

Bamboo for Life and Livelihood in Purnia, Bihar

Discussion Paper 19

MANAGE- Centre for Agricultural Extension Innovations,
Reforms, and Agripreneurship (CAEIRA)



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About the Publication

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Director General's message

Smt. G. Jayalakshmi, IAS

Director General, MANAGE

Bamboo is a versatile crop. It can be used in 1,500 different ways including food, a substitute for wood, building and construction material, handicrafts and paper. It is also considered as poor man's timber. It helps in preventing soil erosion, especially in flood-affected areas. Bamboo produces 30% more oxygen. Because of the vast advantages in cultivating Bamboo, the National Bamboo Mission (NBM) was initiated to provide a new impetus and direction and enable the realization of India's considerable potential in bamboo production.

Northern Bihar is a unique landscape of bamboo with its considerable presence but almost the neglected commodity. Purnia, a flood affected district in north Bihar has the same story, farmers believe in the potentials of bamboo but they do not cultivate bamboo due to several reasons. The Government of Bihar however recognized the gap in 2010 and promoted bamboo nursery in Katihar, a neighboring district. In continuation to that effort the state government included Purnia district along with two other neighboring districts viz Araria and Kishanganj, citing the state's need for rapid industrial growth, bamboo artisan's presence, and prospects of rural livelihood, migration and soil erosion issues in Annual Action Plan 2012 – 13 under National Bamboo Mission which shows the volume of possible all-round prosperity through cultivation of bamboo in Kosi region. Transfer of technology through training and demonstrations form an integral part in the efforts towards promoting bamboo cultivation and bring prosperity back that has been left behind for farmers and bamboo workers of Purnia district over the decades. But the quality of the training needs to be further upgraded to improve the practical knowledge and skills of the stakeholders.

I Congratulate Mr. Anjum Afroz for taking up this study which aims to find those barriers which hinder farmers to cultivate bamboo, associated livelihood for bamboo workers, and underline untapped opportunities for ecological prosperity in Purnia district of Bihar.

(G. Jayalakshmi)



Preface

The study 'Bamboo for Life and Livelihood in Purnia, Bihar' is an attempt to trace the situation of the bamboo cultivation, its utility, and bamboo artisans choosing an alternative source of livelihood among the rural population of Kosi region in northern Bihar with reportedly having more internal migrants across the country.

The present study reviews the potentials of bamboo crop which seems to be left unattended to harness for the rural employment generation in the Kosi region. Bamboo crop can be considered as "Green Gold" as it provides a constant source of monetary benefit for farmers as well as to the environment. By incorporating the better agriculture extension practices and efforts, bamboo cultivation can be made to reach larger farmer masses and realize the benefits through bamboo cultivation.

This study insights has utmost importance for the farmers, rural youth and allied workers in bamboo cultivation, extension officials working for promoting the crop and would set as an example to take up further research in this direction. This will help the public extension service providers to facilitate a concrete dialogue with the state government on the need and promotion of bamboo cultivation for the prosperity of people, environment and economy of the state.

(Saravanan Raj)

Director (Agricultural Extension)

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Abbreviations

AESA	Agricultural Extension in South Asia
ATMA	Agricultural Technology Management Agency
BAMETI	Bihar Agriculture Management & Extension Training Institute
CBO	Community Based Organization
DAC	Department of Agriculture & Cooperation
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
FPO	Farmer Producer Organization
GFDDR	Global Facility for Disaster Reduction & Recovery
GoI	Government of India
ICAR	Indian Council of Agricultural Research
INBAR	International Network for Bamboo and Rattan
KVK`	Krishi Vigyan Kendra
MIDH	Mission for Integrated Development of Horticulture
NABARD	National Bank for Agriculture and Rural Development
NARP	National Agricultural Research Project
NBM	National Bamboo Mission
NGO	Non-Government Organization
SDG	Sustainable Development Goal
SHG	Self Help Group
ToT	Transfer of Technology

Abstract

The amendment of the Indian Forest Act 1927 in view of bamboo's status as grass after a long-time debate based on taxonomy has given a green signal to the pool of opportunities across the bamboo value chain. Indian farmers have an invincible relationship with bamboo for ages with all barriers on the way which significantly led to the reduction of bamboo covers rapidly in the last three decades. Bamboo's versatility in terms of use is so wide that bamboo is being used from cradle to coffin – houses, fencing, daily utility products to high-end industrial products like bamboo tiles and mats. The versatile use of bamboo has the potentials to raise the income of the farmers, a dignified livelihood source for bamboo workers, and a huge capacity to absorb odds in achieving Sustainable Development Goals (SDGs) with its proven contribution in 9 SDGs.

Northern Bihar is a unique landscape of bamboo with its considerable presence but almost the neglected commodity - Purnia, a flood-affected district in north Bihar has the same story, farmers believe in the potentials of bamboo, but they do not cultivate bamboo due to several reasons. The Government of Bihar however recognized the gap in 2010 and promoted bamboo nursery in Katihar, a neighboring district. In continuation to that effort the state government included Purnia district along with two other neighboring districts viz Araria and Kishanganj, citing the state's need for rapid industrial growth, bamboo artisan's presence and prospects of rural livelihood, migration and soil erosion issues in Annual Action Plan 2012 – 13 under National Bamboo Mission which shows the volume of possible all-round prosperity through cultivation of bamboo in Kosi region.

Farmers of Purnia district have sensed the crack in their relationship with bamboo and also felt the losses they incurred but they are not motivated enough to cultivate bamboo in their broken piece of land and lack of knowledge about modern utility and demand for bamboo. This in turn affected the associated livelihood of many artisans and daily wage earners through bamboo work. Despite the local bamboo market's availability in Purnia, farmers are almost out of the bamboo value chain and bamboo's potential remains untapped in the region. A recent change in global perception towards bamboo and the Central Government's seamless efforts towards promoting bamboo cultivation may bring prosperity back that has been left behind for farmers and bamboo workers of Purnia district over the decades. This study aims to find those barriers which hinder farmers to cultivate the bamboo, diminished associated livelihood for bamboo workers, and to underline untapped opportunities for ecological prosperity in Purnia, Bihar.

Executive Summary

The study “Bamboo for life and livelihood in Purnia, Bihar” highlights the key issues faced by farmers in Purnia, Bihar, and how the perception of farmers has been changed over the decades. Farmers in the district have felt the neglect towards and its impact on their life, ecological imbalances and its degradation in recent times. Purnia with a large population of marginal farmers has witnessed how ancestral land division among generations, poor maintenance of the bamboo resources and cultivation of old culms negatively impacted bamboo cultivation. They are not aware of schemes by the Central and State governments and even unaware of the recent amendment of the Forest Act 1927 which opened up the window of opportunities across the bamboo value chain. Farmers have ample opportunity to earn a secure sum by setting up a bamboo nursery on their land using the benefit of the schemes and also by the cultivation of bamboo on barren land near riverfronts.

The study also established the status of the bamboo livelihood in Purnia, on the other hand. This exploration journey exposed the pathetic circumstances of district bamboo workers that can be appreciated by discovering that one out of two respondents has a history of migration in search of livelihoods. More than half of the bamboo workers who have to give up bamboo-based works opt for alternate sources of livelihood and the majority of them end up being daily wage laborers in the construction industry which requires minimal or no skills at all. It's quite remarkable that a significantly very low percentage (14.2%) of bamboo workers opt for farming or agriculture labourers. Purnia is among the focal point of migrant workers in the Kosi region and bamboo has the proven potentials to absorb and check migration if the focused interventions will be carried out by availing skill training which helps these bamboo workers to make value-added products using bamboo.

Purnia is blessed with the institutional resources meant for the agriculture or agricultural extension services as the district has KVK, ATMA, and even an Agricultural College too. But, the finding suggests that despite the complete set of institutional resources, very little effort has been made so far to propagate bamboo or even to transact the knowledge about scientific cultivation of bamboo. Even setting up the bamboo nursery and an information center for knowledge & information sharing can play a magical role in the replacement of old bamboo culm used by farmers for bamboo cultivation. There is no FPO in the district, not even an interest group for bamboo cultivation, association with the union is also missing and hence a formation of any such group is another opportunity to explore.

Here are a few major findings of the study about farmers and bamboo workers which narrates the present scenario and hints at the opportunities that can be tapped for the life and livelihood of the people in Purnia.

A few major findings:

- 8 out of 10 respondents of the farmers are marginal farmers and the remaining are small and semi-medium farmers.
- The majority of the farmers (66.7%) have bamboo culms in 5 Kattha or less area of land merely One-third (34.4%) have 300 – 500 bamboo culms on their lands. It can be observed that farmers have bamboo but not on a large scale.
- Bamboo is not being grown by the farmers for commercial purpose in the locality, the majority of the farmers (64.4%) are not selling their bamboo culms as they say bamboo is for their personal use whereas 23.3 percent of farmers sell some of the bamboos every year to earn a small fraction of amount as and when required i.e. less than Rs 5000.
- Fairly more than half of the respondents consider bamboo cultivation profitable whereas less than half (41.1%) disagree on it and they don't grow bamboo because of unavailability of big plots, bamboos gestation period unavailability of the dedicated market of bamboo etc.
- The majority of the farmers said that the reduction of bamboo areas has been more rapid in the last decade citing the reasons for reduction due to ancestral land distribution among siblings, inattention towards bamboo's potentials and unidentified disease which makes bamboo dry or dwarf in the study area.
- One out of two bamboo workers has a history of migration in search of livelihood.
- Half (55.8%) of the bamboo workers have to adopt alternate source of livelihood and significantly very less (14.2%) opted farming or agriculture labourer, 8.3 percent become unemployed and one-third opted various other minion works in cities where they migrated.
- Migration incidence is 28.3 percent among bamboo workers due to the unavailability of bamboo-based works. Bamboo artisans are least affected than daily wage bamboo workers who making bamboo homes, fencing, etc.
- Self-assessment of bamboo workers highlights the need for some sort of value addition training as only one percent of respondents considered their product as perfect where 22.5 percent of respondents considered that their work is not market competent.

Introduction

Bamboo – A poor man's timber had once a significant presence in farmer's life and a livelihood source to the millions of daily wage laborers in rural India had suffered a lot of consequential threats on its way to sustain so far. There was a time when bamboo was among the main construction materials in rural areas and the main source of income for its growers creating ample opportunities for employing skilled or unskilled laborers in bamboo house constructions, engaging bamboo artisans for a range of daily utility products like baskets, broom, mats, etc. are few to note down here. In a major shift in agricultural practices, demand – supply-based markets and human's insensitivity towards sustainability are key parameters to bring down the bamboo's presence in human lives. All these combined together had affected not just farmer's income but a huge number of bamboo artisans and workers involved in the construction of bamboo houses, fences, etc. While bamboo is considered to be a boon for the rest of the world and India too, Bihar is in its reversal mode. According to Forest Survey of India 2017, a bamboo bearing area in Bihar is 1004 sq.km.in comparison to 739 sq. km. by the year 2011 – a significant increase of 265 sq. km yet stands 21st position among 28 Indian states (with a meager contribution of 0.64% to India's total bamboo bearing area & less than 1% of rest of India excluding bamboo bearing areas of India's Seven Sisters State which are densely covered with bamboo) despite huge potentials of bamboo cultivation in the state, narrates the story of bamboo's disappearance from people's lives in the state.

This study has aimed to understand the consequential changes which resulted in the reduction of cultivation of bamboo and the present mindset of farmers to grow bamboo as an individual or as a group endeavor after 2 years of the announcement of defining bamboo as grass to bring flexibility in its harvesting, transportation and industrial uses.

This study also attempted to trace the situation during the offset period of bamboo cultivation, its utility, and bamboo workers choosing an alternative source of livelihood with a view that whether this shift resulted in internal migration among the rural population of Kosi region in northern Bihar – a region and the state with reportedly more internal migrants across the country.

The core purpose of this study is to review the potentials of bamboo which seems to be left unattended to harness for the rural employment generation in the Kosi region. So that the change in perception of world economies about bamboo from Poor man's timber to "**Green Gold**" reaches to farmers and become a constant source of monetary benefit for farmers as well as the environment by incorporating agriculture extension practices.

The restructured National Bamboo Mission, Scheme of Fund for Regeneration of Traditional Industries and Mission for Integrated Development of Horticulture (MIDH) – a joint mission of the Department of Agriculture & Cooperation (DAC) and Ministry of Agriculture & Farmer's Welfare are the conceptualization factors of this study.

1.1 Background of the study

Recently, in rural areas, people built homes made of concrete that give way to natural building materials such as clay, bamboo, canes, etc. This is in fact a product of many decades of paradigms such as paradigm changes in agricultural activities, government housing schemes in rural India (fostering concrete construction instead of relying on locally used materials) and obstacles to farmers' income and survival killing the category of bamboo as a tree under the Indian Forest Act, 1927, climate change, etc. People of the Kosi region in northern Bihar suffered from the same phenomenon. These phenomenal changes impacted hugely on the bamboo market and most of the retailers across the country. It has been observed that there was a time when retailers and traders from across the country were reaching out to farmers to buy bamboo in the vicinity, giving a good rate for bamboo, but market impact reversed the scenario and these days, farmers have to find out retailers to sell bamboo on retailer's terms and conditions at a meager price without any bargain.

