EVALUATION OF THE EARLY IMPACTS OF THE BETTER COTTON INITIATIVE ON SMALLHOLDER COTTON PRODUCERS IN KURNOOL DISTRICT, INDIA: BASELINE REPORT

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ACRONYMS

ASHA	Accredited Social Health Activist or ASHA
BCCI	Better Cotton Composite Index
BCI	Better Cotton Initiative
BCFTP	Better Cotton Fast Track Program
BPL	Below Poverty Line
CESS	Centre for Economic and Social Studies, Hyderabad, India
COSA	Committee on Sustainability Assessment
CoP	Cost of Production
CSO	Civil Society Organisation
DCED	Donor Committee on Enterprise Development
GIDR	Gujarat Institute of Development Research
ICCC	Intra Cluster Correlation Coefficient
iDH	the sustainable trade initiative, Netherlands
3iE	International Initiative for Impact Evaluation
INM	Integrated Nutrient Management
IPM	Integrated Pest Management
IWM	Integrated Water Management
LG	Learning Group
MDE	Minimum Detectable Effect
NGO	Non-Governmental Organisation
NREGA	National Rural Employment Guarantee Act
NRI	Natural Resources Institute (University of Greenwich)
ODK	Open Data Kit
PRA	Participatory Rural Appraisal
PRDIS	Participatory Rural Development Initiatives Society – *Implementation partner*
PRI	Panchayati Raj Institution
PU	Producer Unit
RCT	Randomised Control Trial
SC/ST	Scheduled Caste / Scheduled Tribe
TBIE	Theory Based Impact Evaluation
ToC	Theory of Change
VSS	Voluntary Sustainability Standard
WHH	Women headed household

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The research team would like to express their gratitude to the 729 farmers (men and women - who participated in the household survey) along with more than 250 other farmers (who participated in focus group discussion and household panel case studies) and many key informants (who provided perspective on cotton value chain). Without their patience, time and perspectives, this study would not have been possible.

CITATION

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COVER PICTURE

Shown in picture on the cover page: Two field researchers interviewing household members (men and women together) in Adoni during baseline study (September 2015), using ODK based tablet for data recording

Photo credits: Abdul Latheef, Dushyant Badal, Aman and other members of the Pragmatix team

EXECUTIVE SUMMARY

Background:

The ISEAL Alliance Secretariat works with its sustainability standard members on various projects aimed at strengthening their approach to M&E systems, learning more about the impacts of standard systems, and determining how to increase the effectiveness of standards. The 'Demonstrating and Improving Poverty Impacts', has this aim and is funded by the Ford Foundation. ISEAL has commissioned a consortium led by the Natural Resources Institute, University of Greenwich, and including the Gujarat Institute of Development Research, the Centre for Economic and Social Studies, and Pragmatix Research and Advisory Services, to conduct an impact evaluation study of the early impact of pre-certification technical assistance and certification on previously uncertified smallholders. This report presents the baseline findings of the study, focusing on a Better Cotton Initiative (BCI) project, being undertaken by PRDIS, the implementation partner of BCI in Adoni *mandal*, Andhra Pradesh, India.

The Better Cotton Standard System is a holistic approach to sustainable cotton production that covers all three pillars of sustainability: environmental, social and economic. The BCI states that better cotton exists to make global cotton production better for **the people** who produce it, for **the environment** it grows in, and better for **the sector's future.** BCI aims to transform cotton production globally by developing Better Cotton as a sustainable mainstream commodity.

Research Design:

The study research questions are as follows:

- To what extent has the **process of becoming or being certified under BCI sustainability standards had an impact** (positive or negative, expected or unexpected) upon smallholders (farmers and households) in Kurnool district? What are the economic (yield, productivity, incomes, food security) and social (child labour, farm workers, no discrimination in wages for women) impacts?
- To what extent do we see an **improvement in environment variables** connected with cotton production (uptake of fertiliser use, reduction in pesticide use, efficient water use, soil health, habitat /biodiversity)?
- To what extent can **Producers Unit and /or Farmer Producer Company 'empower' cotton farmers** and households – both economically and socially?
- Can we see an **increase in Better Cotton availability and uptake** in the district /beyond? How can this be strengthened? What are the relative benefits and costs of meeting BCI standards and achieving certification for intended beneficiaries and supply chain actors?

In order to be able to measure and attribute impact, but also to understand what has created impact and identify lessons, the study employs a **theory based evaluation approach**. The theory of change lays out the anticipated chain of inputs, outputs, outcomes and impacts, and the causal linkages between them. A **Randomized Control Trial (RCT)** is found feasible primarily due to the willingness of the implementing partner to rollout their programme following a randomization strategy identified by the evaluation team. A cluster-RCT approach is proposed with the attribution of impacts of the BCI intervention package analysed by comparison of pre- and post-situation of intervention

farmers and pre and post comparisons between intervention and non-intervention groups. The level of BCI project exposure to the farmers will also be assessed so that the analysis takes account of variations in implementation. Matched pair randomisation is used based on statistical data (village /cluster wise) from various existing sources. Observational approaches were employed following the lines of comparison of the experimental design to further interrogate and gather evidence on the theory of change (and alternative theories of change)–to assess what change has happened and why, through participatory field research techniques including household survey, focus group discussions, household panel and key informant interviews. The baseline study was conducted in July-September, 2015 and the final evaluation will be completed in the same period in 2018. An interim performance monitoring of the project is also part of the research design with two interim studies proposed in 2016 and 2017. The full research design is described in the research design document.

Context Analysis:

The study location: India currently produces 27 per cent of the global cotton (with 36 per cent of global area under cotton). China is second at 24 per cent with USA at third place at 13 per cent of the world cotton. More than 60 million people in India are associated with cotton farming, processing, ginning and in textile industry, etc. Andhra Pradesh state ranks third in terms of Indian cotton production. The site chosen for the study is Adoni Mandal (subdivision) in Kurnool district of Andhra Pradesh, India. The BCI project is being implemented in Adoni Mandal, which has a total population of 250,000 (36026 households as per 2012 revenue data of the government of Andhra Pradesh), living in 46 villages. Adoni offers very favourable conditions (predominantly black soil) for cotton production, with more than 18,000 farmers deriving their main livelihood through the cotton farming. Adoni town has become important trading center in Andhra Pradesh, because the region is a large producer of cotton and because of the presence of more than 200 ginning and pressing factories.

Profile of cotton producers: The main sources of income for Adoni households are agriculture, hired labour and migration. In agriculture, cotton production plays an important role in enabling Adoni farmers to build up their assets and/or to pay off debts. Although some other crops (chilli, groundnut, sorghum and paddy) are grown, this depends on land and irrigation access. There is a strong informal labour market within Adoni – farmers hire labourers from their own village or from neighbouring villages to meet their cotton production needs. In some areas there is outmigration during the off season to find work in other towns and cities outside of Kurnool. The baseline study covered 729 households almost equally among treatment (361) and control villages (368). The educational levels are very low in Adoni. Close to 70 per cent households members in treatment and control groups are either illiterate or literate without formal schooling. Only 12 per cent women in the treatment group and 13 per cent in the control group are literate with formal education. Close to half (47 per cent) of the treatment and control group of farmers in Adoni have small and marginal land holdings (<2 Ha.) under cotton. Overall the ratio of land under cotton to total land for treatment farmers is 0.81 while it is 0.77 for control farmers. Gender relations are highly inequitable. Gender is highly intersected by caste and wealth distinctions in Adoni. Men are generally responsible for land preparation, pesticide spraying and load carrying. Women are involved in almost every sphere of cotton farming, preparing pesticide containers, sowing, gap filling, weeding, applying fertilizers, harvesting and clearing the field after harvest. Women tend to have much greater work burdens in labour in cotton production and also have domestic and reproductive responsibilities.

Main findings:

The overall theory of change is broken down into four potential impact pathways – economic, environmental, social and value chain. There are inter-relationships between the different impact pathways which are explored in the overall synthesis and conclusion chapter of this report.

Economic:

Mobilising learning groups: At the baseline, only one third of the farmers in treatment group and about one-fifth of the farmers in control group are part of any community institution. Among those (in treatment) who are part of a community institution, eighty six per cent are already mobilized into learning groups. There are currently fifty six Learning Groups in Adoni *mandal* mobilized by the PRDIS team during 2015. Within each group there are approximately thirty five to forty farmers. Overall the learning group have 2055 members with 79 women (4 per cent). The 31 learning groups (55 per cent of all LGs) are men learning groups with no women members. The implementation partner have taken a strategy of mobilizing one women only learning group with thirty one women and one men.

Cotton practices used by the farmers: BCI has recommended various practices under six production principles. Through a process of consultation with PRDIS, the research team prioritized overall 39 better cotton practices (37 for rainfed plots) to be tracked by the study over a period of time. Out of these 39 practices, 17 practices (15 for rainfed plots) are recommended by the BCI under Minimum Production Criteria (MPC). The research team has constructed an index called Better Cotton Composite Index (BCCI)1 to understand the cumulative status of current level of knowledge and application on overall and MPC practices. Overall BCCI knowledge and application score for treatment farmers is 0.55 and 0.43 respectively. The index score for control farmers is slightly higher at 0.63 and 0.51 for knowledge and application levels respectively. The index is constructed in a way that index score of 1 can be achieved when all the farmers practice at least eighty per cent of the BCI recommended practices. Over a period of time, as the practice level compliance is hoped to improve, the index score would improve and indicate increasing level of compliance on BCI recommended practices. On the MPCs the index score is lower than the score on overall practices on both knowledge and application for both treatment and control group of farmers.

Cost of production: The cost of production (2014-15) for treatment group of farmers Rs.26,931 ($414) per ha (cotton season 2014-15) and Rs. 25,972 ($400) for the control group. If the full cost of family labour (opportunity cost) is included, then the cost of production will increase by Rs.14820 per Ha.

Cotton yield: Adoni farmers' cotton productivity (rainfed) is slightly lower than the state (569 kg/Ha) and national (565 kg/ha.) level average productivity. The cotton yield (season 2014) is 529 kg /Ha for treatment group and 527 kg /Ha for control group of farmers. This is despite the predominance of Black soils in Adoni which are favourable for cotton production. The primary factors determining yields are rainfall and access to irrigation, and the availability (or lack thereof) of quality seeds.

[1] Refer to BCCI computation methodology at Annex E

Service provision to the farmers: Currently, there is negligible government extension service provision in the intervention and control group villages. In some cases PRDIS training has begun on BCI principles, but this is only a recent occurrence.

Cotton profitability: The baseline values of profits from cotton cultivation is Rs.40,752 per ha for treatment group and Rs. 39,934 for the control group. Same computation methodology will be followed in subsequent rounds of the study to develop a comparative picture. The real profitability will be lower than this amount if all the labour costs (including full cost of family labour /opportunity costs) are included in the cost of production calculations. Real profitability of farmers is Adoni therefore will be around Rs.25,932 per ha for treatment and Rs. 25,114 for control group of farmers. The study result shows that the treatment group have significantly higher values of profitability (significant at 1 per cent level) than the control group.

Incomes: Cotton is reported to be the main source of household income in Adoni (for 80 per cent treatment and 78 per cent control groups of households). The second main source of income for Adoni households is agriculture wage labour. Other agriculture crops contribute to treatment and control households as third main source of income. The baseline values for per capital per day income is $1.20 for treatment group of households and even lower at 0.97 for control group of households. This average per capita income is much lower than poverty line defined by the World Bank at $1.90 a day (2011, Purchasing Power Parity). This is even lower than the $1.25 a day poverty line at 2005 PPP. This means that average income earning household in Adoni will be below the internationally defined poverty line at both 2005 PPP and recent 2011 PPP. It is estimated that about 61 per cent treatment and 71 per cent control households are either at average or below average income levels and therefore below poverty line at the baseline year (2015). To substantiate this analysis, the study uses two key poverty indices to measure the change (or consequences of income change) in farmer households' incomes over a period of time. The UNDP's Multidimensional Poverty Index was used as a measure of poverty. This index measures deprivations in three dimensions: Education, health and living standards. The Progress out of Poverty Index is a tool developed by the Grameen foundation. It consists of 10 indicators that can be easily assessed for each household. As per MPI, 48 per cent household in treatment group and 49 per cent household in control are either MPI poor or near MPI poverty. There is no statistically significant difference in MPI weighted scores between control and treatment households. When measured by the international poverty line of $1.88/day (at purchasing power parity –PPP), the poverty rate among participating households is **57.8 per cent**. For the control group, this is **62.4 per cent**. The difference between the two groups is statistically significant at the 0.01 level. Small and marginal farmers have a significantly higher poverty rate than the other groups.

Environment:

Cotton practices used by the farmers: The farmers in Adoni have limited knowledge of the various practices that can improve pest, soil nutrient and water management in a cotton crop. There is thus an opportunity for the BCI project to facilitate cotton farmer behavioural change, although there is also resistance to change, which should not be under-estimated.

Pesticide use: The assessment shows that monochrotophos is the most excessively used chemical ingredient in various pesticides being used in Adoni area. More than eighty per cent treatment and seventy six per cent control group of farmers have reported the use of this chemical based pesticides. More than 95 per cent of those who have used monochrotophos have used it in more than

recommended dosages. Acephate based pesticide have been used by 49 per cent of treatment and 55 per cent of control group of farmers. More than 95 per cent of those who have used acephate have used it in more than recommended dosages. Even though, smaller number of farmers (< 8 per cent) are using other chemical ingredients like Ulala, confidor, Immidachlophide, Chloripyriphos, Lancer, Polo, Marshal / Polard / Pendol / Rizenta, the dosage comparisons suggest that more than 90 per cent of those who are using these chemical compositions are using in excess of the recommended doses. None of the farmers are using any organic pesticides or practices that would control pests. Spraying a minimum four sprays of pesticides has become a standard practice among the farmers.

Fertiliser use: The assessment of fertilizer usage at baseline level shows a contrasting picture. Urea (46:0:0) is excessively being used while the complex is under-used or not-used. About 60 per cent of households who have used Urea have used it in excess, while the rest 40 per cent have under-used the recommended doses. The status of use of complex, though is reverse, is still the same situation of unbalanced use of fertilizer. Given that soil nutrients are being used without soil test advisories, the inappropriate and unbalanced use of fertilizer is not only increasing the cost of production for the farmers but also leading to depletion of nutrients (macro and micro, organic carbon) in the soil.

Social:

Farmers' awareness of decent work principles: There is very limited knowledge of decent work principles with respect to non-discrimination of women and child labour. Contracts, provision of sanitation facilities, and equal pay for hired labourers (male and female) are all absent. The provision of water to hired labourers for drinking and handwashing is also variable. Child labour is evident, but reports vary as to the level of awareness of this issue. Awareness of the health and safety risks in cotton farming is found to be fairly limited.

Working conditions for hired labour: Farmers are currently hiring labour from the local community, within the village and near-by villages. During sowing, they usually hire both local labour and during harvesting they tend to hire workers from nearby villages. Demand for hired labour spikes during the cotton harvesting period and so during this time both men and women are hired for harvesting. Women are paid less than men: For general work women are paid Rs 100-120 or 150 and men Rs 200-300 per day.

Health and safety of farm worker /hired labourers**:** With respect to pesticide exposure, the level of spraying has increased significantly with the shift to Bt cotton, which is likely to be creating greater exposure of farmers to the pesticides.

Value chain:

Catalysing partnerships and linkages: The BCI project by PRDIS is working with the local unit of the Agriculture Department and also with other government agencies and state level research institutions to develop extension packages and training for the farmers. The project plans to engage with ginners to sensitize them about better cotton custody system. Similarly PRDIS is expected to facilitate financial and market linkages for the BCI project farmers.

Farmers' access to finance: Currently, farmers lack proper access to low-cost finance. Most of the farmers have bank accounts. Many are indebted and rely on informal loans from commission agents, which charge relatively high interest rates. Some 44 per cent of farmers (equally in treatment and control group) have reported having an outstanding loan (average outstanding – Rs. 76,853) with

banks. Some 21 per cent of the farmers have reported having an outstanding loan (average outstanding loan - Rs. 74,049) from money lenders /commission agent.

Sensitisation of ginners: The BCI project along with BCI India team has planned to undertake sensitization of selected ginners about 'better cotton' chain of custody. The study will be tracking the progress and results of these sensitizations activities (in terms of better cotton segregation, recognition etc.).

Functioning of the producer unit: The study will be able to assess and report the functioning of the Producer Unit in year 3 of the BCI project, when the Producer Unit is due to have been established.

Synthesis of baseline data – Linear mixed effect model

The strategy we adopted was to use a mixed effect model (Douglas Bates, Martin Maechler, Ben Bolker, Steve Walker (2015). Fitting Linear Mixed-Effects Models Using lme4. Journal of Statistical Software, 67(1), 1-48) with village as a random effect and BCI participation, land under cotton, irrigation, education and soil type as fixed effects. For statistical inference, allowance was made for the intra cluster (village) correlation using the Design Effect. Standard errors were adjusted in the same way. This analysis shows that there are no significant baseline differences in poverty measures between control and treatment groups, and that control groups have slightly (but statistically significantly) higher knowledge, application (of BCI recommended practices) and cost measure scores than do the treatment groups. For the profit measure, the treatment groups have significantly higher scores than the controls. These baseline differences will be allowed for in the final data analysis. There is very little sign of any significant interaction between the other potential predictors (land under cotton, use of irrigation, education, and soil type) and control/treatment group membership for the poverty, knowledge and application indicators, confirming that the randomization process has worked well, and that the groups are not significantly biased with respect to these predictors. Cost and profit indicators do show some significant interactions with the predictors.

Methodology lessons from the study:

Theory based evaluation in VSS context: The use of theory based evaluation is now fairly well established with respect to impact evaluation of voluntary sustainability standards. However, there is still scope for innovation. The theory of change can be used at baseline stage to identify *potential* weaknesses in the causal linkages, which may be useful to stakeholders. It is useful to unpack the intervention package given that the project involves a portfolio of activities and processes. It will be important to monitor closely the actual implementation processes undertaken by the implementing partner, PRDIS, in order to conduct process tracing on the theory of change and to establish where it has held true and where there are weak links. This type of analysis can provide insights into how a VSS may or may not have impact – complementing the randomized control trial that establishes rigorous attribution of impact in a particular case. In this study we have unpacked a number of impact pathways – economic, environmental, social/decent work and value chain – which are embedded within the overall theory of change. In reality, these will be intertwined and the field research will explore these interconnections.

Experimental research in the VSS context: The randomized control trials are a viable option in VSS contexts as is proven by this study. Applying RCT methodology combined with TBIE can improve assessment quality and validity. However application of RCT methodology will require precision thinking and enabling conditions. Achieving methodological rigour in RCT require certain pre-conditions of resources, suitability of context, willingness of the implementation agencies and private sector partners, and also of reliability of standards own internal control systems. The study provide a methodological lesson in constructing counterfactual in VSS impact research. The research design of Cluster RCT with matched pair randomisation within different strata (selected based on bio-physical and socio-economic parameters) is an innovative approach to constructing a counterfactual. The study design also include a representative household panel (based on anticipated heterogeneity) to be tracked over four years. The panel is not known to the BCI project reducing the chances of biased attention. The behavior of the panel with respect to other members of the treatment and control group will offer methodological lessons to constructing such a panel in VSS impact research.

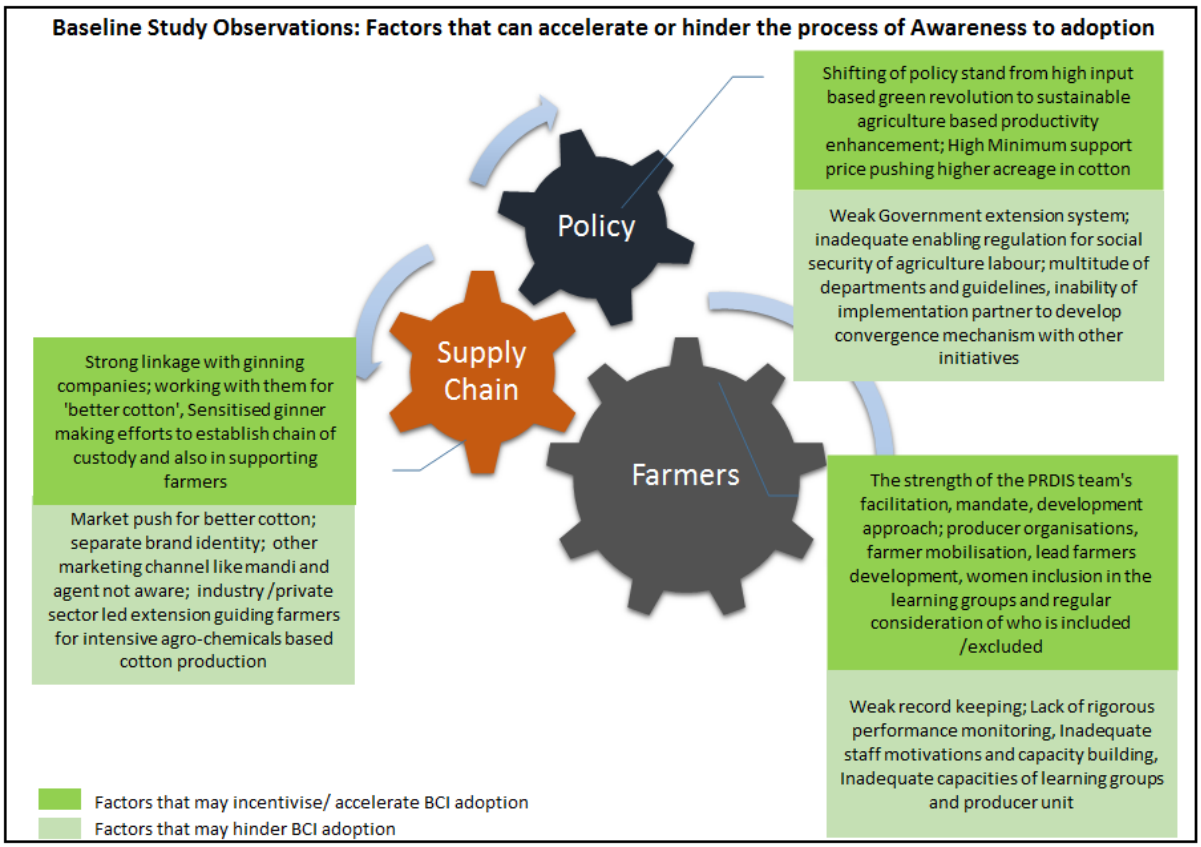
Other methodological lessons: Longitudinal studies or interim performance monitoring can potentially enhance the quality of overall assessment. The research employs a methodology for tracking the programmatic exposure of the cotton farmers to various BCI project activities (treatments). This will help the researchers in validating the contribution of the project, alongside other explanatory variables, including a qualitative enquiry analysing the theory of change, unpacking other potential routes to observed outcomes and exploring unintended and unexpected impacts. The BCI verification /license is awarded to the producer unit (based on a three-tier assessment of sample members). The research charts out the progression of each individual member over a period of time in terms of their knowledge and application of BCI recommended practices. It also tracks the outcome variables (cost of production, yield, profitability, pesticide use etc.). The correlation between practices and outcomes are analysed. The research team have developed an index called Better Cotton Composite Index (BCCI) which tracks every member of the learning group (also those who are not part of learning group in the intervention set and those belonging to 'control' set) in terms of their knowledge and application of BCI recommended practices. This is a simple and potentially replicable analytical index, tracking progression towards 'better cotton'.

Conclusions and Pointers for Reflection:

The baseline findings generate following conclusions and pointers for reflection for the BCI system in general and the BCI project in particular:

1. **Awareness to adoption:** The BCCI shows a clear gap in index score on knowledge (.055) and application (0.45). The BCI project will enhance knowledge of farmers. There is an assumption that once farmers receive training they will adopt the practices which they are taught by PRDIS, including reduced use of harmful chemicals, intercropping etc. However, it is clear from the baseline study that farmers strongly believe that their yields will suffer if they do not sustain frequent spraying with pesticides. That presents the challenge to the BCI project in demonstrating benefit and changing existing mind-set of the farmers regarding excessive or imbalanced use of agro-chemicals. The baseline study throws some light on how the process of awareness to adoption can be accelerated as is depicted in the figure 1 below:

Figure 1: Baseline observations on the process of awareness to adoption



2. **Thrust on profitability and not just productivity:** Overall, the work of the government, civil society, and the private sector on agriculture has been confined to the improvement of production and productivity. The interventions related to technology and management practices (encompassing seeds, chemical inputs, and pesticides) are chosen to enhance the level of cotton production. The farmers, therefore, also tend to look at cotton cultivation from the production/productivity enhancement angle while evaluating the need to take up certain interventions. In this scenario, the BCI project can draw the attention of farmers and other stakeholders to improved profitability through cost reduction (less input use) and some improvement in productivity, additional income possibilities from inter-cropping etc. which will demonstrate a viable economically working model of sustainability standards in a commodity. The study will be able to examine the investment implications of improved profitability towards household productive investments and consequently in poverty reduction.

3. **Market demand for the BCI cotton:** It is not clear whether market demand for BCI licensed cotton will develop. Building the market is not part of the intervention package of PRDIS, and therefore action on building the market relies primarily on BCI via their linkages and engagement with retailers and brands. The theory of change assumes market demand will exist, particularly in the value chain impact pathway.
4. **Inclusion /exclusion of women in the BCI project:** The baseline study shows how gender inequalities are significant. The entrenched gender norms that prevail mean that it will be challenging for the PRDIS project to tackle such norms, without targeted interventions and potentially in concert with other actors. To date very few women are involved in the Learning

Groups (4 per cent), but information is also not shared with them by their husbands on matters relating to cotton farming and marketing, because it is often assumed that they do not need to know this information. Even if these women did obtain access to the information it is not clear how far they could implement the new practices without their husbands' consent, as it is male heads of household who control this decision-making and cotton income. Women's labour is also heavily relied upon and they have the triple burden of cotton farming, combined with domestic and reproductive tasks.

5. **Social dimension of sustainability:** As discussed in the social impact pathway, inequities experienced by women, the informal nature of hired labour markets, and the incidence of child labour and health and safety issues are very challenging for the BCI project to address in short period of time (of next few years). The hired labour market is informal and it may be challenging to introduce formal contracts and other elements of decent work principles, as many of the cotton farmers hiring others to work on their farms also have limited means. As many households rely upon this wage labour for their food and income security, it may be difficult to challenge child labour incidence during harvest time, without additional social protection measures. Health and safety training does not reach hired labourers – because few farmers who hire them are not using protective equipment themselves. These changes will require skills, resources and importantly structural /policy interventions (e.g. on social security of agriculture labour). The BCI standards and the BCI project on the ground may be able to bring about changes in awareness on these issues among the right group of people but real changes may be considered as requiring 'long haul' efforts and interventions.

6. **Service provisions to the farmers (financial and market access)**: The baseline study shows how farmers face indebtedness due to the trading relationships of tied finance that the farmers get from the intermediaries (dalal /commission agent). The extent of disadvantage these trading relationships are causing to the farmers need to be explored further during the study. The BCI project is mandated to work on promoting enabling mechanisms (on finance and market access) to the farmers which will require a proper understanding and an appropriate strategy, but it is not clear how far this is likely to occur or feasible for the implementing partner.

7. **The baseline status of participating households offers both opportunities and challenges**: The baseline study shows a very high proportion of illiteracy for both men and women farmers (70 and 88 per cent respectively, illiterate or without formal education). This offers a challenge to the PRDIS team in implementing training and extension services (particularly so as farmers with less education tends to have lower BCCI score), which will need to be oriented towards the learning requirements and learning styles of the participating farmers. The BCCI scores have also shown that some of the farmers are currently following many of the BCI recommended practices. Some of these farmers can be motivators or demonstrators. Given the current low level of knowledge and application of various practices, the BCI project has the opportunity to make significant changes e.g. almost all farmers are using fertilizers and pesticides in unbalanced way (excessively, untimely, in-appropriately, under-use or no use) and only two per cent of farmers are taking nutrient application decisions based on the soil test.

1. INTRODUCTION

1.1 BACKGROUND TO THE STUDY

The ISEAL Alliance Secretariat works with its sustainability standard members on various projects aimed at strengthening their approach to M&E systems, learning more about the impacts of standard systems, and determining how to increase the effectiveness of standards. The 'Demonstrating and Improving Poverty Impacts', has this aim and is funded by the Ford Foundation. Through this project, ISEAL and six of its forestry and agriculture members (4C Association, Fairtrade International, Forest Stewardship Council, Rainforest Alliance, Union for Ethical Biotrade, UTZ Certified) are working together to evaluate the contribution that certification systems can make to poverty alleviation and pro-poor development and drive improved livelihoods for those working primarily in agriculture and forestry, through improved impacts of certification. The Better Cotton Initiative (BCI) has joined the project in its second phase, where the focus is on measuring the contribution of certification to pro-poor development and testing impact evaluation methodologies.

ISEAL has commissioned a consortium led by the Natural Resources Institute, University of Greenwich, and including the Gujarat Institute of Development Research, the Centre for Economic and Social Studies, and Pragmatix Research and Advisory Services, to conduct an impact evaluation study of the early impact of pre-certification technical assistance and certification on previously uncertified smallholders.

This report presents the baseline findings of the study, focusing on a Better Cotton Initiative (BCI) project, being undertaken by a BCI partner in Adoni Mandal, Andhra Pradesh, India. The project is funded by the Better Cotton Fast Track Fund (BCFTP). Advisory inputs have been provided in the design phase by 3iE on RCT design and sampling framework and the Committee on Sustainability Assessment (COSA) on the selection of indicators.

1.2 BETTER COTTON INITIATIVE

The Better Cotton Standard System is a holistic approach to sustainable cotton production that covers all three pillars of sustainability: environmental, social and economic. Though BCI does not have an explicitly expressed theory of change, the BCI system overall explains the intent of the cotton sustainability standards. Six components make up the Better Cotton Standard System:

i. Production Principles and Criteria
ii. Capacity Building
iii. Assurance Program
iv. Chain of Custody
v. Claims Framework
vi. Results and Impact

The BCI states that better Cotton exists to make global cotton production better for **the people** who produce it, for **the environment** it grows in, and better for **the sector's future.** Better cotton is an agricultural management system defined by:

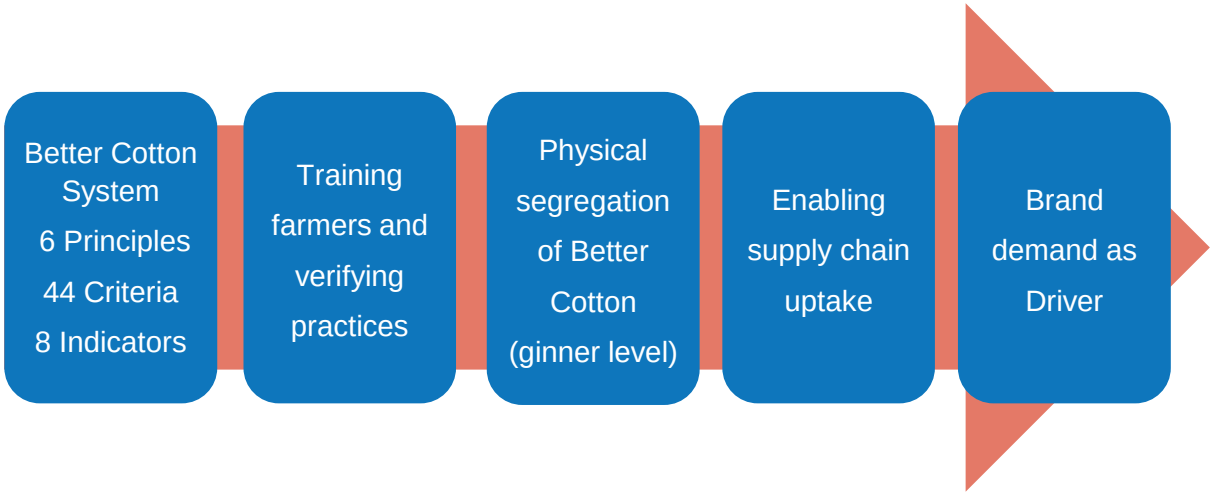


Figure 2: Description of Better Cotton Initiative

BCI aims to transform cotton production globally by developing Better Cotton as a sustainable mainstream commodity. BCI aims to coordinate a sustainable financial model that channels funds from membership and public-private partnerships back into the supply of Better Cotton through farm-level training and verification. The Better Cotton Production Principles and Criteria lay out the global definition of Better Cotton, by upholding the following six principles:

1. Better Cotton is produced by farmers who minimise the harmful impact of crop protection practices.
2. Better Cotton is produced by farmers who use water efficiently and care for the availability of water.
3. Better Cotton is produced by farmers who care for the health of the soil.
4. Better Cotton is produced by farmers who conserve natural habitats.
5. Better Cotton is produced by farmers who care for and preserve the quality of the fibre.
6. Better Cotton is produced by farmers who promote Decent Work.

How BCI works

BCI intends to achieve a number of sustainability outcomes. The following have been identified as relevant for the context of this evaluation.

- Enhanced financial profitability for farmers producing Better Cotton is demonstrated
- Children in Better Cotton communities exercise their right to education
- Working conditions are improved in Better Cotton farms
- Better Cotton is produced by farmers who minimise the harmful impact of crop protection practices

- Better Cotton is produced by farmers who use water efficiently and care for the availability of water
- Better Cotton is produced by farmers who care for the health of the soil and conserve natural habitats

BCI has a number of sustainability indicators to help them track progress towards their intended sustainability impacts. Some of those indicators, Results Indicators, are fully integrated into the Better Cotton Assurance Program to ensure that sustainability improvements are adequately measured everywhere Better Cotton is produced. Each season, Producer Units collect this data from a representative sample of participating farmers and report it to BCI.

Table 1. BCI Result Indicators for small holders

Results Indicators	Measurement	Smallholders
Pesticide Use	Kilograms/hectare/for each active ingredient	√
Fertiliser Use	Kilograms/hectare/for each active ingredient	√
Water use for Irrigation	Cubic metres/hectare	√
Yield	Total cotton produced in kilograms of lint/total cotton production in hectares	√
Profitability	Gross margin/hectare	√
Elimination of Child Labour – A. Leveraging partnership with local specialist organisations	Existence of partnership(s) established by or on behalf of the Producer Unit with credible social organisations to address child labour, in particular to identify and reduce barriers to formal schooling.	√
Elimination of Child Labour – B – Improving understanding and awareness	Percentage of farmers who can accurately differentiate between acceptable forms of children's work and hazardous child labour	√
Inclusion of women	Number of farmers and workers receiving BCI training who are women by training topic	√

Source: BCI

2. RESEARCH DESIGN

The full research design can be found in the research design document. In this section we summarize the research design and provide an overview of the data collection undertaken.

2.1 OBJECTIVES

The overarching goal of the study is to examine the impact that becoming and being certified under BCI's sustainability standard has on cotton farmers and their households. The four main primary objectives of the study are to:

i) Measure the attributable impact on cotton farmers and their households;
ii) Assess the potential benefits that the Producer Unit and Producer Company will bring to cotton farmers;
iii) Improve understanding of the added value and specific contribution of being included in the BCI system;
iv) Identify lessons from the programme and impact evaluation approach of sustainable standards.

