole cotton value chain. However, there are several studies addressing the climate threats facing cotton production. There is however a need to explore the vulnerability pathways through which losses in production translate into high cost production for downstream industrial units and associated industries.

A human dimension of climate related risks needs to be explored. Some potential questions to address are: How does change in climate affect the working environment of agricultural and industrial laborers? Does climate change promote loss of employment through health and safety issues? Does changing climatic parameters also create new job opportunities?

Spatial characteristics have not been incorporated into the CVC analysis. While international literature establishes that climate change may impact some regions (like semi-arid lands) more than others and climate risks may magnify due to socio-economic setting of a particular region (poverty, low water availability etc.), there is a high possibility that cotton value chains in semi-arid regions may be at higher risk from climate change. This is one of the significant aspects of CVC analysis which needs to be explored.

Policy making with respect to climate adaptation is another area which remains unexplored. In this backdrop, a potential question to be addressed is; what sort of policy environment is needed to promote inclusive growth of the cotton value chain and adaptive capacity of the actors associated with the cotton value chain in Pakistan.

The role of private sector should also be explored. Private sector, with the capacity to invest, has the potential to invest in climate smart and climate resilient technologies which would enhance the resilience level of the actors. Keeping this in view, analysis should be done on how the private sector in Pakistan can promote adaptation efforts at the community level (cotton production level).

6. Conclusion and priority policy actions
Some of the important policy recommendations based on our research study are as follows:

1. Agriculture and textile policies should explicitly address the climate change issue. A conducive policy environment to support adaptation measures at the local as well as industrial level should be created. More importantly, sustainability in adaptation should also be focused as short term relief measures like a one time grant, for example, does not deliver in the long run. Agriculture research institutes and R&D units in the Ministry of Textile Industry and Ministry of National Food Security & Research may be taken on board for the assessment of adaptation needs at the community level.

2. The Ministry of Textile Industry has a representative department of cotton. Efforts should be made to improve the linkage between cotton producers and specialized textile units. Industrialists should be sensitized about the climate threats facing cotton production; how these vulnerabilities have the potential to disrupt functioning of their industries; and the industry’s role in promoting adaptation at the local level. Research, development and Advisory cells under the Ministry of Textile Industry and Pakistan Central Cotton Committee may collaborate with each other to strengthen the linkages between the two sectors. Collective adaptation options should be identified and implemented.

3. There is also a need to broaden the role and scope of the Pakistan Central Cotton Committee. A special unit may be formulated to focus on climate related issues facing cotton farmers in Pakistan and to promote adaptation.

4. The difficult working environment of female laborers calls for an introduction of gender conducive working environment in textile units. Female workers should be provided with necessary safety kits like gloves and masks if they’re involved in cotton cleaning. The Ministry of labor and Manpower and Provincial labor departments may undertake awareness campaigns regarding possible health issues and safety as they are mandated to create awareness on occupational diseases. Gender units in provincial labor departments should also be mobilized to oversee this. Moreover, textile units should also ensure proper implementation of labor laws.

References


[I] This sector employs around 42.3 percent of the total work force of the country (source: Government of Pakistan; 2016)

[II] Cotton value chain basically includes cotton production, ginning, spinning, knitting and made ups.

[III] This is a cumulative figure of cotton (1%) and textile (9.5%) contribution to the GDP.


[V] Detailed report titled ‘Mapping of cotton value chain in Pakistan: A Preliminary assessment for climate vulnerabilities & pathways to adaptation’ is in the final phase of publication. It would be available online at www.prise.odi.org or http://sdpi.org/research_programme/researchproject-338-12-30.html.