In a recent development, amendment of the Indian Forest Act -1927 as Indian Forest Act (Amendment) – 2017 envisaged encouraging Bamboo Cultivation in Non-Forest Areas. In a Press Information Bureau report dated November 23, 2017; the Government of India recognized bamboo's status in human life quoting as "Bamboo grows abundantly in areas outside forests with an estimated growing stock of 10.20 million tons. About 20 million people are involved in bamboo related activities. **One ton of bamboo provides 350-man days of employment.** Though India has a 19% share of the World's area under bamboo cultivation, its market share in the sector is only 6%." The same report highlights the **current demand for bamboo in India is estimated at 28 million tons**, which means if this demand can be filled by the farmers within the country, a whopping 98 billion man-days can be generated – a sufficient figure to address rural unemployment. With this amendment, the Government of India aims, besides planting on wasteland, farming soil and private field under the Agro-Forestry mission with the intention of doubling farm income, as well as maintaining and sustainably growing, to enable farmers and individuals to plant/block suitable planting bamboo species in the degraded soil. The restructured National Bamboo Mission also seeks to promote market establishment regain the bamboo market momentum through schemes like the establishment of the bamboo depot and godowns, Rural Haat, Bamboo Bazar, and Bamboo e-Trading which gives an immense hope to bring bamboo growers in the same realm to achieve the aims and objectives of the mission.

National Bank for Agriculture and Rural Development (NABARD) has identified the Bamboo sector as the "Thrust Area" and has taken distinct policy initiatives for creating an enabling environment for promoting this sector under the farm and non-farm sectors (Mehra and Mehra, 2007). A case study by NABARD shows the success story of reopening Paper Mill in West Bengal, motivation to the bamboo growers for a constant supply of raw material to those mills for paper making purpose, at fixed terms and better price, also addressing long term disputes between Mill owners and farmer's

in the vicinity which previously resulted in the loss of farmer's income and livelihood opportunities for daily wage bamboo workers.

These moves indeed are the great hope to revive and harness the untapped potentials of bamboo for the benefit of people at bottom of the pyramid by creating bamboo as a source of constant income for farmers and hence generating rural employment to check internal migration if persists. So, this study mainly focuses on the aims and objective of the government for the bamboo farmers and allied workers to step forward to achieve the expected outcomes by engaging the agricultural extension fraternity.

1.2 Study context with location

Purnia is one of the four districts in Purnia subdivision of Bihar with a geographical area of 3229 sq. km. is 8th largest district (in terms of area) in Bihar surrounded by Madhepura district in the west, Kishanganj in the east, Araria in the north and Katihar in the south. It has a total population of 3264619 of which 2921614 (89.49%) are rural and 343005 (10.51%) are urban (Delhi, N. 2011 Census). Purnia is well connected with North East and South West via roads as four national highways cross through the district including Golden Quadrilateral.

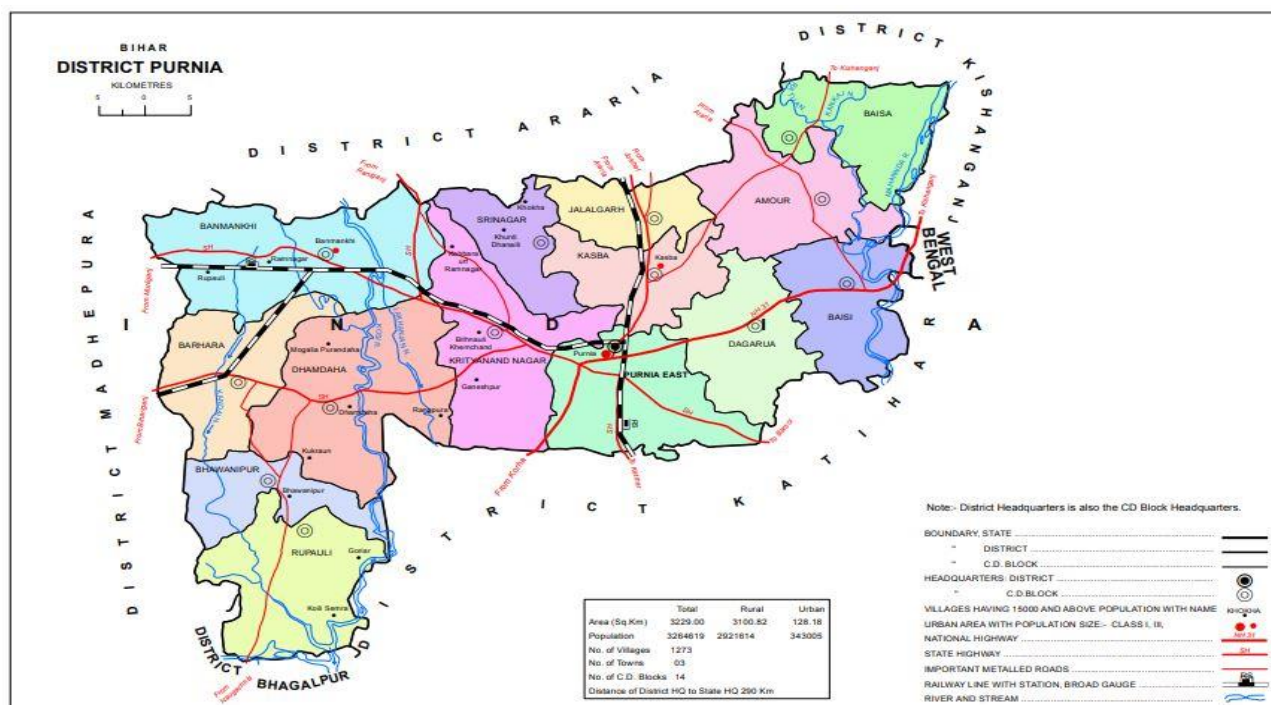
Table 1: Key Statistics of Purnia District, Bihar

Sr. No.	Parameters	Statistics
1	Total number of villages	1273
2	Number of blocks	14
3	Total number of towns (Statutory)	3
4	Administrative Division	4
5	Total number of Households	647389
6	Population	
	Rural (in %)	2921614 (89.49%)
	Urban (in %)	343005 (10.51%)
	Total	3264619
7	Area (in sq. km.)	3229
8	Literacy Rate	51.08
9	Total Workers (Main & Marginal)	1143318
10	Category of Workers	
	Cultivators	197424
	Agricultural Labourers	745015
	Workers in the household industry	28840
	Other workers	172039

Source: Census 2011

According to the Ground Water Information Booklet, Purnia district, published by the Ministry of Water Resources, 2013, Agriculture is the main source of sustenance for the majority of the

population in Purnia district. The physiographical construct of Purnia district is Gagnetic Alluvium, Ganga, Kosi, Panar, Mahananda and Kaska are major rivers flowing through this district.



Source: Groundwater information booklet, 2013

Fig 1: Purnia District Map

The Kosi region is well known for recurring floods and devastation affecting the livelihood of millions of farmers and agricultural laborers living within the Kosi Embankments. Apart from this, the post-flood situations significantly increase the seasonal as well-disguised unemployment where farmers were left with no other choice than to be a daily wage worker or to migrate to some other cities in search of livelihood.

Bamboo is non-exacting, hardy and drought resistant in nature and poses a wide range of soil/climatic adaptability. It grows on marginal and degraded lands, elevated grounds, along field bunds and river banks from coastal regions to mountain slope (up to 4000m above sea level) under moist to the semi-arid area. Bamboo, however, cannot withstand saline soil, alkaline soils and waterlogged area (Mehra and Mehra, 2007).

Different types of bamboo species are found to grow in all types of soil and sufficiently grow on alluvial soil in the tropics as well. There are four bamboo species (*Bambusa Bambos*, *Nutan*, *Tulda* and *Balcoa*) that grow without scientific interventions at a sufficient volume of harvesting and another three bamboo species which have significant evidence of growth in the region are *Dendrocalamus Giganteus*, *Bambusa Strictus* and *Melocana Baccifera*. (RamNirmal et.al, 2010) concluded their study “Bamboo plantation diversity and its economic role in North Bihar” that *Dendrocalamus Giganteus* is the most productive and commercial bamboo but is being cultivated

by very few farmers. These species need the motivation to adopt by every villager for mass cultivation. They further suggested that genetically superior culms with high production value should be cultivated in mass multiplication by farmers and they can also use the bamboo understory land for cultivation of medicinal or other economical plants to boost their economy.

Department of Horticulture, Bihar in its Annual Action Plan 2012-13 mentioned that Purnia has been included as Bamboo District in their annual plan for the year to promote bamboo cultivation, but there is no record of implementations of the provisions of schemes. However, this suggests the potentials of bamboo cultivation in the Purnia district and the government's concerns in this regard for Purnia.

1.3 Agro–Ecological Characteristics of Purnia

Purnia falls in Agro-Climatic Zone – II category as per District Irrigation Plan 2016 for Purnia district published by Department of Agriculture, Bihar. The alluvial plains of Kosi, Mahananda and its tributaries are slightly undulating to rolling landscape mixed with a long stretch of a nearly flat landscape. The area is full of streams and abandoned dead channels of Kosi River which is a major factor in changing the course of Kosi River year after year. It has Alluvial Soil (fine loamy, sandy to coarse loamy soil) and receives 1411.5 mm annual average rainfall. Weather is moderate with an average temperature 28°C with a range of maximum temperature 43°C to minimum temperature 3°C.

Table 2: Agro-ecological profile of Purnia, Bihar

Sr. No.	Parameters	Statistics
1	Agro Ecological Sub Region (ICAR)	Eastern Plain, Hot sub-humid (moist) Eco sub-region (13.1)
2	Agro Climatic Zone (NARP)	North East Alluvial Plain Zone (BI-2)
3	Annual Rainfall	1314.6 mm
4	Geographical Area	320231 ha
5	Forest Area	116 ha
6	Land under non-agricultural use	45856 ha
7	Permanent Pastures	454 ha
8	Cultivable Waste land	12725 ha
9	Land under miscellaneous crops and grasses	8939 ha
10	Barren and uncultivable land	36164 ha
11	Major Soil	
	Sandy Loam Soil	21.66%
	Loam Soil	40.76%
	Clay Loam Soil	21.74%
	Other Soil	15.84%
11	pH range of soil	6.5 – 7.6


12 Major contingency the district is prone to

Regular:


Flood, Heatwave, Coldwave, Frost, Pests and Disease

Occasional:

Drought

 *Source: Agriculture Contingency Plan for Purnia District 2013*

Purnia district lies in the Gangetic alluvial plain. The order of alluvium is found in the north of Purnia consisting of coarse gravel and surface kankar and newer alluvium composed of silts, clays occurring south of Purnia. These alluvial deposits are carried by the river system originating from the Himalayas.

According to the District Irrigation Plan 2016 report published by the Department of Agriculture, Cooperation  farmer's Welfare, GoI that the Gross cropped area is about 94.03% of the total geographic area whereas the net sown area is 65% of which about 30.69% of cultivable lands are double-cropped area. The area under forest is almost negligible with 313 ha (0.11%) land of the total geographical area. More than 24,817 ha of land which constitutes about 7.76% of the total geographical area is found to be Cultivable wastelands and fallow land is about 10% in the district. The same report further suggests that net sown area can be increased by bringing part of the fallow land, lands under single cultivation in a year and increasing forest cover by introducing some solutions.

1.4 Study context with nature

Kosi region falls under seismic and flood-prone zones, which brings intense agricultural losses year after year. A report "Bihar's Agricultural Development: Opportunities and Challenges" published by the Government of India in the year 2008 highlighted that 40.6% of the total cropped area (119 ha) are affected due to flood. The people living around river banks tend to suffer a lot during and after flood every year, which wash out their cash crops, livestock, homes etc. and badly affects their source of income for several months, leaving them in miserable living conditions or in a castaway situation-changing soil fertility, reversing the course of river, soil erosion and huge-scale deforestation.

Bamboos cultivated on wasteland and barren land are supposed to increase green cover in a region and significant contribution has been noted in terms of checking soil erosion due to extensive net-like roots and rhizomes which bind the soil together and silt deposition. Bamboo provides 35% more oxygen in comparison with equivalent stands of trees (Baksy, 2013).

Purnia, as a flood-prone and seismic zone, needs special attention to mitigate the losses (financial loss, infrastructure loss, etc.) due to earthquakes and recurring floods. According to the 2007-08 District-Level Household Survey, only a small fraction of the population in the affected districts resided in "pukka" houses. Global Facility for Disaster Reduction & Recovery (GFDDR) in collaboration with the World Bank mentioned that apart from a huge loss in terms of infrastructure, the damage

was caused to the livelihood, health, education, social and environmental sector. It also highlighted the housing pattern and importance of using bamboo for house construction in the region in their report “Bihar Kosi Flood (2008) Need Assessment Report” that was published in 2010.

Promotion and plantation of bamboo at a huge scale can be a significant step in disaster mitigation measures in terms of increase in livelihood sources, reduction in the cost of infrastructural and environmental losses. A report “Life in the shadow of the embankment – Turning Lost land into Assets in the Koshi Basin of Bihar, India” by WINROCK International India, 2017 highlighted the use of bamboo as a material used for coping strategy during flood stress in the region.