Two further secondary objectives of the study are:

- To improve understanding of how market dynamics in Kurnool and the livelihood context in the area are likely to have affected observed outcomes;
- To assess the strength of the BCI system and its implementation model, suitability of project design, the Better Cotton sustainability and its effects on the cotton supply chain in Kurnool

There are also additional learning objectives for this study, namely:

- Testing selected ISEAL common core indicators and reflecting on how well they work and how best to report on observed results;
- Facilitate discussion of the maintenance of counterfactuals in quasi-experimental and experimental research designs;
- Testing the use of qualitative approaches to answer research questions that cannot be examined solely through a quantitative approach;
- Insights on the production of informative research reports, with clear, transparent results and communicable stories and experiences, to help ensure the influence of the research both within the standard system organisations and beyond.

The study requires changes to be examined over the four year period at three levels – farm/ household, Product Unit and cotton value chain levels as depicted in the figure 3 below.

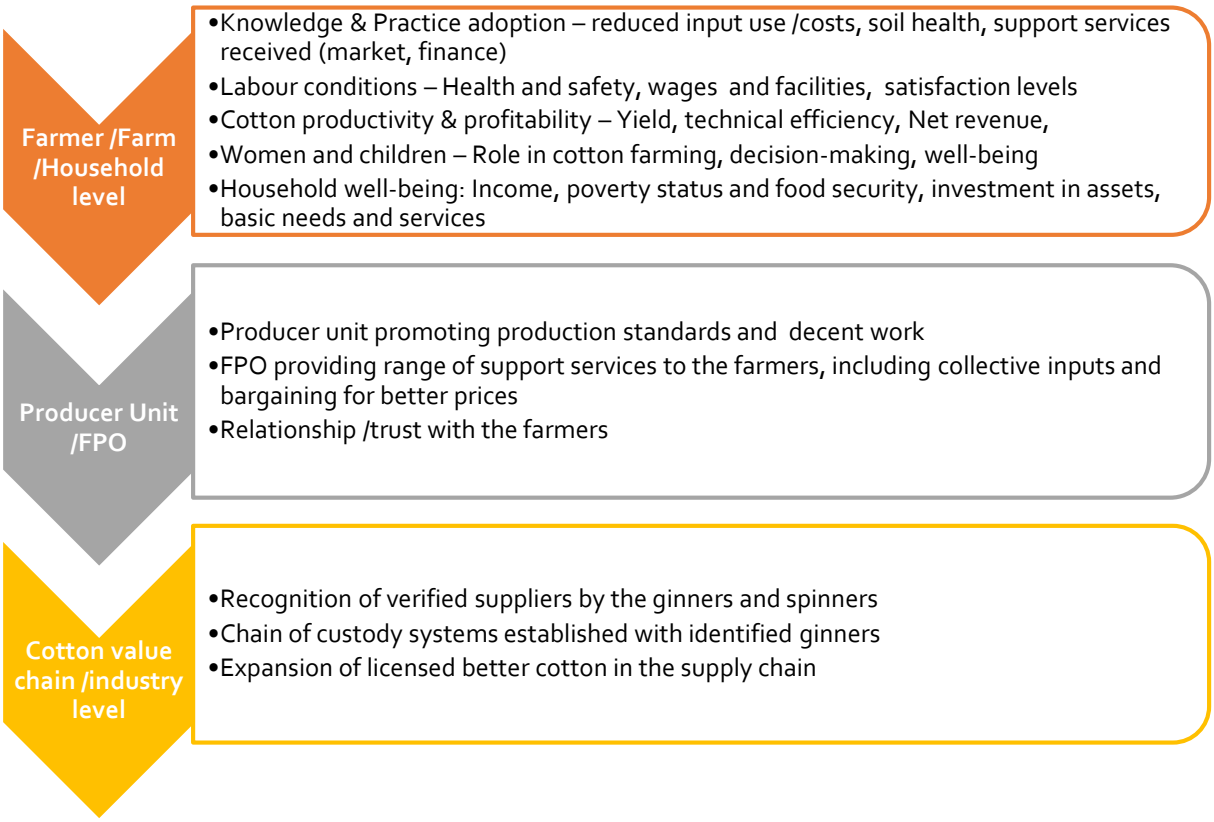


Figure 3: Better cotton – level of changes in sustainable production and supply

The study will examine how participation and outcomes differ across farmers with different poverty profiles and starting level of assets.

2.2 RESEARCH QUESTIONS

In line with above evaluation objectives, the study research questions are as follows:

- To what extent has the **process of becoming or being certified under BCI sustainability standards had an impact** (positive or negative, expected or unexpected) upon smallholders (farmers and households) in Kurnool district? What are the economic (yield, productivity, incomes, food security) and social (child labour, farm workers, no discrimination in wages for women) impacts?
- To what extent do we see an **improvement in environment variables** connected with cotton production (uptake of fertiliser use, reduction in pesticide use, efficient water use, soil health, habitat /biodiversity)?
- To what extent can **Producers Unit and /or Farmer Producer Company 'empower' cotton farmers** and households – both economically and socially?
- Can we see an **increase in Better Cotton availability and uptake** in the district /beyond? How can this be strengthened? What are the relative benefits and costs of meeting BCI standards and achieving certification for intended beneficiaries and supply chain actors?

2.3 OVERALL APPROACH - THEORY BASED IMPACT EVALUATION (TBIE)

In order to be able to measure and attribute impact, but also to understand what has created impact and identify lessons, the study employs a theory based evaluation approach. The theory of change lays out the anticipated chain of inputs, outputs, outcomes and impacts, and the causal linkages between them. By identifying this expected impact chain and the associated assumptions inherent within it, we can gather evidence to establish whether the theory of change holds true and where it does not, i.e. where there are weak linkages, as well as unexpected and unintended consequences of the intervention. The theory of change allows for a consideration of the relative contribution of the intervention vis-à-vis other interventions. Through the combination of theory of change, which allows us to understand how impact has or has not been achieved, with randomized control trial –the latter enabling a rigorous attribution of impact -we can assess the impact of the intervention – in this case the BCI project implemented by PRDIS.

A Randomized Control Trial (RCT) combined with statistical analysis is found feasible primarily due to the willingness of the implementing partner to rollout their programme following a randomization strategy identified by the evaluation team. As BCI and implementation partner targets and resources are limited for Kurnool, in terms of outreach to farmers, randomisation is a fair approach to reach out to farmers and households (not unfair to other farmers not selected). The research team along with the implementation partner considered various options for randomization before finalizing the best suitable approach for the context of the BCI project.

A cluster-RCT approach is proposed with the attribution of impacts of the BCI intervention package analysed by comparison of pre- and post-situation of smallholders within the intervention mandal, and pre and post comparisons between intervention and non-intervention groups within the intervention mandal. The level of exposure of farmers will also be assessed so that the analysis takes account of variations in implementation.

Observational/ethnographic approaches will also be employed (following the lines of comparison of the experimental design) to interrogate the theory of change – to assess what change has happened and why through participatory field research techniques including focus group discussions, household panel survey and key informant interviews. The evaluation team will seek to understand the context of implementation, unexpected outcomes, and the relative influence of different drivers of change.

The baseline study was conducted in July-September, 2015 (taking the data on cotton season in 2014) and the final evaluation will be completed in the same period in 2018. An interim performance monitoring of the project is also part of the research design with two interim studies proposed in 2016 and 2017.

The envisaged theory of change of the BCI project is described in Figure 4 below.

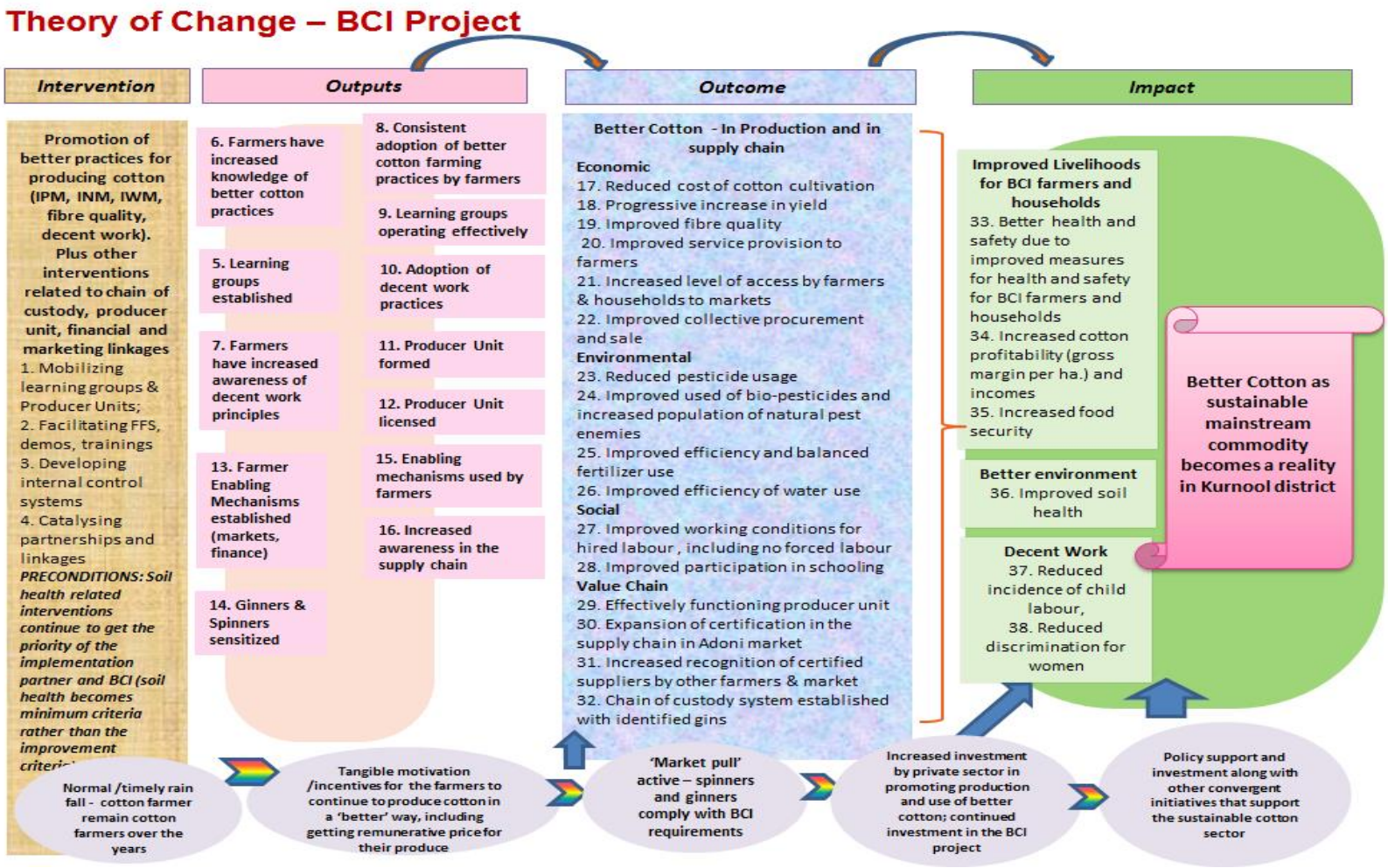


Figure 4: Thoery of Change of the BCI project

The theory of change reflects how BCI and PRDIS has envisaged the roll out of the project and how results will be achieved (in terms of what will lead to what) over a period of time. Clearly the theory of change starts with host of interventions by the BCI project for promoting knowledge and consistent adoption of better cotton practices. The route to promotion of better cotton practices is the formation of a learning group and later a producer unit and includes various agriculture extension approaches like Farmer Field School, demonstrations and exposure visits. With capacity building support, the farmers are motivated for consistent adoption as they start seeing the benefits of being better cotton farmers. According to the PRDIS team, a reduction in the cost of production of cotton is the key outcome which will motivate increasing number of farmers to join the learning groups and to try and meet the BCI standards. Therefore the incentives for the farmer lie in saving inputs costs. Inter-cropping (with red gram /pigeon pea, green gram and other crop combinations) can also provide additional returns (estimated[2] to about Rs.10,000 to 15,000 per Ha) to cotton farmers. With a portfolio of agronomic practices[3] improving soil fertility and cotton fibre quality, the progressive realisation of increased yields and better returns from cotton farming is expected to be achieved.

The flow of economic benefits to the cotton farmers in Adoni is expected and intended to simultaneously lead to positive environmental outcomes and impacts. Farmers realise economic benefits when they reduce their use of inputs, such as pesticides and fertilizers, and at the same time stabilising /progressively increasing yields through improved soil fertility management - which in the long run is expected to improve soil health. Alongside the economic and environmental benefits accruing, social benefits are also intended from the BCI intervention package. Practices promoted by BCI include those related to improving working conditions (e.g. ensuring workers have access to safe drinking water) and better health and safety (e.g. the safer use of pesticides, the non-use of banned pesticides, the non-application of pesticides by children and pregnant women etc.). The BCI intervention package also intends to lead to reduced discrimination in wages for women along with reduced instances of forced labour on the cotton fields. These are expected to be achieved through a series of interventions related to awareness raising and building a culture of compliance among the BCI farmers in the learning group /producer unit. Clearly the achievements of social standards will enhance the well-being of smallholder cotton farmers and hired labourers on their cotton farms.

However, the impact pathways identified above may not occur if the assumptions implicit within the theory of change do not hold true in the context being studied. For example, in the process of implementation realities on the ground may mean that changes are made by implementation partners leading to different impact chains occurring in practice. Ineffective implementation is also possible such that the expect results may not occur or may be of lower magnitude than expected, or there could be unanticipated or unexpected results. In some instances projects may achieve their

[2] By PRDIS team

[3] As recommended by BCI and developed over a period of time by the implementation partner. These practices have been well-proven to improve soil fertility status and cotton yields by the pre-BCI and BCI projects implemented by PRDIS. These practices include those which are also being promoted by the state government of Andhra Pradesh and state agriculture universities. This alignment ensures the scientific validity of the practices being beneficial in improving sustainability in cotton farming and also yields and incomes. The household research instrument is designed to capture the knowledge and application levels of these practices by the cotton farmers so as to capture the baseline and end line status which will assist in making inferences regarding impact of the BCI project.

outputs, but the expected outcomes do not occur, because the assumptions that are implicit within the theory of change are found to be false.

Each transition in the theory of change has an assumption associated with it that must hold true for observable outcomes and impacts to be found in practice (see Figure 3). Moving along the theory of change the influence of contextual factors becomes more important – thus there are limits to the accountability of any development intervention. Each project has a sphere of control (inputs and outputs) and a sphere of influence (outcomes) and sphere of concern (impacts) which can be distinguished.

Normal timely rainfall is a key assumption as cotton farmers wait for the signs of rains before sowing cotton seed. If the rains fail, some of the cotton farmers may adopt some other crop or leave the land fallow. For the theory of change to function effectively there is an inherent assumption that farmers will have tangible incentives to continue to produce cotton in a 'better way' and this requires market demand for the BCI cotton. Market demand depends upon continued support from multi-national brands, not only in funding initiatives at production level, but in sourcing BCI cotton and at sufficient scale, if the sector transformation is to occur i.e. across the Kurnool production sector. If the brands demand supply of better cotton through their vendors /supplier then the 'market-pull' will start working throughout the supply chain. Achieving this kind of mainstreaming of BCI sourcing in Kurnool will take longer than the duration of this study, but key informant interviews will be conducted to identify any early signs of change in this direction.

As the intervention package involves a number of different intervention areas and consequences it is possible to identify impact pathways, while also recognizing the inter-relationships between them. We have included these analyses in each of the relevant sections of the report.

2.4 EVALUATION DESIGN AND METHODOLOGY

Theory based impact evaluation should enables understanding not only whether the intervention has or has not had an impact, but – and as importantly – how. The evaluation emphasizes rigour and the study design includes a Randomized Control Trial (RCT) design, nested within the TBIE approach, and associated also with a mixture of quantitative and qualitative methods, providing an overall highly credible approach to impact evaluation.

There is also an emphasis on informing learning and knowledge generation on impact evaluation for sustainability standards and collaboration with other interested stakeholders, such as researchers, donors, companies etc. The research team, in consultation with key partners (including the Committee on Sustainable Agriculture - COSA), has developed a set of indicators emanating from the theory of change. Figure 5 sets out the selected indicators linked to the Theory of Change:

Figure 5. Evaluation Framework and Indicators

Evaluation Framework: Demonstrating and Improving Poverty Impact of Sustainability Standards

IMPACT

Improved livelihoods; Better environment; Decent Work; Sustainable Cotton Sector

33. Improved health and safety of BCI farmers; 34. Increased profitability /income from cotton; 35. Increased food security; 36. Improved soil health 37. Reduced incidence of child labour; 38. Reduced discrimination of women

OUTCOMES

Economic; Environmental; Social; Value Chain

17. Reduced cost of cotton cultivation; 18. Progressive increase in yield; 19. Improved fibre quality (no. of best practices, no. of farmer adopting); 20. Improved service provision to farmers, including support services provided by the PU to members 21. Improved level of access to these services by farmers and households; 22. Improved collective procurement and sale of better cotton; 23. Reduced pesticide use; 24. Increased use of bio-pesticides and increased population of natural pest-enemies through various practices; 25. Improved efficiency and balanced fertiliser use; 26. Efficient water use; 27. Improved working conditions for hired labour, including no forced labour; 28. Improved participation in schooling; 29. Effectively functioning farmers producer unit (governance and management systems in place, as mandated by the BCI system); 30. Expansion in license in supply chain in Adoni market; 31. Increased recognition of certified suppliers by other farmers and market; 32. Chain of custody system established at identified gins (Physical segregation, creation of identifiable 100% better cotton bale, lint cotton at the

OUTPUTS

Cotton production and supply chain improved

Cotton Produced in a Better way	Cotton supply chain improved	Producer Unit
5. Learning Groups established; 6. Farmers have increased knowledge of better cotton production practices; 7. Increased awareness of decent work principles - child labour, health and safety issues and non-discrimination; 8. Consistent adoption of better cotton practices by x% of targeted farmers; 9. Learning Groups operating effectively; 10. Farmers have adopted decent work practices	14. Ginners and spinners sensitized to better cotton; 16. Increased awareness in the supply chain actors	11. Farmer Producer Unit established; 12. license obtained by Producer unit; 13. Enabling mechanisms (finance, market) established; 15. Enabling mechanisms used by

PRINCIPAL INTERVENTIONS /PROCESSES

Promotion of agronomic practices for producing cotton in a 'better way' accompanied by other interventions related to chain of custody, producer unit, financial and marketing linkages

Mobilising Learning Groups	Facilitating FFS, Demonstrations and Farmers' Training	Developing Internal management Systems	Catalysing Partnerships and linkages
1. Activities to facilitate the establishment of 100 learning groups in Adoni Mandal & one Producer Unit	*2. No. Of farmers participating in FFS, exposures, trainings, demos and other events; Farmers satisfaction levels from knowledge and service support received*	*3. Monitoring system; Verification system, record keeping in place as per BCI assurance program; Improvement plans are regularly prepared and updated*	*4. Ensuring and leveraging partnerships with for decent work, finance and market linkage*

2.5 RCT DESIGN

A cluster RCT design is proposed as this is a more appropriate design[4] given the study context of specific heterogeneity within a broadly homogenous *mandal.* The village was considered to be a cluster and the unit of random assignment, as methodologically it was not possible to randomly assign farmers /households to the intervention within a village, given the saturation approach. The saturation approach entails targeting all farmers for the programme, wherein a few join voluntarily in the first year and then progressively more become part of the project promoted learning groups /producer unit in the second and third year. The unit of intervention by the BCI project is the learning

[4] Detailed options and explanations on RCT designs considered while selecting the cluster RCT design is provided in the research design document

group (member households within the learning group) and the producer unit. The unit of assessment and analysis for this study is the household, learning group and clusters.

The cluster RCT is expected to reduce or eliminate the influence of confounding variables as cluster based randomisation will ensure that the randomly assigned clusters represent all typical situations available in the *mandal*. The cluster RCT design can address the control of the spread effect to a certain extent as the clusters are spread out across the *mandal* since they are selected based on stratification using bio-physical and socio-economic parameters and not on the basis of geographical proximity.

The implementation partner wanted to prioritise black or mixed soil areas in the first phase of project implementation[5] (first 3 years) and hence this bio-physical measure (dense black, medium black, mixed soil) was used as a filter to create the universe for random selection of the clusters /villages. The sampling universe of 21 clusters (so obtained after applying the filter) was divided into 10 best matched pairs (using existing bio-physical and socio-economic parameters) and then from each pair, a treatment and control cluster/ village was randomly assigned.

Table 2. Randomly selected Intervention and Non-intervention clusters

S. No.	Stratum	Best- Paired Clusters	
		Cluster / Village Names*	
1	Stratum 1	Baladur	Naganathana Halli
2	Stratum 1	Dhanapuram	Madire
3	Stratum 1	Chinna Harivanam	G.Hosalli
4	Stratum 2	Pedda Thumbalam	Chinna Gonehal
5	Stratum 2	Virupapuram	Billekallu
6	Stratum 3	Pedda Harivanam	Ganekal
7	Stratum 3	Hanavalu	Kadithota
8	Stratum 3	Kuppagal	V.Kondapuram
9	Stratum 3	Pandavagallu	Santhekudlur
10	Stratum 3	Yadavalle	Jalibenchi
11	Stratum 3	Salakalakonda	-

**Green coloured – Intervention cluster; Yellow coloured – Non-intervention cluster*

The detailed RCT design is described in the research design document.

[5] PRDIS has not worked earlier in Adoni *mandal*. The BCI project will face the additional challenge of not much governmental or NGO intervention in agriculture or cotton sectors. This as per PRDIS necessitates interventions in areas which are recommended for cotton cultivation (black soil) as a better demonstration effect can be created in these areas within the mandal, consequent to which more mixed soil and red soil areas can be added to the project in subsequent years.

2.6 METHODS AND TOOLS

Photo 1: Farmer interview

The research was conducted at household levels - with farmer groups (Learning groups, Producer Units) and from supply chain actors (e.g. ginners, spinners) and other stakeholders (e.g. the implementation partner, BCI team in India, Government of India local agriculture department etc.). The four main data collection instruments were:

1. Household survey instrument
2. Focus group discussion guide
3. Farmer/household panel interview
4. Key Informant interview checklist

Additionally Producer unit assessment checklist will be used in year 3 and year 4 of the project. Details about these instruments are provided in the research design.

2.7 DATA ANALYSIS

The analytical framework is aligned with the theory of change – evidence is gathered and analysed against the theory of change to assess the extent of and causes of impact, including exploration of other potential pathways to observed outcomes through the qualitative enquiry. The experimental design is nested within the overall study approach allowing for rigorous assessment of what impact the BCI intervention package has had (by controlling for other variables) and thus an attribution of impact.

The key lines of comparison are – before and after the BCI project (2015 and 2018) and between treatment and control group of farmers ('with and without' scenario).

We will be able to understand the profile of farmers who join the programme voluntarily in the first year and also those who join in the second and third years. We will also be able to track those who do not continue into the programme for all three years demonstrating inconsistent participation. We will be thus be able to analyse the level of consistent adoption of practices.

The analytical approach for assessing the impact through comparison between control and treated series is to use a **Generalised Linear Mixed Effect model**. The study uses standard multivariate regression to better understand the causal relations. The RCT analysis involve constructing multiple regression model, both based on and also analysing behaviour of explanatory variables.

Statistical methodologies are adopted to ensure robust inference and standard errors for the model parameters, allowing for the constraints imposed on the study design by practical considerations relating to the intervention. These include:

- clustering effects from the limited number of clusters

- difference in difference calculations, backing off any secular improvements in the performance of the control group

The study measures heterogeneous effects i.e. subgroup analysis for different clusters and for different type of farmers. The sampling framework has been derived to ensure statistical power (0.8) for undertaking sub-group analysis. The study analyses the findings on various independent variables viz. education, land size, poverty profile, caste etc. Overall the study is able to capture the level of achievement on the outcomes of interest and explanatory variables and other factors responsible.

2.8 SAMPLING DESIGN

We recognise that a 10-cluster design will result in a reduction of power for the statistical tests, but that our sample sizes within clusters compensates for this as far as is possible, and that we are confident that our analysis is not subject to type 1 errors[6]. Clustering reduces the effective sample sizes and so allowance for this has been made in the data analysis. To develop the sampling design, the following have been our guiding principles:

- **Sampling Method:** Difference in means of two equal size groups
- **Samples estimates:** Effect size: 0.4 (moderate); Power: 0.8; significance level: 0.05 (95%)

Further explanation of sample determinants is given in the research design document.

Table 3. Sample size determination

Sample size with no clusters								Effective sample size with Clusters				
Outcome of interest	Mean	SD	Impact	Effect size	Coefficient of variability	N for power =0.9	N for power = 0.8	effective sample size allowing for 10 clusters **0.9**	**0.8**	No. of clusters - 10	Corrected N power **0.9**	Corrected N power **0.8**
Yield	1925	348	142	0.41	0.18	126	94	88	72	ICCC: 0.037	180	123
CoP	33497	20625	6523	0.32	0.62	206	154	119	100		355	236

Among the two sample sizes for two different outcomes of interest as calculated in table 3, we have considered the outcome of interest (cost of production) which suggests take-up of higher samples. This will ensure enough statistical power for both direct and derived measures. Given the above, the study sample for both the treatment and control groups is 472. To this, we have applied 35% attrition rate (observations lost to follow ups or other reasons for farmers dropping out from the study before or during the end line stage). The higher samples taken in this way will also aid in improving the sub-group samples and consequently the sub-group analysis. The overall sample size for the study

[6] In statistical hypothesis testing, a type I error is the incorrect rejection of a true null hypothesis (a "false positive"), while a type II error is the failure to reject a false null hypothesis (a "false negative"). More simply stated, a type I error is detecting an effect that is not present, while a type II error is failing to detect an effect that is present.

therefore is 640 i.e. 320 for the treatment group and 320 for the control group. To improve the power of sub-group analysis, we have further increased the sample to **729 households** in baseline research.

2.9 IMPLEMENTATION OF THE FIELD RESEARCH - BASELINE

2.9.1 HOUSEHOLD QUESTIONNAIRE SURVEY

A household survey was conducted with 729 households (a larger sample was covered to improve the power of sub-group analysis), using tablet based data collection. The Open Data Kit (ODK) platform was used for the household (HH) survey. In case of intervention cluster, we used the database of farmers who are already in the learning group and added to this database, the list of farmers who have not yet become part of the learning group (and may do so subsequently). We then applied population proportion to size (PPS) sample selection procedure i.e. in the case of intervention clusters, based on the proportion of households within a cluster who are already part of a learning group, we selected that proportion of the sample randomly from the database of farmers within the learning group in a cluster. The remaining proportion of the sample was selected from a listing done of other cotton farmers in the cluster who have not yet become part of the learning group. In non-intervention situation, we developed a listing of cotton farmers within the cluster and carried out random sample selection from that sampling universe.

Photo 2: Household Survey

2.9.2 FOCUS GROUP DISCUSSIONS

Focus group discussions (FGDs) were held across the study sites with intervention and non-intervention farmers in order to explore in more depth the difference that becoming and being certified to BCI cotton makes. The focus groups covered a variety of information related to village level social and physical infrastructure, factors affecting cotton production and productivity, role of BCI implementation partner in promoting standards and fostering learning among farmers, productivity and related farmers livelihoods etc.

Photo 3: FGD with women group

A total of twenty four FGDs were planned - approximately fourteen in intervention villages and ten in non-intervention villages, with separate groups for women's and men's interviews (112 men and 74

women participants). In the intervention villages, five FGDs were envisaged with male participants drawn from the learning groups already formed by the project and five FGDs with female members from the same groups (generally a much smaller number), plus wives of male members. Two FGDs (men and women separately) were held with cotton farmers who have not yet become part of the learning groups. In addition, in the intervention villages, at least two FGDs were planned with hired labour /migrant workers. Five focus groups were planned with male cotton farmers and five with female cotton farmers/wives of male cotton farmers in the control villages. Figure 6 below sets out the focus group discussions planned and held during the baseline study. It is to be noted that in one of the village, a planned FGD with migrant labour was actually conducted with the hired labourers (as migrant labourers were not available).

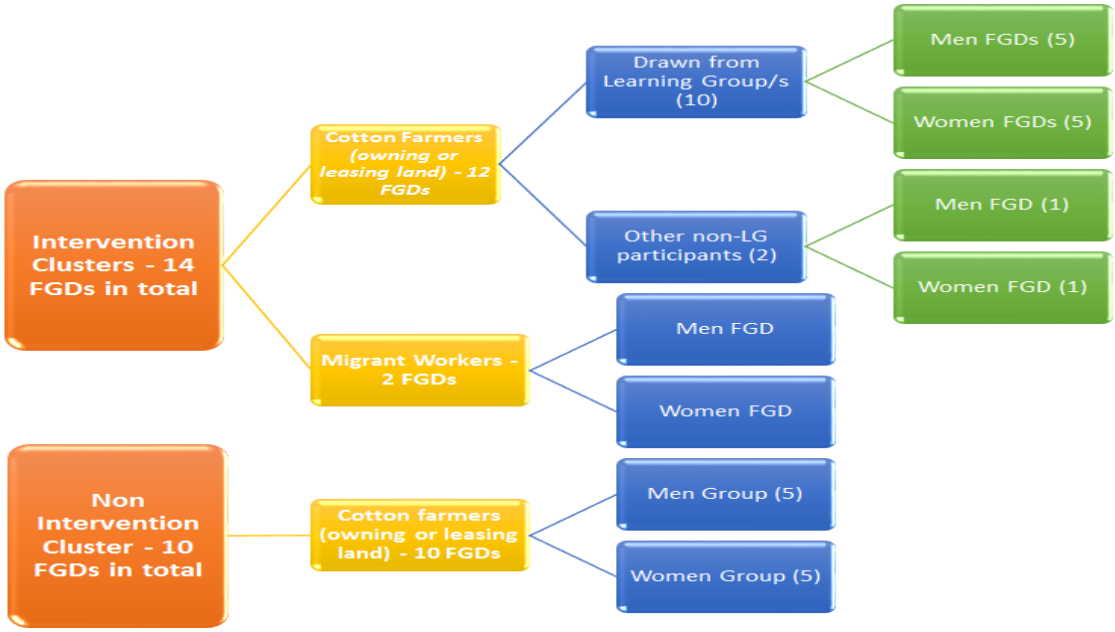


Figure 6: Coverage of Focus group discussions during baseline study

2.9.3 HOUSEHOLD CASE STUDIES /PANEL

A set of fifteen household case studies / a panel was established at the baseline, which will be tracked every year till the final evaluation in 4th year of the BCI project. The panel will be a 'blind' panel, i.e. the implementation partner will not know the participants forming the panel in order to reduce potential bias in targeting the BCI project interventions towards the panel (i.e. targeting the BCI project interventions towards the panel). The panel of fifteen households was selected from the five intervention villages. These households were selected purposively, based upon anticipated heterogeneities, including male and female headed households. Separate interviews were conducted with the main farmer and spouse, in order to gather an understanding of intra-household dynamics as well as to track changes between the baseline and final evaluation.

The panel household in each intervention village (three households selected) was selected based on the following segmentation:

a. Women headed households – five WHH
b. Households belonging to small and marginal land holding – five households

c. Households belonging to medium and large land holding – five households

In each of the above three categories, three members were selected from those who are already part of the learning group, while two members were selected from among those who are not yet part of the learning group. Overall the panel consist nine households who are part of the learning groups and six households who are not yet part of the learning groups (and may subsequently become LG members).

Photo 4: Household panel interview

2.9.4 KEY INFORMANT INTERVIEWS

A limited number of key informant interviews were conducted to further understand Kurnool cotton value chains, and to understand how becoming and being licensed to BCI cotton alters value chain relationships. It also seeks to establish what the enabling and constraining factors are which influence the willingness of ginners and spinners to participate in the BCI system. The following KIIs were conducted:

1. Agriculture Extension Officer of Department of agriculture in Adoni
2. Commission Agent at cotton market yard
3. Two Ginning & Pressing Factory
4. A Fertilizer and Pesticide dealer

Photo 5: Key Informant Interview

2.9.5 INNOVATIVE ELEMENTS OF THE RESEARCH

Assessing the impact of sustainability standards using randomised control trials (nested within theory based impact evaluation) in cotton sector is fairly innovative with respect to voluntary sustainability standards impact evaluation. Although this is not the first theory based evaluation and possibly not the first experimental design that is underway with respect to VSS, quasi-experimental designs being more commonplace, there are limited situations in which an experimental design is feasible, and it is unlikely to have been combined with TBIE, offering fertile ground for lesson learning for ISEAL and other audiences.

The research design of Cluster RCT with matched pair randomisation within different strata (selected based on bio-physical and socio-economic parameters) is an innovative approach to constructing a counterfactual.

The study design also include a representative household panel (based on anticipated heterogeneity) to be tracked over four years. The panel is not known to the BCI project reducing the changes of biased attention.

The research employs a methodology for tracking the programmatic exposure of the cotton farmers to various BCI project activities (treatments). This will help the researchers in validating the contribution of the project, alongside other explanatory variables, including a qualitative enquiry analysing the theory of change, unpacking other potential routes to observed outcomes and exploring unintended and unexpected impacts.

The BCI verification /certification is awarded to the producer unit (based on a three-tier assessment of sample members). The research charts out the progression of each individual member over a period of time in terms of their knowledge and application of BCI recommended practices. It also tracks the outcome variables (cost of production, yield, profitability, pesticide use etc.). The correlation between practices and outcomes are analysed. The research team have developed an index called Better Cotton Composite Index (BCCI) which tracks every member of the learning group (also those who are not part learning group in the intervention set and those belonging to 'control' set) in terms of their knowledge and application of BCI recommended practices. This is a simple and potentially replicable analytical tool.

2.9.6 PERSPECTIVES ON POTENTIAL LIMITATIONS OF THE RESEARCH

The BCI interventions are not a single 'treatment' but consist of a 'package' of treatments offered to farmers who come forward voluntarily to understand and apply practices which they were not doing earlier. The application of a package of practices leads to some changes at farm, farmers and household level. The RCT (nested within TBIE) will be able to identify 'what works' in a general sense and 'for whom'. We will be able to delineate the cause and effect to the extent of combination of practices being adopted by the farmers but the ability of the research to pin-point the specific practice leading to specific outcomes (e.g. crop rotation or inter-cropping or mulching or any specific pest control technique leading to better yield and /or profit realisation) will be limited given the nature of the interventions in the BCI project.

Our theory of change was developed based upon a distinction between the BCI global system and the specific intervention – the PRDIS project – being implemented in India. As such we included all of the elements noted in the PRDIS project proposal. However, there is a temporal element in the PRDIS project proposal that should be highlighted more clearly in our TOC – because some aspects are not expected to be achieved within the initial stages of the project. Indeed in reality it is possible that some aspects will not be covered by the implementing partner during the period of the project. The BCI system mandates work on social, economic, environmental and value chain dimensions of sustainability in production and trade. However, the implementation project is mainly resourced for working on production principles, which are mostly related to the environmental and economic dimensions. The social dimension is considered very challenging by the implementation partner, requiring structural changes which are considered 'long-haul' for a BCI project focussed on cotton production related practices. Similarly, value chain interventions (post-harvest, storage, financial linkages, market access, ginners' sensitisation, chain of custody system etc.) are not necessarily expected from the implementation partner. BCI India team suggested during the research validation workshop that they will work in this direction. Both social and value chain aspects of the intervention require specific expertise and partnerships which may not necessarily be provided for as part of the BCI project.