1.5 Study context with livelihoods

Since the study aimed to explore opportunities for farmers, who seek direct and indirect livelihood combination through bamboo throughout their value chain to gather additional income, it is also exciting to examine the lives of bamboo workers. Though it's a matter of a separate detailed assessment, there are visible segments to think of livelihood opportunity creation. If efforts have been made and farmers are able to be put in a single umbrella for this purpose, there is a tremendous opportunity to involve local people – starting with cultivation, harvest, treatment, processing, adding value, storage, transport and marketing, at various stages of the Bamboo value chain. One such observation is worth noting here: ‘To visualize the loss that Kosi region had suffered.’ It can be understood with the fact noted by Christopher J. Barrow, 1988 in his book *Water Resources and Agricultural Development in the Tropics* about one indigenous invention – **Bamboo Tube well**. He states that under favorable circumstances, smallholders with well under 0.5 ha could afford to install Bamboo Tube well (Arnon, 1981). Moreover, farmers with **at** out 4 ha are near the lower limit of those able to afford bamboo **tu** be well and access to the pump. Further, one attractive aspect of this indigenous technology is that it appears to have generated quite a lot of off-farm employment. From 1972-1973, in the Kosi region of Bihar, the fabrication, sinking and maintenance of bamboo tube well systems is believed to have generated about 6,00,000 man-days of employment. In addition, irrigation probably created another 4 or 5 million man-days of employment. Such potential of bamboo had to meet its fate and disappearance due to the promotion and rise of pumping set for irrigation in the area, which was not just beyond the reach of marginal or small farmers but led to an increase in the input cost. Central Ground Water Board, Ministry of Water Resources, GoI in their Ground Water Information Booklet, 2013 recognized the scope of using Bamboo boring in Purnia for irrigation purposes which entail revival of the indigenous invention to generate the projected man-days.

Apart from this, reduction in agricultural cost or setting up the ground for additional income out of regular farming may increase the income of farmers and may have the capacity to engage thousands of bamboo workers and bamboo artisans in the region.

1.6 Study context with Agriculture Extension Institutions

Though agriculture extension and advisory services are spread across the country in recent decades, the Kosi Region of Northern Bihar is yet to receive fruitful benefits from these services. Krishi Vigyan Kendra (KVK) was established in 2004 at Jalalgarh in Purnia with an aim to conduct on-farm testing/trials assessing, refining and documenting agricultural technologies to boost location-specific sustainable production system. Bihar Agriculture Management & Extension Training Institute (BAMETI) - a state-level autonomous extension institution set up the Agricultural Technology Management Agency (ATMA) in the year 2006 in Purnia. Bholu Paswan Shastri Agricultural College, Purnia came into existence in 2011 with the aims and objectives to improve crops, horticulture & livestock production, management and policy research. However, most of these organizations are in their beginning phase due to which the findings of the study can help them to look forward with need-based new dimensions in the area.

NABARD- an apex body in agriculture and rural development in India has set bamboo as "Thrust Area" since 2005. Farmers across the country from the east to west get the benefits from it, but poor states like Bihar seems left behind due to the scattered farming practices, lack of knowledge about the potentials of bamboo for economic contributions, least attention from government bodies or extension practitioners.

In this report, extension professionals in the area and government bodies could draw their attention promptly, by making the prudential leap in the field, to explore and exploit the capacity of bamboo, as envisaged by the government of India.

1.7 Statement of the problem

In the last two decades, in line with the dialogues on Sustainable Development, bamboo has gained momentum in its production, utility and propagation of its unique features and potentials for the wellbeing of humans, nature, environment and addressing issues related to climate change. Six out of 17 Sustainable Development Goals (SDGs) debated and adopted by the United Nations are directly related to Bamboo and Rattan producing countries and their Green Economy Plans- poverty reduction, energy, housing & urban development, sustainable production & consumptions, climate change & land degradation, which signifies the positive contribution that bamboo can make to other SDGs addressing food security, women's empowerment, economic growth and technology. International Network for Bamboo and Rattan (INBAR) highlighted and recommended the states across the world through the document *Preparation for UN Summit for the Adoption of Post 2015 Development Agenda, 2015* for each and every related sustainable development goal with a greater emphasis on cultivation and utility of bamboo products.

Following the call, bamboo-rich countries acted promptly and gave thrust to harness the potentials to raise a green economy.

India, being the third largest country after China and Myanmar, has a rich bamboo cover with a varied range of species. According to the Forest Survey of India, 2017, there are 125 indigenous and 11 exotic bamboo species belonging to 23 genera that are reportedly found in India. The principal bamboo genera occurring in India are *Arundinaria*, *Bambusa*, *Chimonobambusa*, *Dendrocalamus*, *Dinochola*, *Gigantochola*, etc. with an estimation of 15.69 million-hectare bamboo bearing area in India. The same report highlights the reduction in bamboo bearing area in Bihar from 1004 sq. km. to 739 sq. km.- a significantly huge decrease of 265 sq. km which indeed is an indicator that this reduction will directly affect farmers, bamboo artisans and the economy of state if not taken in consideration.

Despite the rich presence of bamboo, India still needs to harness the green economy and use all-round benefits to enhance the population, mainly because of the barrier imposed by the 1927 Indian Forest Act and the longer-term negative perception of bamboos. However, with the Indian Forest (Amendment) Act-2017 and the restructured National Bamboo Mission, bamboo drew attention from the state governments, architects, agriculture extension practitioners, growers, and economists in some or other way.

Bihar, being an agricultural district (85% of the population dependent on agriculture) and with an average bamboo cover among the Indian states (except northeastern part of India), can be the best place to leverage technology for improved production through scientific cultivation of bamboo and marketing the same to benefit the marginal farmers who have been affected by the flood.. But it has been felt that awareness about recent changes and projected economy through the bamboo is far-reaching from farmers in rural India, particularly in the Kosi region of northern Bihar. There are 21 registered FPOs in Bihar and the majority of them are concentrated near the state capital, Patna and none of them are promoting climate-smart farming or modern practices, rather most of them are following traditional practices. There are only two FPOs in the adjacent district Katihar of Purnia Division, that too for vegetables and fruits.

It has been observed that the decision making and functioning of government mechanism take longer than usual time for any sort of innovative steps for the state. Bamboo, as a most ignored sector in the state, possesses the same kind of potential threat.

1.8 Scope of study for farmers and Allied Workers

The study may serve as a source of messengers for farmers as the study will check the consequential phenomenon of the change in farming pattern, impact on the livelihood of allied workers & artisans, and associated internal migration in search of livelihood. This could be a means of forwarding their

message to the concerned authority for their due attention so that farmers get assistance- financial, technological, extension services and for innovative ways to increase their income through the benefits of MIDH schemes.

Further, the respondents were not just a source of data collection but in parallel, they received a message about the potentials of bamboo and the government's recent efforts to harness the same.

After knowing about the schemes and opportunities, farmers were keen to know more about the scientific method of bamboo cultivation to maximize their income through mixed farming with bamboo for beginning years and then set for constant income from bamboo cultivation.

1.9 Scope of study for Community Development

When it comes to Community Development, generating a constant source of livelihood is one of the key steps that a community development worker thinks of.

This research is also a valuable resource to help bamboo growth and restoration of lost rural jobs, connected to the region's bamboo value chain. Many Community-Based Organizations (CBOs) and NGOs at a grass root level are already doing innovation in livelihood interventions up to their capacities. Hence, this study may draw their attention towards bamboo-based livelihood interventions to serve the farmers and allied workers community in a focused manner- creating a constant source of income to make them financially independent. They can bridge the gap between farmers and extension services and campaign for farmers and local bamboo workers to secure living conditions to manage domestic imbalances due to domestic migration.

1.10 Scope of study for Agricultural Extension Institutions

Agriculture Extension Institutions are the driving factors for good practices *on the farm* and *off the farm* activities. These institutions are not just the facilitator of extension practitioners, scientists, managers but had proven the extended, effective and direct support to farmers as well, with an aim to the welfare of farmers.

The study can be helpful for institutions and professionals to understand the need for grassroots development in their soil, in the Kosi region of Northern Bihar, to meet farmers in public and private areas for sustainable agribusiness. The opportunity for Agricultural Extension Institutions is not limited to this. There is a huge scope to achieve the core purpose of these institutions- uplifting the people at the bottom of the pyramid by enabling them for long term sustained impact as bamboo has a huge potential to create small enterprises by applying commercial strategies to maximize improvements in human and environmental wellbeing rather than maximizing the profits for the external shareholders. Thus, extension services have a major role to play.

Panda, Chandan and Siya Ram (2016), in their study 'Role of extension in leveraging FPOs for small and marginal farmers' highlight that in India, 85 percent of farmers are small and marginal with a landholding of less than 2 hectares and the average size of landholding is 1.33 hectare/farmer household. Even after the second-generation economic reforms in India, the critics argued that there was no major growth in the agricultural sector in India that led to the economic prosperity of small and marginal farmers. Under this backdrop, the Government of India has been promoting FPOs through the NABARD and the fact is that FPOs are the need of the hour as GoI is preparing for FDI in agriculture.

This research is also a valuable resource to help bamboo growth and restoration of lost rural jobs, connected to the region's bamboo value chain. Many Community-Based Organizations (CBOs) and NGOs at a grass root level are already doing innovation in livelihood interventions up to their capacities. Hence, this study may draw their attention towards bamboo-based livelihood interventions to serve the farmers and allied workers community in a focused manner- creating a constant source of income to make them financially independent. They can bridge the gap between farmers and extension services and campaign for farmers and local bamboo workers to secure living conditions to manage domestic imbalances due to domestic migration.

Research Methodology

This study focuses on farmers and bamboo workers, and so the participants were those farmers who had bamboo culms in their land, either by scientific or non-scientific methods and rural workers who had been a daily bamboo worker for more than 5 years.

The study was a convergent parallel design of the mixed method strategy where quantitative and qualitative data were collected, analyzed and interpreted simultaneously in order to gain a comprehensive view of the phenomenon- consequential changes related to bamboo cultivation and impact on the associated bamboo worker's livelihood. Researcher himself was the enumerator for this study.

2.1 Research Design

This study has been designed as a mixed method strategy in line with a convergent parallel design i.e. quantitative & qualitative research and is descriptive in nature. According to the definitions mentioned in "Manual on Good Practices in Extension Research & Evaluation" (Sivakumar et al., 2017) published by Agricultural Extension in South Asia (AESAs):

The mixed method research design is a procedure for collecting, analyzing and combining both the quantitative and qualitative methods in a single study or a series of studies to understand a research problem (Creswell and Plano Clark, 2011).

Qualitative research is an inquiry process of understanding based on distinct methodological traditions of inquiry that explores a social or human problem. The research builds a complex, holistic picture, analyses words, reports, detailed views of informant and conducted the study in a natural setting as defined by (Creswell, 1998).

Here to note that for the said report, in-depth interviews and focused community conversations are data collection methods.

In the same way, the researcher planned to collect data through a semi-structured questionnaire to collect both qualitative and quantitative data for this study. Two case studies have been incorporated for better descriptions of qualitative findings.

2.2 Specific Objectives

1. To assess the socio-economic condition of the farmers having bamboo culms and bamboo workers in Purnia, Bihar.

2. To trace the presence of bamboo resources, its significance in a farmer's life and adoption of alternate farming in the region.
3. To trace bamboo utility and its linkage with rural livelihood, employment and internal migration.
4. To trace the presence of agricultural extension services and the scope of extension service practices in the region to promote bamboo cultivation.

2.2 Sampling Technique

This study has adopted a purposive, non-probability sampling since official data had not been found related to the target respondent because the respondent categories fall in the unorganized sector of the Indian economy. Secondly, the time bound research doesn't permit the researcher for a survey of all farmers in the region.

2.3 Sample Size

There are 14 blocks in the Purnia district with 1,113 inhabited villages. The researcher selected 2 villages each from 8 blocks purposively with a rough estimate of the low bamboo bearing area and high bamboo bearing area through field observations and conversations with people who have seen the changes over the decades. Blockwise list of the respondent farmers have been mentioned in Table 3 below:

Table 3: List of blocks and corresponding villages selected for interaction with farmers

Sr. No.	Name of the Block	Name of the Village	No. of Respondent farmers
1	Dagarua	Sakrail	6
		Patringa	8
2	Amour	Doria	6
		Gerua	6
3	Baisi	Hariram Pur	6
		Chandragama	6
4	Banmankhi	Madhuban	4
		Jhali Ghat	5
5	Jalalgarh	Dhushmar	7
		Sauntha	5
6	Kasba	Banaili	5
		Malharia	5
7	Purnia East	Fariyani	5
		Harda	6
8	Krityanand Nagar	Pothia	5
		Pothia Milik	5
Total Respondents			90

Apart from this, 7 Focus Group Discussion (FGD) has been conducted with the farmers other than the individual respondent farmers. A total of 80 farmers participated in FGDs at Dagarua (13), Amour (14), Baisi (11), Banmankhi (10), Jalalgarh (9), Kasba (13) and Purnia East (10) respectively. So, the total number of respondent farmers is 170.

In order to select the bamboo workers, the researcher opted for purposive sampling and visited villages suggested by the farmers where the population of bamboo workers is more. The researcher mixed the sampling in such a way that it covers a wide range of workers i.e. those who were experts in constructing houses, fencing, artisans etc. and combined all together as bamboo workers. A blockwise list of the respondent bamboo workers has been mentioned in Table 4.

Table 4: List of blocks and corresponding villages selected for interaction with bamboo workers

Sr. No.	Name of the Block	Name of the Village	No. of Respondent bamboo workers
1	Dagarua	Patringa, Chaanpi	12
2	Amour	Bishanpura, Gerua, Sonapur	23
3	Baisi	Hariram Pur, Dargachi	18
4	Banmankhi	Madhuban, Rikabganj	16
5	Jalalgarh	Banaili, Kajra,	14
6	Kasba	Sauntha, Tikapur	12
7	Purnia East	Kavaia, Pirganj	15
8	Krityanand Nagar	Baghmara, Pothia Milik	10
Total Respondents			120

Apart from this, 2 case studies of bamboo workers have been conducted to understand the phenomena with deep insight.

2.4 Tools Method of Data Collection

Semi-structured questionnaire was used to collect data from the respondent through semi-structured interviews with respondents. The researcher himself enumerated the data. Questionnaires for farmers and bamboo workers have been attached with this report in Annexure – I and Annexure – II respectively.

Predefined sessions were held for the Focus group Discussions with a very precise set of queries and topics which have been included in Annexure – III.

Resource mapping was done using charts and semi-structured interviews with the authorized person of the respective institutions and organizations. A semi-structured questionnaire has been attached in Annexure – IV.

2.5 Data Analysis

Quantitative data collected through questionnaire had been analyzed on SPSS Student Version free for 15 days and incorporated with the observation interpreted through semi-structured interviews which were descriptive and thus described in narration.

Results and Discussion

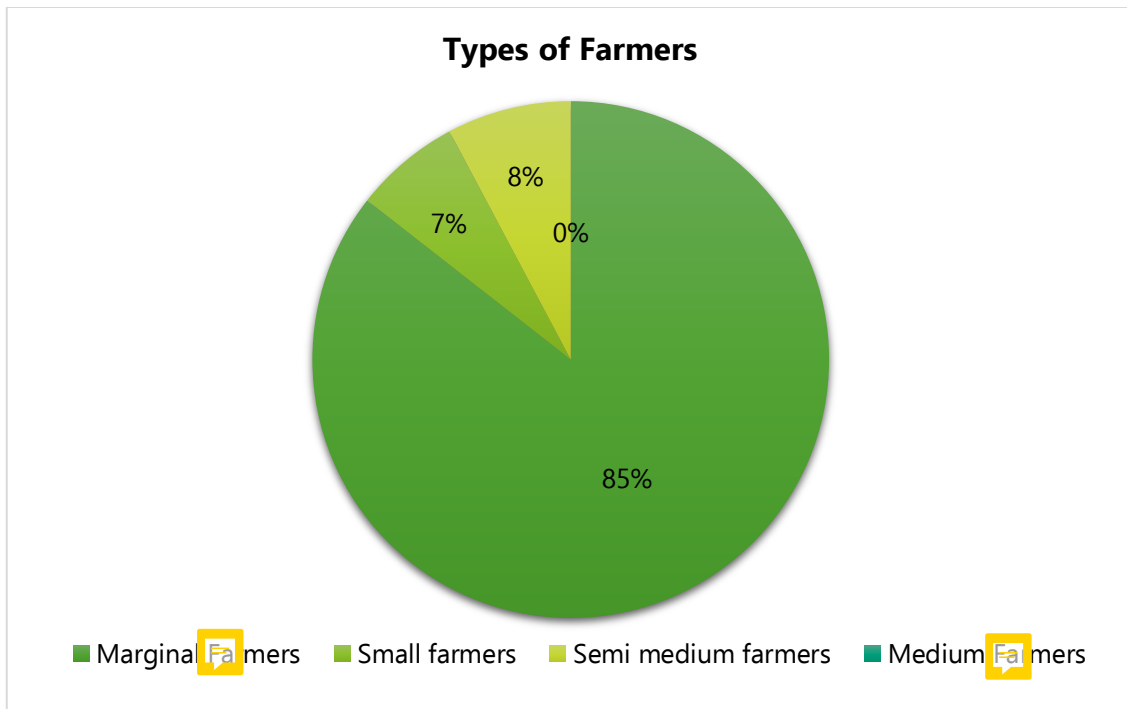


Fig 2: Types of bamboo farmers among respondents

The above figure 2 shows the distribution of the types of farmers who participated as respondents. It is clear from the table that the majority of the farmers (85.6%) are marginal farmers among the respondents. Small and medium farmers are 7.8 percent and 6.6 percent respectively. There were no medium or big farmers in the locality.

Table 5: Estimated number of bamboo culms available among farmers

Number of bamboo culms	Frequency	Percentage
Less than 300 culms	18	20.0
301 to 500 bamboo culms	31	34.4
501 to 1000 bamboo culms	24	26.7
1001 or more culms	17	18.9
Total	90	100.0

The above table 5 shows the distribution of bamboo culms available with farmers. Significantly, less than one-fifth (18.9%) of the farmers have more than 1000 bamboo culms on their lands. Most of the farmers i.e. 34.4 percent have 300-500 bamboo culms on their lands. It can be observed that farmers have bamboo but not on a large scale.

Table 6: Area of land with bamboo culms

Area of land with bamboo culms	Frequency	Percentage
5 Kattha or less	60	66.7
6 – 10 Kattha	19	21.1
11 – 15 Kattha	8	8.9
16 – 20 Kattha	3	3.3
Total	90	100.0

The above table 6 shows the distribution area of land on which farmers have bamboo culm. Two-third of the farmers (66.7%) have bamboo culms in 5 Kattha or less area of land. Significantly, very few farmers (3.35%) have bamboo in a bigger piece of land i.e. 16-20 Kattha. It shows that bamboo culms are cultivated very densely i.e. more number of bamboo culms in less area of land.

Table 7: Average Annual Income from bamboo

Average Annual Income from bamboo	Frequency	Percentage
No income from bamboo	58	64.4
Rs 5000 or less	21	23.3
Rs 5001 to Rs 10000	7	7.8
Rs 10001 to Rs 20000	4	4.4
Rs 20001 or more	0	0
Total	90	100.0

The above table 7 shows the distribution of average annual income earned by the farmers by selling bamboo culms. The majority of the farmers (64.4%) are not selling their bamboo culms as they say that bamboo is for their personal use whereas 23.3 percent of farmers sell some of the bamboos every year to earn a small fraction of the amount as and when required i.e. less than Rs 5000. None of the farmers earned more than Rs 20,000 by selling bamboo ever.

All the respondent farmers were male which shows that despite the visible engagement of women in agriculture, females are at abeyance in terms of ownership.

Table 8: Presence of youth in agriculture

Age	Frequency	Percentage
18 years to 29 years	17	18.9
30years-45 years	47	52.2
46 years to 60 years	10	11.1
60 years or more	16	17.8

Total	90	100.0
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The above table 8 shows the distribution of respondents by their age. It is seen that the participation of youth age group 18-29 years is significantly very less (18.9%) i.e. close to one-fifth only. Fairly, half of the farmers (52.2%) are of the age group 30-45 years. Finding suggests that 17.8 percent of old age people are also engaged in farming.

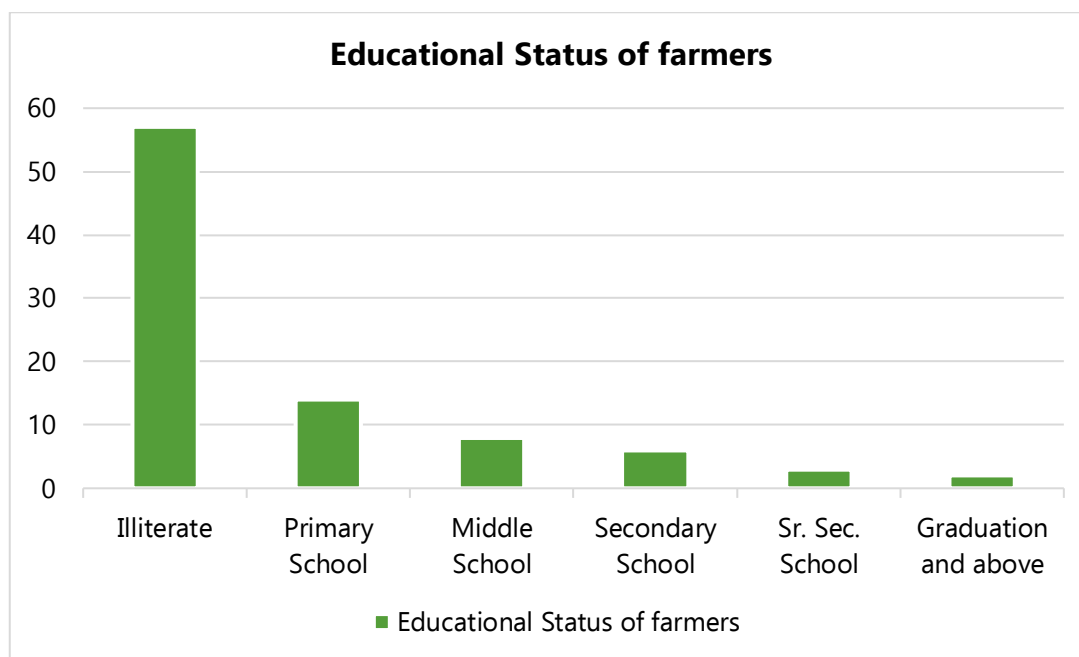


Fig 3: Educational Status of respondent bamboo farmers

The above table 3.7 shows the educational qualification of the respondents. It is seen that the majority (63.3%) of respondents are illiterate. Significantly, less i.e. 15.6 percent have attended primary school, (8.9%) attended middle school, (6.7%) earned secondary school certification and meagerly 2.2 percent of the respondents are graduates. In comparison to previous years, it has been significant to see more than one-third of farmers (36.7%) as literate.

Table 9: Social category of the respondent farmers

Social Category	Frequency	Percentage
General	14	15.6
OBC	76	84.4
SC	0	0.0
ST	0	0.0
Total	90	100.0

Table 9 shows that the majority (84.4%) of the respondents belong to the 'Other Backward Classes (OBC)' and less than one-fifth (15.6%) belong to the general category. There were no respondents from SC and ST in farming.

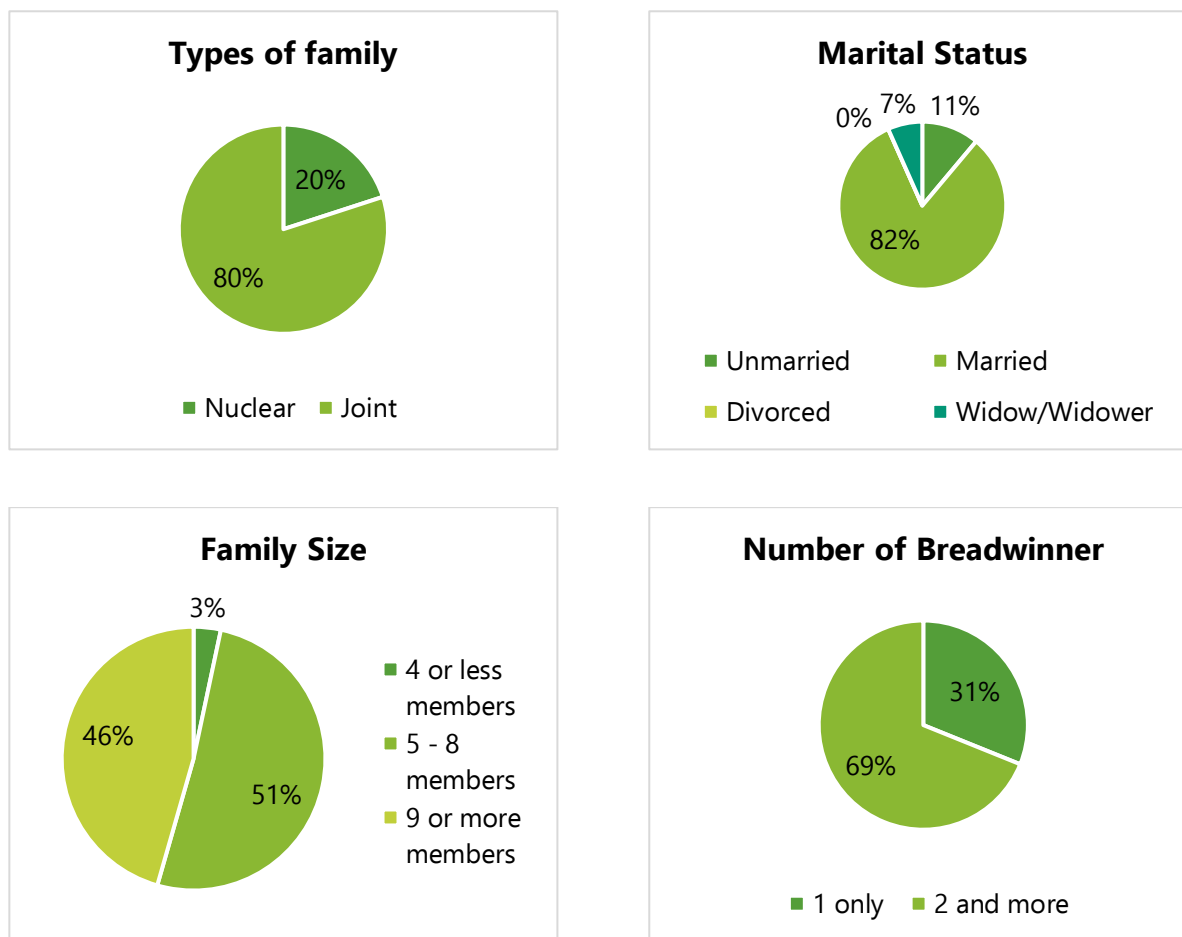


Fig 4: Familial status of respondent farmers

The above figure 4 shows the distribution of familial details of the respondent farmers by their marital status. The trend of joint family is quite visible as 8 out of 10 respondent farmers live in a joint family. The majority of the respondents (82.2 %) are married, (11.1%) are unmarried and the remaining (6.7 %) are widows or widowers. Very least 3.3 percent of the respondents have a small family size i.e. 4 or fewer members in the family whereas fairly half (51.1%) of the respondents have a family consisting of 5 to 8 members. Significantly, 45.6 percent of the respondents have a comparatively large family size with 9 or more than 9 members. As per the findings, it is clear that more than two-thirds of the respondents (68.9 %) have 2 or more members who earn a livelihood for their family whereas the remaining 31.1 percent are the sole breadwinner of the family.