This baseline study has begun the process of documenting the implementation process. The BCI Standard and Assurance Model are the starting point for the intervention, but there is also a process of implementation as the standardized model is adopted in a concrete context – i.e. that of Adoni mandal in India. In the light of rural realities, BCI India has allowed the implementing partner some scope for flexibility. For example, the Minimum Production Criteria & Improvement Requirement apply in all cases, but the specific agronomic practices promoted will vary depending on the local conditions. For some aspects of the proposed intervention, as noted above, no strategy has yet been developed, but may still be later in the project. Once a strategy and activities are developed these will be incorporated within (a more temporally extended) theory of change.

There is a different level of expectation of the implementation partner and the project between the BCI global team and BCI India team. The latter is closer to the reality on the ground and so unsurprisingly is more attuned to the practical challenges on the ground and therefore willing to provide more flexibility with respect to the implementation partner in terms of what needs to be done and achieved. This flexibility, in the light of rural realities, is a strength of the BCI system in some respects, from a development perspective. However, there is also risk that more challenging issues could be neglected as too difficult, with no clear strategy in place to begin the hard task of overcoming such obstacles. Methodologically speaking it is important that the theory of change reflects the temporal nature of the project more clearly than in the research design document. However, the theory based evaluation approach includes process tracing which itself helps to identify what happens in practice in processes of implementation.

It is well known that the implementation process of standards is not standardized and this is the strength of using theory of change to unpack where implementation diverges from the theoretical plans at the outset of an intervention, because this shows why certain outcomes might not have been achieved or why unexpected impacts occur etc. It is important to retain sight of the original theory of change in the analysis, while also taking account of how the theory of change may be evolving in practice in order to accurately evaluate impact and to understand the causal linkages and assumptions therein.

While the RCT design will allow for a relatively strong attribution of impact *in this specific case*, it is not possible to generalize the findings across the BCI system. However, it will provide a more powerful insight, particularly with respect to the economic and environmental impact pathways, (and possibly the other impact pathways if the research is carried on for a longer period of time than currently envisaged), and more so than quasi-experimental designs, as the attribution of impact is more robust.

The research will be able to provide the status-check and throw light on the lessons to be learnt from experience of implementing BCI system at a particular site. The lessons will have global relevance but still require understanding of the context within which these are generated as in some other contexts, relatively more emphasis may be placed on some other interventions unlike Adoni.

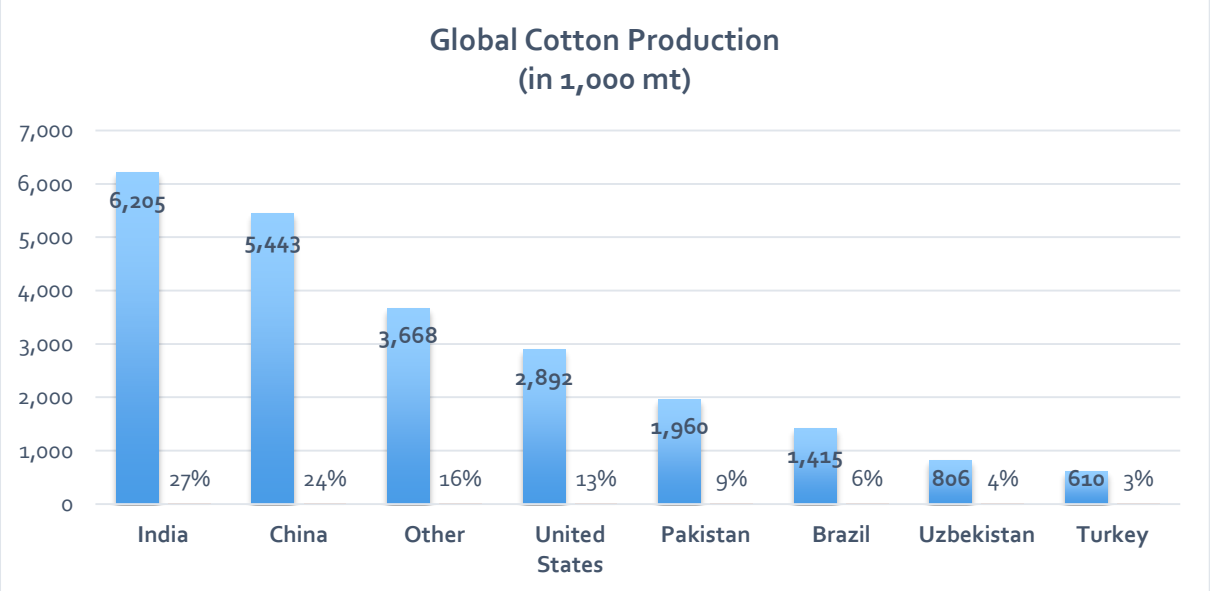
3. CONTEXT ANALYSIS

The contextual analysis section explores global cotton markets, Indian cotton production, the Kurnool – study site context, and the sustainability standards landscape in India. The contextual analysis also presents the profile of farm, farmers and households in the Adoni mandal, with whom the BCI project is working.

3.1 GLOBAL COTTON MARKETS

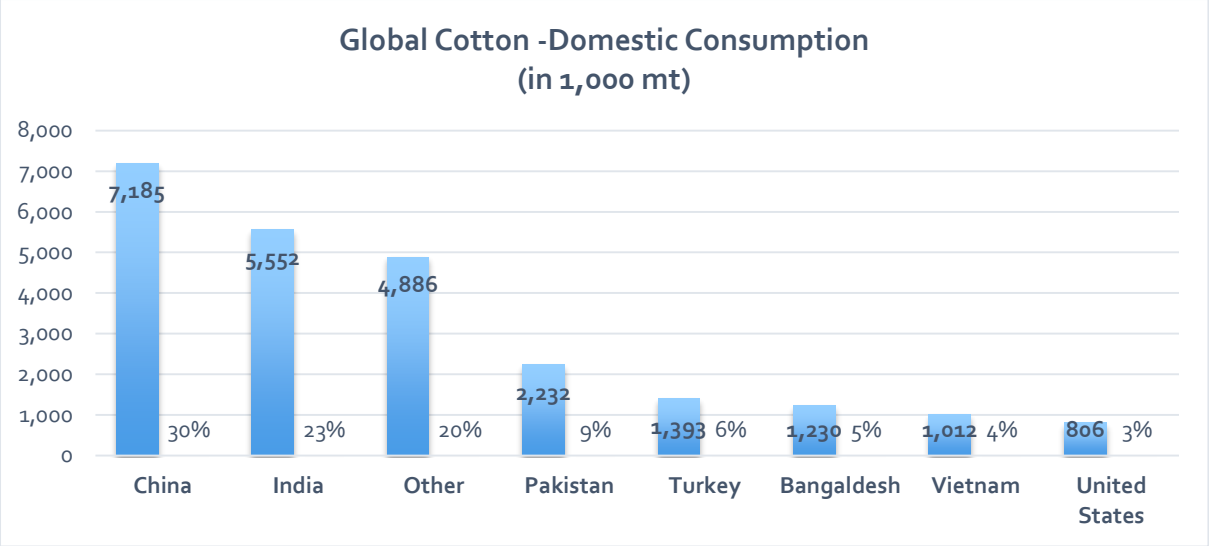
Cotton is one of the most important and widely produced agricultural and industrial crops in the world. Cotton is grown in more than 100 countries, on about 2.5% of the world's arable land, making it one of the most significant crops in terms of land use after food grains and soybeans. Cotton is also a heavily traded agricultural commodity, with over 150 countries involved in exporting or importing cotton. More than 100 million family units are engaged directly in cotton production. When family labour, hired farm labour and workers in ancillary services such as transportation, ginning, baling and storage are considered, total involvement in the cotton sector reaches an estimated 350 million people. It provides employment to additional millions in allied industries such as agricultural inputs, machinery and equipment, cotton-seed crushing and textile manufacturing. Cotton cultivation contributes to food security and improved life expectancy in rural areas of developing countries in Africa, Asia and Latin America. Cotton played an important role in industrial development starting in the eighteenth century and continues to play an important role today in the developing world as a major source of revenue[7]. The figure 7 below presents the global cotton production, use, import and export scenario in 2015 (baseline year for this study):

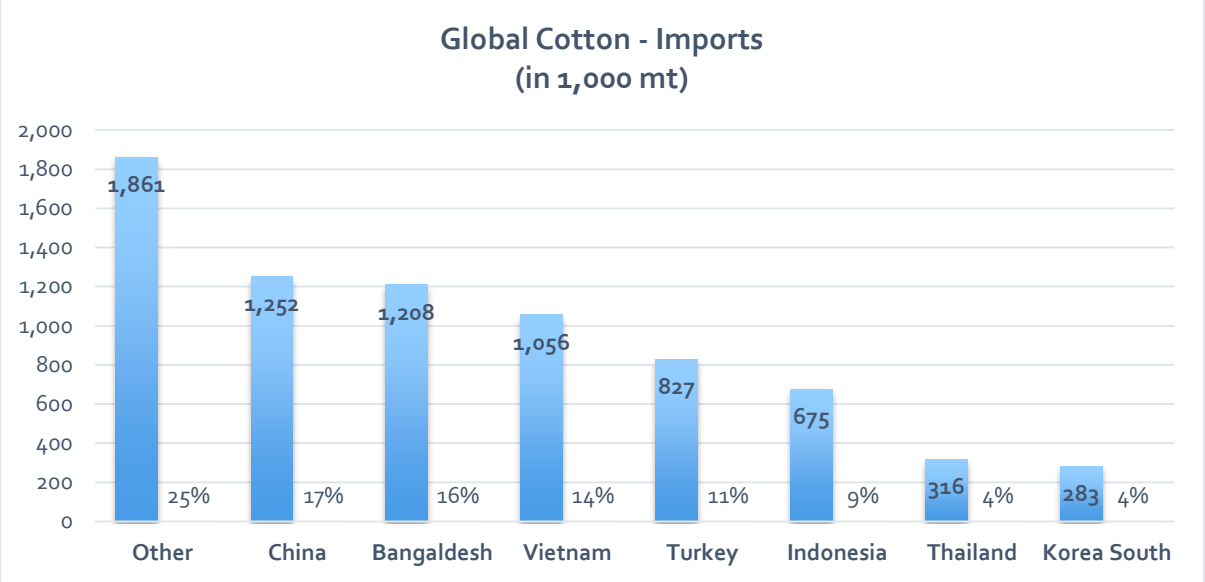
Figure 7: Global cotton production, use, import and export[8]

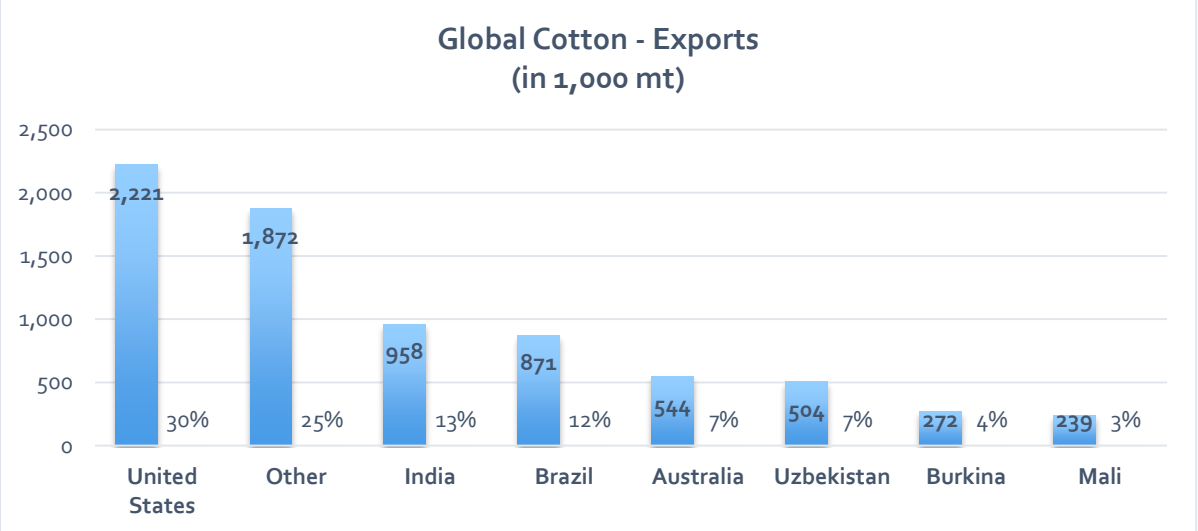


[7] Source: http://www.cottonguide.org/cotton-guide/the-world-cotton-market/overview/#sthash.U2y42qoD.dpuf

[8] Source: Cotton: World Markets and Trade, United States Department of Agriculture, November 2015







India currently produces 27 per cent of the global cotton (with 36 per cent of global area under cotton). China is second at 24 per cent with USA at third place at 13 per cent of the world cotton. India

has surpassed China in 2015 to become the largest producer of cotton in the world. This has happened due to decrease in area under production and yield (due to less favourable weather) in China which is also a response to China government policy of reducing price support in recent years. India has more than double area under cotton production (12.6 Million Ha in 2014-15) than China (5.1 Million Ha in 2013-14), yet produces almost same level of cotton as China due to largely rainfed nature of cotton and less productivity. China's productivity is 1380 Kg /Ha while India's is 537 Kg./ha.

Despite being the major producer of cotton, China is the net importer of cotton. China consumes 30 per cent of total cotton produced in the world. Its import constitute 17 per cent of total cotton imported by various countries. India is the net exporter and has a share of 13 per cent export to total exports, behind USA which is the largest exporter of cotton in the world.

3.2 COTTON PRODUCTION IN INDIA

Cotton originated from India. 'Four hundred fifty years before Christ, Herodotus testified that India had wild trees that bore fleeces as their fruit, of these the Indians made their clothes' (Dantwala 1947: 1). Two important processes that altered the course of India's development, namely the industrial revolution and the consolidation of the political power by the British in India, have been closely associated with cotton.

3.2.1 AREA, PRODUCTION AND PRODUCTIVITY OF COTTON IN INDIA

India is the only country in the world growing all the four cultivated species of cotton, G.hirustum, G.arboretum, G.herbaceaum and G.barbadense are cultivated on commercial scale besides hybrids. The maximum area is covered by the hybrids. Cotton is grown in the nine major states in three different zones. Punjab, Haryana and Rajasthan in north zone; Maharashtra, Gujarat and Madhya Pradesh in central zone and Andhra Pradesh, Karnataka and Tamil Nadu in the south zone are the major cotton growing states. Central zone accounts for about 60 per cent of all cotton, and where only16 per cent is irrigated. Cotton is also grown in other parts of the country and about four million farmers grow the crop in 13 states. India is unique among the major cotton growing countries because of the broad range of agro-climatic and soil conditions which permit cultivation of all varieties and staple lengths of cotton (Samuel J 2013).

Presently in India, *G. Arboretum* and *G.hirsutum* are the principal species that are being cultivated (Table 1). Traditional (desi) varieties and in particular, *G.arboreum,* are known for their drought tolerance and resistance to bollworms and sucking pests. On the other hand, American cottons usually have long and extra-long staple and better spinning potential (higher counts) than traditional (desi) cottons. They were introduced in India by the colonial administrators to meet the demands of English textile manufacturers anxious to secure an alternative and cheaper source than the United States (Guha, 2007).

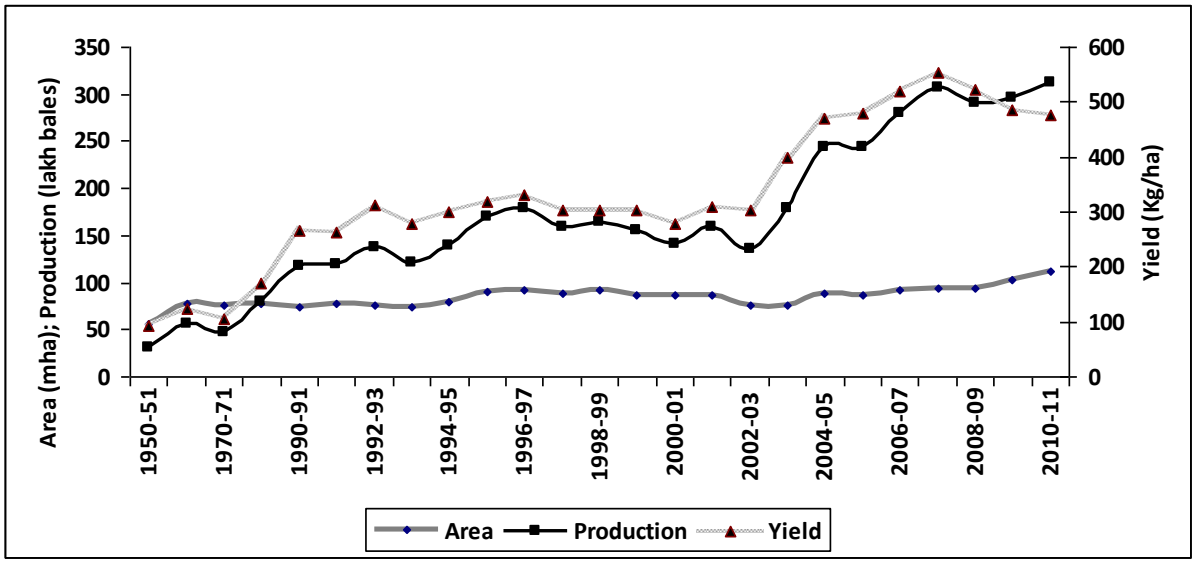
Cotton is vulnerable to a large number of insects/pests and natural enemies and most of these occur at different stages of crop growth. A few of them are: (1) Wilt where the leaves turn brown and drop off; (2) Root-and complete wilting of the plant; (3) Anthracnose—reddish brown depression spots on leaves and bolls; (4) Bacterial blight at all stages which causes secondary infection; (5) Alternaria which causes leaf spots and affects the plant at all stages; (6) Areolate or grey mildew, and (7) Carcospora or leafsop—both occur at maturity stage where the leaves become yellowish and finally

fall. Further, American bollworm, pink bollworm, spotted bollworm, tobacco caterpillar, jassids and spider mite are active throughout the year on the cotton plant, necessitating pesticide sprays.

More than 60 million people in India are associated with cotton farming, processing, ginning and in textile industry, etc. In view of the direct and indirect employment opportunities and livelihoods dependent on cotton-processing, the GOI has set up a number of agencies for the promotion and development of cotton, viz., Ministry of Agriculture, Directorate of Cotton Development, Central Institute for Cotton Research, and the ones at the state level, Department of Agriculture and state Agricultural Universities. Until the late 1990s, the public sector played a critical role in the provision of a very fundamental input in agriculture viz., seeds. Particularly in the case of cotton, public sector institutions in India have the credit of introducing the world's first hybrid variety in 1970 known as H4.

The introduction of hybrid varieties in cotton while increasing the yield, also resulted in increased use of inputs such as irrigation, fertilizer and pesticides. Imbalances in the use of inputs resulted in newer kind of insects, necessitating more use of insecticides in cotton. Heavy attack of pests is one of the reasons for the fluctuations observed in the production and yield of cotton presented in figure 1. Till the early 2000, cotton was infamously known as a crop that used largest share of insecticides compared to other crops. The long-term trends in area, production and productivity of cotton shown in Figure 8, clearly brings out the substantial increase in production and productivity of cotton following the introduction of genetically modified cotton (Bascillus thuringensis) in 2002–03, while increase in cotton area was only marginal.

Figure 8: Trends in Area, Production and Productivity of Cotton in India



Source: Compiled from Directorate of Economics and Statistics, Ministry of Agriculture, Government of India

Bt cotton was introduced in India in three cotton hybrids of Mahyco (a well-known seed company) in the year 2002, in the central and southern zones in India. The percentage of hybrids which was 24 per cent of the cotton seed sales in 1996–97 increased to 95 per cent of the total cotton seeds in 2009–10 (Pray and Nagarajan 2010).

Since the introduction of Bt technology in cotton, India's cotton area had increased from 7.63 million ha during 2003–04 to 11.1 million ha during 2010–11. While cotton production has more than doubled

from 137 lakh bales to 335 lakh bales, productivity increased from 321 kg/ha to 518 kg/ha during the same period. If expressed in annual terms, the post-Bt cotton period witnessed an annual increase in cotton area by 3.71 per cent, 14.6 per cent increase in production and 8.3 per cent rise in productivity during the reporting period.

There has been a significant increase in production and productivity of cotton in all the nine major cotton growing states, though there was a marginal decline in cotton area in Haryana and Rajasthan between the pre and post-Bt cotton scenarios. Among the major states, Maharashtra continued to occupy the largest share in area during both the periods (36.5 per cent and 35.6 per cent respectively), while Gujarat has emerged as the largest producer in the post-Bt scenario with a relative share of 33 per cent in the national cotton output, followed by Maharashtra (26.3 per cent) and Andhra Pradesh (17 per cent). Gujarat also significantly improved its status as number one in terms of cotton productivity (659 kg/ha) in the post-Bt scenario. Gujarat, with an average productivity of 317 kg/ha, was ranked fourth in the pre-Bt scenario and the state has pushed backwards the other leading producers, viz., Andhra Pradesh and Madhya Pradesh as well as Tamil Nadu, which had the highest productivity (600 kg/ha) in the pre-Bt scenario.

3.2.2 COMPOSITION OF THE SEED SECTOR

The Indian seed industry comprises of both organised and unorganised segments. The organised seed segment consisting of both public and private sectors account for 15–20 per cent of the total seed supplied in the country and the remaining comes from the unorganised sector (State of Indian Agriculture 2011–12: 51). This scenario has drastically changed over the years from a conservative structure dominated by public sector corporations to the present scenario where the total seeds sales turnover is shared in the ratio of 60:40 per cent[4] between the private and public sectors. (This scenario is applicable for the cotton seed sector as well).

Companies generally appoint a distributor or stockist for a region which may comprise of more than one state. Dealers are appointed at the district level. Depending on the companies' network, the dealers may be appointed at talukas who take care of the retail sales. Mostly dealers deal with more than one company's product and sell pesticides, fertilisers, and other agricultural implements. Normally 15–20 per cent commission is given to distributors who pass 12–17 per cent on to the dealers, while the retailers get 9–14 per cent gross discount on sales. If some portion of the seed remains unsold, companies, on request, help in revalidation of the seed by the certification agency at the dealers/distributor's cost. A few companies have the policy of getting back the unsold stocks so that they are not sold as fresh stocks in the subsequent season by the channel, which might damage the image of the company among the farmers (Singh and Asokan 1997: 421–440).

The distributor/dealer indent seed with the companies in December. Though, the seed multiplication agencies have to undertake the seed activity well in advance, no forecasting method is used to estimate the demand of the seeds (Alagh 2004: 124). Hence, the seed multiplication agencies both in the private sector and the public sector assess the demand based on the past sales, but the actual sales would depend on a host of other factors.

3.2.3 USE OF PESTICIDES IN COTTON

India is the largest producer of agrochemicals after the US and China (Dave 2012: 37), and has about 30 per cent of the total cultivated area under pesticide cover. The agrochemical market is highly fragmented. A number of pesticides formulations have become generic and about 600 generic companies are operating in this field in India. Hence, the same chemical would be sold by different trade names by different manufacturers. Patented new molecules are held mainly by the multinationals. The pesticide industry consists of both organised and unorganised manufacturers.

The use of insecticides is regulated under the Insecticides Act 1968 which regulates the import, manufacture, sale, transportation, distribution and use of the pesticides with a view to prevent 'risks to human beings or animals and for matters connected therewith'. The Insecticides Rules 1971 governs registration, license to manufacture, labelling of the product etc. As of November 2012, 241 insecticides have been registered for use in India and 32 products have been banned from manufacture, import and use in India[9].

Recent data reveals that pesticide consumption in India had reduced from 72.13 thousand tonnes in 1991–92 to 55.54 thousand tonnes in 2010–11 (GOI 2012: 60). An important difference between India and developed countries is that India uses more insecticides (80 per cent), while other countries depend on agronomic practices and rely on weedicides (Sreenivasa 1992: 79–88). Also, the small size of land holdings in India and the availability of farm labour explains to a certain extent the lower use of weedicide compared to the large holdings in the developed countries which rely on weedicides due to lack of availability of farm labour. But the fungicide and herbicide sectors are growing rapidly in India (Dave 2012). The relative share of cotton in total pesticide consumption which was estimated to be more than 50 per cent in India (Shetty 2004:261–267), appears to be changing after the introduction of Bt cotton in the country (Table 4).

Over the years, there has been a shift in the kind of pesticides being used. Organochlorines are highly persistent both in the environment and biological systems, and are prone to development of insecticide resistance. Organophosphate group of pesticides are more toxic to parasitoids and predators than to insect, pests, and results in pest resurgence of secondary pests. Carbamates are highly toxic in nature to parasitoids and predators. Repeated application of synthetic pyrethroids has resulted in resurgence of mites, aphids, white fly etc. and also phytotoxicity. Neonicotinoids though do not have the limitations of the above mentioned nature yet are generally costly (Kumar et al. 2010). Industry sources point out that organochlorines, organophosphate and carbamates that were introduced during 1950–1970, and synthetic pyrethroids that were introduced during 1970–1990 and are out of intellectual property rights (IPR) protection. But most of the neonicotinoids are under intellectual protection and hence there are no generic formulators for them in India, which make this group of pesticide costly. Hence, comparison of costs could lead to more use of organochlorines or carbamates and recent studies on cotton have observed the mixed use of all these groups of pesticides in the context of India (Mancini et al. 2005: 221–232, Peshin et al. 2008: 73–80).

[9]Available at www.cibrc.nic.in, accessed on 25 March 2013.

Table 4: Trends in Pesticide Usage in Cotton in India, 2000– 010 (Rs Million)

Year	Insecticides on cotton	Fungicides on cotton	Herbicides on cotton	Total insecticides in agriculture	Total pesticides in agriculture	Insecticides used on cotton as % of total insecticides
2000	8390	96	15	20520	29725	40.9
2001	10520	64	10	22680	32070	46.4
2002	5970	34	5	16830	26223	35.5
2003	9250	78	34	21460	31474	43.1
2004	10320	60	39	24550	35814	42.0
2005	6490	85	78	20860	24388	31.1
2006	5790	111	118	22230	22960	26.1
2007	7330	248	215	28800	46970	25.5
2008	7906	315	261	32820	52933	24.1
2009	8337	522	455	39090	69988	21.3
2010	8804	669	869	42830	76836	20.6

Source: Kranthi et al. 2011: 19.

3.3 THE STUDY AREA

The site chosen for the study is Adoni Mandal (subdivision) in Kurnool district of Andhra Pradesh, India. Andhra Pradesh state ranks third in terms of Indian cotton production. Kurnool district has a strong agricultural background, with about 70% of the working population of the district either directly or indirectly engaged in agriculture or related activities and roughly 10% of the cultivated land used for cotton production. The agricultural season commences with the onset of the southwest monsoon, normally during the second week of June bringing a total normal rainfall of 670 mm. The climate is mainly tropical, with temperatures from 31 °C to 45 °C in summer and 21 °C to 29 °C in winter.

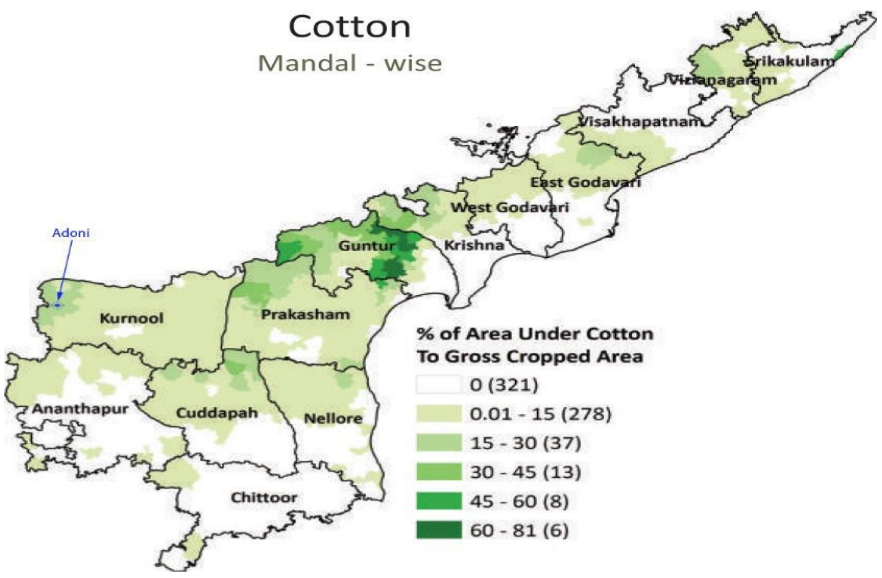
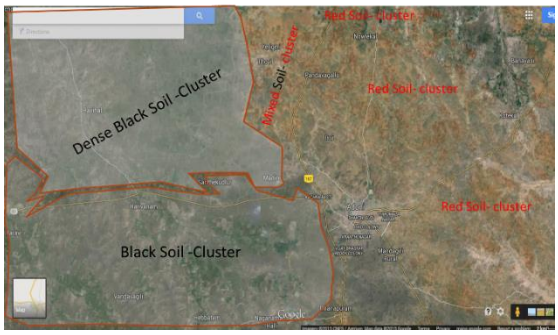


Figure 9. Percentage of Area under Cotton to grossed cropped area

The BCI project is being implemented in Adoni Mandal, which has a total population of 250,000 (36026 households as per 2012 revenue data of the government of Andhra Pradesh), living in 46



villages. The population mainly depends on agriculture for their livelihoods. Cotton is the main source of income for more than half (18232 households) of Adoni households.

Figure 10: Goggle soil profile map of Adoni

A snapshot picture of Adoni is presented in table 5 below based on secondary information collected from local government office by the research team:

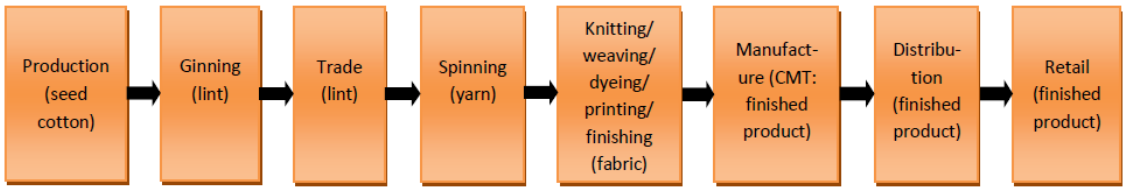
Table 5: Demographic /socio-economic situation in Adoni (as per 2012 government data)

Parameter	Status	Description
Number of Households	36026 households in 41 villages	a. Minimum no. of household in a village: 18 in V.kondapuram b. Maximum no. of household in a village: 3809 in Pedda thumbalam c. Average no. of households - 948 d. No. of HHs in treatment villages – 5788 e. No. of HHs in control villages - 4158
Cotton growing HHs	18232 HHs in 41 villages	a. Average no. of cotton growers in a village: 479 b. Total cotton growers in treatment villages: 4250 c. Total cotton growers in control villages: 2025
Soil profile	Variable	Mostly Black soil – 21 villages, Mostly Red soil – 12 villages, Mostly Mixed soil – 9 villages
Female Literacy	35% average	a. Lowest literacy rate -15% in Kuppagal and highest 83% in Arekal b. Average literacy 36% in treatment and 32% in control villages
Irrigation	Average 2% households have access to assured irrigation	a. 12 villages have access to canal b. 4% area under irrigation (2094 Ha irrigated of total 47625 ha)
Small and marginal households	Overall 39% having less than 2 ha.	

3.3.1 VALUE CHAIN STRUCTURES AND POWER RELATIONS

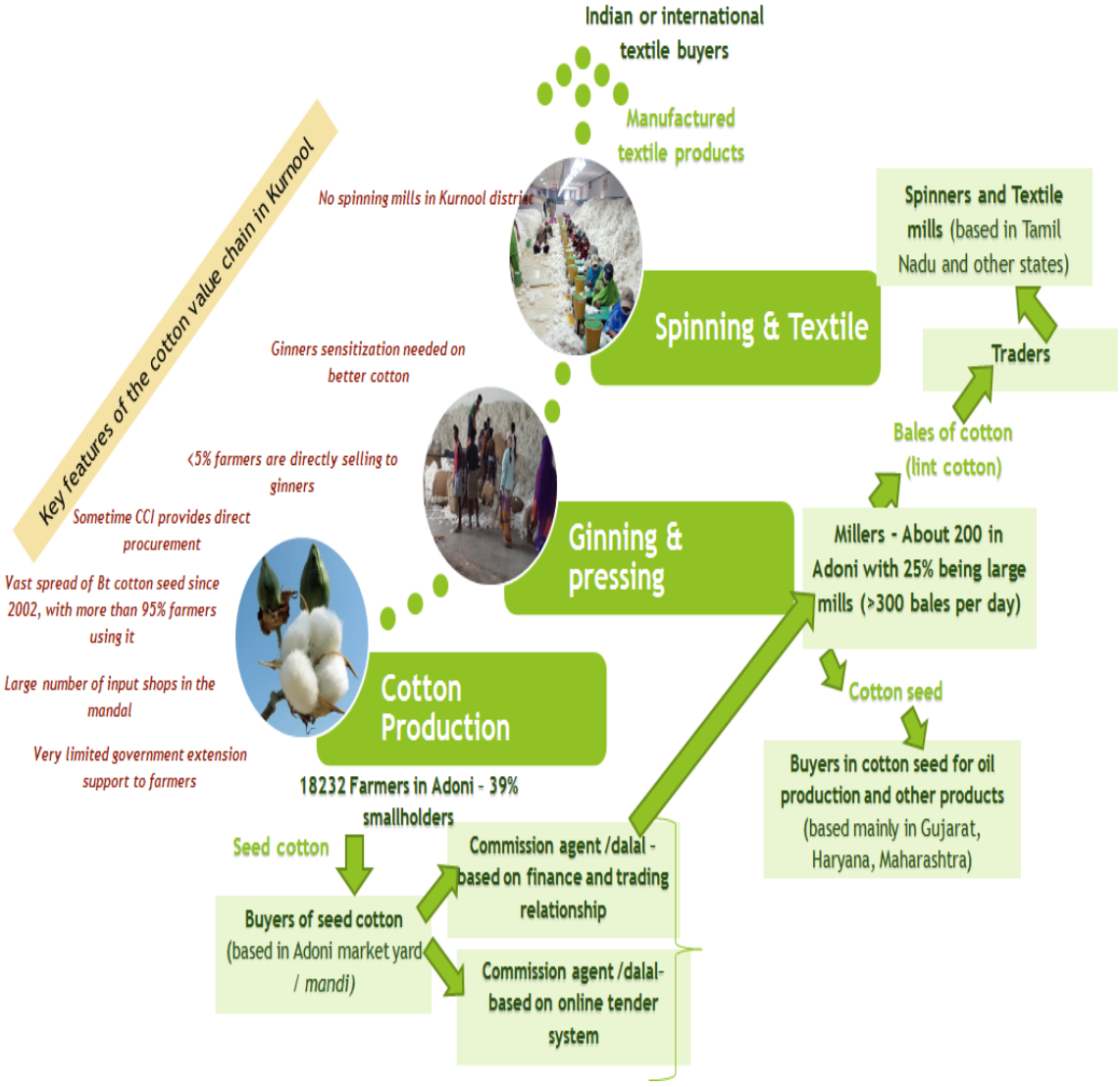
The general cotton value chain usually follows the steps presented below in figure 11:

Figure 11: Key steps in generic cotton value chain



In the context of Adoni /Kurnool, the value chain structure (as it exist in 2015) is presented in figure 12. There are three main nodes in the value chain – cotton production, ginning and pressing, spinning and textile. Cotton production, ginning and pressing happens in Adoni /Kurnool while the spinning happens in Tamil Nadu and other states where the bales of cotton are transported via diverse set of traders. There are no spinning mills in Kurnool nowadays (there used to be few spinning mills but they were closed due to labour issues).