Table 10: Farmers with government Identity Card

Name of ID Cards	Status	Frequency	Percentage
Govt. ID Cards	No	9	10.0
	Yes	81	90.0
BPL Card	No	21	23.3
	Yes	69	76.7
MGNREGA Card	No	75	83.3
	Yes	15	16.7
Total		90	100

The above table 10 shows the numbers of breakdowns of several identity cards that a farmer could have. According to the table, it is clear that the majority (76.7%) of the respondents are living under the 'Below Poverty Line (BPL)' category whereas less than one-fifth of the respondents (16.7%) have MGREGA cards which ensure 100 days employment guarantee. None of them had been found registered with the Department of Agriculture in the district.

Table 11: Sources of income for the family of farmers

Sources of income	Frequency	Percentage
Agriculture alone	20	22.2
Agriculture and other	70	77.8
Total	90	100.0

The above table 11 shows that the source of income for 22.2 percent of farmers is solely agriculture whereas the majority of the farmers (77.8%) have to do some other work for the family income.

Table 12: Average Annual income of the farmer's household

Average annual income	Frequency	Percentage
Less than Rs 27000	9	10.0
Rs 27001 to Rs 35000	11	12.2
Rs 35001 to Rs 50000	14	15.6
Rs 50001 to Rs 1Lakh	28	31.1
Rs 1 Lakh to 3 Lakh	22	24.4
Rs 3Lakh to 5 Lakh	6	6.7
5Lakh or more	0	0
Total	90	100.0

The above table 12 shows that significantly less than one-third of the farmers (31.1%) are able to cross the mark of 1 Lakh per annum. Nearly, half of the respondent farmers (46.7%) earn Rs. 35,001

to 1 Lakh per annum whereas 22.2 percent of the respondents are earning less than Rs. 35,000 per annum which resembles either living in 'Below Poverty Line' or vulnerable to fall within.

Table 13: Availability of convenience in farmer's household

Name of ID Cards	Status	Frequency	Percentage
Smart phone with internet	No	50	55.6
	Yes	40	44.4
Television	No	86	95.6
	Yes	4	4.4
Radio	No	79	87.8
	Yes	11	12.2
Motorcycle	No	73	81.1
	Yes	17	18.9
Tractor	No	83	92.2
	Yes	7	7.8
Agri Machineries	No	70	77.8
	Yes	20	22.2
Total		90	100

The above table 13 shows the distribution of some household convenience or devices owned by farmers. It shows that nearly half of the respondents (44.4%) are using a smartphone with the internet and only 18.9 percent of respondents have a motorcycle in their households. Very few have a television (4.4%), tractor (7.8%) and Agri machineries (22.2%) of which most of them are said to have pumping set for irrigation purpose.

Table 14: Beneficiary of Agricultural Loan, KCC, Crop insurance, Schemes

Name of ID Cards	Status	Frequency	Percentage
Beneficiary of Agricultural Loan	No	83	92.2
	Yes	7	7.8
Beneficiary of KCC	No	68	75.6
	Yes	22	24.4
Beneficiary of Crop insurance	No	87	96.7
	Yes	3	3.3
Beneficiary of agricultural scheme	No	69	76.7
	Yes	21	23.3
Total		90	100

The above table 14 shows the number of breakdowns of some assistance to farmers. It shows that the agricultural loan and crop insurance are not accessible to the farmers. Meagerly one-fourth of the respondent farmers availed of Kisan Credit Card (KCC) and some agricultural schemes.

Table 15: Experience of respondent farmers in farming

Experience in years	Frequency	Percentage
Less than 5 years	6	6.7
5 to 10 years	11	12.2
11 to 15 years	16	17.8
16 to 20 years	28	31.1
21 to 25 years	14	15.6
More than 25 years	15	16.7
Total	90	100.0

The above table 15 shows that nearly one-third of the respondent farmers (32.3%) are experienced for more than 20 years whereas only 18.9 percent falls under less than 10 years of experience which indicates that the youth intake in the farming sector is comparatively lower than the outflow of the experienced farmers.

Table 16: Farmer's perception of the profitability of bamboo

Response	Frequency	Percentage
Loss	37	41.1
Profitable	53	58.9
Total	90	100.0

The above table 16 shows that more than half of the respondents consider bamboo cultivation profitable whereas less than half (41.1%) disagree with it.

Table 17: Migration intensity of bamboo workers in the view of farmer

Yes	Frequency	Percentage
Yes, many	17	18.9
Yes, few	34	37.8
No, not migrated	39	43.3
Total	90	100.0

The above Table 17 indicates that the migration of bamboo workers was observed by slightly more than half (56.7 percent of respondents, but varies in strength from many bamboo workers (18.9 percent) to few bamboo workers (37.8 percent), while 43.3 percent disagree with it.

Table 18: Knowledge about agricultural institutional resources among farmers

Institutions	Status	Frequency	Percentage
Agricultural College	No	58	64.4
	Yes	32	35.6
Krishi Vigyan Kendra	No	80	88.9
	Yes	10	11.1
Agriculture Technology Management Agency (ATMA)	No	65	72.2
	Yes	25	27.8
Common Facility Centre	No	90	100
	Yes	0	0
Kisan Helpline number	No	77	85.6
	Yes	13	14.4
Total		90	100

The above table 18 depicts the institutional resource mapping. This finding reveals farmer's knowledge of available institutions in the district and hence the presence of institutions among farmers as well. The data highlights that farmers are least aware (less than one-third of the respondents) of the agricultural institutions available in the Purnia district. There are 35.6 percent respondents who know about Agriculture College, 27.8 percent know about ATMA and 14.4 percent know about Kisan Helpline services. Very few respondents (11.1%) know about KVK.

Some other meaningful observations:

- Nearly one-third (31.1%) of the farmers are living life below the poverty line for more than 10 years.
- The farmers in the study area do not have a membership or any affiliation with the Farmer Producer Organizations, farmer's union or any such institutions. Few farmers are registered with the Department of Agriculture, Purnia.
- The farmers in the study areas are cultivating bamboo in the traditional method mostly due to a lack of knowledge about the scientific methods of bamboo cultivations.
- The majority of the farmers said that the reduction of bamboo areas has been more rapid in the last decade and half of the respondents agree that the livelihood of bamboo-based workers has been affected.
- The reasons for reduction are ancestral land distribution among siblings, inattention towards bamboo's potentials and unidentified disease which makes bamboo dry or dwarf.
- There are no agencies for promoting the scientific cultivation of bamboo in the area of study.
- Very few farmers (11.1%) got some kind of training at some point in time but not in recent time.

Table 19: Analysis summary of 1st FGD with farmers

Variable	Findings
Bamboo Species Available (Rate)	<ul style="list-style-type: none"> • Banbas (Rs 100 – 150) • Makla (Rs 80 – 120) • Farrout (Rs 60 – 80)
Major Utilities of bamboo in past	<ul style="list-style-type: none"> • House construction • Fuel • Fencing • Food for cattle • Grain Storage
Method of Cultivation	<ul style="list-style-type: none"> • Traditional method
Major Challenges in bamboo cultivation for making it the main source of income	<ul style="list-style-type: none"> • Covers land for a long time • Affects crops in neighboring land – creates a dispute • Disease – low number of new shoots, slow growth • Market – No constant buyer
Livelihood & Migration Quotient	<ul style="list-style-type: none"> • The affected livelihood of bamboo workers • Migration – rampant among bamboo workers • People who migrated want to work in a locality but no such job available. • Bamboo Artisan Community in the adjacent village
Flood mitigation & Bamboo	<ul style="list-style-type: none"> • Utility – Fuel, Machaan above lodged water • Flood mitigation – The majority disagree • Unknown about the role of bamboo in flood mitigation
Institutional Resource Mapping	<ul style="list-style-type: none"> • Presence and interventions are significantly less • None of the respondents received any training/workshop ever
Bamboo Cover in the area	<ul style="list-style-type: none"> • Almost every farmer has a small segment of land for bamboo – can be seen while going to the village
Why people gave up using bamboo houses	<ul style="list-style-type: none"> • Not long-lasting as concrete • High maintenance cost – labor not available for repairs, if available then seeks more wages
Interest in cultivating bamboo at a big scale	<ul style="list-style-type: none"> • Not interested, as they think that despite bamboo profitable, it cannot fulfill the need as and when they require money instantly. • Very few said about the trial if support is provided by the government (when schemes related to bamboo explained to them)

FGD-1

Major Challenges faced by them as a farmer	<ul style="list-style-type: none"> • Negative perception about schemes had been built as they didn't receive any agricultural schemes by governments. • Badly saddened over high input cost specifically due to high price pesticides and fertilizers • Complains about low-grade seeds, fertilizers supply • It seems that unethical businesses are being done by fertilizer companies. • Low rate for their produce
Solution and Expectation from government bodies	<ul style="list-style-type: none"> • Check the quality of seeds and fertilizers in the market • Increase rate for our produce • Very few farmers are able to figure out the problem and solution

Special Note

Table 20: Analysis summary of 2nd FGD with farmers

	Variable	Findings
FGD- 2 (Some information apart from previous FGD)	Bamboo Species Available (Rate)	<ul style="list-style-type: none"> • Jabo (Rs 60 – 80) • Volcoa (Rs 70 – 80) • Chaabh (Rs 80 – 100)
	Major Utilities of bamboo in past	<ul style="list-style-type: none"> • Cremation activities • Bullock cart construction
	Method of Cultivation	<ul style="list-style-type: none"> • Traditional method
	Major Challenges in bamboo cultivation for making it the main source of income	<ul style="list-style-type: none"> • Large plots not available, so densely cultivated • Disease – dwarf • Market – twice a week along the nearest highway
	Livelihood & Migration Quotient	<ul style="list-style-type: none"> • The affected livelihood of bamboo workers • Migration – Prevalent among bamboo workers • People are getting more wages so they won't come. • Bamboo Artisan Community is in the adjacent village
	Flood mitigation & Bamboo	<ul style="list-style-type: none"> • Utility – Puliya, Fuel, Machaan above lodged water • Flood mitigation – The majority disagree • Old aged people agree on the role of bamboo in flood mitigation as they have seen how to reduce flood water flow in earlier days
	Institutional Resource Mapping	<ul style="list-style-type: none"> • Presence and interventions are significantly less • ATMA and KVK is known and does some intervention for regular crops

Bamboo Cover in the area	<ul style="list-style-type: none"> Reducing for 2-3 decades due to disease, weight loss, people are worried as well as they believe that a farmer without bamboo is not a farmer!
Why people gave up using bamboo houses?	<ul style="list-style-type: none"> Got Indira Awas Yojna support due to which they shifted Catches fire and easy to be broken by a thief!
Interest in cultivating bamboo at a big scale	<ul style="list-style-type: none"> The majority said yes if support is provided by the government and if people see a demonstration of profit. Then, they will believe in their potential. Very hopeful and eager to do something for an alternate source of income
Major Challenges faced by them as a farmer	<ul style="list-style-type: none"> Low availability of agricultural labour – no rupees to use technology in farming. Irrigation cost is high Government officials do not visit their villages We are facing market issues. So, mostly we have to sell our produce to middlemen
Solution and Expectation from government bodies	<ul style="list-style-type: none"> We are demanding a soil test centre at the block level for a long time. Break nexus of fertilizers companies Ensure availability of quality seeds

Table 21: Analysis summary of 3rd FGD with farmers

	Variable	Findings
FGD- 3 (Some information apart from previous FGDs)	Bamboo Species Available (Rate)	<ul style="list-style-type: none"> Harauta (Rs 60 – 70)
	Major Utilities of bamboo in past	<ul style="list-style-type: none"> Uses in fishing Utilities as previously mentioned even lesser than the previous two FGDs
	Method of Cultivation	<ul style="list-style-type: none"> Traditional method
	Major Challenges in bamboo cultivation for making it the main source of income	<ul style="list-style-type: none"> We have small plots with us – bamboo cultivation is not possible Affects crops in neighboring land – creates a dispute Disease – unidentified, start drying from the top after a certain level of growth, then no one buys Market – Local Retailers come as and when they require
	Livelihood & Migration Quotient	<ul style="list-style-type: none"> Affected livelihood of bamboo workers Migration – not just among bamboo workers but others also. So, it's not unique to bamboo workers

Flood mitigation & Bamboo Institutional Resource Mapping	<ul style="list-style-type: none"> • People who migrated will not come to do bamboo work as they become Pardesi Babu! • Bamboo Artisan Community in the adjacent village • A not flooded area- so they were not able to respond • Presence and interventions are significantly less • Few of them received training/workshop from ATMA and visited KVK • ATMA and the Department. Of Agriculture have their presence here.
Bamboo Cover in the area	<ul style="list-style-type: none"> • Not decreased much and it was never the main source of income for people due to which they left caring for bamboo. • Fathers or grandfathers cultivated bamboo and sons or grandsons are cutting and earning out of it. So, it's profitable!
Why people gave up using bamboo houses	<ul style="list-style-type: none"> • Due to housing schemes, people have become rich these days. The young generation aspires to live like urban people. So they make a concrete house • Wages are high for bamboo workers and the least available.
Interest in cultivating bamboo on a big scale	<ul style="list-style-type: none"> • Not interested as the majority of them have fragmented lands and scattered here and there – not a single plot • Very few said about a trial in the backyard if bamboo culms were provided
Major Challenges faced by them as a farmer	<ul style="list-style-type: none"> • Low-grade seeds and fertilizers in the market • Pesticides are not working • Market access is a big issue for us. • Selling produce to intermediaries and so, they do not give a reasonable rate for our produce
Solution and Expectation from government bodies	<ul style="list-style-type: none"> • Subsidy in fertilizer and seeds also increase the rate for our produce • Provide market in our block

Table 22: Analysis summary of 4th FGD with farmers

Variable	Findings
Bamboo Species Available (Rate)	<ul style="list-style-type: none"> Species as noted in earlier FGD summary
Major Utilities of bamboo in past	<ul style="list-style-type: none"> Utilities as previously mentioned even lesser than the previous two FGDs
Method of Cultivation	<ul style="list-style-type: none"> Traditional method
Major Challenges in bamboo cultivation for making it the main source of income	<ul style="list-style-type: none"> Engages land for a longer period of time Affects crops in the neighboring land – creates a dispute Gives returns after a long period Disease – unidentified, thickness reduces, no strength in timber Market – available alongside the highways once a week, we need to harvest and reach the selling point.
Livelihood & Migration Quotient	<ul style="list-style-type: none"> Affected livelihood of bamboo workers Migration – prevalent but they got good as well as acts as a constant source of income in Delhi, Punjab, Haryana – some are in agriculture laborer Migration can't be checked through bamboo works
Flood mitigation & Bamboo Institutional Resource Mapping	<ul style="list-style-type: none"> Not a flooded area - so they were not able to respond ATMA is working with a few of the farmers from the locality. People are not knowing about other institutions
Bamboo Cover in the area	<ul style="list-style-type: none"> Yes it has been reduced but not to a great extent Bamboo was never a main source of income Most of the farmers cultivate bamboo for their own domestic use whereas few farmers are selling as and when money is required.
Why people gave up using bamboo houses	<ul style="list-style-type: none"> Not totally gave up but reduced due to a high wage for bamboo workers and least available. Not fire resistant as well.
Interest in cultivating bamboo at a big scale	<ul style="list-style-type: none"> Not interested as the majority of them show worries that land will be engaged for a longer time and at the end upcoming generation will remove bamboo for some or the other reasons. Then, what is the use of cultivating bamboo today!
Major Challenges faced by them as a farmer	<ul style="list-style-type: none"> Low produce and low income due to a low rate for their produce

FGD- 4 (Some information apart from previous FGDs)

	<ul style="list-style-type: none"> Farmers in this area are even not able to explain their problems related to agriculture in an orderly manner, but most of them started explaining about their burden of debt, health issues, old age problems etc. It's worth noting that whenever the farmer's welfare is conceived, it surrounds their income! They are in need of other welfare measures too.
Solution and Expectation from government bodies	<ul style="list-style-type: none"> Subsidy to minimize irrigation cost and in fertilizer Farmers are more concerned about monetary benefits.

Table 23: Analysis summary of 5th FGD with farmers

	Variable	Findings
FGD- 5 (Some information apart from previous FGDs)	Bamboo Species Available (Rate)	<ul style="list-style-type: none"> Species as noted in earlier FGD summary
	Major Utilities of bamboo in past	<ul style="list-style-type: none"> Chatayi (bamboo Mat) apart from previously mentioned utilities
	Method of Cultivation	<ul style="list-style-type: none"> Traditional method
	Major Challenges in bamboo cultivation for making it the main source of income	<ul style="list-style-type: none"> Disease – prevalent and unidentified but people are eagerly looking for a solution to those diseases Market –available alongside highways once every week, we need to harvest and reach the selling point. People observed that they are using old culm while cultivating and expecting healthy bamboo! Felt a need for cultivating fresh bamboo culms from the nursery but they do not know any such nursery.
	Livelihood & Migration Quotient	<ul style="list-style-type: none"> Affected livelihood of bamboo workers Migration – prevalent but bamboo is not the only reason. Migration can't be checked through bamboo works as they believe that there is no work available on a regular basis.
	Flood mitigation & Bamboo	<ul style="list-style-type: none"> Bamboo Artisan's community at Singhiya Village Puliya (Temporary bridge) and other utilities as mentioned earlier. No knowledge regarding the effectiveness of bamboo for flood mitigation
	Institutional Resource Mapping	<ul style="list-style-type: none"> Interventions through institutions are negligible in this area; schemes are not reaching out to them.
	Bamboo Cover in the area	<ul style="list-style-type: none"> Yes, it has been reduced to more than 50% area

Why people gave up using bamboo houses	<ul style="list-style-type: none"> Bamboo was the main source of income for many bamboo workers – now it diminished. Bamboo homes are not long-lasting every year; you need to repair and run behind a bamboo worker Not fire resistant as well.
Interest in cultivating bamboo at a big scale	<ul style="list-style-type: none"> The majority do not find any reason to cultivate bamboo when there is no constant buyer and so, they doubt its profitability. Few are keen to cultivate fresh saplings to renew bamboo on their field.
Major Challenges faced by them as a farmer	<ul style="list-style-type: none"> Advisory – people are fed up with suggestions regarding the use of pesticides, fertilizers, seeds, etc. given by fertilizer sellers, Farmers do not find fertilizer sellers reliable and doubt about nexus with the fertilizer company.
Solution and Expectation from government bodies	<ul style="list-style-type: none"> Fertilizer, pesticides quality check should be conducted in these shops, an annoyed old aged man said. Increase rate for our produce and schemes also.

Table 24: Analysis summary of 6th FGD with farmers

	Variable	Findings
FGD- 6 (Some information apart from previous FGDs)	Bamboo Species Available (Rate)	<ul style="list-style-type: none"> Species as noted in earlier FGD summary
	Major Utilities of bamboo in past	<ul style="list-style-type: none"> Utilities are mostly the same as mentioned in the previous FGDs
	Method of Cultivation	<ul style="list-style-type: none"> Traditional method
	Major Challenges in bamboo cultivation for making it the main source of income	<ul style="list-style-type: none"> Engages land for a longer period of time Affects crops in neighboring land – creates a dispute Give returns after a long period Disease – unidentified, thickness reduces, no strength in timber Market – available alongside the highways once every week, we need to harvest and reach the selling point.
	Livelihood & Migration Quotient	<ul style="list-style-type: none"> Affected the livelihood of bamboo workers but many left intentionally as well. Migration – prevalent but they won't prefer to return if bamboo works are provided because they are earning more than that. Some might come back, especially those who have a family.

Flood mitigation & Bamboo	<ul style="list-style-type: none"> • Migration can't be checked through bamboo works • The area isn't water-logged; can be used for some work but can't control flood
Institutional Resource Mapping	<ul style="list-style-type: none"> • ATMA is working at the block level as some farmers said that people are not knowing about other institutions
Bamboo Cover in the area	<ul style="list-style-type: none"> • Yes, degraded but not to a great extent • Bamboo was never a main source of income • Disease and stunting in bamboo caused degradation • One farmer highlights the negligence towards bamboo by this gen farmer; old culms
Why people gave up using bamboo houses	<ul style="list-style-type: none"> • Awas Yojna helped people to construct long-life houses; people's income also increased • Not fire resistant as well, still making but with a mix
Interest in cultivating bamboo at a big scale	<ul style="list-style-type: none"> • If fresh culms will be provided and scientific methods are taught, then few are ready to cultivate
Major Challenges faced by them as a farmer	<ul style="list-style-type: none"> • No one is here to advise us regarding agriculture. • We understand that regular traditional farming will not give much profit but what to do? • Low production and low rate of the produce as well
Solution and Expectation from government bodies	<ul style="list-style-type: none"> • Bring some schemes for us • Advice or guidance for scientific cultivation <p>Increase rate for paddy and other produce</p>

Table 25: Analysis summary of 7th FGD with farmers

	Variable	Findings
FGD- 7 (Some information apart from)	Bamboo Species Available (Rate)	<ul style="list-style-type: none"> • Java (Rs 80 – 100) and the above-mentioned species
	Major Utilities of bamboo in past	<ul style="list-style-type: none"> • Mostly as same as previously mentioned in the FGDs
	Method of Cultivation	<ul style="list-style-type: none"> • Traditional method
	Major Challenges in bamboo cultivation for making it a main source of income	<ul style="list-style-type: none"> • Covers land for a longer period and affects other lands as well. Affects the crops in neighboring lands, • Disease – at an early stage effect, slow growth and stunting, become dwarf and lining on bamboo culms as well. Dries up from the bottom. No treatment. • Market – These days buyers come from Punjab, Haryana, Gujarat and other states to buy bamboo

Livelihood & Migration Quotient	<ul style="list-style-type: none"> • Affected livelihood of bamboo workers as they say • Migration – very less among bamboo workers • Bamboo Artisan Community is in the same village
Flood mitigation & Bamboo	<ul style="list-style-type: none"> • Utility – Fuel, Machaan above lodged water • Flood mitigation – The majority disagree • Unknown about the role of bamboo in flood mitigation but agrees that it checks soil erosion and slows down the flood water current (shown landscape on-road)
Institutional Resource Mapping	<ul style="list-style-type: none"> • Presence and interventions are less and only a few farmers said that one scientist from the Agricultural College is working in the field with them – at the time suggests and advices about farming as well. • None of the respondents received any training/workshop ever.
Bamboo Cover in the area	<ul style="list-style-type: none"> • Reduced 50% approximately over a few decades due to disease and less concern by farmers towards bamboo. • No maintenance. • Bamboo was never a main source of income for farmers and it can't be made so.
Why people gave up using bamboo houses	<ul style="list-style-type: none"> • Not long-lasting as concrete. • Indira Awas Yojna • High maintenance cost – labour not available for repairs. If available, then seeks high wages
Interest in cultivating bamboo at a big scale	<ul style="list-style-type: none"> • Though it is profitable, bamboo cultivation is not suitable for marginal farmers. • Can't be cultivated in fragmented lands.
Major Challenges faced by them as a farmer	<ul style="list-style-type: none"> • Annoyed over high input cost specifically due to high price pesticides and fertilizers • Complains about low-grade seeds, fertilizers supply • It seems that unethical businesses are being done by fertilizer companies.
Solution and Expectation from government bodies	<ul style="list-style-type: none"> • Low rate for their produce. • Check the quality of seeds and fertilizers in the market • Increase rate for our produce • Very few farmers are able to figure out the problem and solution

Bamboo Workers Data analysis and suggestions

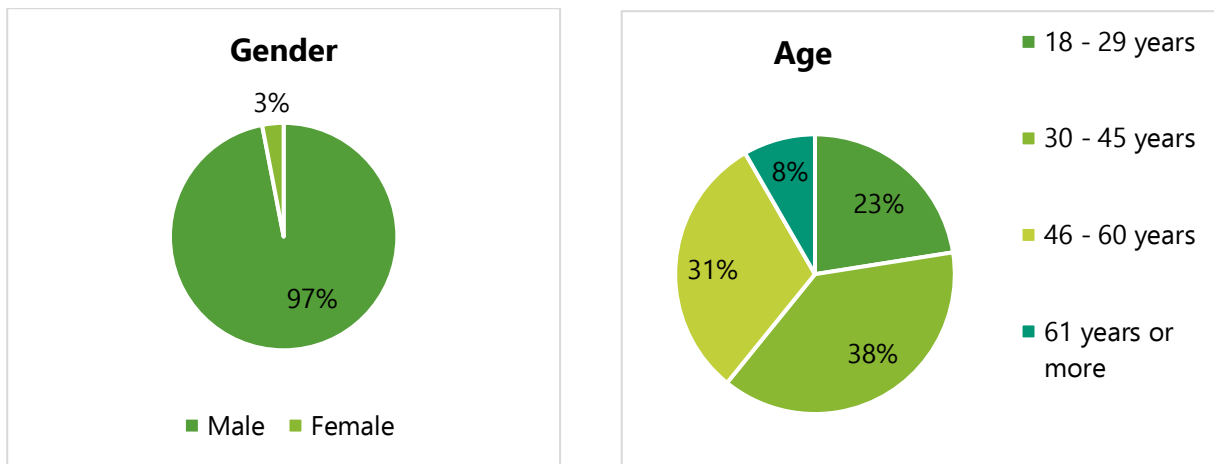


Fig 5: Gender and youth's presence in bamboo-based works

The above figure shows the distribution of respondents by their gender and age. The majority (85.0 %) is the male population and the remaining (15.0 %) are females. Bamboo-based works in Purnia are male-dominated. This also indicates the meager share of women workforce in villages.