Figure 12: Cotton value chain in Adoni /Kurnool



Adoni offers very favourable conditions (Black soil) for cotton production, with more than 18,000 farmers deriving their main livelihood through the cotton farming. As per secondary information (Accordng to Government of Andhra Pradesh Census and Agriculture data), about 39 per cent of cotton farmers in Adoni are smallholders (having < 2Ha land under cotton). The cotton yield depend on the seeds that farmers use. 'Ajith' is a good choice of seed which experience less pest attack (KI interview, FGDs). 'Jadu' brand is also highly preferred by farmers (KI Interview, FGD). The shift to Bt cotton has been comprehensive. Bt cotton produces a higher income, because it usually produces higher yields (L Nagarajan, 2015), but requires higher agrochemicals and labour inputs. During this season (2015-16) due to the delayed rains farmers have lost their seeds and have had to replant many times. When replanting the farmers have still opted to use Bt seeds. All of the farmers interviewed

in the FGDs reported that the expenditures and yields were lower earlier (about 10-12 years ago) when they using conventional seeds. With Bt cotton, there was consistent reporting that both the yields and expenditures are higher. Other livelihood strategy opportunities (wage labour, industrial jobs etc.) are relatively limited within Adoni.

Indebtedness is prevalent, with many farmers taking loans with the commission agents (also known as mandi agent or dalals) in Adoni town. Large proportion of farmers (estimated to be more than 95 per cent) are selling their cotton to *Dalal* or commission agents from whom they have already borrowed money as a loan for cotton cultivation purpose. Commission Agent /*Mandi* Agent/ *Dalal* work as financiers to farmers without any documents or security. They finance Rs. 5000 to 15000 per acre to each farmer as input costs with a recovery period of 5-6 months. However sometime recovery takes two years (e.g. when rains affect the crop and farmers are unable to pay on time). Delays in repayments leads to indebtedness as these intermediaries charge a high interest of 24 per cent (at Rs.2/100/Month). The intermediaries also take 2 per cent commission on sale value of the cotton while selling to the ginner/Buyer. Less than 5 per cent farmers are selling direct to ginners (KII, FGD). Farmers are very rarely able to negotiate cotton prices with *dalals.* Each morning and evening, cotton rate is fixed through the online tender system. All are licensed tenders are able to bid and quote for the rate; whoever quotes highest will get allotment of the day for a particular auction lot. The *dalal* will calculate the rate to be offered to the farmers based on online tender rate minus loading and unloading cost and minus 2 per cent commission. The payment to the farmers is given after 8 days.

After declaration of the bidding, ginner will weigh the whole cotton (including seed) and prepare a chart. The cross verification weight will be checked at ginning level only if discrepancy or scope for doubt occurs. In this arrangement, online tender system provides some transparency in price setting, however there are still chances of farmer exploitation on prices remain due to lack of awareness and negotiating skills /position of the farmers with the intermediaries. Additionally, most farmers are not in position to select the commission agent or traders to whom to they sell cotton as they are indebted to them. It takes some time to build up a trading relationship between the farmer and the *dalal*, and so it is not easy for farmers to change between them.

Adoni town has become important trading center in Andhra Pradesh, because the region is a large production of cotton and because of the presence of a large ginning and pressing factory. There is also substantial trading of groundnut oil in Adoni town. It has a big market situated in the center. The town is also well connected with surface transport facility. Adoni ginners are sending the ginned /pressed cotton to spinners in South Indian states, especially Tamil Nadu, and a few are also sending ginned/pressed cotton to spinners in Maharashtra.

Ginners demarcate is the quality of cotton through dryness, staple length and colour. Moisture free white good staple length cotton attract a good price (KII). Ginners says that electronic scales are largely used to weigh the cotton. According to ginners in the key informant interviews sometimes farmers moisten their cotton to increase the weight. Long staple and Dryness of cotton determines the quality.

Photo 6: View of seed cotton in a ginning mill

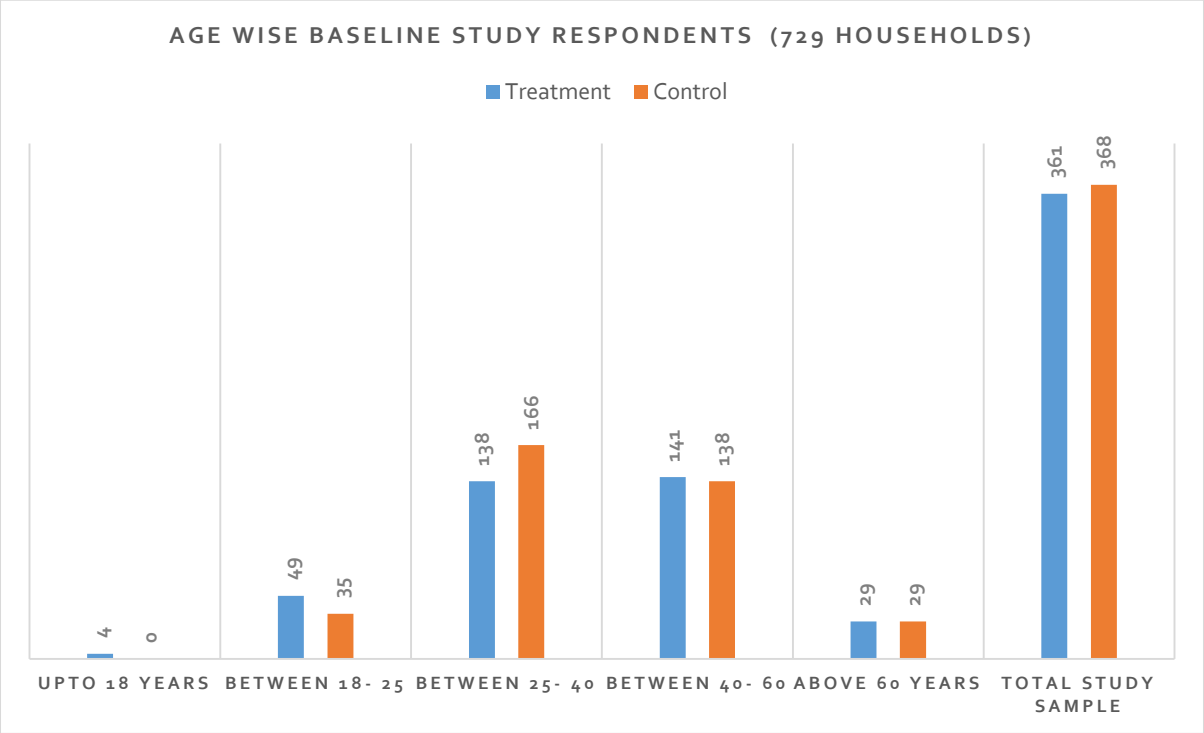
The research team interviewed the founder of a ginning mill, which has been established for almost ten years and has a capacity of 300 bales per day (each bale being 150 to 180 kg in weight). The ginning mill sells the bales in Khandi (1 Khandi = 359 Kgs). The Khandi of the highest quality currently fetches Rs: 32000 – 34000. Medium Quality Khandi fetch Rs: 28000 – 30000 while the lowest quality is worth Rs: 10000 – 15000. Cotton seeds are sold at Rs: 2000 – 2500/quintals. Cotton seeds are sold to buyers in Maharashtra, Gujarat and Haryana for the production of oils and other products.

3.3.2 FARMER HOUSEHOLD PROFILE AND CHARACTERISTICS

Most households are relying on cotton production for their income. Cotton production plays an important role in enabling Adoni farmers to build up their assets and/or to pay off debts. Although some other crops (chilli, groundnut) are grown, this depends on land and irrigation access. There is a strong informal labour market within Adoni – farmers hire labourers from their own village or from neighbouring villages to meet their cotton production needs. In some areas there is outmigration during the off season to find work in other towns and cities outside of Kurnool.

The baseline study covered 729 households almost equally among treatment (361) and control villages (368).

Figure 13: Baseline study respondents



The age of the study respondents are a reflection of the age-group of the farmers (head of the household) in the study area. More than one third of the treatment farmers (38 per cent) and 45 per cent of control farmers are in 25 to 40 age group. About two-fifth of the farmers (39 per cent and 38 per cent for treatment and control respectively) are in 40 to 60 age group.

3.2.2.1 EDUCATION

The educational levels are very low in Adoni. Close to 70 per cent households members in treatment and control groups are either illiterate or literate (can read and write) without formal schooling. Levels of educational attainment are not significantly different between control and treatment heads of households. Women, in particular, have more limited opportunities for formal education. Many of these interviewed in the FGDs and household case studies were found to be illiterate, and the literacy level of women is lower than for men. Female illiteracy is 54 per cent in the treatment group and 57 per cent in the control group. Only 12 per cent women in the treatment group and 13 per cent in the control group are literate with formal education.

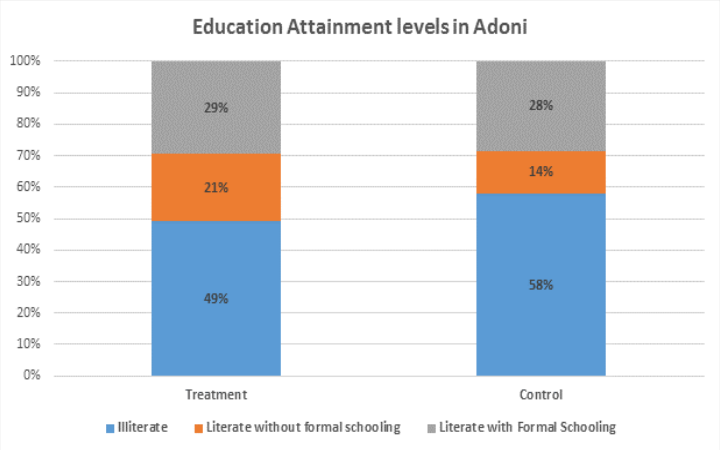


Figure 14: Education status

3.2.2.2 RELIGION AND CASTE

The population of Adoni is mix of three religions – Hinduism, Islam and Christianity. While 80 per cent are Hindus, 17 per cent Muslims and 3 per cent Christians in the treatment villages, in control villages, 89 per cent are Hindus, 8 per cent Muslims and 4 per cent Christians. The treatment and control villages have a mix of farmers from different castes, whose living areas are clearly defined. Other Backward Caste (OBC) is the main social class in Adoni. 92 per cent farmers in the treatment group and 90 per cent in control group are OBCs. In the qualitative work we came across mostly groups ascribed to Scheduled and Backward castes. More exploration is needed of how caste, a system of social stratification, influences the poverty and wealth status of the different caste groups and what this means for their participation in the intervention programme and any differentiation of impacts.

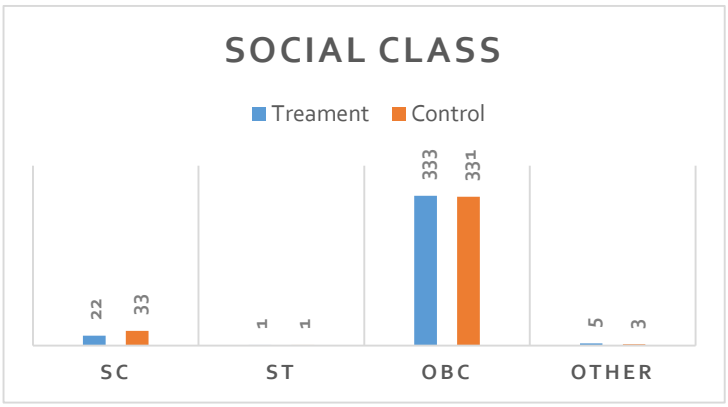
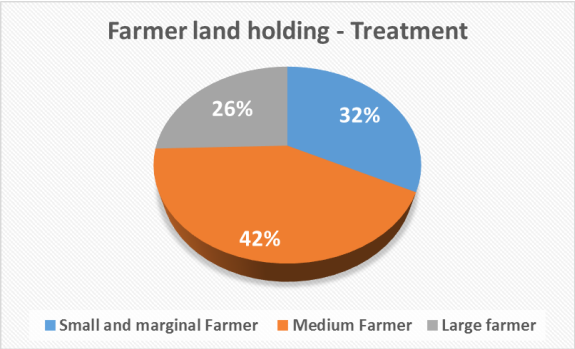


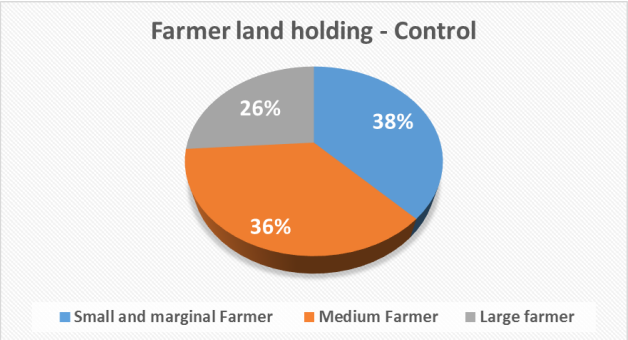
Figure 15: Social classification

3.2.2.3 LANDHOLDING

Close to half (47 per cent) of the treatment group of farmers in Adoni have small and marginal land holdings (<2 Ha.) under cotton. The same proportion of control group of farmers have small and marginal land holdings under cotton. On the basis of total land holding, the graph below shows the farmer categorization:

Figure 16: Farmer classification based on total land holding





Overall the ratio of land under cotton to total land for treatment farmers is 0.81 while it is 0.77 for control farmers. Only 68 farmers (22 treatment group, 46 control group) have reported irrigated plots under cotton. About 80 farmers (11 per cent) have reported access to irrigation (mostly canal or borewell).

3.2.2.4 HOUSEHOLD SIZE

The household roster of the baseline study sample of 729 households have reported 3618 household members, which means the average household size in Adoni is about five members. The sex ratio in the household sample in Adoni is about 800 females to every 1000 male which compares poorly with the sex ratios of all India (914), Andhra Pradesh (978) and Kurnool district (984) sex ratios as per 2011 census.

3.2.2.5 LIVELIHOOD STRATEGY

The main sources of income for Adoni households are agriculture, hired labour and migration. In agriculture the majority of farmers are reportedly relying upon cotton production. Cotton is an important source of income for farming households (confirmed by both the household survey and FGD data) either from production in on their own lands or as hired labour on others' farms. Thus cotton plays a key role in the household economic well-being and in enabling Adoni households (in the study area) to build up assets or to pay off debts.

Other crops grown include ajwain (carom seeds), korra, millet, chilli, onion, white jowar (sorghum) and paddy. Farmers growing other crops such as paddy, chilli, and millet tend to have some access to irrigation.

> *'The amount of water that is required to irrigate an acre of paddy can irrigate three aces of cotton' (FGD participant).*

The NREGA scheme also provides opportunities for a few to supplement incomes. In one village the water reservoir has been deepened through the NREGA programme.

Some households reported that, except for elderly members of the family, they may all migrate, during the non-cotton season, including the children, to places such as Bangalore (masonry work), Guntur (hired labour in chilli cultivation, construction), Tirupathi (wage labour) and Mumbai (for

drying and catching fish). Migration was more prevalent in some of the villages than others (qualitative enquiry).

Only a few farmers reported having livestock in their house, and this also means that few have access to farm yard manure for cotton cultivation.

In one of the FGDs farmers said that in the past they had grown sunflowers and groundnut, and now farmed cotton, but their future choices would depend upon future rains and also the cost of seeds. Currently, the seed costs of ground nuts are high, but they may reduce in the future and farmers might choose to grow ground nuts again or to move to other crops such as bishops weed, fox tail millet, pearl millet, sorghum, onion, castor and chilli. In this particular focus group their cotton yields had declined as compared with the previous year, which has led them to be considering alternatives. They did not envisage any major investments by government infrastructure in the area in the next few years, which might influence their decision-making. In other FGDS, however, mostly farmers say they will continue to grow cotton for the foreseeable future as this is where they can make better returns in good years.

There was limited discussion in the FGDs about the attitudes of young people with respect to their aspirations and the likely role of cotton farming in their future activities. In one FGD group where it was discussed it was reported that young people's interest would be influenced by the nature of the rains in the future, given that many rely upon rainfed production.

3.2.2.6 GENDER AND SOCIAL RELATIONS

Gender relations are highly inequitable. Gender is highly intersected by caste and wealth distinctions in Adoni. A highly patriarchal society, women have limited voice and influence in household decision-making. In the qualitative work some female farmers reported that their husbands consult them on household expenses, but on farming decisions, it is the men that make all of the decisions. In some men's FGDs, the men reported that they make all of the decisions and have control of household income. Men decide, for example, on the varieties to be sown and on the appropriate price at which to sell cotton. In other cases participants highlighted a process of consultation within the household on income-related decisions. In female headed households women do make these farming decisions, including with respect to the sale of cotton, but also consult with other neighbouring farmers on cotton marketing. Generally, women have much lesser access to formal education and to land.

In terms of the gender division of labour, in general both men and women are involved in cultivation, but women have more work to do. Men are generally responsible for land preparation, pesticide spraying and load carrying. Women are involved in almost every sphere of cotton farming, carrying out land preparation, preparing pesticide containers, sowing, gap filling, weeding, applying fertilizers, harvesting and clearing the field after harvest. Women tend to have much greater work burdens in labour in cotton production and also have domestic and reproductive responsibilities.

> *'Arranging finance for input costs, land preparation, inter-cultivation, transportation and marketing are the major roles led by men, where women are not involved very much' (FGD participant).*

These gender inequalities stem from gender norms that ascribe certain roles to women and men and which fail to recognize women's rights (e.g. to land, to participation in decision-making). In several focus group discussions and household interviews it was clear that women tend not to have a strong voice in their households. Frequently, the view was expressed that women are more appropriate for farm labour, yet this belief is an example of an internally socialized norm, rather than having a basis in physical abilities.

> *'Females have more patience and are fit for farm operation than men who are impatient. He gave his own example wherein he had also put in his part of labor in planting the chilli plants, which affected his back badly, because he was not used to the job and the bending posture. That apart he said, women handle the tender plants better and they are faster (household case study participant).*

Fraser (2009) identifies three aspects of gender justice - recognition, redistribution and representation. It would appear that on all three aspects, women have limited gender justice in Adoni mandal. They are not fully recognized as full members of the household and society – e.g. as having rights to land and resources. They have lesser access to resources, including land, labour and credit, except through their husbands. Female headed households do have greater control of household affairs, but more research is needed with respect to their relative power and influence. Overall, women's access to education appears to be more limited than that of their male counterparts. Their mobility is similarly more limited. Women do not tend to travel to Adoni town to engage in cotton marketing, for example. The PRDIS project is seeking to engage women in the Learning Groups, and there are a small number of examples of women participants and lead farmers (FGDs, HH case studies).

Some groups reported that children are involved in household work and in field at the time of harvesting, even if they are studying. Thus there are children who are not attending school during the cotton picking. However, other groups said that all young children are going to school.

4. ECONOMIC IMPACT PATHWAY

The overall theory of change is broken down into four different impact pathways – economic, environmental, social and value chain. The economic impact pathway is presented in figure 17 below. There are inter-relationships between the different impact pathways which are explored in the overall synthesis and conclusion chapter.

This chapter explores economic impact pathways through developing understanding of the baseline status of:

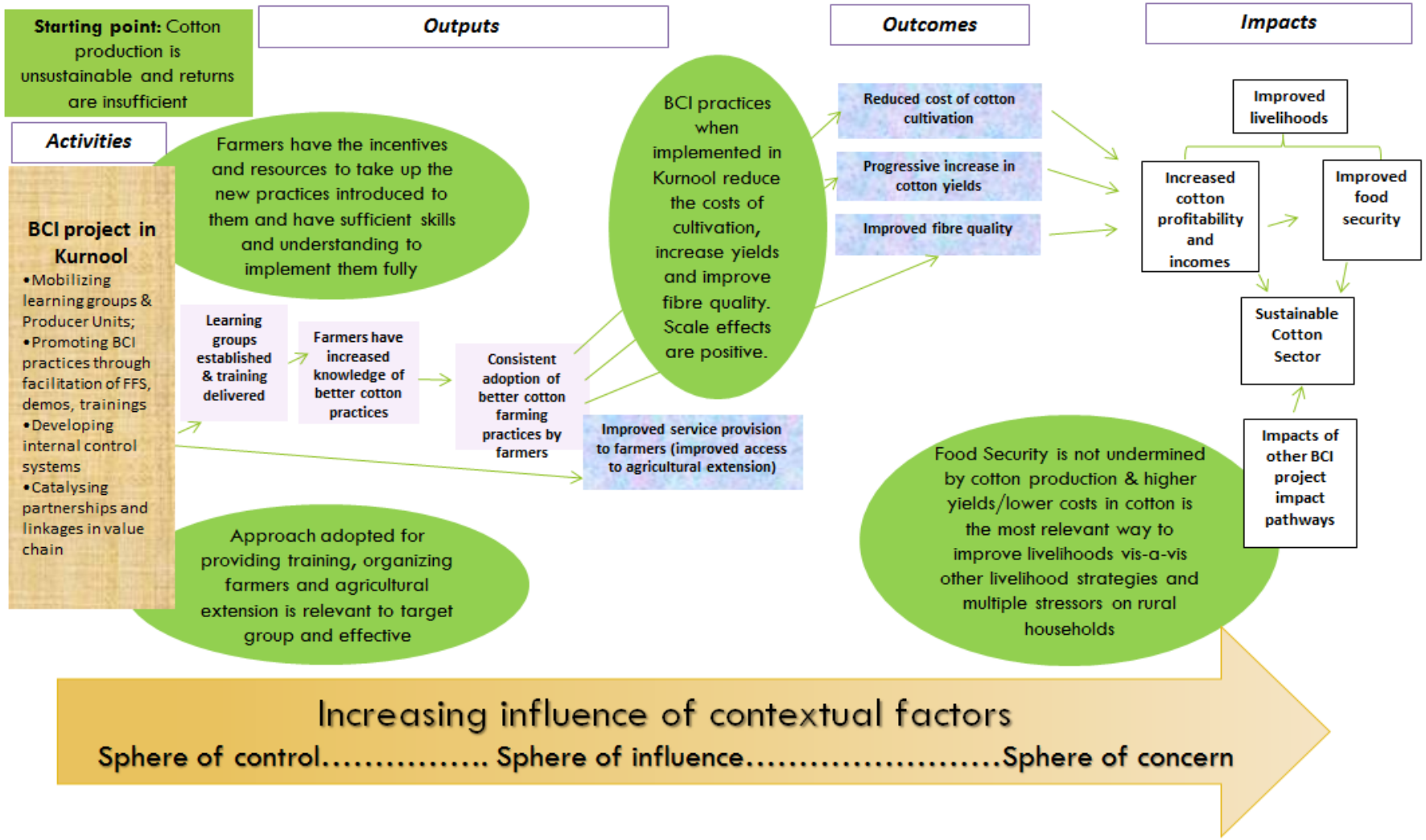
- BCI project activities
- Outputs which can contribute to economic outcomes and impact
- Economic outcomes
- Economic impact

This section presents the baseline data gathered against the theory of change. In some parts of the theory of change we present the baseline status (e.g. the current costs of production), but for other elements (e.g. training delivered) there may be a zero score given that this is a 'before' project scenario. We also explore the implicit assumptions which need to hold true at the transitions (activities to output, output to outcomes, outcomes to impact) for the 'economic impact pathway' for the overall theory to work – against the baseline data.

It will be important to identify alternative pathways to observed outcomes, through qualitative enquiry which reaches beyond the confines of the intended theory of change, in order to more accurately reflect contribution of the intervention vis-à-vis other contextual drivers.

The starting point for economic impact pathway is that the current cotton cultivation is unsustainable and economic returns to the farmers are not sufficient and /or there is a high potential to improve returns. The BCI project activities of learning group mobilization, and the promotion of better cotton practices through farmer training (e.g. through diverse approaches and methods – Farmer Field School, field demos, exposure visits) are expected to lead to increased knowledge among farmers and consistent adoption which could then result in increasing yields, while reducing the cost of production, as well as improvements in fibre quality and market access – all improving returns for farmers. Improved returns will contribute to improved food security. Combined with outcomes and impacts of other pathways (social, environmental and value chain related), the ultimate result of all this would be a sustainable cotton sector. The research will track how this happens over the next four years and what are the accompanying assumptions that should hold true for this to happen e.g. farmers should have the incentives and resources to take up the new practices introduced to them and have sufficient skills and understanding to implement them correctly to realise the economic gains.

Figure 17: Economic Impact Pathways

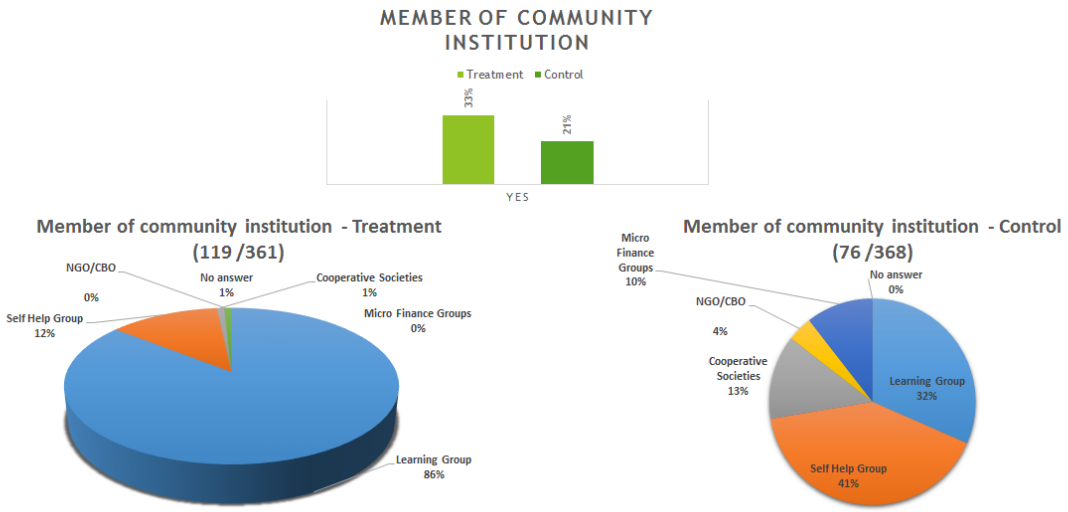


4.1 ECONOMIC IMPACT PATHWAY - ACTIVITIES

4.1.1 MOBILIZING LEARNING GROUPS & PRODUCER UNITS

At the baseline, only one third of the farmers in treatment group and about one-fifth of the farmers in control group are part of any community institution. Among those (in treatment) who are part of a community institution, eighty six per cent are already mobilized into BCI learning groups. Some thirty two per cent of the farmers in control group are reportedly in the learning group (not a BCI group), primarily due to presence of the Reliance Foundation (a corporate NGO in India) which is working on general agriculture development activities with farmers in one of the control villages (Dhanapuram).The research will be able to track any differential impact among this set of control farmers due to the activities of another NGO.

Figure 18: Baseline status of membership to community institutions (including learning groups)



There are currently fifty six BCI Learning Groups in Adoni *mandal* mobilized by the PRDIS team. Within each group there are approximately thirty five to forty farmers. In the intervention villages, the number of Learning Groups is as follows:

Table 6: Details of learning group mobilized in 2015

Intervention Village	No. of Learning Group	Total number of Members	Women members
Virupapuram	20	743	31
Madire	21	766	26
Chinna Harivanam	7	261	12
Santekudlur	4	144	4
Baladur	4	141	6
Total	**56**	**2055**	**79**

The number of women members in learning group is 4 per cent of the total members (2055). The implementation partner have taken a strategy of mobilizing one women only learning group with thirty one women and one men. In most of the other learning groups, there is only one to seven women members. The 31 learning groups (55 per cent of all LGs) are men learning groups with no women members. Except in three learning groups, the average women members land holding size is less than the average landholding of all the members suggesting that women members of the learning groups are slightly less endowed (in terms of land holding) than the other members. The detailed learning group data (2015) is presented in Annex G.

The wives of the men who are attending the Learning Groups were not aware of the Learning Group activities and information. The qualitative inquiry suggests that so far only a few of the participants of the Learning Groups who have attended one or more meetings organized by PRDIS have shared information beyond the group. Future monitoring should continue to explore whether information is being cascaded within the household and disseminated among peers in the intervention villages.

'A few months back the field officer of PRDIS approached me to join learning group and he has taken my name to include in the list. They visited the village and have seen different farmers. They identified a farmer with motivational skills, who is energetic and good in communication, as a lead farmer in the village. This lead farmer provided the names of fellow farmers in the village and formed a group called 'Learning Group'. Nearly 20 such groups are there in this Madire village. One of the meetings I attended and some border crops seeds were given to me by PRDIS to protect the cotton plant. He [the trainer] *said that by joining PRDIS program you all get benefits like this'.*

As expected, there is very limited awareness among the farmers about the learning groups to date. The BCI project has already identified lead farmers and through them the process of identification of other farmers as members of the learning groups has begun. The lead farmers are expected to be slightly 'better-off' farmers given that the average land holding size of lead farmers (4.8 acres) is slightly higher than the average land holding of all the members of the learning groups (4.2 acres). The lead farmer has offered a set of names to the PRDIS representative for participants in the learning groups in many cases. It is still relatively early as the learning groups are only just being formed and so the process of learning group development will be further explored during the monitoring process. The lead farmers are just starting to be sensitized about their role (FGD). The FGD participants in one village explained that the role of the lead farmers will be to mobilize interested farmers to be active in the Learning groups, to share information beyond the group and to act as a coordination mechanism between the village and the implementing organization. The PRDIS team is creating awareness about the project in the villages and it is expected that more farmers will self-select themselves to become a member of the learning group as time goes on. Currently, not all of those named on the lists appear to be aware of the learning groups they are apparently members of (FGDs).

'The PRDIS field supervisor contacted me and explained about the upcoming program. He motivated me and asked me to find out 20 members to nominate - those who do cotton agriculture, with good learning interests on Agriculture practices; He also asked to include women in this list. Now we have 20 Learning groups in the village and every group have some 1-2 female farmers' (FGD participant).

In Santekudulur village, the lead farmer said he was contacted in April, 2015, by PRDIS who said they wanted him to work with cotton farmers in the village. They asked him to provide the names of farmers with or without land. After forming the group in April, PRDIS held a meeting with the farmers in May-June, in which various practices in cotton cultivation were discussed (lead farmer interview).

The lead farmer said he was still unsure as to his role. Both the lead farmer and the other participants in this village said that they do not use the practices taught by PRDIS. This is because they strongly feel that their yields would be negatively affected if they did so. Farmyard manure is more expensive than chemical fertilisers. Manure costs Rs 5000 or USD 76.92 per tractor load. A minimum of three to five pesticide applications is needed when there is no irrigation. In irrigated conditions five to six applications are needed to get good yields. The participants said that even if they have black soil, they will not get the desired yield unless they spray the required inputs.

Understandably, as the project is only just beginning, just a few farmers reported having been given a Farmer Field Book and fewer still have yet to start inputting information in the book.

4.1.2 FACILITATING FARMER FIELD SCHOOLS, DEMONSTRATIONS AND TRAININGS

Where initial meetings of the Learning Group have been held, farmers said that the BCI principles have been explained to the members. Each group includes approximately thirty to forty members. During initial meetings some of the farmers have been introduced to PRDIS and their plans for the village. In some cases the farmers interviewed in the FGDs were unaware that they had been named as part of a Learning Group. The Lead Farmers are expected to motivate the group and mobilize them for upcoming capacity building activities. Where such information sharing has begun, the feedback from FGD discussions was that the information was generally useful. Where such information sharing has begun, the feedback from FGD discussions was that the information was generally useful.

> *'I am glad to say - somebody is there for us, to help and guide on our basic livelihood that is agriculture' (FGD participant).*

4.1.3 DEVELOPING INTERNAL MANAGEMENT SYSTEMS

There was mixed reporting by respondents in the qualitative work as to how far they document their farm expenses and income. Many farmers do not keep any records at all and it is only through memorization that they remember major expenses, loans, repayments and yields etc. Several respondents could not see the point of record keeping as they knew they were making a loss and said it was rare to make a good income and be able to save money.

> *"What is the use of keeping accounts? To whom we are accountable? If we keep and look at the end of season year we get mad"! Every year we get loss only and very rare we find any surplus' (FGD participant).*

Some farmers said that they do keep track of their farm expenses, but often this is primarily major expenses only. A small number keep more detailed record of their expenses over several years. But no farmers said that they are documenting their agronomic practices (e.g. the number of pesticides sprays undertaken and the types of pesticides used).

> *"We have records of our land and related documents. Somewhere we keep a track of our loan amount and its repayments' (FGD participant).*

As most farmers are only educated to primary level and many cannot read or write, it is too difficult for them to maintain their records. Women do not keep records and FGD participants said that they have not seen any record keeping by their husbands.

If the farmer bodies join together and form a producers' company in the future, as currently envisaged, the process of documentation is likely to be an even greater challenge, as well as the fact that considerable land holding will be required (FGD).

4.2 ECONOMIC IMPACT PATHWAY - OUTPUTS

4.2.1 LEARNING GROUPS ESTABLISHED

As the learning groups are only just being established it is not possible at baseline reporting stage to assess how effectively the training delivered has changed farmer awareness of BCI practices. The Better Cotton Composite Index has been established, because there are such a large number of practices that will be introduced to farmers and could be taken up. The BCCI will be used to assess change in farmer awareness and adoption levels. The qualitative data will interrogate in monitoring rounds, how far farmers' awareness and knowledge is changing and that they ascribe this change to, and whether different types of method employed (e.g. if there is diversity in approaches – with FFS, demonstrations) that influence change.

4.2.2 KNOWLEDGE AND APPLICATION OF COTTON PRACTICES

At the baseline stage we outline current cotton practices. At final evaluation we will establish if and how far cotton practices have changed and if this change has been caused by the BCI project or other contextual drivers.

Cotton cultivation in Adoni dates back to more than 20 years. Most of the villagers, in both intervention and non-intervention villages, have been growing cotton for these many years. There has been a major shift to Bt cotton production (since 2002). Previously, traditional varieties such as Laxmi and Panduranga varieties were cultivated. Nowadays, only Bt cotton varieties are being cultivated. Ajith, Jaju, Jadu, Kaveri, Jhony, Bhakthi, Tulasi, Sriram, Janu, Jaadu, Police, and Jaan were all mentioned as the common brands of BT seeds used by farmers in the villages.

BCI has recommended various practices under six production principles. Through a process of consultation with PRDIS, the research team prioritized overall 39 better cotton practices (37 for rainfed plots) to be tracked by the study over a period of time. Out of these 39 practices, 17 practices (15 for rainfed plots) are recommended by the BCI under Minimum Production Criteria (MPC). The research team has constructed an index called Better Cotton Composite Index (BCCI) to understand the cumulative status of current level of knowledge and application on overall and MPC practices. BCCI score will provide informative indication of levels of knowledge and application of BCI recommended practices by the treatment and control farmers as various knowledge building and application support related interventions are carried out the BCI project. The movement in BCCI scores over a period of time can indicate the trajectory of outcomes of the BCI project. The methodology of construction of the index in described in Annex-E. Overall index summary is presented below in figure 19:

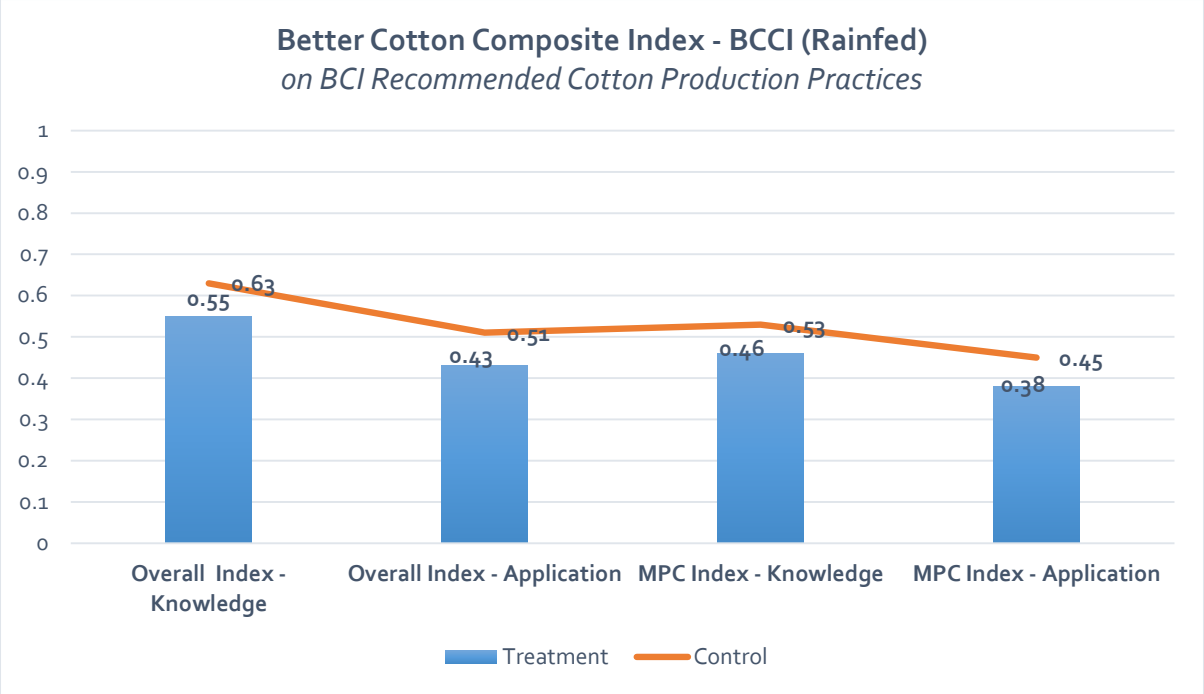


Figure 19: Better Cotton Composite Index for treatment and control farmers

Overall BCCI knowledge and application score for treatment farmers is 0.55 and 0.43 respectively. The index score for control farmers is slightly higher at 0.63 and 0.51 for knowledge and application levels respectively. The index is constructed in a way that index score of 1 can be achieved when all the farmers practice at least eighty per cent of the BCI recommended practices. Over a period of time, as the practice level compliance is hoped to improve, the index score would improve and indicate increasing level of compliance on BCI recommended practices. On the MPCs the index score is lower than the score on overall practices on both knowledge and application for both treatment and control group of farmers.

For analyzing the statistical significance of mean among various groups, Mann-Whitneys U test was carried out (non-parametric test), which throws up two significant pattern as depicted in the table below:

Irrigation: Significantly higher scores for irrigators

Report

Using irrigation?		Composite Score for Knowledge BCI-Overall	Composite Score for Application BCI-Overall	Composite Score for Knowledge BCI-MPC	Composite Score for Application BCI-MPC
No	Mean	.5882	.4910	.6165	.5098
	N	649	649	649	649
	Std. Deviation	.23911	.20736	.23972	.21158
Yes	Mean	**.6913**	**.6175**	**.7450**	**.6761**
	N	80	80	80	80
	Std. Deviation	.21403	.19683	.21769	.21777
Total	Mean	.5995	.5049	.6306	.5281
	N	729	729	729	729
	Std. Deviation	.23853	.20986	.24064	.21840

Soil type: Significantly lower scores for black soils (in Control Group)

Report

Soil type 2 groups		Composite Score for Knowledge BCI-Overall	Composite Score for Application BCI-Overall	Composite Score for Knowledge BCI-MPC	Composite Score for Application BCI-MPC
Black soil	Mean	.5710	.4801	.6001	.5059
	N	516	516	516	516
	Std. Deviation	.23204	.20597	.23532	.21643
Other soil	Mean	**.6685**	**.5649**	**.7045**	**.5818**
	N	213	213	213	213
	Std. Deviation	.24047	.20751	.23787	.21428
Total	Mean	.5995	.5049	.6306	.5281
	N	729	729	729	729
	Std. Deviation	.23853	.20986	.24064	.21840

Table 7: Statistical significance of BCCI scores for different groups

BCCI - Irrigation: Both irrigating and non-irrigating members of the control group have higher BCCI scores than the treatment group. Within the control group, farmers using irrigation have higher scores than farmers not using irrigation on all parameters of the index. Within the treatment group, farmers using irrigation only score higher on the application of MPC practices.

BCCI- Land size: Within the group of small and medium farmers, the control farmers have higher BCCI scores than the treatment farmers. Within the treatment group, farmers with a small landholding score higher than medium farmers on two aspects: application of all practices and knowledge of MPC practices.

BCCI- Education: Farmers from the treatment group who have not had any formal education have lower BCCI scores than any of the other categories.

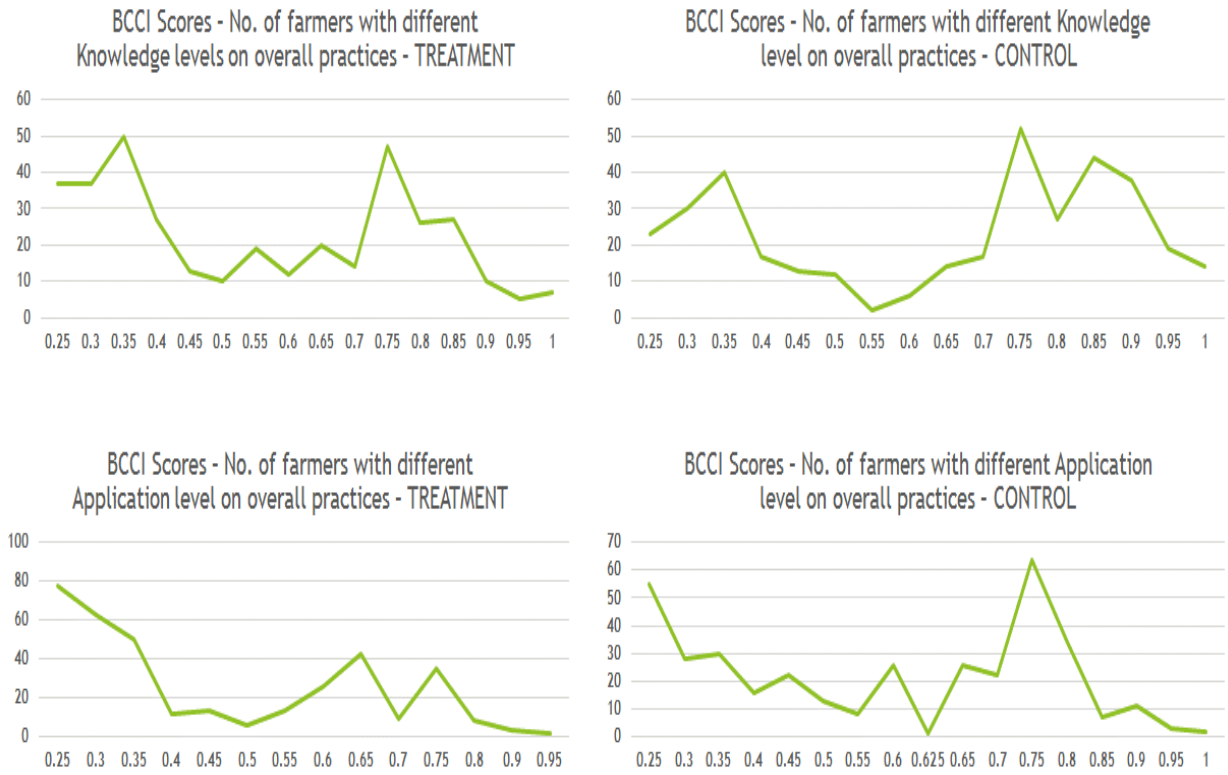
BCCI –soil type: There is no clear pattern when looking at soil types. Farmers with black soils seem to score lower than those with other soils, but this is only within the control group. Within the treatment group, there is no difference.

The knowledge and application of BCI recommended practices are varying across the farmers (both treatment and control groups). There are 75 treatment and 144 control farmers who have a very high BCCI-knowledge score in the range of 0.8 to 1. Similarly there are 13 treatment and 57 control farmers who have a very high BCCI-application score in the range of 0.8 to 1. The BCI project can work with these farmers (as demo or lead farmers) to promote the BCI recommended practices.

Qualitative study also indicate very low levels of application of various BCI practices. Few farmers use border crops or do intercropping – a few grow red gram alongside the cotton. Very few farmers use the refuge seeds, that they are supposed to use alongside the Bt cotton as a resistance management strategy. Intercropping practices among farmers are not very popular. Double cropping is followed by a handful of farmers who have their own tube well (FGD). Farmers who have their plots near the canal are able to irrigate their farm at least three times. All the farmers who have access to canal irrigation, flood irrigate their farms and do not seem to use any water saving technologies. But after March, when the canal dries up, the farmers do not have access to irrigation. Most of the farmers interviewed in the FGDs reported burning the cotton residues in the field itself and are not aware of the implications of burning the crops, except in one case where participants said that they did not burn the cotton residues (FGD data). The varying levels of knowledge and application of better cotton practices is depicted in the figure below:

The graphs (figure 20) shows number of farmers (Y-axis) who have BCCI score at various levels. Both knowledge and application histograms shows two peaks suggesting somewhat large number of farmers having low and high index scores. The application level histograms tends to show a larger drop (than the knowledge level histograms) in number of farmers as the index score moves higher. These graphs demonstrate the distribution of farmers (treatment and control) on the BCCI knowledge and application scores. These patterns will be analyzed /superimposed over the next four years consequent to changes that happens due to the BCI project interventions.

Figure 20: Distribution of farmers on BCCI score - knowledge and application level



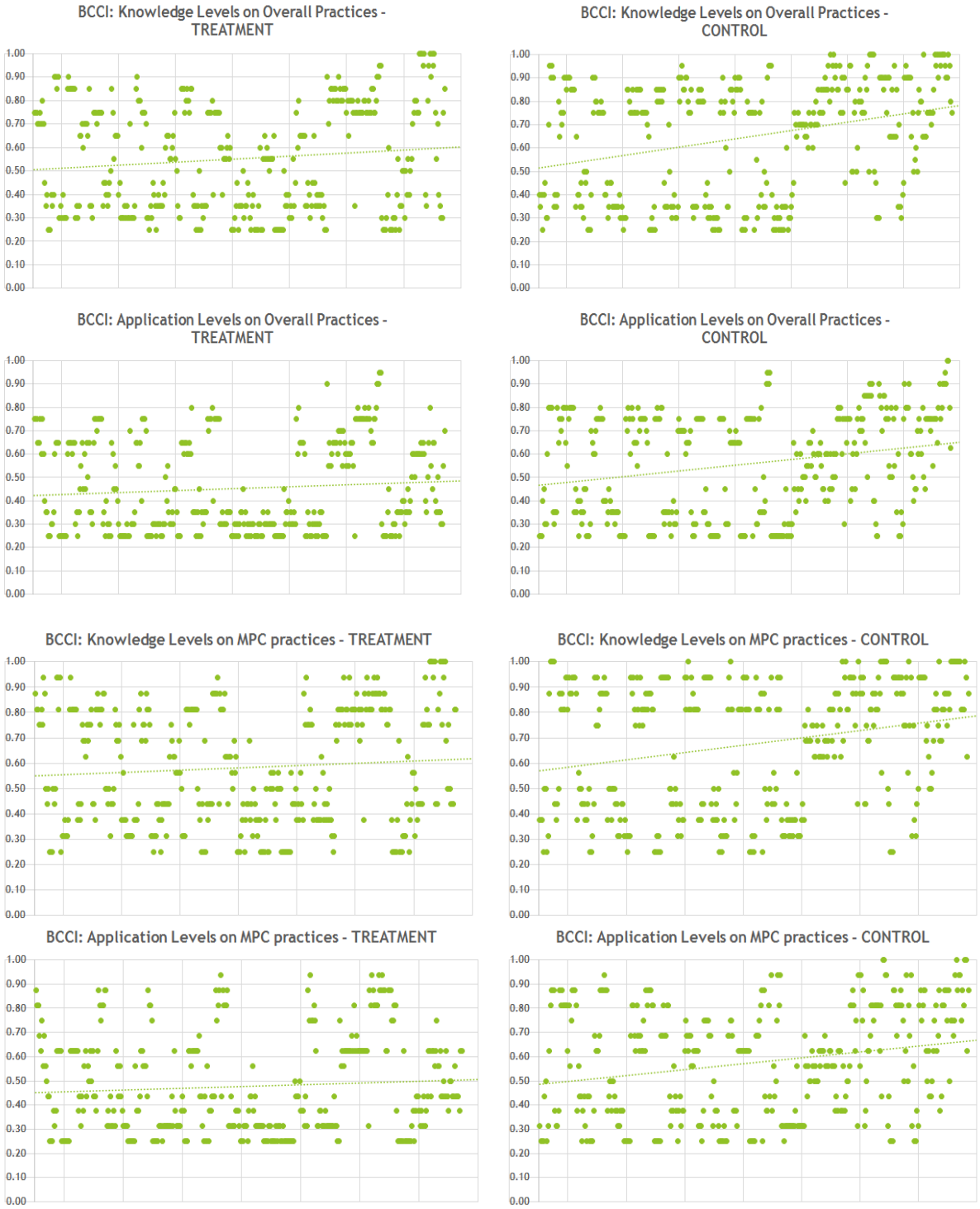
An each dot (bubble) in the histograms (figure 21) represent a farmer. The dots which are nearer to the highest index score of 1 are the farmers who are currently following more than 80 per cent of BCI recommended practices. This representation is another way of understanding where different farmers are currently situated on the index. Increasing level of adoption will shows the dots moving up the scale to demonstrate the success of the BCI interventions.

The given level of knowledge and application of various cotton production practices (as recommended by the BCI) could be because the government extension services are reported to be non-existent in these villages (FGD data). Only in a very few cases were visits by extension workers mentioned. In one case an extension worker had visited, but had not provided the inputs he promised and the farmers were left disillusioned. The key challenges in cotton production reported in the qualitative data are as follows:

- Adequate and timely rainfall and/or access to irrigation;
- Deer eating the tender shoots of the cotton plant in its early stages of growth;
- Limited access to quality seeds, as well as good quality pesticides;
- Pests and diseases;
- Access to labour;
- Damage to crop by monkeys

'Deer are the biggest uncontrollable challenge. We cannot hurt or kill them due to the strict laws protecting this animal. If we do something to control them, we will put behind bars! When plants start growing these deer will spoil the plants by eating them. Farmers are losing a huge future yield. Deer and untimely rain attracts more input cost as well as seeds and labour' (FGD participant).

Figure 21: Knowledge and application levels on BCI recommended practices



For those reliant on rainfed cultivation, erratic or late rains can be problematic. Additional seeding has been undertaken this year due to the rain delays. In the qualitative fieldwork farmers in the intervention and control group villages also discussed the factors which are conducive to cotton production, including the predominance of black soil, with its high levels its nutrients. Other

> *'If it rains we will get yield, we are left with only one source that is rain. The rest of the problems like pests and labour we can have some solution but rain is not in our hands' (FGD participant).*

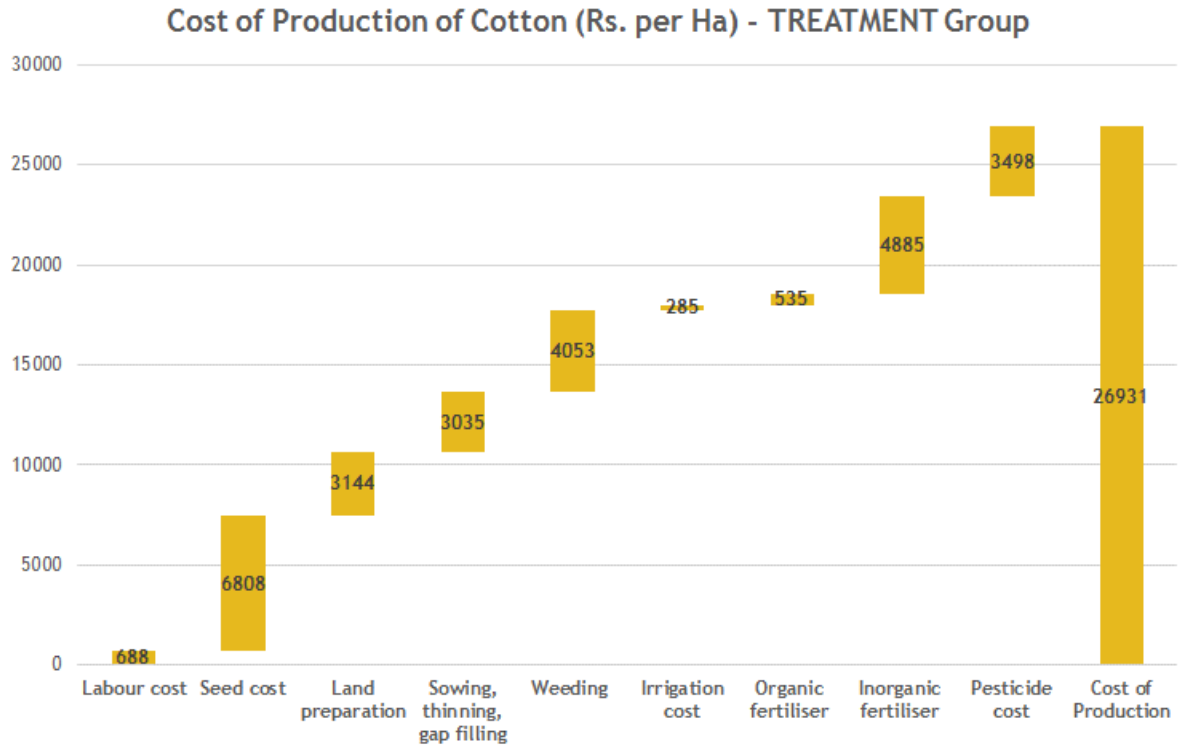
supporting conditions were said to be access to cotton markets, fertilizers and seed shops, and supportive commission agents for providing timely finance to the farmers.

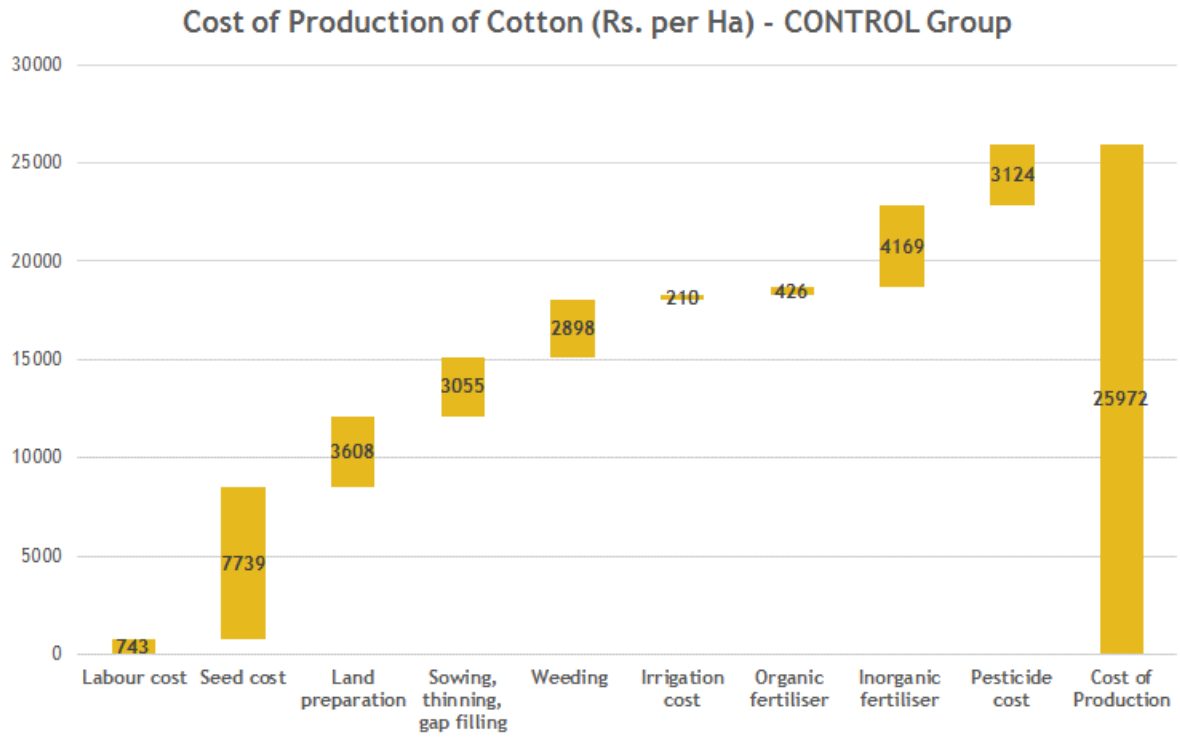
4.3 ECONOMIC IMPACT PATHWAY - OUTCOMES

4.3.1 COST OF PRODUCTION

The largest cost for cotton farmers in the region is paying for labour. The second most important cost is buying agrochemicals (pesticides and fertilizers) from shops in Adoni (FGD). The household survey asked the farmers about their estimated cost of production in the last season (2014). The enumerators were trained in estimating the costs and were provided with the necessary benchmarks on level of usage and range of prices for various inputs (labour, seeds, fertilizer, pesticides). The overall costs were computed by the tablet and validated with the farmers. The limitation of this exercise was the under-estimation of the labour costs. The family labour costs were estimated only for land preparation and sowing (based on farmers response in the household survey). The hired labour costs could partially be estimated (given the limited recall and no record keeping at the farmer level on the hired labour). The cost of production of cotton per ha. without full incorporation of family labour costs have been worked out at the baseline level. Using same computation methodology, cost of production will be tracked over the years to see the trend and make appropriate inferences. The cost of production for treatment group of farmers Rs.26,931 ($414) per ha (cotton season 2014-15) and Rs. 25,972 ($400) for the control group. If the full cost of family labour (opportunity cost) is included, then the cost of production will increase by Rs.14820 per Ha. This cost-estimate of family labour is arrived at by the PRDIS team in their consultations with the farmers. The break-up of cost of production per ha. are shown in figure 22 below:

Figure 22: Cost of Production of cotton per ha. (Treatment and Control groups)

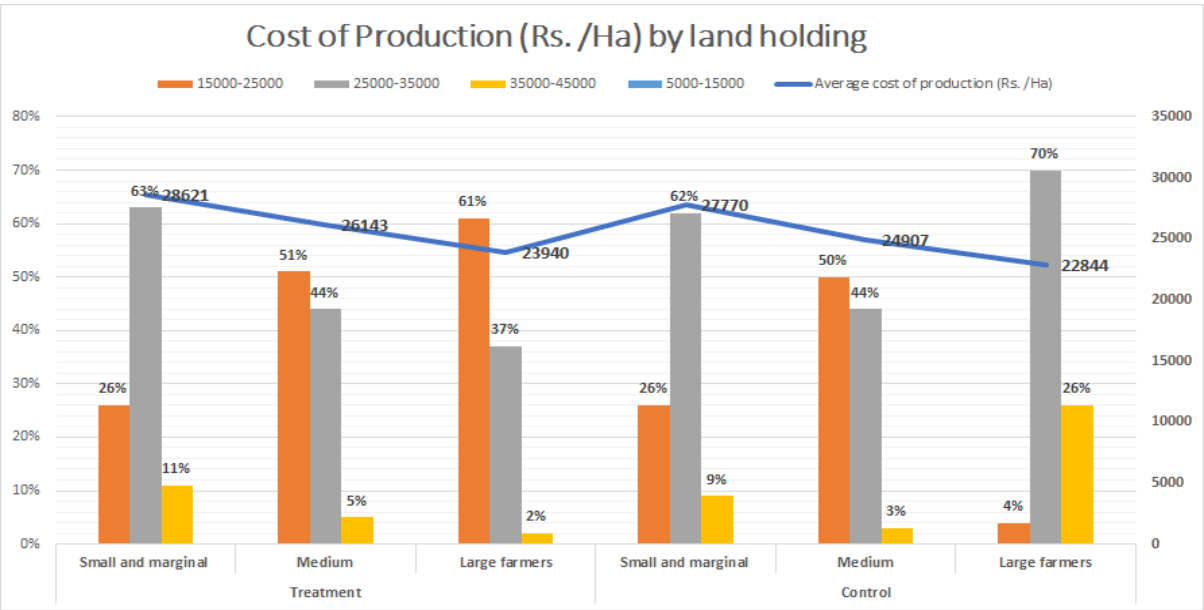




The control group has significantly higher values for seed costs (significant at 1 per cent level), land preparation costs (significant at 1 per cent level). The treatment group has significantly higher values for manual weeding cost (significant at 1 per cent level), inorganic fertilizer costs (significant at 1 per cent level), pesticide costs (significant at 5 per cent level), sowing thinning and gap filling costs (significant at 5 per cent level).

The labour costs are positively correlated with age, meaning that older farmers have higher labour costs (significant at 5 per cent level). Pesticide costs are negatively correlated with age, meaning that older farmer have lower pesticide costs (significant at 1 per cent level).

Figure 23: Cost of production (Rs/Ha) by land holding



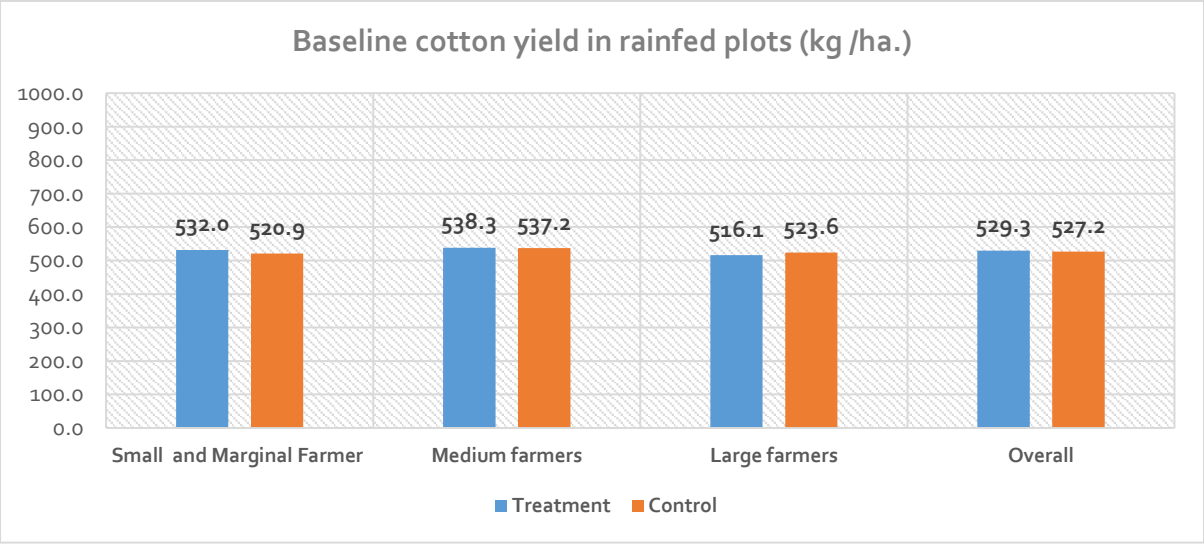
The cost of production varies across farmers, with about half of farmers in both treatment and control group having this in the range of Rs.25000 to 35,000 per ha. About forty per cent of farmers in both treatment and control group have cost of production in the range of Rs.15,000 to 25,000 per ha. These variations acquire some meaning when seen for different land holdings. The figure 23 below demonstrate that small and marginal farmers have higher cost of production than medium farmers who in turn have higher cost of production than large farmers. These differences are statistically significant (0.01). These differences are consistent for both treatment and control group of farmers.

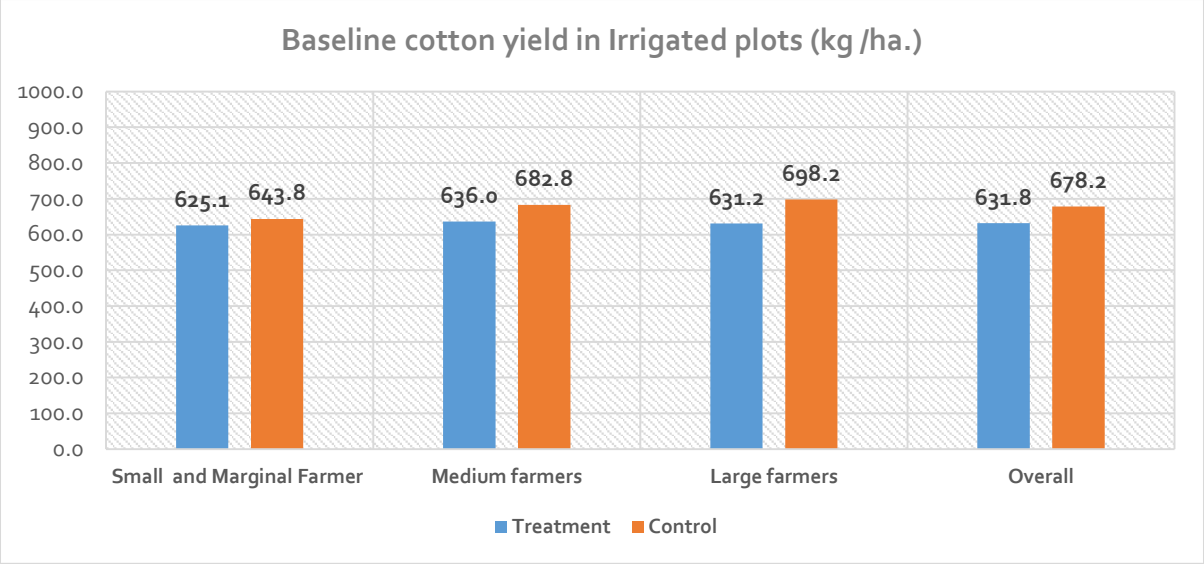
The cost of production for irrigated plots is higher (Rs.28481 per ha) than the rainfed plots (Rs. 26811/Ha) for treatment group of farmers, while reverse is the case for control group of farmers. These differences are statistically significant at .05 level. The cost of production tends of rise with increasing level of education, however, with most of the farmers either illiterate or educated up to primary standards, it is difficult to decipher any consistent pattern in cost of production based on the level of education attained by head of household or his/her spouse.

4.3.2 YIELD

The yield /productivity of cotton data was collected from the farmers for their rainfed and irrigated plots. In most circumstances, cotton cultivation in Adoni is rainfed. Only about 68 farmers have reported having access to some irrigation for cotton. It is possible that the farmers having only rainfed plots are also able to provide very limited supplementary or protective irrigation. Yield data is analysed by rainfed and irrigated plots. The following picture on baseline productivity levels emerges from this analysis:

Figure 24: Baseline status of cotton productivity (Kg/Ha.)





Adoni farmers' cotton productivity (rainfed) is slightly lower than the state (569 kg/Ha) and national (565 kg/ha.) level average productivity. This is despite the predominance of Black soils in Adoni which are favourable for cotton production. The primary factors determining yields are rainfall and access to irrigation, and the availability (or lack thereof) of quality seeds (FGD).

The 'medium' landholding farmers have reported better yields than small and marginal farmers and also higher yield than large farmers. In many FGDs it is reported that Bt cotton has been positive for the majority of farmers, although there has been variation in yields, costs are higher and pest problems are continuing according to some of those interviewed. In some of the FGDs the farmers were less positive, saying that yields of every variety are only good for the first two yields. In some villages farmers said that cotton cultivation does not now have advantages and they experienced bad yields last year and this year will again be poor. The main advantage they said of cotton production is that when yields are good it produces a good income and can enable the farmers to clear debts.

4.3.3 FIBRE QUALITY

The BCI production principle 5 says that better cotton is produced by farmers who care for and preserve the quality of the fibre, which is fundamental to its marketability and value. The efficiency of the gin will be affected by the level of trash and contamination of the seed cotton, and the quality and therefore value of yarn that can be spun is directly related to the quality of the lint cotton delivered to the spinning mill (the cost of the cotton can represent up to 65 % of the total operating costs for a spinning mill). The value of cotton lint is related to both the quality of yarn that can be produced from it, and the efficiency with which this yarn can be produced.

Three broad characteristics of the cotton are important: the inherent fibre characteristics, the level of trash (i.e. waste), and the level of contamination. As per BCI, the diverse range of quality characteristics includes aspects that are directly influenced by genetic and seasonal considerations and conditions – and also those which can be influenced by farm management decisions. BCI has not established a base quality grade that has to be achieved to meet this Production Principle. Rather the focus is on promoting the adoption of practices that are aimed at producing the best quality cotton possible under the prevailing circumstances – taking into account the market that the cotton is being produced for. The research therefore studies the level of knowledge and application among farmers

related to BCI recommended practices which can enhance intrinsic and extrinsic characteristic of cotton fibre. Planting rate (seed rate) and row spacing which is appropriate to variety, soil type and seasonal condition is one such practice taken up by PRIDS as per BCI production principle 5. The other practices relate to how seed cotton is harvested, managed, and stored to minimise trash, contamination and damage. As the baseline results (table 7) shows, there is a wide-scope for improving the knowledge and application of management practices which can enhance the fibre quality of cotton.