It is seen that 22.5% fall under the age group of 18-29 years i.e. youth, 22.5 % fall under the age group of 30-45 years, 30.8% fall under the age group of 46-60 years. There were significantly 8.2% of the respondents beyond the age of 60 years. It shows that more than two-thirds of the respondents are of age group 30-60 years which indicates that the livelihood opportunities through bamboo are not attracting the rural youth. At the same time, bamboo works can be a source of income for able-elders.

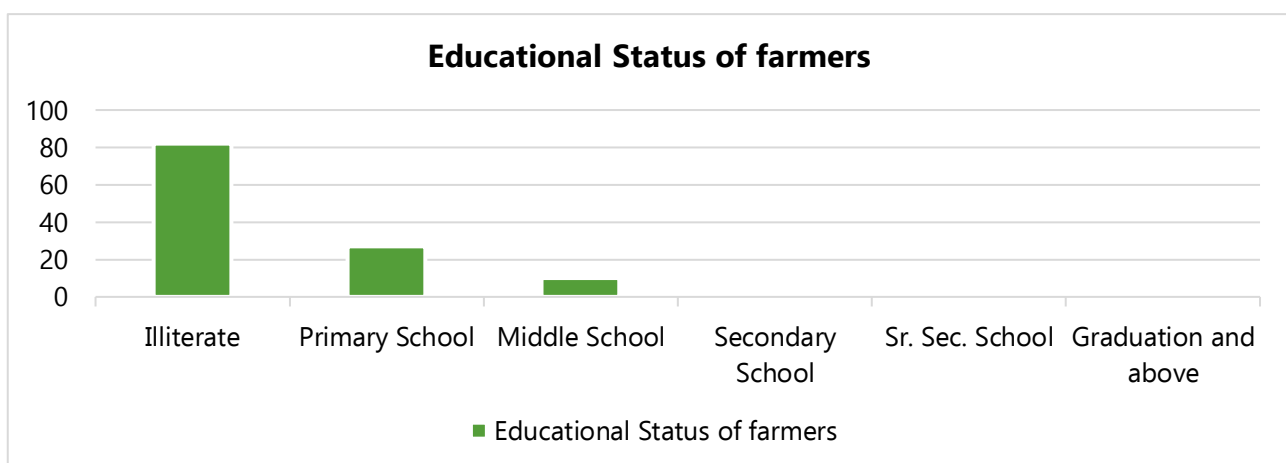


Fig 6: Education among Bamboo based workers

The above figure shows the educational qualification of respondents. It is seen that the majority (68.3%) of respondents are illiterate. Less than one-third (22.5%) have attended primary school, 8.3% attended middle school, 0.9% earned Secondary Certification whereas none of the respondents earned Senior Secondary or above. It's worth noting that the participation of literates decreases with an increase in the level of education.

This study finds that the majority (73.3%) of the respondents were 'Other Backward Classes (OBC)' and less than one-third (26.7%) were scheduled caste. There were no respondents from the general category and STs are not present in the Purnia district.

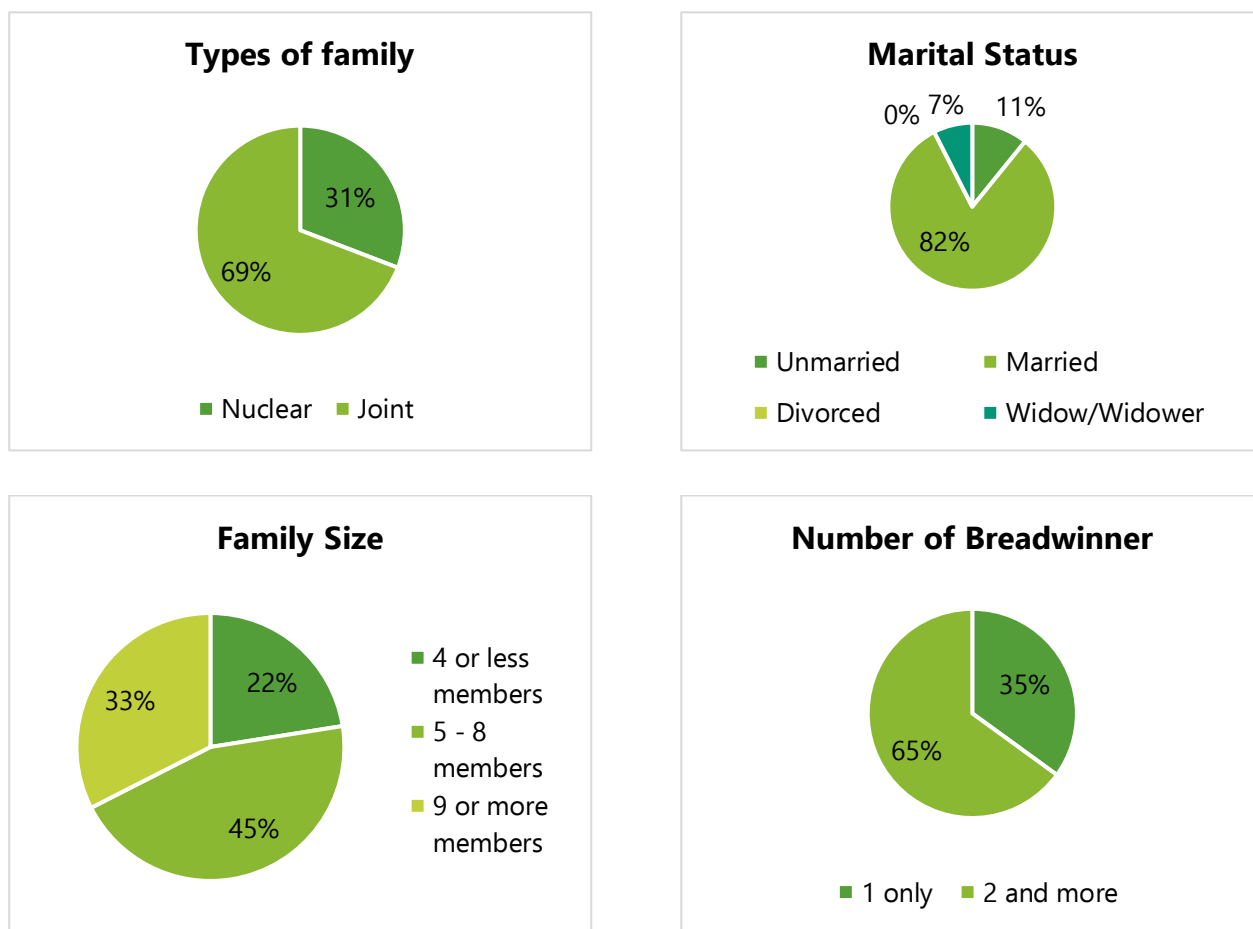


Fig 7: Familial Status of bamboo-based workers

The above figure shows the distribution of respondents by types of the family they live in. According to the table, it is clear that more than two-thirds of the respondents (69.2 %) live in a joint family and the remaining i.e. less than one-third (30.8%) are living in a nuclear family. The trend of a joint family still prevails. The majority of the respondents are married.

According to the figure, it is clear that 22.5 percent of the respondents have a small family size whereas nearly half (45.0%) of the respondents have a family consisting of 5 to 8 members. One-third of the respondents have a comparatively large family size with more than 9 members.

The above figure shows that approximately two-thirds of the respondents (65.0 %) have 2 or more members who earn a livelihood for their family whereas the remaining one-third (35.8%) are sole breadwinners of the family.

Table 26: Bamboo workers with government ID cards

Name of ID Cards	Status	Frequency	Percentage
Govt. ID Cards	No	23	19.2
	Yes	97	80.8
BPL Card	No	34	28.3
	Yes	86	71.7
MGNREGA Card	No	96	80.8
	Yes	23	19.2
ID issued by Labour Department	No	100	100
	Yes	0	0
Total		120	100

The above table 26 shows the numbers of a breakdown of several identity cards that a daily wage worker must have. According to the table, it is clear that the majority (71.7%) of the respondents are living under the 'Below Poverty Line (BPL)' category whereas less than one-third of the respondents have MGREGA cards which ensure 100 days employment guarantee. None of them had been found registered with the Department of Labour in the district.

Table 27: Average Monthly income of the bamboo workers

Average monthly income	Frequency	Percentage
Less than Rs 8500	77	64.2
Rs 8501 to Rs 10500	25	20.8
Rs 10501 to Rs 12500	14	11.7
Rs 12501 to Rs 15000	4	3.3
Rs 15001 or more	0	0
Total	120	100.0

The above table 27 shows that significantly about two-thirds (64.2%) are earning lesser than the wage mentioned for unskilled labours, very few (15.0%) are able to earn more than Rs. 10,500.

Tracing bamboo work as a livelihood, impact and general observations on bamboo workers:

Table 28: Category of bamboo workers among respondents

Category of workers	Frequency	Percentage
Regular bamboo workers	44	36.7
Occasional Bamboo Workers	21	17.5
Regular Bamboo Artisans	43	35.8
Occasional Bamboo Artisans	12	10.0
Total	120	100.0

The above table 28 shows that the study covered almost equal numbers of daily wage bamboo workers (54.2%) and artisans (45.8). It has been observed that the presence of regular bamboo artisans in the areas is very significantly one-third of the respondents (35.8%).

Table 29: Number of workdays before adopting alternate livelihood

(at the time of choosing alternate livelihood)

Availability of work	Frequency	Percentage
I was not getting work at all	21	17.5
Irregular workdays <i>(less than 15 days)</i>	33	27.5
Seasonal work	25	20.8
Yes, Very often <i>(less than 15 days)</i>	41	34.2
Total	120	100.0

Above table 29 shows that only one-third were getting workdays more than 15 days whereas nearly half of the respondents (45.0%) were either getting irregular work or were not getting work at all, which led them to opt for an alternate source of livelihood.

Table 30: Migration Intensity among respondent bamboo workers

Response	Frequency	Percentage
No, never migrated	59	49.2
Yes, migrated	61	50.8
Total	120	100.0

Above table 30 shows that though an almost equal number of respondents said they were migrated or not migrated; it shows the significantly high incidence of migration of bamboo workers.

Table 31: Present work status of respondent bamboo workers

Nature of work	Frequency	Percentage
Unemployed	10	8.3
Farming	5	4.2
Agriculture Laborer	12	10.0
Regular bamboo workers	15	12.5
Occasional Bamboo Workers	9	7.5
Regular Bamboo Artisans	16	13.3
Occasional Bamboo Artisans	13	10.8
Others	40	33.3
Total	120	100.0

The above table 31 shows that significantly more than half (55.8%) of the bamboo workers have to adopt an alternate source of livelihood and significantly very less (14.2%) opted for farming or agriculture laborer, 8.3 percent become unemployed and one-third opted for various other works like masons, vending or small works in cities where they migrated. Bamboo artisans seem to be least affected in comparison to daily wage bamboo workers.

Table 32: Reason to adopt alternate source of livelihood

Reasons	Frequency	Percentage
Unavailability of bamboo workers	56	46.7
Less wage than alternate work	40	33.3
Migrated for better income	24	20.0
Total	120	100.0

The above table 32 shows the reasons why bamboo workers looked for an alternate source of livelihood. It indicates that the major reason (46.7% response) was the unavailability of bamboo-related works whereas one-third of the respondents talked about wages being lesser than the alternate source of livelihood. Very few (20.0%) said they migrated to cities for better income due to the above said reasons. In addition, as they reported, the unavailability of employment in the state forced them to migrate out of the state.

Table 33: Intensity of getting more workdays and more wage after the transition

Reasons	Status	Frequency	Percentage
Work days	No	68	56.7
	Yes	52	43.3
Wage	No	60	50.0
	Yes	60	50.0
Total		120	100

The above table 33 shows the responses of respondents who are making the query ambiguous and thus, it is difficult to conclude majorly due to the wide range and nature of work opted for by the bamboo workers as an alternate source of livelihood.

Table 34: Self-rating of expertise to bamboo works done by respondents

Expertise levels	Frequency	Percentage
Not market competent	27	22.5
Good	68	56.7
Best	24	20.0
Perfect	1	0.8
Total	120	100.0

The above table 34 shows the expertise level of bamboo workers rated by them. A sum of 56.7 percent of bamboo workers considers their work as good and 20.0 percent consider their product as the best. Only one percent of respondents considered the product as perfect where 22.5 percent of respondents considered that their work is not market-competent. It can be concluded that the average quality of work is done by more than three-fourth (76.7%) of the respondents.

Table 35: Bamboo worker's perception of people giving up using bamboo house

Response	Frequency	Percentage
No	27	22.5
Yes	68	56.7
Total	120	100.0

The above table 35 shows that fairly more than half (56.7%) of the respondents agree that people gave up using bamboo houses whereas 22.5 percent of the respondents disagree on this question.