Table 8: Baseline status of knowledge and application of management practices that enhance fibre quality

Management Practice – Fibre quality	% Farmers – Treatment Group		% Farmers – Control Group	
	Knowledge	*Application*	*Knowledge*	*Application*
Seed rate and row spacing	89	83	89	86
Ensuring low trash and contamination	7	4	19	10
Harvest management and general hygiene	52	17	57	21
Proper storage	49	24	61	42
Proper transport	51	37	62	54

4.3.4 IMPROVED SERVICE PROVISION TO THE FARMERS

Currently, there is negligible government extension service provision in the intervention and control group villages. Thus, farmers are not receiving training on cotton cultivation. Currently, farmers mostly learn from their own experience and that of their peers with regard to cotton cultivation. Some information is gleaned from the television, and from books. Farmers have access to cotton prices through their mobile phones.

Table 9: Baseline level of service provisions to farmers from various agencies

Service Provision	% Farmers – Treatment Group				% Farmers – Control Group			
Parameters	*Overall*	*Small and marginal farmers*	*Medium farmers*	*Large farmers*	*Overall*	*Small and marginal farmers*	*Medium farmers*	*Large farmers*
First main source of agriculture information								
TV	44	42	49	42	51	53	45	55
Fellow farmer	41	42	37	45	34	30	41	31
Govt. extension	0	0	0	2	1	1	2	0
PRDIS	6	6	6	3	0	0	0	0
Other NGOs	0	0	0	0	0	2	2	0
Second main source of agriculture information								
TV	16	17	13	19	15	16	14	17
Fellow farmer	33	33	29	40	43	48	37	41
PRDIS	1	1	0	2	0	0	0	0
ICT - mobile, internet	0	0	1	0	2	2	4	0
Services from the government in last three years								
Received subsidy on seed /fertiliser/agri-equipment/other -Yes	1	1	1	2	3	2	3	6
Received information /exposure/training	0	0	0	0	1	1	2	2

In all of the villages private company representatives raise awareness of their products through television advertising. Pesticide dealers also give information to farmers about the type of pesticide they should spray, as well as providing other cotton farming related information. FGD participants in one group said that if the advice of the trader fails to control the pest, then their follow-on advice is to spray a more powerful pesticide.

In some cases PRDIS training has begun on BCI principles, but this is only a recent occurrence.

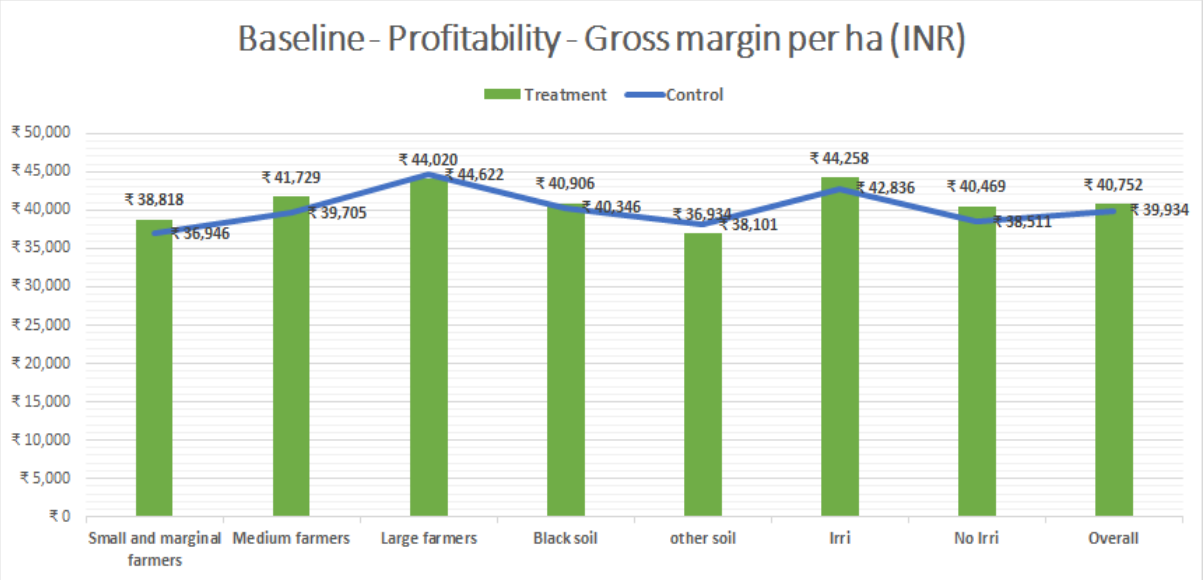
4.4 ECONOMIC IMPACT PATHWAY – IMPACTS

4.4.1 COTTON PROFITABILITY

Profitability (gross margin per ha) is one of the eight key result indicators of BCI. The profitability is calculated as gross margin per ha for each farmer, based on cost of production, yield and market price data provided by the farmer. The baseline values of profits from cotton cultivation is Rs.40,752 per ha for treatment group and Rs. 39,934 for the control group. Same computation methodology will be followed in subsequent rounds of the study to develop a comparative picture.

The real profitability will be lower than this amount if all the labour costs (including full cost of family labour /opportunity costs) are included in the cost of production calculations. Real profitability of farmers is Adoni therefore will be around Rs.25,932 per ha for treatment and Rs. 25,114 for control group of farmers.

Figure 25: Baseline level of Profitability –Gross margin per ha (INR)



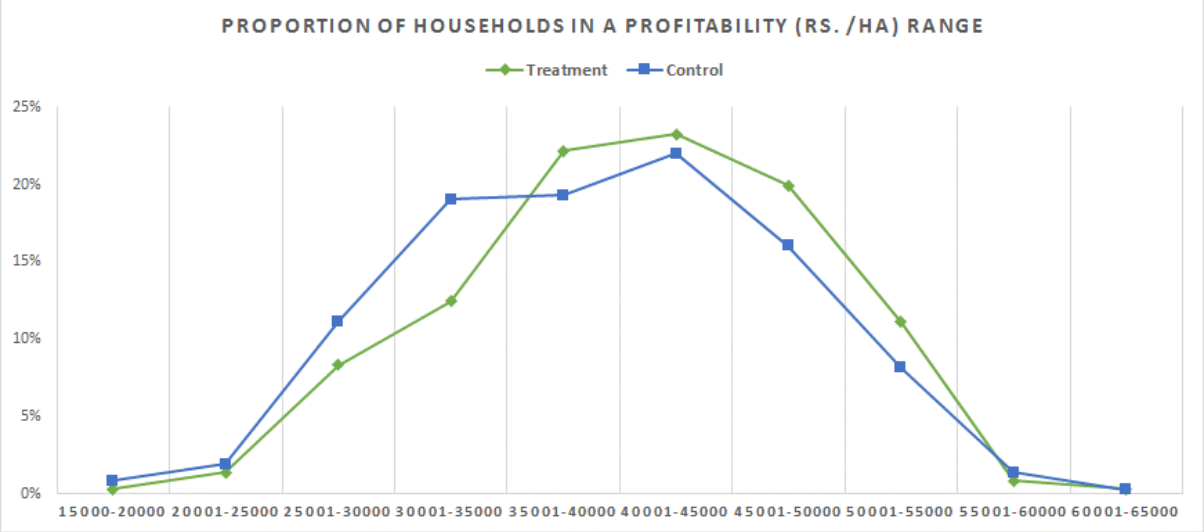
The study result shows that the treatment group have significantly higher values of profitability (significant at 1 per cent level) than the control group. Large farmers are getting higher levels of profits per ha. than the medium farmers which in turn are achieving higher levels of profits per ha. than the small and marginal farmers. This is not due to higher yields being obtained by large farmers than medium and /or small and marginal farmers. The yield levels are not significantly different between different categories of farmers. The yields depend on the quality of seeds, rains and management factors and not necessarily on the size of landholdings (FGD). The higher profits per ha of large and medium farmers can be explained due to their lower cost of production. This finding

provides validity to the approach of the BCI project for focusing on reducing the cost of production leading to increase in profitability.

The profits margins are higher for those having black soil and access to irrigation. This is true for both treatment and control group of farmers. The difference in profitability (gross margin per ha) is statistically significant (0.01) for soil type and irrigation access.

The profitability (gross margins per ha) from cotton varies across the treatment and control households and is well-represented in a Gaussian bell-shape curve (see figure 25 below). The shape of the curve for treatment and control group of farmers shows that higher proportion of control group of farmers are in lower profitability ranges than the treatment group while higher proportion of treatment group of farmers in higher profitability ranges than the control group.

Figure 26: Proportion of households in a profitability range



Village /cluster level profitability - Baladur households have reported lowest level of profitability in the treatment group of villages. Pandavagallu households have reported lowest level of profitability in the control group of villages. The reasons for low levels of profitability lies in either low yields or high cost of production as can be seen in the table below:

Table 10: Village /cluster wise baseline status on outcome indicators (economic impact pathway)

Village wise	Yield -rainfed (Kg /Ha)	Yield -irrigated (Kg /Ha)	Average Cost of Production /Ha	Average profitability /Ha	Average cost of pesticides /ha	Average cost of inorganic fertiliser/ha
TREATMENT						
Baladur	477	608	26762	39277	3659	5365
Chinna Harivanam	511	656	27361	41221	2919	4775
Madire	568		26839	41815	3018	3849
Santhekudlur	535		26489	42397	3842	5166
Virupapuram	554		27298	39314	3644	4983
Treatment Overall	**531**	**631**	26932	40752	3498	4885
CONTROL						
Billekallu	543	697	26684	39827	3505	4649
Dhanapuram	513	675	25620	40778	3302	4219
G.Hosalli	554	741	25246	39725	2965	3857
Naganathana Halli	477	637	24269	38562	3142	3869
Pandavagallu	557	694	27458	36889	2572	4107
Control Overall	**527**	**678**	25972	39132	3124	4169

4.4.2 INCOMES

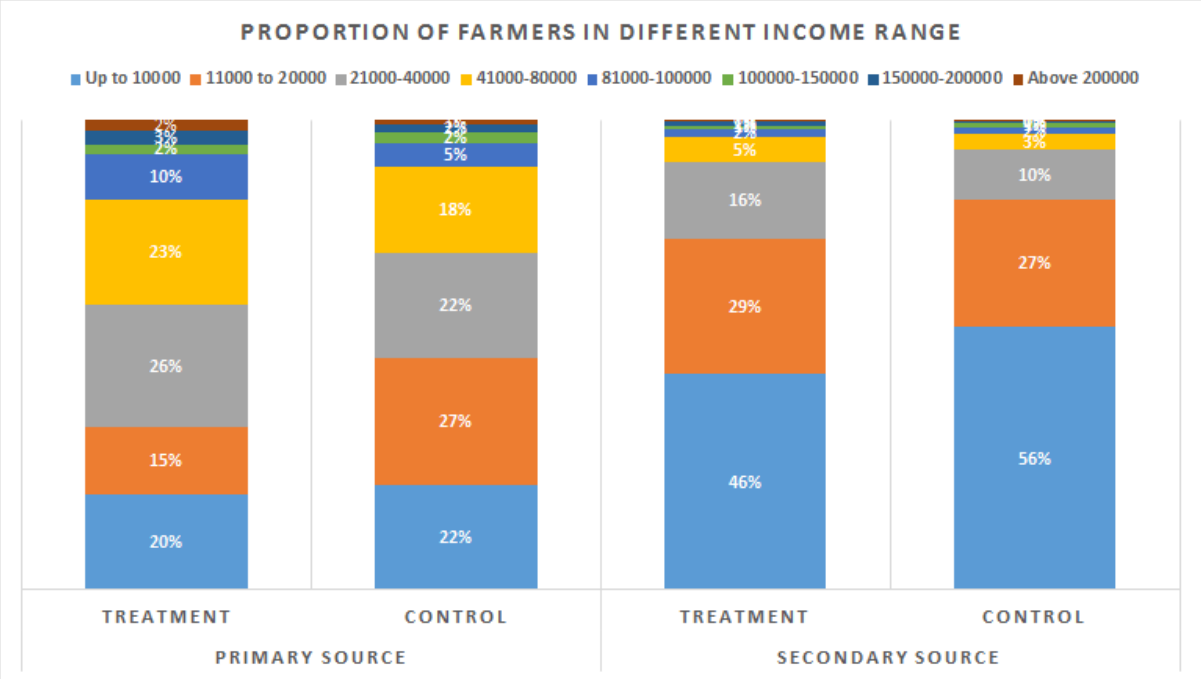
The cotton incomes are measured through profitability analysis (see section 4.4.1). Cotton is reported to be the main source of household income in Adoni (for 80 per cent treatment and 78 per cent control groups of households). The second main source of income for Adoni households is agriculture wage labour. Other agriculture crops contribute to treatment and control households as third main source of income. No one from among these households is part of government service or is in trading activities. Agri-allied (fisheries, livestock, and poultry) is secondary source of income for only three per cent households.

Table 11: Primary and secondary income sources in Adoni

Occupation	TREATMENT		CONTROL	
	Primary	Secondary	Primary	Secondary
Cotton cultivation	80%	20%	78%	22%
Other Agricultural crops	4%	27%	3%	17%
Agri labour	9%	38%	9%	46%
Agri allied	0%	3%	0%	3%
Casual labour	2%	4%	4%	4%
Trading	0%	0%	0%	0%
Government service	0%	0%	0%	0%
Private Service	3%	3%	2%	2%
Petty business	1%	1%	0%	2%
Domestic household worker	0%	0%	1%	1%
Other	1%	2%	2%	3%

The household survey asked farmers about their total annual income from primary and secondary sources. This incomes data, as reported by the farmers, is depicted in figure below.

Figure 27: Proportion of farmers in different income ranges (INR)



Majority of farmers (more than eighty per cent) are below the income range of Rs.80000 per annum and Rs. 40,000 per annum for primary and secondary sources of income respectively as per self-reported data.

The primary source of income is cotton cultivation for which the research team has done rigorous validation and computation, using benchmark ranges. The secondary sources of income are not arrived at based on the detailed income questionnaires (which was the case for primary source – cotton incomes). While estimating the overall household annual incomes therefore, a small adjustment factor has been applied to secondary sources of incomes to account for general under-reporting of incomes, if any. The same adjustment factor will be applied in subsequent round of the studies (monitoring studies and end line survey) to maintain the comparability of time-series income data.

Table 12: Annual household income estimation (average for study respondents) from combined primary and secondary income sources

Income estimation - household	Treatment	Control
Primary source: Cotton incomes per Ha.	₹ 40,752	₹ 39,934
Average land holding under cotton	2.5	2.3
Average annual household income from cotton	101,880	91,848
Annual income from other sources (estimated)	33,111	27,095
Average annual household income (INR)	134,991	118,943
Average household income per day (INR)	370	326
Per capita per day (INR)	78	63
Per capita per day (USD)	1.20	0.97

The baseline values for per capital per day income is $1.20 for treatment group of households and even lower at 0.97 for control group of households. This average per capita income is much lower than poverty line defined by the World Bank at $1.90 a day (2011, Purchasing Power Parity). This is even lower than the $1.25 a day poverty line at 2005 PPP. This means that average income earning household in Adoni will be below the internationally defined poverty line at both 2005 PPP and recent 2011 PPP. Taking this analysis further, it is estimated that about 61 per cent treatment and 71 per cent control households are either at average or below average income levels and therefore below poverty line at the baseline year (2015).

To substantiate this analysis, the study uses two key poverty indices to measure the change (or consequences of income change) in incomes over a period of time. The UNDP's Multidimensional Poverty Index was used as a measure of poverty. This index measures deprivations in three dimensions: Education, health and living standards. We used the methodology from the technical paper (UNDP, 2014). The Progress out of Poverty Index is a tool developed by the Grameen foundation. It consists of 10 indicators that can be easily assessed for each household. It results in a score between 0 and 100. This score is converted to a poverty likelihood value by using a lookup table. These tables are provided for different poverty lines. In this baseline study we have used the international $1.90/day 2005 PPP poverty line. The methodology of use of MPI and PPI is described in Annex-F.

4.4.2.1 MULTIDIMENSIONAL POVERTY INDEX

As per MPI, 48 per cent household in treatment group and 49 per cent household in control are either MPI poor or near MPI poverty. There is no statistically significant difference in MPI weighted scores between control and treatment households. The distribution among the different grades of poverty can be seen in the figure below.

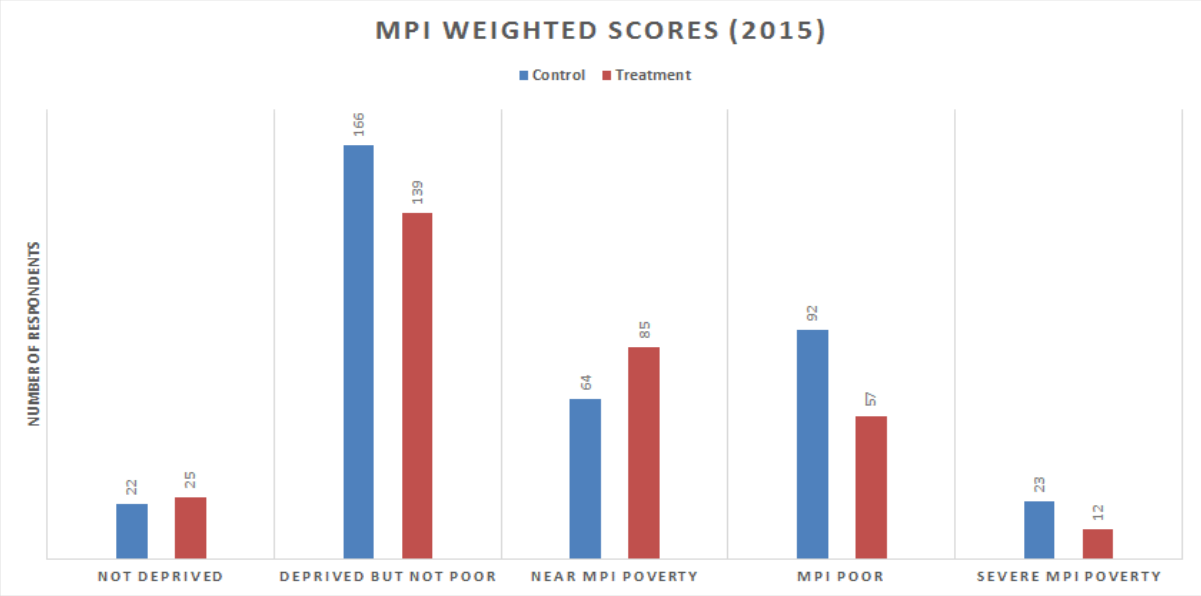
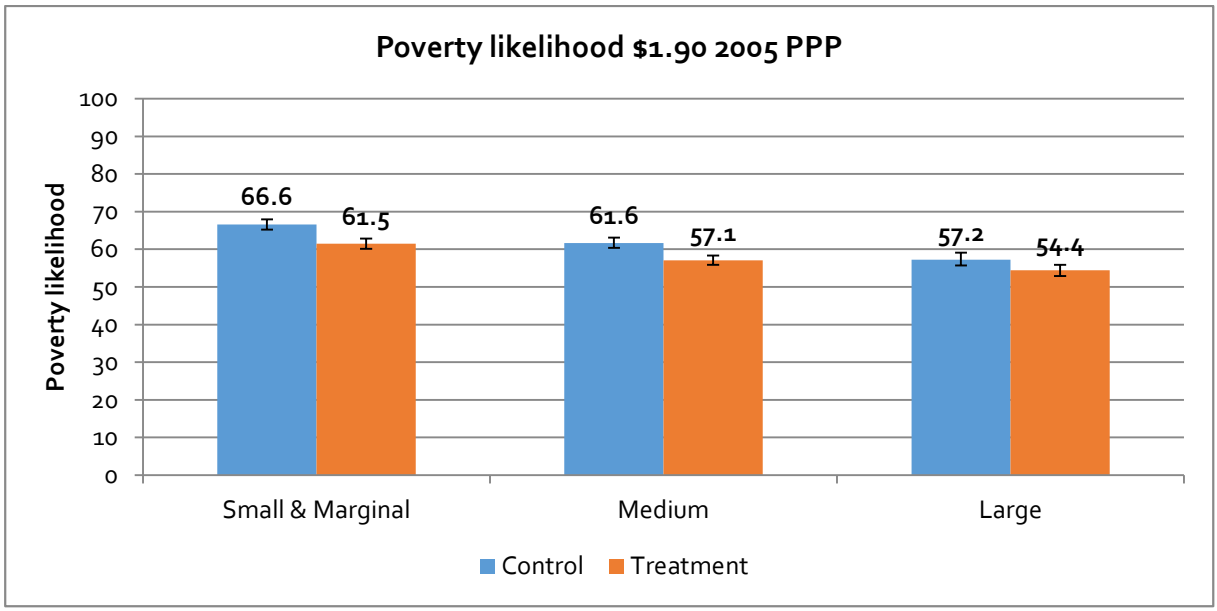


Figure 28: Distribution of MPI weighted scores among respondents

4.4.2.2 PROGRESS OUT OF POVERTY INDEX

When measured by the international poverty line of $1.88/day (at purchasing power parity –PPP), the poverty rate among participating households is **57.8 per cent**. For the control group, this is **62.4 per cent**. The difference between the two groups is statistically significant at the 0.01 level. Small and marginal farmers have a significantly higher poverty rate than the other groups.

Figure 29: Poverty likelihoods by land sizes



Both the PPI and MPI methodologies for poverty estimation are based on household assets. Besides the overall index scores and poverty likelihoods, it is important to analyse the asset status on each individual asset, part of PPI and MPI, as is done in subsequent paragraphs.

NUMBER OF HOUSEHOLD MEMBERS < 18

The average number of household member younger than eighteen is 1.4 for treatment households and 1.7 for control households. Control households have more children (statistically significant at the 0.10 level), which makes them score lower on PPI on this asset indicator.

EDUCATION LEVEL OF HOUSEHOLD HEAD

70 per cent of the heads of household have either not received schooling or only attended primary school. Only 20 per cent have finished secondary school or above. Levels of educational attainment are not significantly different between control and treatment heads of households.

LABOUR OR SELF-EMPLOYED

Cotton cultivation is the primary occupation for the large majority of respondents (88 per cent). They all receive five points. About 6 per cent depend on agricultural or casual labour for their income (0 points).

SOURCE OF ENERGY FOR COOKING

The household survey shows that 70 per cent of the households use wood, charcoal or cow dung for cooking (0 points). The rest uses LPG.

DRINKING WATER

About 21 per cent households in treatment group and 18 per cent households in control group have clean drinking water available within the house (water pipeline). Most of other households fetch water from a source located within 30 minutes of walk. The likelihood of water source being in the house is more for those who are literate and educated up to secondary or more.

PUCCA HOUSE

About 67 per cent households in treatment group and 86 per cent household in control group have pucca house. The likelihood of having a pucca house is more for those with access to irrigation or are literate and educated up to secondary or more.

TOILET

About 76 per cent households in treatment group and 80 per cent household in control group do not access to a toilet and practice open defecation. Improved toilet at the household is available with 21 per cent households in treatment group and 16 per cent households in control group. The likelihood of improved toilet being in the house is more for those who are literate and educated up to secondary or more.

THERMOS / CASSEROLE/ THERMOWARE

Most of the household in Adoni own a thermos/ casserole/ thermos ware. Only 2 households don't own this.

TV AND VCR/VCD/DVD PLAYER

Most households have a TV (93 per cent). Very few have a VCR/DVD player in addition to this. This means the majority scored 4 points for this indicator.

MOBILE PHONE / LANDLINE

Overall 86 per cent households have mobile (in both treatment and control groups).

SEWING MACHINE

Only 4.8 per cent of the households own a sewing machine.

ALMIRAH/ DRESSING TABLE

Overall 39 per cent of the households have an almirah/ dressing table. (5 points)

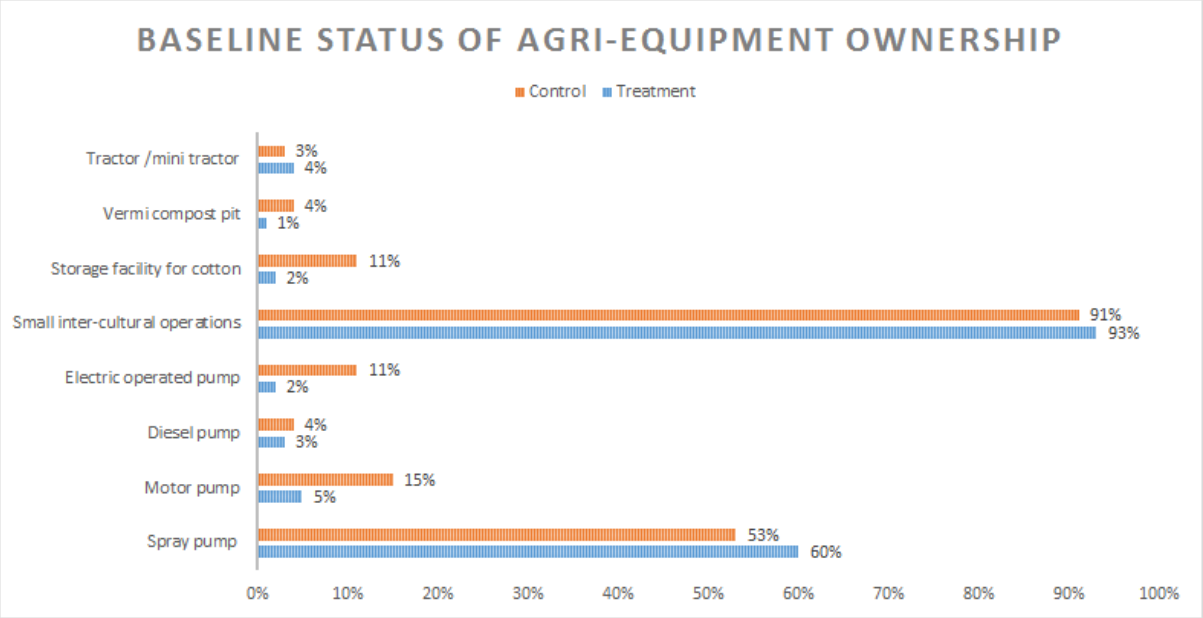
BICYCLE, MOTORCYCLE, CAR

Most households have neither of these (41 per cent), while 26 per cent have a bicycle only, and 33 per cent own a motorcycle or scooter. Large farmers are most likely to own a motorbike (48 per cent of them do).

AGRICULTURE ASSET STATUS

The study tracked the level of agriculture asset ownership, which is also a proxy indication of well-being status of the household. The study results shows that except small equipment (for inter-cultural operations) and spray pump, the level of agriculture asset ownership in Adoni is very low (See figure below for more details).

Figure 30: Agriculture Asset ownership in Adoni



4.4.3 FOOD SECURITY

The food security issue was researched through household survey and FGDs. In the household survey, all household have reported that they had not spent any day without sufficient food for the family in

the last year (2014-15). Only three households have reported the case when a child or adult in the house is suffering from mal-nutrition. Several of the individual panel case studies reported being food secure – either through having sufficient land holdings and access to labour (they can pay for hired labour), or through working as hired labourers in cotton picking. This suggest that basic level of food security in terms of access and availability of food is being achieved by Adoni households. However family level nutrition security is reported to be an issue of concern during the FGDs. Households of the intervention and non-intervention villages mostly consume jowar (Sorghum) roti, rice and Dal (pulses), bajra (pearl millet) roti. Substantial numbers of households are eating reasonable quality food, including millets and non-vegetarian products (FGD). However, small and marginal farmers and migrant labourers consume rice purchased through Public Distribution System (PDS) and are expected to be experiencing moderate levels of mal-nutrition. The deeper exploration of the family level nutrition will be carried out during the monitoring round of the research study.

5. ENVIRONMENTAL IMPACT PATHWAY

The overall theory of change is broken down into four different impact pathways – economic, environmental, social and value chain. The environmental impact pathway is presented in figure 28 below. There are inter-relationships between the different impact pathways which are explored in the overall synthesis and conclusion chapter.

This chapter explores environmental impact pathways through developing understanding of the baseline status of:

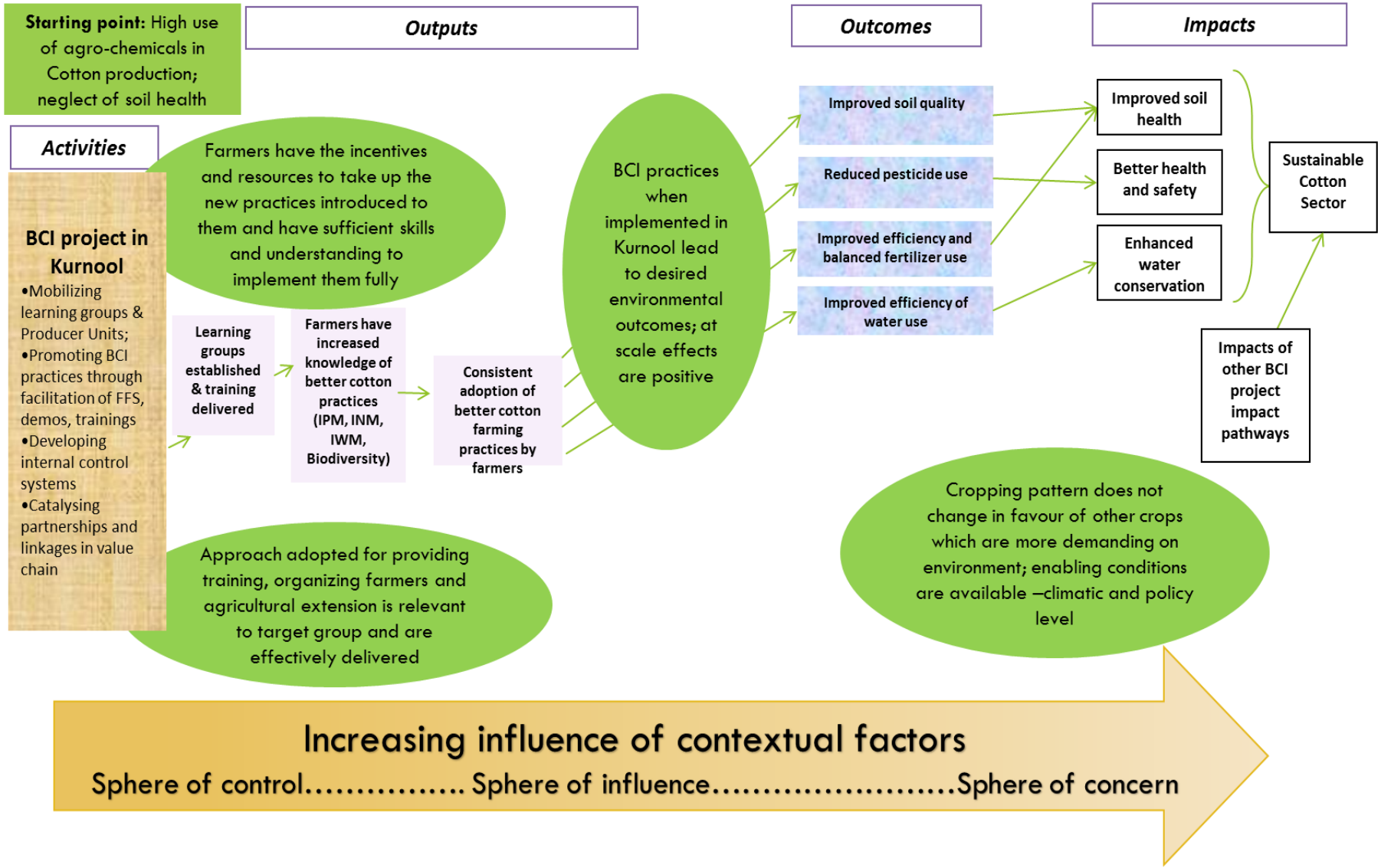
- BCI project activities
- Outputs which can contribute to environmental outcomes and impact
- Environmental outcomes
- Environmental impact

This section presents the baseline data gathered against the theory of change. In some parts of the theory of change we present the baseline status (e.g. the current level of pesticide use), but for other elements (e.g. training delivered) there may be a zero score given that this is a 'before' project scenario. We will also explore (in monitoring studies and at impact evaluation stage) the implicit assumptions which need to hold true at the transitions (activities to output, output to outcomes, outcomes to impact) for the 'environmental impact pathway' and for the overall theory to work – against the baseline data.

It will be important to identify alternative pathways to observed outcomes, through qualitative enquiry which reaches beyond the confines of the intended theory of change, in order to more accurately reflect contribution of the intervention vis-à-vis other contextual drivers.

The starting point for environmental impact pathway is the current status of high use of agro-chemicals in cotton cultivation and neglect of soil health. The BCI project activities of learning group mobilization, and the promotion of better cotton practices through farmer training (e.g. through diverse approaches and methods – Farmer Field School, field demos, exposure visits) are expected to lead to increased knowledge among farmers and consistent adoption which could then result in reduced pesticide use, improved efficiency and balanced fertilizer use, improved efficiency of water use and consequently improved soil quality and soil health. This is expected to result in better health and safety for the farmers and hired labourers. Improved environmental variables combined with outcomes and impacts of other pathways (social, economic and value chain related) can ultimately result in a sustainable cotton sector. The research will track how this happens over the next four years and what are the accompanying assumptions that should hold true for this to happen e.g. farmers should have the incentives and resources to take up the new practices introduced to them and have sufficient skills and understanding to implement them correctly to realise the improvement in environmental variables.

Figure 31: Environmental Impact Pathway



5.1 ENVIRONMENT IMPACT PATHWAY – ACTIVITIES

The activities for progressing on the environmental impact pathways are the BCI project activities of mobilizing learning groups and producer units, facilitating farmer field schools, demonstrations and trainings, developing internal control systems and facilitating partnerships and linkages in value chain. The baseline status and progress on these activities are captured in section 4.1 above.

5.2 ENVIRONMENT IMPACT PATHWAY – OUTPUTS

The environment impact pathway is critically based on knowledge and adoption of better cotton practices as recommended by the BCI under production principle 1 (IPM), 2 (INM) and 3 (IWM). These three production principles have large number of BCI recommended practices out of which 31 practices are prioritized and considered by the research team in consultation with PRDIS, as the BCI project will focus on promotion of these practices. The BCI project is promoting knowledge and then adoption of these practices which will have a direct bearing on improving environmental variables of cotton production e.g. reduced and appropriate use of pesticides and balanced use of fertilizer is expected to improve soil quality /soil health. Similarly improved methods of irrigation can enhance water conservation. Therefore environmental impact pathway crucially hinges on levels of practice adoption by the farmers.

5.2.1 LEARNING GROUPS

See section 4.1.2.

5.2.2 COTTON PRACTICES USED BY FARMERS

The farmers in Adoni have limited knowledge of various practices that can improve pest, soil nutrient and water management in a cotton crop. This shows the opportunity that exist for the BCI project to make a significant contribution. Some of the highlights of the baseline findings for the treatment group are:

- Soil testing - for taking decisions on nutrient application – is being done by only 2 per cent farmers
- Moisture conservation using mulching is being done by only 5 per cent farmers
- Use of cover legume rotations, inter-cropping is being done by 30 per cent farmers
- Zero or no tillage /conservation tillage is practiced by 2 per cent farmers
- Use of cover crop is reported by 7 per cent farmers
- About 80 per cent households are not reusing pesticide containers
- About 60 per cent households are using protective equipment in pesticide application
- Correct time or rate of pesticide application is reported by only half of the farmers
- Use of border crop is reported by 44 per cent farmers while trap crop is being used by only 7 per cent farmers
- Use of various pest control techniques (bio-control agents, pheromones) is reported by only 6 per cent farmers.

The baseline compliance levels on knowledge and application for both treatment and control group of farmers is captured in the table below:

Table 13: Baseline level of compliance with BCI recommended practices

Better Cotton Practice	% Farmers – Treatment Group		% Farmers – Control Group	
(Production principles -1, 2 and 3)	*Knowledge*	*Application*	*Knowledge*	*Application*
Use of pest control techniques - bio-control agents, pheromones and hormones	13	6	26	10
Regular monitoring of the crop for pests, beneficial insects and crop damage	59	49	69	60
Rotation of insecticide group	37	36	57	50
Limiting the total number of applications of any one class of insecticide	36	26	54	45
Use of trap crops	20	7	36	14
Use of mechanical means to control a pest	38	25	45	31
Selection of insecticide that are least disruptive to beneficial insect	38	16	46	30
Improving beneficial insects by sowing random /gap filling with castor /sunflower	21	10	32	13
Use of border crops (e.g. maize, sorghum, pearl millet)	53	44	49	42
Use of correct and registered brand of pesticide	52	44	65	57
Correct rate of application	65	58	86	66
Correct time of application	54	47	76	70
Banned pesticides are not used	53	49	67	65
Workers using pesticides are trained	36	21	48	29
Workers using pesticides are healthy and are 18 years older	84	76	90	85
Workers using pesticides are not pregnant	85	77	91	82
Protective and safety equipment are used in pesticide application	80	61	86	60
Pesticides are not stored in drink or food containers	90	80	93	82
No pesticide containers are used for any household or other purposes	90	78	95	82
Use of cover crop	19	7	27	15
Monitoring and maintenance of irrigation infrastructure, pump, plant	23	18	45	33
Proper irrigation practices and scheduling	46	22	55	40
Zero or no tillage, conservation tillage or minimum tillage system	46	2	55	8
Applying FYM /compost	64	56	73	72
Use of cover legume rotation, inter-cropping	45	30	52	38
Moisture conservation using mulching	8	5	16	9
Appropriate timing of application of any fertilizer	48	33	61	55
Appropriate placement of any fertilizer	50	38	59	53
Appropriate quantity of any fertilizer	51	37	60	53
Soil test done for taking decision on nutrient application	29	2	49	14
Practice of crop rotation for maintaining /improving soil health	46	33	63	51

In terms of pesticide usage, farmers are typically spending Rs 1000 – 1,500 per acre for cotton (FGD). Five years ago, farmers in the FGDs said that they used to spray pesticides much less – only three or four times. Nowadays, in 2015, the number of spray applications of pesticides has increased up to seven to nine times during cultivation in villages such as Chinnaharivanam.

5.3 ENVIRONMENT IMPACT PATHWAY – OUTCOMES & IMPACT

5.3.1 REDUCED PESTICIDE USE AND INCREASED BIO-PESTICIDE USAGE

None of the farmers are using any organic pesticides or practices that would control pests (FGD). Spraying a minimum four sprays of pesticides has become a standard practice among the farmers

(FGD data). There is a widespread view among farmers that their crops would fail, if they did not use chemical pesticides (FGD data). Many farmers interviewed in qualitative discussions, were skeptical about the effectiveness of bio-fertilizers and bio-sprays. Most farmers are entirely convinced that Bt cotton requires higher levels of spraying and that if this is not sustained their yields will drop significantly. This represents a challenge for the PRDIS trainers.

The maximum reported pest problem during the last cotton season is white fly (reported by 78 per cent households) and cotton aphids (reported by 37 per cent households). A small number of households have also reported to have experienced Thrispp sp, sucking pests, pink bollworm and cotton leaf worm pest problems. The farmers in Adoni are mainly using Acephate and Monochrtophos chemical ingredient based pesticides brands locally available in the market. To attack whiteflies, the farmers are mostly using monochrotophos based solutions, while to save crop from cotton aphids, the farmers are using many combination of chemical ingredients like acephate, monochrotophos, ulala, confidor, lancergold, Immidachlophide and Rizenta. The farmers are neither aware of the right type of pesticide and its appropriate quantity to be used nor are they much aware about the right time of application of the pesticide. The research team in consultation with BCI India team develop some initial benchmark of recommended doses for each chemical ingredient. For doing this exercise, AP state universities and TN Agriculture University recommendations were also taken into consideration. Based on these consultations, an initial assessment framework of pesticide usage has been developed which will be progressively improved upon while tracking the pesticide-usage rate over a period of time.

The assessment shows that monochrotophos is the most excessively used chemical ingredient in various pesticides being used in Adoni area. The target pest for this chemical is Thrips and sucking pests but it is being used indiscriminately by farmers for all pest related problems. More than eighty per cent treatment and seventy six per cent control group of farmers have reported the use of this chemical based pesticides. More than 95 per cent of those who have used monochrotophos have used it in more than recommended dosages.

Acephate based pesticide have been used by 49 per cent of treatment and 55 per cent of control group of farmers. More than 95 per cent of those who have used acephate have used it in more than recommended dosages.

Even though, smaller number of farmers (< 8 per cent) are using other chemical ingredients like Ulala, confidor, Immidachlophide, Chloripyriphos, Lancer, Polo, Marshal / Polard / Pendol / Rizenta, the dosage comparisons suggest that more than 90 per cent of those who are using these chemical compositions are using in excess of the recommended doses. The damage to crop (buildup of resistance among pests, harm to beneficial insects etc.) and to the environment due to excessive pesticide use is not being assessed currently in Adoni *mandal* or in Kurnool district by the Government agriculture department. Given that only few chemical ingredients (pesticide cocktails) are being used repeatedly, the household level data suggest that rotation of pesticides group in a crop cycle are not being done in Adoni.

5.3.2 IMPROVED EFFICIENCY AND BALANCED FERTILISER USE

The assessment of fertilizer usage at baseline level shows a contrasting picture. Urea (46:0:0) is excessively being used while the complex is under-used or not-used. Only nine per cent households

in treatment and 17 per cent households in control group have reported not using Urea in the last cropping season (2014-15). About 60 per cent of households who have used Urea have used it in excess, while the rest 40 per cent have under-used the recommended doses. This suggest that in all cases, it is unbalanced use of fertilizer. The status of use of complex, though is reverse, is still the same situation of unbalanced use of fertilizer. Under-use of complex (against the recommended doses) is reported by 19 per cent treatment and 20 per cent control group of households. About 10 per cent of households have used complex in excess of recommended doses. This has created unbalanced N:P:K soil profile in Adoni mandal, which is testified by the official (department of agriculture, Government of Andhra Pradesh) soil health data of2014-15 (discussed in the next section) Given that soil nutrients are being used without soil test advisories, the inappropriate and unbalanced use of fertilizer is not only increasing the cost of production for the farmers but also leading to depletion of nutrients (macro and micro, organic carbon) in the soil. With a predominantly black soil profile, Adoni *mandal* farmers can potentially achieved better technical and production efficiencies in cotton if agro-chemicals are appropriately and judiciously used.

5.3.3 IMPROVED SOIL HEALTH

The study assesses how improved adoption of practices (outputs) leads to improved soil health. The soil health quality is assessed based on official soil test data as well as sample soil testing conducted by the implementation partner. The study will capture this aspect through estimation based on level of adoption of practices that have direct bearing on soil health and also through understanding farmers and key informants' perspectives on soil health (through qualitative inquiry).

The study have accessed official soil health data of 2014-15 of all villages in Adoni *mandal*. Though only a limited number of soil samples (10) were taken from each village, it is still indicative of soil health status. The soil testing on higher number of soil samples can be carried out by the implementation partner, to gain understanding of soil health issues for appropriate advisory and training to the farmers.

Across both control and treatment village, official soil test data suggest low organic carbon status among 90 per cent of the samples taken. P205 is low or medium in majority of samples. K20 is low or medium in about half of the samples. Most of the samples show zinc, ferrous, copper, manganese at critical or slightly critical level deficiencies. Fertility index of nitrogen and sulpher is assessed to be low as well.

6. SOCIAL IMPACT PATHWAY

The overall theory of change is broken down into four different impact pathways – economic, environmental, social and value chain. The social impact pathway is presented in figure 29 below. There are inter-relationships between the different impact pathways which are explored in the overall synthesis and conclusion chapter.

This chapter explores social impact pathways through developing understanding of the baseline status of:

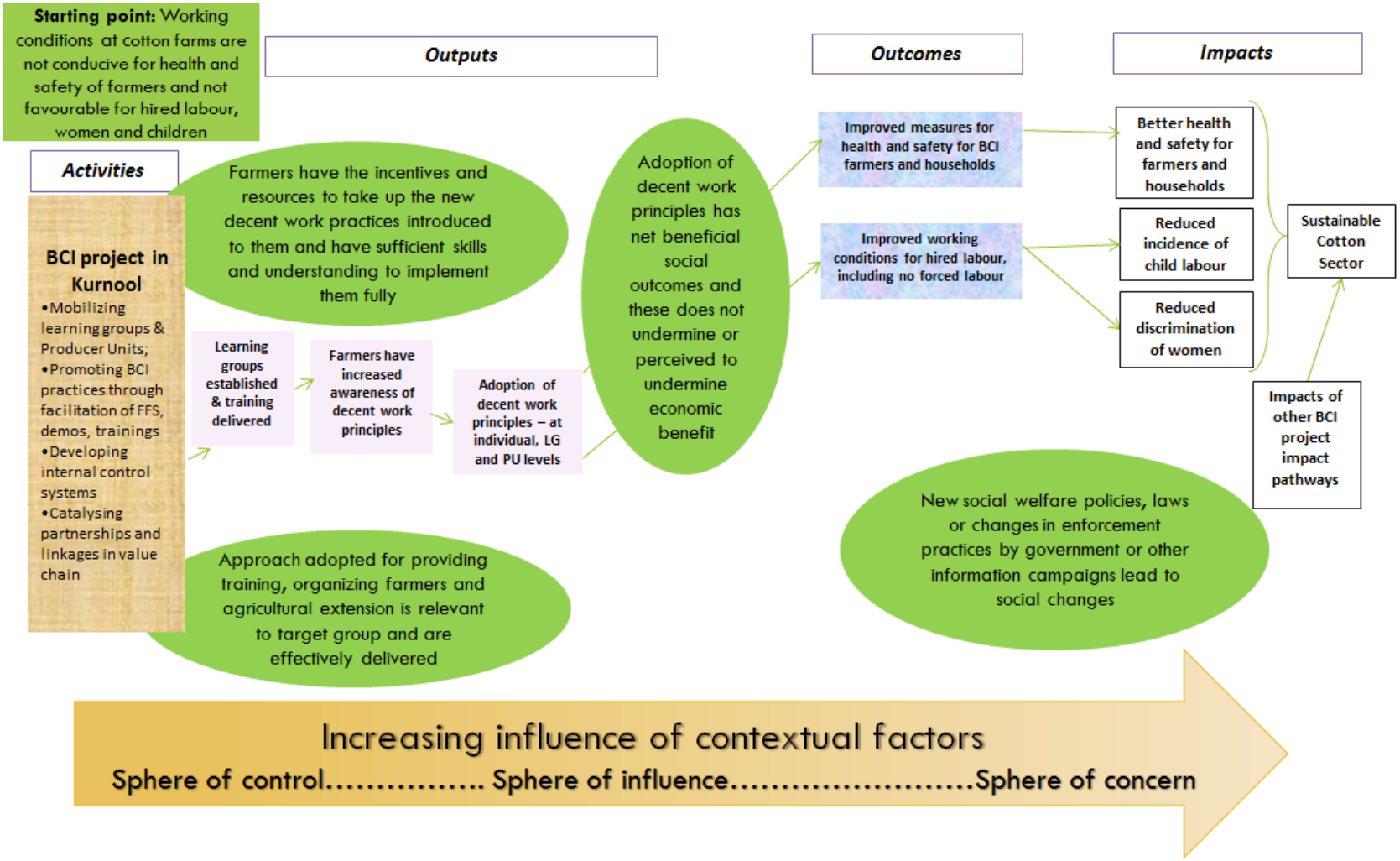
- BCI project activities
- Outputs which can contribute to social outcomes and impact
- Social outcomes
- Social impact

This section presents the baseline data gathered against the theory of change. In some parts of the theory of change we present the baseline status (e.g. the current level of decent work awareness), but for other elements (e.g. training delivered) there may be a zero score given that this is a 'before' project scenario. We will also explore (in monitoring studies and at impact evaluation stage) the implicit assumptions which need to hold true at the transitions (activities to output, output to outcomes, outcomes to impact) for the 'social impact pathway' and for the overall theory to work – against the baseline data.

It will be important to identify alternative pathways to observed outcomes, through qualitative enquiry which reaches beyond the confines of the intended theory of change, in order to more accurately reflect contribution of the intervention vis-à-vis other contextual drivers.

The starting point for social impact pathway is the current status where working conditions at cotton farms are not conducive to health and safety of the farmers and not favourable for hired labourers, women and children. The BCI project activities of learning group mobilization, and the promotion of better cotton practices (related to decent work) through farmer training, learning group and producer unit level sensitization are expected to lead to increased awareness and adoption of decent work principles among farmers, learning group and producer unit level. This is expected to result in better health and safety for the farmers and hired labourers. Improved social welfare combined with outcomes and impacts of other pathways (environmental, economic and value chain related) can ultimately result in a sustainable cotton sector. The research will track how this happens over the next four years and what are the accompanying assumptions that should hold true for this to happen e.g. farmers, learning group and producer unit should have the incentives and resources to take up the new decent work practices introduced to them and have sufficient skills to implement them.

Figure 29: Social Impact Pathway



6.1 SOCIAL IMPACT PATHWAY - OUTPUTS

6.1.1 LEARNING GROUPS AND PRODUCER UNIT

The BCI project has mobilized 56 learning groups. More groups will be promoted by the project in due course of time. These groups will be federated into a producer unit in year three of the project. The decent work principles apply to individual farms, learning group and producer units. The minimum production criteria related to decent work prescribes:

- **Freedom of association:** Smallholders (including tenants, sharecroppers and other categories) have the right on a voluntary basis to establish and develop organisations representing their interests.
- **The PU has a time-bound plan** for the prevention and progressive eradication of child labour in accordance with ILO convention 138 and to improve the position of disadvantaged groups.
- **Children at family farm:** Exceptionally in the case of family smallholdings, children aged under the national minimum age for access to employment may help on their family's farm in certain defined conditions, and these conditions are cumulative:
    - children may only work on family smallholdings if their work is structured so as to enable them to attend school;
    - this work should not be so demanding as to undermine their education;
    - they should not perform tasks that are hazardous for them because of their age;
    - they must be guided – both in terms of learning skills and supervision of tasks – by a family member;
    - they have attended appropriate training
- **No forced labour:** Employment is freely chosen: no forced or compulsory labour, including bonded or trafficked labour.

The study has generated data points related to level of compliance on decent work practices at household level. Given that learning groups are just being formed and the producer unit will come up only in third year, the study will examine the status and achievements on above at learning group and producer unit level during the monitoring rounds.

6.1.2 FARMERS' AWARENESS OF DECENT WORK PRINCIPLES

It is clear from the baseline qualitative enquiry that there is very limited knowledge of decent work principles with respect to non-discrimination against women and child labour. Contracts, provision of sanitation facilities, and equal pay for women and men are all absent. Provision of water for drinking and handwashing is also variable. Child labour is evident, but reports vary as to the level of awareness of this issue. Awareness of gender discrimination was also extremely limited.

Awareness of the health and safety risks in cotton farming is found to be fairly limited. In many cases, respondents said that that cotton farming was not hazardous. Although many could report cases of hospitalization from exposure to pesticides by those spraying, few articulated the longer-term potential health risks of pesticide exposure.

6.1.3 FARMERS' ADOPTION OF DECENT WORK PRINCIPLES

As this is the baseline survey it is not possible to assess the extent to which farmers have taken up the BCI decent work principles based upon the training provided by PRDIS. The household level knowledge and application of decent work issues is presented in table below.

Table 14: Baseline level of compliance on decent work related practices

Better Cotton Practice	% Farmers – Treatment		% Farmers – Control	
(Production principles - 6)	*Knowledge*	*Application*	*Knowledge*	*Application*
Access to potable and washing water is provided for workers/hired labour	87	77	92	91
Workers receive regular health and safety training appropriate to the work that they perform	51	34	60	48
There is no child labour	36	33	57	51
For hazardous work, the minimum age is 18 years	41	33	61	51
Employment is freely chosen: no forced or compulsory labour, including bonded or trafficked labour	37	34	51	48
Waged workers are paid wages at least equivalent to the applicable legal national minimum wage	69	47	78	64

6.2 SOCIAL IMPACT PATHWAY - OUTCOMES

6.2.1 WORKING CONDITIONS FOR HIRED LABOUR

Currently, contracts are not given to hired labourers, and there is no provision of sanitation facilities for workers. Women and men are not paid equally for the same work. Provision of water for drinking and handwashing is also variable.

According to the FGD participants they are currently hiring labour from the local community, within the village and near-by villages. During sowing, they usually hire both local labour and during harvesting they're hiring from nearby villages. Demand for hired labour spikes during the cotton harvesting period and so during this time they hire both men and women. Most farmers obtain hired labourers by informing auto-rickshaw and mini-van drivers of their need for hired labour and the intermediaries then seek this labour in nearby locations (usually within twenty to thirty kms), bringing mostly women to work on the farm.

The Women particularly are involved in picking the cotton and men collect the cotton and carry heavy loads. The women in a FGD said that they work for six to seven hours a day (from 10 am to 6 pm with a one hour lunchbreak). They do not receive any training on these tasks, and each said that they have plenty of experience. More women are employed as hired labourers. Where reasons are given for this by male and sometimes female farmer interviewees is that women are 'more patient', for example, and are more able to do the arduous labour. This reflects a legitimation strategy for gender inequality which has been internally socialized by women and men.

There is no fixed contract when labour is procured in this way. The intermediary is paid a commission of thirty to fifty Rs ($0.46 or 0.76) depending on the distance travelled.

Women are paid less than men. During general work women are paid Rs 100-120 or 150 and men Rs 200-300 per day. In another FGD they said that women are paid Rs200 per day, while men are paid Rs 300 per day. During the harvest period workers are paid by the weight they can harvest (i.e. piece

rates), rather than given a fixed daily wage. The charges range from Rs. 6 to 10 per kilogram ($0.09-0.15).

'Our own village people are not enough for the work, so we depend on outside labourers. Whenever we face a shortage of labour then we hire from other villages. There is no selection of labour based on any caste or religion. Women are mostly selected during sowing. Women and children were selected during harvesting for faster process and simple calculations'.

Women participants in an FGD said that they do not stay in the village overnight, but return home each evening. The work in cotton is not available all year round - wage work is only available for nine months of the year and in summer for three months there is no work.

Child labour is fairly widespread, but reports vary as to the level of awareness of this issue.

6.2.2 OBSERVANCE OF HEALTH AND SAFETY MEASURES FOR BCI FARMERS AND HOUSEHOLDS

The key health and safety issues were reported in the qualitative work as follows:

- Pesticide exposure
- Risk that women experience on health and safety
- Exposure to hot sun (heatstroke)
- Snake and scorpion bites

Pesticide exposure: With respect to pesticide exposure, the level of spraying has increased significantly with the shift to Bt cotton, which is likely to be creating greater exposure of farmers to the pesticides.

Spraying is a task ascribed to men, so it is men who are generally most directly exposed to this risk. However, women in FGD discussions also said that they may help men by mixing the pesticides in a bucket, and they get a headache as a result.

Photo 7: Farmer ready to spray

Protective clothing is rarely used, such as helmets, face masks, boots and eye masks (exceptions). One of the reasons for not using protective equipment was that they hinder the work.

'Sir, if we wear helmet or spectacles are a few hours this glass becomes covered with pesticides and we cannot see and move along the field. Some company representatives came and introduced these to us' (FGD participant).

Some farmers mentioned taking the following precautions to reduce their exposure to the chemicals: avoiding the chewing of tobacco while spraying; not smoking while spraying; not drinking water while spraying.

When a pesticide container is opened a strong smell emerges and if the farmer is directly exposed to this while mixing the chemicals then the impact is said to range from strong skin irritation, burning of the eyes, dizziness, dullness, a burning sensation in the stomach, breathlessness, headaches, body pains and burning sensation on the face, to nausea and vomiting and in severe cases hospitalizations involved. In Chinnaharivanam village FGD participants said that every year at least 10 to 12 people are hospitalized due to pesticide spraying and need treatment for four to five days before they can return home. Some interviewees said that fevers and coughs result after spraying of pesticides. Exposure tends to be worst when the crop height is similar to that of the person spraying (FGDs). Persistent illnesses were not said to result from pesticides, but it is likely that awareness of the potential longer-term health effects is limited. In another village, a participants reported having vomited and been hospitalized following pesticide spraying.

'Once I was spraying pesticide for Ajwan 5 years before; after washing hand had food same evening while coming back to home fell down and hospitalized for 5 days. Doctor said my body couldn't bear the chemicals; it was very strong in nature' (FGD participant).

Exposure to pesticides appears to be less for more educated households. Women in relatively better off houses only supervise farm work and do not participate in cotton production activities and so avoid health related issues. In Chinnaharivanam, the women in the FGD said that their husbands recognized the labels of the powerful pesticides and do not use them, they instead use less expensive pesticides such as monocrotophos (Rs 500 per litre). Pesticides used in October and November are more costly due to heavy demand as the plant is almost fully grown at this stage and they have a longer duration of impact on the pests on the crop.

While applying potash a few farmers also reported experience headache and skin irritation.

Health and safety risks that women experience: Women suffer from pain in their back and legs from cotton cultivation tasks and their skin on their feet peels off after working in the paddy fields (Particularly during the transplanting when they have to work in the water soaked fields). Women said they get severe pain in the legs and back due to the type of work they do which requires long hours of standing. This is because women tend to have a higher work burden in cotton production tasks, except for spraying and ploughing, when working on their household lands or in wage labour. During inter-cultivation (weeding between the rows of cotton), they experience such pains and especially have pain in their knees. During harvesting, when the cotton is picked the cotton bolls prick into their eyes. Scratches on the skin also occur during cotton harvesting and Saris (clothes) are torn.

Exposure to sun /heatstroke: It was also widely reported that exposure to the sun and heat can affect farmers and labourers while working in the cotton fields. One group of FGD participants said that even bullocks can faint as the heat can be so intense. In Chinnaharivanam village, it was reported that eight to ten people fainted and had to be treated in hospital for four days due to heat exposure.

Further, the FGD participants said that some farm workers who overheat working in the summer picking cotton can get a fever as a result and sometimes this is the result of not having enough drinking water – some bring water with them but do not have enough for the entire day and they have to supplement their supplies with rainfall or from open areas of water, such as small ponds. In some cases hired labourers are given drinking water and sometimes they also provide water for washing hands, but not always.

'Drinking water we carry with bottle, without touching we drink directly without washing. When this water is finished we use to use water from small water ponds which reserves rain water for almost 1-2 months'.

In one of the FGD participants reported the risk of being bitten by scorpions and snakes. They reported that once two people from the same family had died due to snake bite while working.

6.3 SOCIAL IMPACT PATHWAY - IMPACTS

6.3.1 INCIDENCE OF CHILD LABOUR, PARTICIPATION IN SCHOOLING

An issue associated with hired labour is that some women, depending on their home and economic circumstances, have no option but to bring their children, including children below 14 years of age, along to work in the farm. If the farmer were to resist the presence of the children, then the labourers would have to leave the farm. The hired labourers are relying upon this income to make ends meet. Also as the farm operations need to be completed in a timely manner, farmers accept the situation. Most farmers said the presence of children becomes an issue only in the harvest season, as child labour becomes an additional source of income for the family - children are paid the same rate as an adult worker (a piece rate). Otherwise our respondents said their own children work in their own farm if required – beyond the holidays and days off school. Children who work on the cotton farms are involved in all tasks, except pesticide spraying. Children working the cotton fields report body pains, giddiness and headaches according to the FGD participants. In one women's FGD they said that on Saturdays and Sundays at least 100 to 150 children are working in the cotton fields. In Chinnaharivanam, FGD participants said that during the holidays children work in the fields to cover their book and pencil expenses for school, and they work on their own farms doing weeding and cotton picking. Only a few members of the FGD said that few children go to the fields during school days.

Reports among farmers interviewed on awareness-raising activities on child labour issues in the region are limited. Only in a few cases has been some information shared, for example in one village by a UNICEF worker. However, in some FGDs it was clear that the participants were aware of labour norms, i.e. that children below 18 should not be involved in farming, especially during school hours.

6.3.2 DISCRIMINATION AGAINST WOMEN

There is widespread and entrenched gender inequality. There is little recognition of women's rights with respect to education and land tenure. Women and men are not paid the same rates when they work as hired labourers. Women have more limited access to education, and are less involved in household decision-making. They have a greater work burden – in domestic and reproductive tasks as well as in farming. Men also work in the fields in ploughing and spraying, and they tend to control

the marketing of the cotton and have greater mobility than women, travelling to Adoni town to see the *dalal* to raise loans or to sell the cotton.

The gender division of labour in cotton production is continued in hired labour situations, with more women employed in hired labour and women working in all tasks except for ploughing and pesticide spraying, and men being involved more in ploughing, harrowing, inter-cultivation, agrochemical applications and pooling of cotton bags together.

In addition to the qualitative inquiry, the baseline status /socio-economic situation of women and girls in the context of cotton production in Adoni is understood by the study through specific questions in the household survey, related to following nine aspects:

i. Educational attainment
ii. Decision making in cotton production
iii. Access and control over income
iv. Membership to community institutions and leadership roles
v. Financial inclusion (bank account)
vi. Participation /involvement in activities of the BCI project
vii. Involvement in hazardous work
viii. Wage discrimination
ix. Working conditions on the farm – availability of clean drinking water

We present the baseline findings from the household survey on the 17 indicators associated with above nine aspects which provide indications on the existing socio-economic status of women in Adoni. The data below is currently presented for all the surveyed households (treatment and control groups). We will be able to conduct separate analysis in monitoring round of the study.

Table 15: Socio-economic status of women and girls in Adoni (in the context of cotton production)

Baseline status / socio-economic situation of Women and Girls in Adoni, in the context of cotton production				
Aspect	**Indicators**	**Status check parameters**	**N**	**% women**
i. Educational attainment	1. Level of educational attainment of wife or female head of household	Illiterate	890	71%
		Literate without formal schooling	161	13%
		Literate with formal schooling	199	16%
ii. Decision making in cotton production	2. Involvement in decisions regarding how much cotton to grow	Have idea, takes decision independently	151	21%
		Consult husband but decide self	72	10%
		Require permission for her ideas	13	2%
		Husband consult her	389	53%
		Husband decides without consulting her	104	14%
iii. Access and control over income	3. Amount of income (Rs.) of wife or female head of household	No Primary Income	138	19%
		up to 10,000	187	25%
		Between11,000 - 20,000	136	18%
		Between 21,000 - 40,000	126	17%
		Between 41,000 - 81,000	94	13%
		Between 81,000 - 1,00,000	29	4%
		Between 100,000 - 1,50,000	15	2%
		Between 1,50,000 - 2,00,000	9	1%

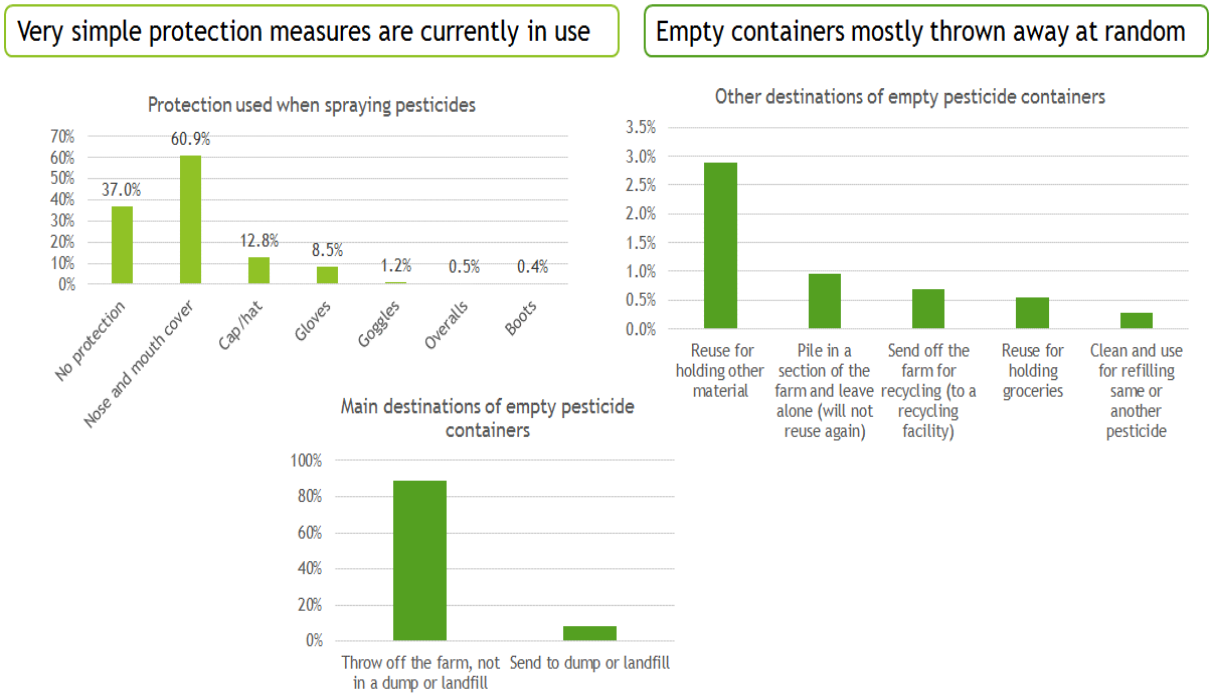
Baseline status / socio-economic situation of Women and Girls in Adoni, in the context of cotton production				
Aspect	**Indicators**	**Status check parameters**	**N**	**% women**
		Above 2,00,000	4	1%
	4. Control over income made from cotton production	Complete control	33	5%
		Consult husband but decide self	203	28%
		Require permission from husband, with her ideas	393	55%
		Give money to other person	86	12%
	5. Does wife or female head of household work on other cotton farms as labourer	0 - No	286	39%
		1 - Yes	443	61%
	6. Equal wages	0 - No	563	77%
		1 - Yes	165	23%
iv. Membership to community institutions and leadership roles	7. Is wife or female head of household part of learning group	1 - Yes	17	2%
		0 - No	712	98%
	8. Have you spoken in publice	1 - Yes	3	0.4%
		0 - No	726	99.6%
	9. Leadership positions in learning group	1 - Yes	-	0%
		0 - No	729	100%
	10. Leadership positions in producer unit	1 - Yes	-	0%
		0 - No	729	100%
v. Financial inclusion (bank account)	11. In whose name is the bank account	0 - Man	631	86%
		1 - Woman	101	14%
		2 - Joint	1	0%
vi. Participation /involvement in activities of the BCI project	12. Number of project activities in which the wife or female head of household took part (out of 20)	Less than 4	729	100%
		4 - 8	-	0%
		9 - 12	-	0%
		13 - 16	-	0%
		17 - 20	-	0%
vii. Involvement in hazardous work	13. Number of person days women were hired for fertiliser application, insecticide application and spray	High number of days	-	0%
		Medium number of days	-	0%
		Low number of days	729	100%
	14. Was a pregnant woman working on the farm	1 - Yes	-	0%
		0 - No	729	100%
viii. Wage discrimination	15. Labour rate of women divided by labour rate of men: All types of agricultural field work	> 1 (meaning women's rate was higher than men's rate)	-	0%
		1 (exactly equal)	-	0%
		>= 0.9 (women's rate slightly lower)	729	100%
		>= 0.8 (women's rate quite a bit lower)	-	0%
		< 0.8 (women's rate much lower)	-	0%
	16. Labour rate of women divided by labour rate of	> 1 (meaning women's rate was higher than men's rate)	729	100%

Baseline status / socio-economic situation of Women and Girls in Adoni, in the context of cotton production				
Aspect	**Indicators**	**Status check parameters**	**N**	**% women**
	men: Harvesting/Picking the cotton (per kg)	1 (exactly equal)	-	0%
		>= 0.9 (women's rate slightly lower)	-	0%
		>= 0.8 (women's rate quite a bit lower)	-	0%
		< 0.8 (women's rate much lower)	-	0%
ix. Working conditions on the farm – availability of clean drinking water	17. Longest distance to reach clean water	0 - 0 minutes carried from home	14	2%
		1 - 0 minutes provided by landowner	364	55%
		2 - <5 minutes	84	13%
		3 - 5-10 minutes	147	22%
		4 - 11-20 minutes	57	9%
		6 - more than 60 minutes	1	0%

6.3.3 HEALTH AND SAFETY

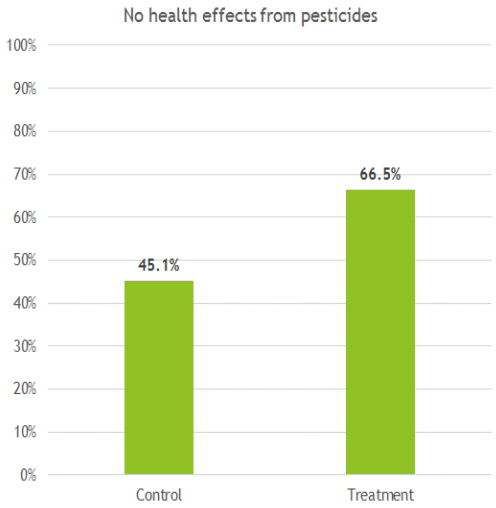
Health and safety level impacts are expected to result due to better protective clothing while doing pesticide spraying and also due to improved working conditions for women, children and hired labourers. The study will track the status and results of health and safety measures being promoted by the BCI project.

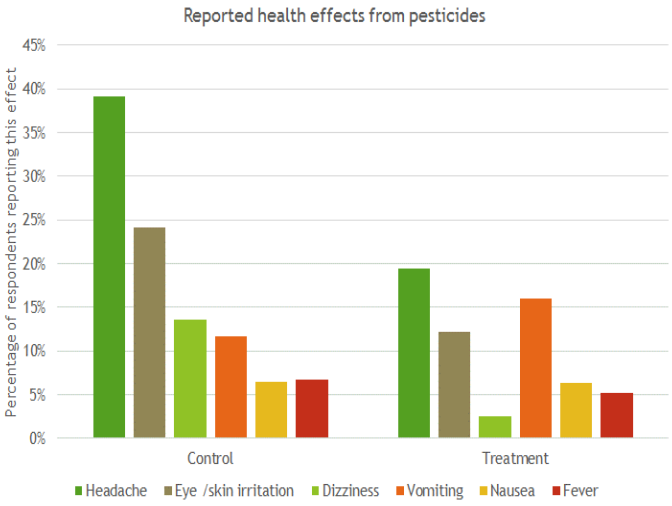
Figure 32: Baseline level of health and safety measure in pesticide use



Only rudimentary protective measures are being taken and the level of awareness on health effects is low among Adoni farmers as is shown in the figure 29 below. Awareness of the health and safety risks in cotton farming was fairly limited. In many cases, respondents said that that cotton farming was not hazardous. Although many could report cases of hospitalization from exposure to pesticides by those spraying, few articulated the longer-term potential health risks of pesticide exposure

Figure 33: Level of reported awareness and health issues faced due to unprotected pesticide use





7. COTTON VALUE CHAIN IMPACT PATHWAY

The overall theory of change is broken down into four different impact pathways – economic, environmental, social and value chain. The value chain impact pathway is presented in figure 32 below. There are inter-relationships between the different impact pathways which are explored in the overall synthesis and conclusion chapter.