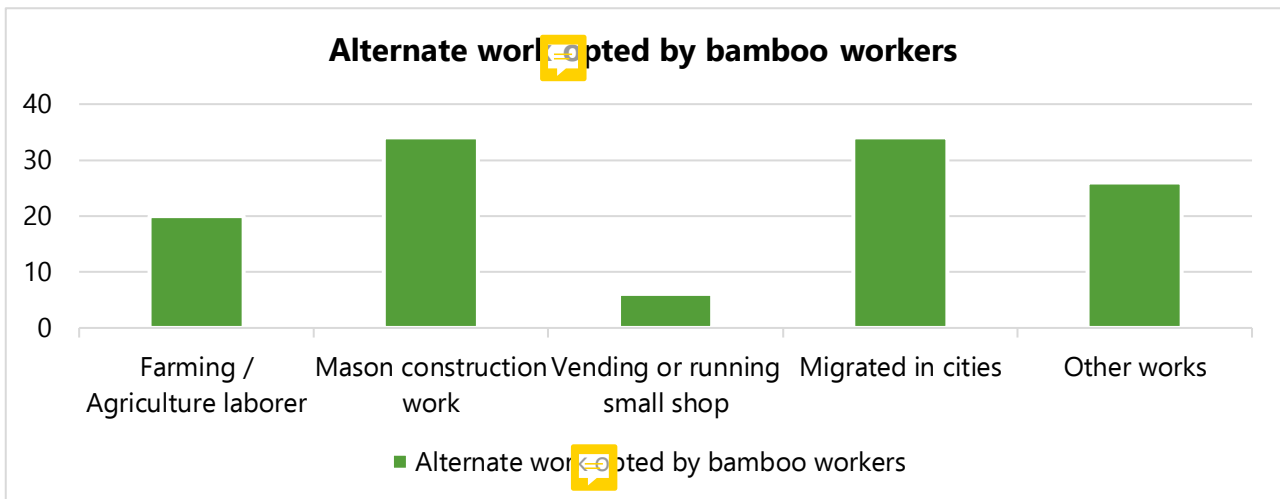


Fig 8: Alternate works opted by bamboo workers

The above figure 7 shows that the bamboo workers in the locality looked for alternate livelihood opportunities in a wide range of works. Majorly, they are prone to migrate to cities (28.3%) or to opt for mason-construction work (28.3%) in the locality. Significantly, very few (16.7%) are going into the field of agriculture. Running a small shop or vending (5.0%) is significantly the least choice mainly due to the non-availability of initial investment required for these.

Table 36: Bamboo worker’s perception of the return of bamboo in people’s lives

Response	Frequency	Percentage
No	78	65.0
Yes	42	35.0
Total	120	100.0

The above table 36 shows that nearly two-thirds (65.0%) of the bamboo workers consider that bamboo is not making a comeback in people’s lives.

Some other meaningful observations:

- All of the bamboo workers have their own home.
- The majority of the bamboo workers either have to engage their family members in their work or have to do multiple works for livelihoods.
- None of the respondents are registered with the Department of Labour at the district level.
- None of the bamboo workers have a membership in any union, labour organization or labour welfare society.
- None of the bamboo workers got training or attended workshops related to bamboo works ever. All of them gained skills related to bamboo work from their ancestors.

Case studies of Bamboo Workers have been mentioned below:

Bhikhu – Invisible fighter with poverty

Look at the life story of Bhikhu (55, Male) who never attended school as there was no access to education in his time. He is the son of an agriculture laborer and worked in the agriculture field with his parents from an early age. He remembers his hard time, every closing month of the crop cycle was like hell when his family had no single penny for more than a month and was forced to eat plain boiled rice or roti with salt and chilly, without any vegetables. One fine day, he met a person who was going to sell baskets and broomsticks to the local village market. Bhikhu accompanied him and spent the whole day with that basket seller. At the end of the day, Bhikhu found that the basket seller was



Bhikhu on his way to sell out Bamboo Lids

happy enough and went to a fish market, bought a big fish for his family just by selling a few baskets & broomsticks! Bhikhu recalls the day as a blissful day. Since then, he planned to do the same so that he can earn some amount daily or at least on a weekly basis but not after a long crop season like his father. It took years to learn skills to make bamboo baskets as he did not have appropriate tools but the end result was very joyous. His family never met any situation of fasting thereafter as Bhikhu started earning fortnightly by selling bamboo baskets. Gradually, he increased his skills and capacity to make baskets and increase his income by selling those products in a nearby weekly market as well as ferrying in villages. Bhikhu's eldest daughter got married in a well-off family, one is attending college & three other children are going to school and his family is living happily. Developing countries, particularly India, is full of stories like Bhikhu, which comes under the umbrella of an unorganized sector of the Indian economy, invisible, lone fighter with poverty.

Kaushalya – Proud breadwinner in difficult times through bamboo products making skills

Kaushalya (31, Female) is a mother of five children, living with an ailing husband in Dargachi village in Baisi, Purnia. She is a victim of child marriage who has grown up helping her father in making handheld fans, baskets, winnower, etc. without knowing that her fate will make her a bamboo worker in the future. Her husband was a daily wage worker in construction and was earning well to meet the daily expenses of his family. Hence, she was not doing any paid work during her early marriage days. Husband's ailment due to Tuberculosis put her in a difficult time and pushed her to earn a livelihood

for the family. She was left with nothing but to work somewhere else to fulfill the basic needs of her family but she couldn't go to cities for even domestic works due to her youngest baby and the city area was nearly 40 km from her home. So, she started making hand-held bamboo fans and baskets that she learned from her father. In the initial stages, she was not able to earn much due to less productivity and scarcity of time for ferrying across villages to sell finished products. Her husband's deteriorating health further aggravated her life situation. At present, she makes hand-held bamboo fans, baskets, mats on demand, Sooppa (winnowers) according to seasonal cycles in a year and sells out in both ways – by ferrying in villages and sending her husband in two nearby weekly markets in Baisi and Dagarua to sell out bamboo products made by her. She says that the art of making bamboo products saved her and it's sufficient to fulfill household needs adding the notes on the difficulty that she faces to sell out her products by ferrying in villages. After a pause, she says that she is happy. At least, she is not going to beg from people and work from home. She uses a single tool called Dabiya (made of iron) and it takes 2 days to work using one thick Makla Baans (Bambusa Nutan) that she buys at Rs. 100 (approximately) and she makes 20-25 handheld bamboo fans which have a retail market rate of Rs. 40-50 to earn a profit of Rs. 300-500. On inquiry that if she would like to have some training, she said that she knows that training could help her to do her work more efficiently and with perfections, but she promptly replied that she couldn't go for training leaving her ailing husband and children at home.

Vulnerability is a common fate for thousands of women in the community. Kaushalya comes from – ranging from poverty, illiteracy, child labour and child marriage, etc. All these together make it difficult to earn a livelihood. However, a skill training facility to make a value-added product from bamboo can change the scenario – as a self-learned skill to make bamboo products stopped Kaushalya to be a beggar and made her a proud woman who earns a dignified livelihood income right from her home.

Conclusion and Recommendations

The paradigm shift in agriculture in the Purnia district has captured the attention of farmers towards cash crops, primarily maize and paddy from wheat and jute, three decades ago. Bamboo was never a prime agricultural output and has always been considered useful in day to day life of the farmer and communities. Farmers in the district never thought of earning profits by cultivating bamboo even after three years of amendment in the Indian Forest Act 1927 which resulted in the change under the category of bamboo from timber to grass. Farmers in the region are not aware of these changes and their significance. However, bamboos' potential in the region is huge since nine genres of bamboo can be cultivated in the region. A geographical benefit with the district of Purnia is introduced as Assam is in the 600 km periphery and fresh bamboo culms are transported, qualified cultivators are used and it is very convenient to engage with bamboo artisans as a trainer due to excellent road, rail and airway connectivity. Farmers, however, are much worried about their bamboo culms as these culms are decreasing day by day and they are eager to know about bamboo cultivation and its profitability. They are also keen on schemes and government support. Bamboo workers on the other hand are unskilled as most of them are self-learners or got the skills from their forefathers. Artisans are not exposed to modern tools even for bamboo handicrafts! A bare minimum effort on skilling and upskilling bamboo workers in Purnia can change the life scenario of these underprivileged bamboo workers and artisans and can bring them out of poverty. In the view of flood and soil erosion, a detailed analysis of locations for a mass bamboo plantation in riverine habitats has the potential to check soil erosion very effectively. Bambusa Bambos, being a thorny species and sturdy, is famous for its extensive fibrous root system and so, this species can actually be planted alongside the riverbanks of erosion-prone areas.

Despite all the odds with bamboo plantation in Purnia, there are a lot more that can be done in bamboo propagation, cultivation, market linkage and training for the bamboo workers. This is the role of extension agencies for agriculture, government and civil society organisations working with farmers. The small scale, but a very localised approach, will provide the greatest achievement. The presence of agriculture extension services along with the agricultural college in Purnia has a green field to leverage those resources in a very efficient manner that too is very less expensive. Here are a few recommendations:

1. Effective and continuous information and extension services delivery

Farmers have been found less aware of the real potentials of bamboo cultivation and recent changes in perceptions towards bamboo. So, there is a huge gap to fill in terms of information, knowledge and the available technology for scientific and measurable farm practices. It has been also observed that the farmers in this region are poorly equipped with technology. So, extension services can plan and execute some strategies for effective and continuous information, knowledge and technology transfer.

2. Institutional linkage to boost farmer's interest in the adoption of modern farm practices

Purnia is blessed with the presence of Bhola Paswan Shastri Agricultural College in the heart of the district that is well connected to all the corners but the findings of this study suggest that farmers are less aware of the presence of this institution. Irrespective of the reasons, reaching out to farmers should be ensured in all possible ways – the practice of village reception is in practice, but it caters significantly less to farmers and only to cash crops. There is a need to formulate and design some platform through which academicians; researchers, scientists and extension practitioners associated with the agricultural college reach out to the farmers to take them on board for rapidly growing and changing farm practices.

3. Bamboo market mapping and linking farmers with the market

A thorough understanding of the bamboo value chain in the district suggests the uncertainty and insecurity of the bamboo market that the farmers in Purnia have to face. It has been observed that the local aggregators are in contact with traders who buy bamboos from farmers and sell out the same overnight to the traders pinching off a huge sum in between. As evidence of the practice across the whole district, the market established in the district may be concluded by the Bamboo Mandi / Bamboo Bazar Establishment Scheme under National Bamboo Mission. Bamboo Bazar will cater doorstep market availability to the remotest corner of the district whereas centralized Bamboo Mandi in the district centre will link farmers to the national and international bamboo markets. Purnia is well connected by road and rail network which makes a suitable place to establish Bamboo Mandi as well.

4. Technology and innovation orientation among bamboo workers and artisans

Technology transfer is always found to be a challenge to propagate to the end needy person but it is worthy to do so. Technology is the only way for value addition in bamboo artisan's products which can increase the income of the artisans. Needless to say that innovation in bamboo products made by local artisan can't be achieved without the adoption of technology. Hence, equipping bamboo artisans with technology and advanced tools is the need of the hour – a little more delay can exclude them from the fast-growing bamboo market and opportunity. Extension services and extension practitioners have major roles to play in leveraging technology on the bamboo-based product in rural India.

5. Promoting bamboo interest group of farmers and SHGs of bamboo workers

The majority of farmers are either marginalized or small-scale farmers who break land rather than large plots, creating a barrier in the cultivation of bamboo because they fear that they will be fighting over land waste for other agriculturists on adjacent agricultural lands. Mobilizing farmers in the locality for bamboo farming by creating an interest group to club their barren lands on riverfront areas can also benefit everybody and the environment. Bamboo workers and artisans in the district are also lacking market reach beyond the district and mostly end up selling bamboo products in the local market at a very cheap rate. Organizing bamboo workers and forming SHGs may help them to brand their products and maximize their market reach at state, national as well as international levels. Both the activities can easily be done through the engagement of non-profit and for-profit organizations who are closely working in the agriculture sector and for farmer's welfare.

6. Establishment of bamboo nursery through Transfer of Technology (ToT) Model


The selection of nurseries is very significant, with a focus on the fact that most established bamboo culms are old in Purnia, that farmers borrow the remains of the culm after the harvest of bamboos and that they are thus subjected to a set of conditions. The absence of a bamboo nursery in the locality gave rise to such practices. Here, district level offices of the Department of Horticulture and Department of Forest & Climate Change can play a major role in the establishment of bamboo nursery and its promotion so that the replacement of bamboo culms is possible for ecological prosperity.

7. Mass plantation of Bambusa Bambos in soil erosion prone regions

As Purnia falls in the flood-prone zone, it has to face off with the devastating floods year after year which eventually increased soil erosion in the district. The mass plantation of Bambusa Bambos on barren land alongside riverbanks can effectively check soil erosion in the region as Bambusa Bambos have extensive fibrous roots. Here, the Department of Forest and Climate Change have major roles to play right from the identification of soil erosion-prone region, land availability and bearing plantation cost. The government of Bihar, however, has announced a mass plantation scheme under the Jal Jeevan Haryali Campaign for the year 2020 but it's been poorly planned and failed to consider bamboo plantation despite bamboo being a bonafide wonder grass and its promotion comes under the horticulture departments of the district.

With all these interventions, bamboo can be a boon for the region and can effectively bring prosperity

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