This chapter explores value chain impact pathways through developing understanding of the baseline status of:

- BCI project activities
- Outputs which can contribute to value chain outcomes and impact
- Value chain outcomes
- Value chain impacts

This section presents the baseline data gathered against the theory of change. In some parts of the theory of change we present the baseline status (e.g. the current level of awareness regarding better cotton in the supply chain) but for other elements (e.g. sensitization training delivered to ginners) there may be a zero score given that this is a 'before' project scenario. We will also explore (in monitoring studies and at impact evaluation stage) the implicit assumptions which need to hold true at the transitions (activities to output, output to outcomes, outcomes to impact) for the 'value chain impact pathway' and for the overall theory to work – against the baseline data.

It will be important to identify alternative pathways to observed outcomes, through qualitative enquiry which reaches beyond the confines of the intended theory of change, in order to more accurately reflect contribution of the intervention vis-à-vis other contextual drivers.

The starting point for value chain impact pathway is the current status where farmers lack access to finance and there is no recognition of better cotton and its certification in the market. The BCI project activities of learning group and producer unit mobilization, and facilitation of enabling mechanisms (finance and markets) are expected to lead to increased level of access to finance and markets for the farmers and increased recognition of certified suppliers by the market, along with establishment of chain of custody system with identified gins. This along with other such outcomes are expected to result in improved livelihoods of the farmers, which when combined with outcomes and impacts of other pathways (environmental, economic and social related) can ultimately result in a sustainable cotton sector. The research will track how this happens over the next four years and what are the accompanying assumptions that should hold true for this to happen e.g. market demand for better cotton and other incentives should continue to motivate farmers to form and sustain Learning Group and then Producer Unit.

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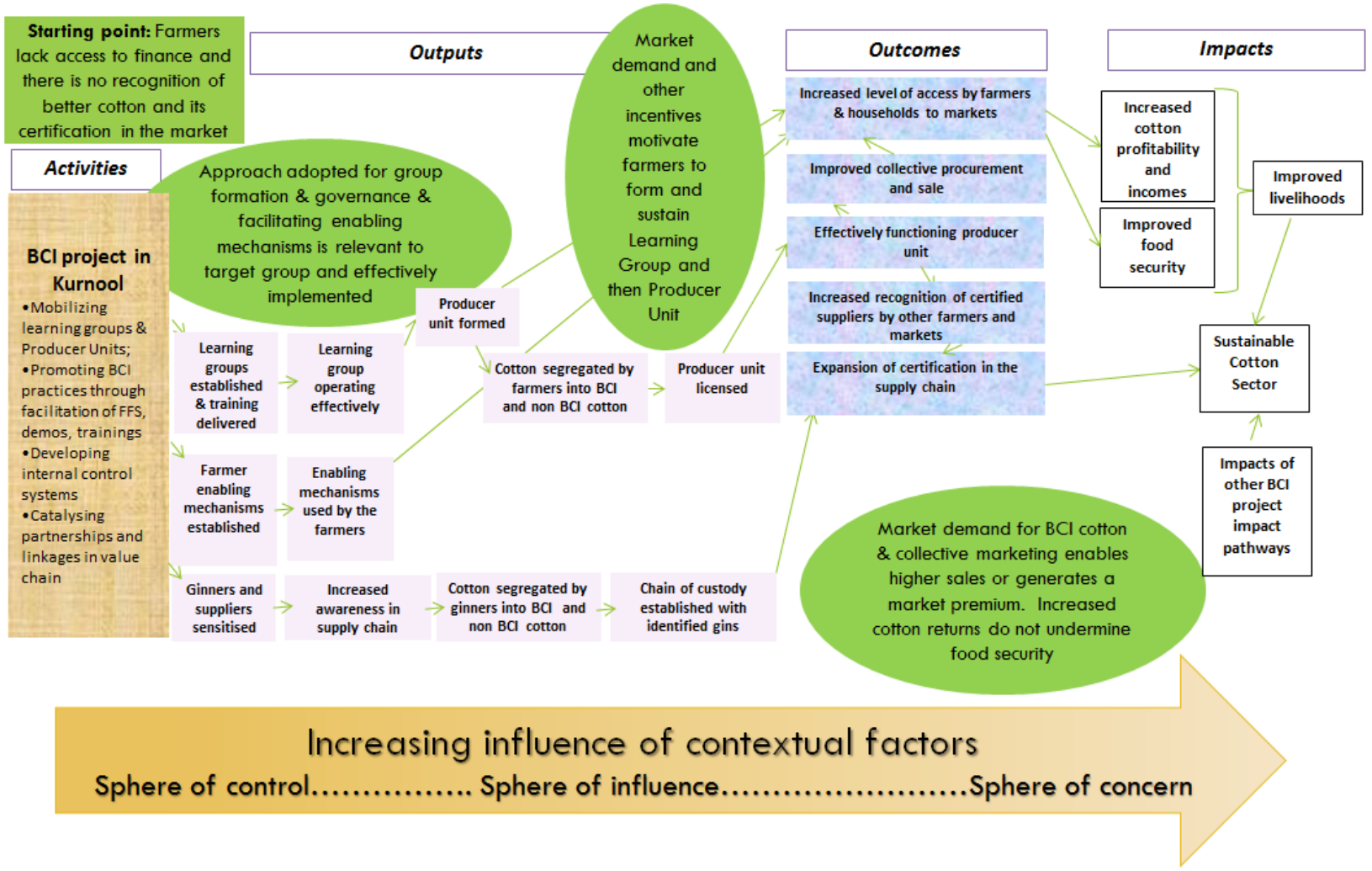
Figure 34: Value chain impact pathway



7.1 VALUE CHAIN IMPACT PATHWAY – ACTIVTIES AND OUTPUTS

7.1.1 LEARNING GROUPS & PRODUCER UNITS

See section 4.1.2

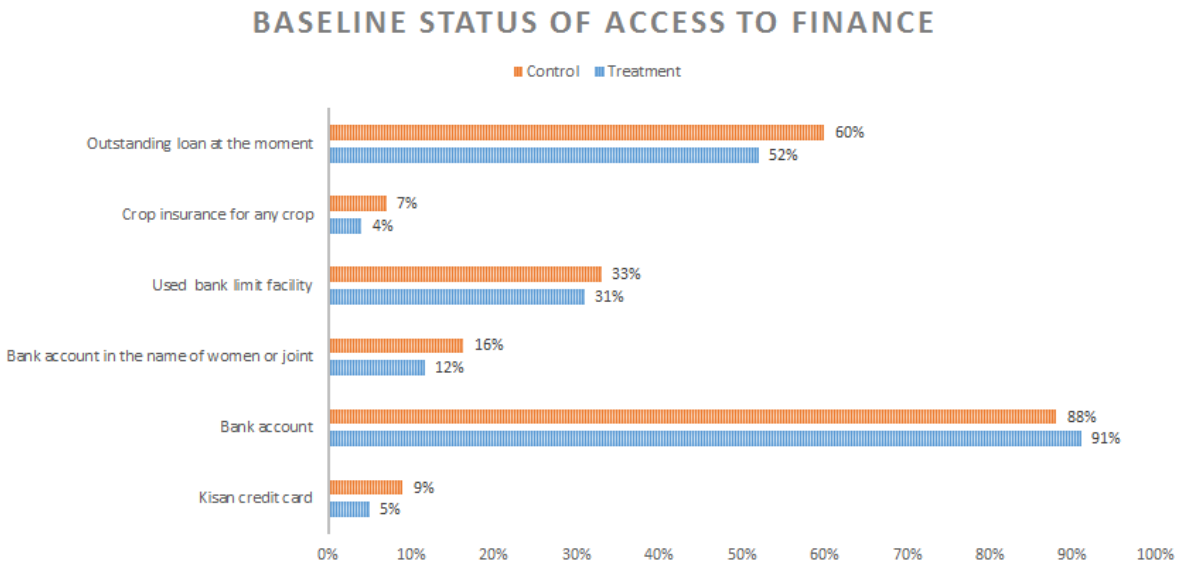
7.1.2 CATALYSING PARTNERSHIPS AND LINKAGES

The BCI project by PRDIS is working with the local unit of the Agriculture Department and also with other government agencies and state level research institutions to develop extension packages and trainings for the farmers. The project plans to engage with ginners for sensitizing them towards better cotton. Similarly PRDIS is expected to facilitate financial and market linkages for the BCI project farmers. The PRDIS also shared about the potential association with AME foundation for initiating efforts related to 'decent work' principle of BCI. At the baseline level, none of these linkages are concretely available. As the project progresses, the evaluation team will seek to clarify the exact nature, extent and implementation of the training provided in order to understand how it influences outputs, outcomes and impacts.

7.1.3 ENABLING MECHANISMS FOR FARMERS

Currently, farmers lack proper access to low cost finance. While most of the farmers have bank accounts, many are indebted and rely on informal loans from Commission Agents, which have relatively high rates of interest. Some 44 per cent of farmers (equally in treatment and control group) have reported having outstanding loan (average outstanding –Rs. 76,853) with banks. Some 21 per cent of the farmers have reported having outstanding loan (average outstanding loan - Rs. 74,049) from money lenders /commission agent.

Figure 35: Baseline status of access to finance



Most of the inputs for cotton production are bought from the dealers in Adoni town. Some families buy the inputs with cash, but others obtain credit. It was also reported that some families mortgage their silver and gold in order to buy inputs.

Indebtedness is highly prevalent among farmers in the FGD discussions. Most of the farmers interviewed said that they have taken loans from the commission agents, who are also known as *dalals*. The cotton is sold primarily to the dalal, as the farmers have financial commitments (i.e. have taken loans from the dalal, who provide them with loans, without requiring collateral – the relationship is based upon trust that the farmer will sell the cotton crop to the dalal to pay off his or her loan). The access to funds via the dalal is important for the farmers, to cover emergencies, household needs and particularly input costs. The range of loans is 5 to 15,000 per acre to pay for inputs, according to one FGD. It requires five to six months usually to pay back this amount, but it depends upon the rainfall – when the rains fail, many farmers take longer to pay back their loans, sometimes up to two years.

The Commission Agents give loans of between 5 to 10,000 Rs, but if the rains do not come the loans can be extended further. Some households obtain cash from the dalal and buy seeds and fertilizers, from other shops, and then sell some or all of their cotton to the dalal to repay the loan. However, with respect to pesticides in one FGD the participants said that the pesticides are bought from the dalal on credit. The few who have not taken loans are free to sell to the dealer of their choice.

During several FGDs it was reported that farmers have to build up a relationship of trust with the dalal over a number of years (i.e. 4 to 5 years) with regular borrowing. At the outset dalals may ask for someone else to provide the borrower with surety.

All of the farmers store cotton at home and sell it usually when a minimum quantity of 4 to 5 quintals has been reached and depending upon their need for cash and the prevailing market rate. In G. Hoselli village FGD participants said that 50% of the farmers in their village hold cotton for one or two months waiting for a better price and the remaining 50% sell immediately after harvest. If the cotton price is too low then all families will try to hold stocks for some time. Some farmers in the FGDs said that there were put under pressure to sell their stock by the Commission Agents before they wanted to sell and could get a good price. The Commission Agents send a clerk from the shop to the farmers' home.

Farmers get market price information from fellow farmers who have been to Adoni cotton market and by telephoning Commission Agents. Some Commission Agents send messages to cell phones. Further, cotton prices are published each day in the newspapers.

7.1.4 SENSITIZATION OF GINNERS AND SPINNERS

The BCI project along with BCI India team has planned to undertake sensitization of selected ginners. The study will be tracking the progress and results of these sensitizations (in terms of better cotton segregation, recognition etc.).

7.2 VALUE CHAIN IMPACT PATHWAY – OUTCOMES AND IMPACTS

7.2.1 FUNCTIONING OF PRODUCER UNIT

The study will be able to report and analyse the functioning of the producer unit, when it comes up in year 3 of the BCI project.

7.2.2 CERTIFICATION & RECOGNITION OF BETTER COTTON IN THE SUPPLY CHAIN

Currently 'better cotton' is not understood or recognized as 'better' in the supply chain in Adoni /Kurnool. This is also due to the fact that there is no 'better cotton' in the supply chain. While the BCI does not promote distinct 'branding' of cotton produced in a better way, still it is important that the market (composed of textile mills, spinners and ginners) demand for a 'better cotton' product in progressively increasing volumes. The market demand can push the incentives for the farmers to produce it and vice versa. The virtuous cycle of demand and supply will need to operate in the Adoni /Kurnool market. The study will track the changes that happen during the course of actions by the BCI project.

7.2.3 CHAIN OF CUSTODY SYSTEM ESTABLISHED WITH IDENTIFIED GIN

As narrated above, the study will watch out for strategies and actions on this front during the monitoring round. At the end line year (2018), the study will be able to comprehensively analyse and report on the achievements and challenges.

7.2.4 IMPROVED FARMER AND HOUSEHOLD ACCESS TO MARKETS

The Adoni cotton market yard is the only market where cotton can be sold for all villages of the Adoni mandal and nearby districts. Men will take cotton either in Auto-rickshaw, min-van or tractor. A normal bag of cotton weighs 25 kgs. A 'butter bag' carries 200 Kgs. A tractor can carry 15 butter bags and an auto-rickshaw can carry three to four bags. For one butter bag the charge is 60 Rs to Adoni. Traders do not come to the villages to buy the cotton. All harvested cotton is stored in the corner of the house in a small moisture free storage area. A fewer farmers still have cotton stored in their houses from last season. They are waiting for better rates: Last year cotton sold at 3000-4000 rupees/quintals (FGDs) for seed cotton (in one location the current market rate for cotton was said to be 3,800 to 4,500 Rs per quintal). The decision to sell cotton is based partly upon the rates the farmer can obtain, but also how desperately they are in need of funds. A few sell immediately after the harvest, and some store the cotton to gain better prices. If cotton is wet it fetches a lower price in the market. Farmers try to separate out cotton that has got wet in the rain as it changes colour and loses quality. Similarly, the last crop of cotton picked, which is harvested when the cotton leaves are already dry, is often dis-coloured from the dried leaves. The market value of such cotton is lesser by Rs.500 per quintal. Group members in one of the FGD said that the 1st and 2nd pickings of cotton are of best quality. Cotton picked after December is of second grade quality. The price difference between good quality and bad quality varies between Rs.150-Rs500.

Photo 8: Cotton being transported to the Adoni market yard

In one FGD the women participants said that women in female-headed households take the cotton to market immediately after the harvest and tend to sell for whatever rate prevails on that day.

Access to bank loans to fund cropping activities is limited. Obtaining a loan from the *dalal* depends upon the level of confidence that the latter has in the farmer and his antecedents. Because of the loan that is outstanding with the *dalal*, farmers usually sell their harvest only to the *dalal* – the quantity sold depends on the outstanding level of the loan. For example, for those earning a cotton income of Rs.100,000 ($1538), then Rs.24000 ($369.2) is used for the interest payment alone. As many farmers do not have major alternative sources of income, such as livestock or income from any other secondary source, paying such a high rate of interest will trap many farmers in a vulnerable situation. The 24 per cent rate of interest keep the farmers in debt and economically they are very vulnerable to price fluctuations in both output and input prices

Farmers in the FGDs said that they prefer to sell the cotton to the *dalal* as they obtain cash instantly in this way as well. In contrast the ginners do not pay cash immediately. A key informant interview with a ginner revealed that until he gets the loan released from the bank to facilitate buying cotton, he is unable to pay the farmers instantly.

Irrespective of the fact whether the farmer has taken loan from the *dalal* or not, farmers have to pay a commission to the cotton buyer and for paying with cash: i.e. Rs.4 ($0.061) per 100 ($1.53) Rs i.e. a (Rs 2) commission to the buyer of the cotton and for paying cash instantly (Rs 2). Access to formal credit is limited to a fixed sum per acre, and this is insufficient for farming and household expenses. Except for one marginal farmer, who reported to be buying agri inputs from his own savings, all other farmers reported to have taken loan from *dalal* and at times from the formal source of credit as well.

Photo 9: Cotton lined up for auction at Adoni market yard

7.2.5 COLLECTIVE PROCUREMENT AND SALE

There is currently no collective marketing and sale of cotton by farmers, who sell individually in Adoni market. PRDIS has plans to establish a Producer Unit, as a federation of the Learning Groups.

8. SYNTHESIS OF BASELINE FINDINGS ON THE THEORY OF CHANGE

8.1 ANALYSIS OF INTERACTIONS BETWEEN THE FOUR IMPACT PATHWAYS

The BCI standards emphasize four main dimensions of sustainability - social, economic, environmental and value chain- which are expressed as impact pathways in this research study. Overall theory of change of the BCI project clearly articulates how interactions between environmental and economic variables or between economic and social variables or other combinations will play out. The baseline findings show some of these inter-connections.

8.1.1 ENVIRONMENTAL VARIABLES VS. SOCIAL AND ECONOMIC BENEFIT

The cost of production is a factor of use of inputs, primarily agro-chemicals like inorganic fertilizers and pesticides. These two items contribute about one third to the cost of cotton production per ha. The baseline results shows clear linkages between lower cost of production and higher profitability. The medium and large farmers are able to achieve higher profits per ha. of their cotton production than the small and marginal farmers, primarily due to their lower cost of production. Lower and balanced use of agro-chemicals can reduce the cost of production, while improving the soil nutrient and soil quality. Furthermore, lower and safe use of agro-chemicals is associated with health and safety benefits for the farmers and hired labourers. The baseline results show how pesticide use is done using very simple protection measure of nose and mouth cover and no proper safety precautions are being taken by large number of farmers and possibly as a consequence of that about one-fifth of farmers have reported health effects (like headache, eye/skin irritation, dizziness etc.).

Overall, the push from multi-national brands and retailers towards sustainable production is for ensuring that cotton that is sourced by them or is part of their supply chain comes from a process which is better for the environment. The BCI project intends to demonstrate that 'what is better for the environment' is also 'better for the farmers' - economically and socially. The baseline results indicate the validity of these linkages.

8.2.2 SOCIAL VARIABLES VS. ECONOMIC AND ENVIRONMENTAL BENEFIT

The process of change within the BCI project will start with establishment of many learning groups and one producer unit involving about 3000 to 4000 farmers in totality. The collectivization and collective learning processes are part of the social change that happens first, which then can lead to consistent adoption of better cotton practices which in turn is expected to provide the necessary economic benefit to the farmers. Clearly economic glue that will ensure farmers motivation to continue to be part of the BCI project is a result of a social mobilization intervention, which means that social capital gets built first which then support the augmentation of financial capital for the farmers. This is true for women as it is for men farmers. Increased women participation in the learning groups (as of now only two 2 per cent are part of the learning group) has the potential to generate better economic benefit to the households.

8.1.3 ECONOMIC VARIABLES VS. VALUE CHAIN, SOCIAL AND ENVIRONMENTAL

The key assumption of the theory of change of the BCI project is that the farmers should see the tangible incentives to continue producing cotton in a better way. The value chain need to provide that incentive to the farmer for the assumption to hold true. The market demand for better cotton is

a key assumption as well. Once that assumption hold, then it can lead to economic benefit to the value chain players (ginners, spinners, and textile mills), as the ginning efficiency and spinners requirements are better met through the characteristic (low trash, contamination and good quality fibre) that the better cotton promises to have. Therefore a virtuous cycle has been initiated in Adoni through the BCI project interventions. If the project is able to create, align and sustain interest of farmers and value chain players, an overall improvement in economic benefit and environmental and social conditions can be expected.

It is necessary to put a point of caution on the sustainability dimension of social change, which may not necessarily be linked with improved economic status of the farmers even though there is some evidence that women of large landholding families are less engaged as hired labour and also that children of these families are less involved during cotton picking times. The working conditions for hired labourers and changes in child labour situation may also require enabling laws related to social security of agriculture labour and strict enforcements of these laws and regulations, which are beyond the remit of the BCI project.

8.2 BASELINE DATA ANALYSIS - LINEAR MIXED EFFECT MODEL

The strategy we adopted was to use a mixed effect model (Douglas Bates, Martin Maechler, Ben Bolker, Steve Walker (2015). Fitting Linear Mixed-Effects Models Using lme4. Journal of Statistical Software, 67(1), 1-48) with village as a random effect and BCI participation, land under cotton, irrigation, education and soil type as fixed effects. For statistical inference, allowance was made for the intra cluster (village) correlation using the Design Effect. Standard errors were adjusted in the same way.

Table 16: Baseline data: Linear mixed effects

Output measure	Intra-cluster correlation coefficient	Mean ± SE Control group	Mean ± SE BCI group	P-value	Significant interactions with other fixed effects
PPI	0.040	62.4±2.2	57.8±2.1	0.21 NS	None
MPI	0.023	0.216±0.012	0.203±0.011	0.54 NS	Land under cotton, p=0.05
RF_BCCI_K_OA	0.056	0.631±0.029	0.547±0.28	0.026*	None
RF_BCCI_A_OA	0.067	0.509±0.023	0.427±0.021	0.0002***	None
RF_BCCI_K_MPC	0.039	0.526±0.018	0.464±0.018	0.002**	None
RF_BCCI_A_MPC	0.058	0.449±0.019	0.379±0.019	0.0003***	None
IRR_BCCI_K_OA	0.163	0.685±0.015	0.561±0.016	0.21 NS	
IRR_BCCI_A_OA	0.243	0.6±0.015	0.509±0.017	0.42 NS	
IRR_BCCI_K_MPC	0.169	0.721±0.015	0.620±0.018	0.36 NS	
IRR_BCCI_A_MPC	0.206	0.651±0.018	0.590±0.019	0.66 NS	
yield -rainfed (Kg/Ha)	0.036	527±13	531±15	0.95 NS	None
yield -irri (Kg/ha)	0.054	678±5	631±3	0.13 NS	none
Production efficiency (Rs./Kg)	0.028	39.2±0.29	39.9±0.22	0.06 NS	none

Output measure	Intra-cluster correlation coefficient	Mean ± SE Control group	Mean ± SE BCI group	P-value	Significant interactions with other fixed effects
Cost of production (Rs. per Ha.)	0.018	25972±462	26931±413	0.09 NS	Land under cotton, p<0.01 Irrigation, p<0.05
Profit (Rs./ha)	0.028	39132±748	40752±698	0.09 NS	none
Inorganic fertiliser cost	0.014	4169±230	4884±239	0.012*	
Seed cost	0.089	7739±400	6802±240	0.026*	
Pesticide cost	0.017	3124±187	3498±167	0.16 NS	
Urea use	0.015	330±35	403±50	0.24NS	
Complex use	0.003	104.5±19	68.6±13	0.14 NS	
Acephate use	0.034	0.672±0.08	0.714±0.1	0.88 NS	
Monochrotophos use	0	0.98±0.02	1.01±0.02	0.58 NS	
Ulala use	0.033	0.041±0.023	0.209±0.056	<0.0001***	

This analysis shows that there are no significant baseline differences in poverty measures between control and treatment groups, and that control groups have slightly (but statistically significantly) higher knowledge, application (of BCI recommended practices) and cost measure scores than do the participation groups. For the profit measure, the treatment groups have significantly higher scores than the controls. These baseline differences will be allowed for in the final data analysis.

There is very little sign of any significant interaction between the other potential predictors (land under cotton, use of irrigation, education, and soil type) and control/treatment group membership for the poverty, knowledge and acceptance indicators, confirming that the randomization process has worked well, and that the groups are not significantly biased with respect to these predictors. Cost and profit indicators do show some significant interactions with the predictors.

9. METHODOLOGICAL LESSONS

9.1 THEORY BASED EVALUATION IN THE VSS CONTEXT

The use of theory based evaluation is now fairly well established with respect to impact evaluation of voluntary sustainability standards. However, there is still scope for innovation. The theory of change can be used at baseline stage to identify *potential* weak links in the implicit assumptions, which may be useful to stakeholders.

It is useful to unpack the intervention package given that the project involves a portfolio of activities and processes. It will be important to monitor closely the actual implementation processes undertaken by the implementing partner, PRDIS, in order to conduct process tracing on the theory of change and to establish where it has held true and where there are weak links. This type of analysis can provide insights into how a VSS may or may not have impact – complementing the randomized control trial that establishes rigorous attribution of impact in a particular case. In this study we have unpacked a number of impact pathways – economic, environmental, social/decent work and value chain. These will be intertwined in reality and the field research will explore these interconnections, but by breaking up the theory of change it may be easier to closely follow and test causal linkages of a portfolio intervention.

9.2 EXPERIMENTAL RESEARCH IN THE VSS CONTEXT

The randomized control trials are a viable option in VSS contexts as is proven by this study. Applying RCT methodology combined with TBIE can improve assessment quality and validity. However application of RCT methodology will require precision thinking and enabling conditions. Achieving methodological rigour in RCT require certain pre-conditions of resources, suitability of context, willingness of the implementation agencies and private sector partners, and also of reliability of standards own internal control systems.

The study provides a methodological lesson in constructing a counterfactual in VSS impact research. The research design of Cluster RCT with matched pair randomisation within different strata (selected based on bio-physical and socio-economic parameters) is an innovative approach to constructing a counterfactual. On applying the Linear Mixed-Effects Models, it is known that there is very little sign of any significant interaction between the potential predictors (land under cotton, use of irrigation, education, and soil type) and control/treatment group for the poverty, knowledge and application (of BCI recommended practices) indicators, confirming that the randomization process has worked well, and that the groups are not significantly biased with respect to these predictors.

The study design also includes a representative household panel (based on anticipated heterogeneity) to be tracked over four years. The panel is not known to the BCI project reducing the changes of biased attention. The behaviour of the panel with respect to other members of the treatment and control group will offer methodological lessons to constructing such a panel in VSS impact research.

9.3 OTHER METHODOLOGICAL LESSONS

Longitudinal studies or interim performance monitoring can potentially enhance the quality of overall assessment.

The research employs a methodology for tracking the programmatic exposure of the cotton farmers to various BCI project activities (treatments). This will help the researchers in validating the contribution of the project, alongside other explanatory variables, including a qualitative enquiry analysing the theory of change, unpacking other potential routes to observed outcomes and exploring unintended and unexpected impacts.

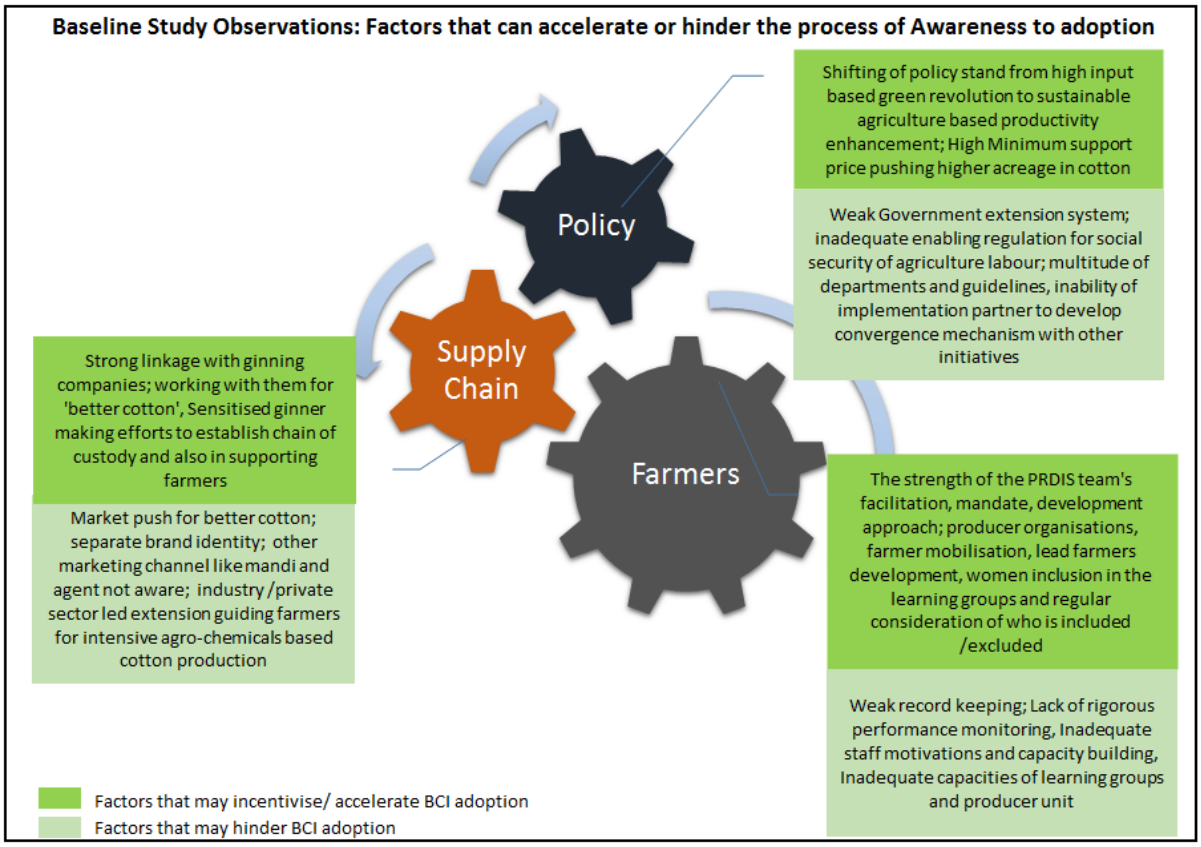
The BCI verification /certification is awarded to the producer unit (based on a three-tier assessment of sample members). The research charts out the progression of each individual member over a period of time in terms of their knowledge and application of BCI recommended practices. It also tracks the outcome variables (cost of production, yield, profitability, pesticide use etc.). The correlation between practices and outcomes are analysed. The research team have developed an index called Better Cotton Composite Index (BCCI) which tracks every member of the learning group (also those who are not part learning group in the intervention set and those belonging to 'control' set) in terms of their knowledge and application of BCI recommended practices. This is a simple and potentially replicable analytical tool.

10. CONCLUSIONS AND POINTERS FOR REFLECTION

The baseline findings generate following conclusions and pointers for reflection for the BCI system in general and the BCI project in particular:

8. **Awareness to adoption:** The BCCI shows a clear gap in index score on knowledge (.055) and application (0.45). The BCI project will enhance knowledge of farmers. There is an assumption that once farmers receive training they will adopt the practices which they are taught by PRDIS, including reduced use of harmful chemicals, intercropping etc. However, it is clear from the baseline study that farmers strongly believe that their yields will suffer if they do not sustain frequent spraying with pesticides. That presents the challenge to the BCI project in demonstrating benefit and changing existing mind-set of the farmers regarding excessive or imbalanced use of agro-chemicals. The baseline study throws some light on how the process of awareness to adoption can be accelerated as is depicted in the figure 1 below:

Figure 36: Baseline observations on the process of awareness to adoption



9. **Thrust on profitability and not just productivity:** Overall, the work of the government, civil society, and the private sector on agriculture has been confined to the improvement of production and productivity. The interventions related to technology and management practices (encompassing seeds, chemical inputs, and pesticides) are chosen to enhance the level of cotton production. The farmers, therefore, also tend to look at cotton cultivation from the production/productivity enhancement angle while evaluating the need to take up certain interventions. In this scenario, the BCI project can draw the attention of farmers and other stakeholders to improved profitability through cost reduction (less input use) and some

improvement in productivity, additional income possibilities from inter-cropping etc. which will demonstrate a viable economically working model of sustainability standards in a commodity. The study will be able to examine the investment implications of improved profitability towards household productive investments and consequently in poverty reduction.

10. **Market demand for the BCI cotton:** It is not clear whether market demand for BCI licensed cotton will develop. Building the market is not part of the intervention package of PRDIS, and therefore action on building the market relies primarily on BCI via their linkages and engagement with retailers and brands. The theory of change assumes market demand will exist, particularly in the value chain impact pathway.

11. **Inclusion /exclusion of women in the BCI project:** The baseline study shows how gender inequalities are significant. The entrenched gender norms that prevail mean that it will be challenging for the PRDIS project to tackle such norms, without targeted interventions and potentially in concert with other actors. To date very few women are involved in the Learning Groups (4 per cent), but information is also not shared with them by their husbands on matters relating to cotton farming and marketing, because it is often assumed that they do not need to know this information. Even if these women did obtain access to the information it is not clear how far they could implement the new practices without their husbands' consent, as it is male heads of household who control this decision-making and cotton income. Women's labour is also heavily relied upon and they have the triple burden of cotton farming, combined with domestic and reproductive tasks.

12. **Social dimension of sustainability:** As discussed in the social impact pathway, inequities experienced by women, the informal nature of hired labour markets, and the incidence of child labour and health and safety issues are very challenging for the BCI project to address in short period of time (of next few years). The hired labour market is informal and it may be challenging to introduce formal contracts and other elements of decent work principles, as many of the cotton farmers hiring others to work on their farms also have limited means. As many households rely upon this wage labour for their food and income security, it may be difficult to challenge child labour incidence during harvest time, without additional social protection measures. Health and safety training does not reach hired labourers – because few farmers who hire them are not using protective equipment themselves. These changes will require skills, resources and importantly structural /policy interventions (e.g. on social security of agriculture labour). The BCI standards and the BCI project on the ground may be able to bring about changes in awareness on these issues among the right group of people but real changes may be considered as requiring 'long haul' efforts and interventions.

13. **Service provisions to the farmers (financial and market access)**: The baseline study shows how farmers face indebtedness due to the trading relationships of tied finance that the farmers get from the intermediaries (dalal /commission agent). The extent of disadvantage these trading relationships are causing to the farmers need to be explored further during the study. The BCI project is mandated to work on promoting enabling mechanisms (on finance and market access) to the farmers which will require a proper understanding and an appropriate strategy, but it is not clear how far this is likely to occur or feasible for the implementing partner.

14. **The baseline status of participating households offers both opportunities and challenges**: The baseline study shows a very high proportion of illiteracy for both men and women farmers (70 and 88 per cent respectively, illiterate or without formal education). This offers a challenge to the PRDIS team in implementing training and extension services (particularly so as farmers with less education tends to have lower BCCI score), which will need to be oriented towards the learning requirements and learning styles of the participating farmers. The BCCI scores have also shown that some of the farmers are currently following many of the BCI recommended practices. Some of these farmers can be motivators or demonstrators. Given the current low level of knowledge and application of various practices, the BCI project has the opportunity to make significant changes e.g. almost all farmers are using fertilizers and pesticides in unbalanced way (excessively, untimely, in-appropriately, under-use or no use) and only two per cent of farmers are taking nutrient application decisions based on the soil test.

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