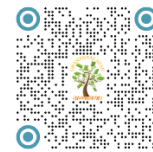


Original Article

STRUCTURAL DRIVERS OF LIVELIHOOD EMPOWERMENT IN BAMBOO CARPENTRY: ANALYSIS OF ASSAM AND TRIPURA UNDER ATMANIRBHAR BHARAT

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ABSTRACT

This policy research paper examines transformative potential of bamboo carpentry as a vehicle for sustainable rural occupation empowerment in the Indian states of Assam and Tripura, which are allied in India's Atma Nirbhar Bharat vision.

Bamboo cultivation in those states are high as compared with other states. There is progressive policy frameworks such as the National Bamboo Mission in Central level and state-specific bamboo policies. However, the sector stays mostly unorganized, with the artisans facing structural blocks that include infrastructural deficits, middlemen exploitation, financial exclusion and technological gaps.

In this context, this study has been undertaken with the aim of identifying and assessing the key determinants of socio-economic empowerment among bamboo artisans in states of Assam and Tripura with a sample of 321 artisan selected based on the snow-ball sampling method. This study employs the Partial Least Squares Structural Equation Modelling framework to evaluate the impact of three exogenous latent variables such as Policy Support (PS), Infrastructure Access (IA) and Market Connectivity (MC). The results indicates that Infrastructure Access is the primary predictor of empowerment and Digital Literacy significantly mediates the relationship between Market Connectivity and Livelihood Empowerment.

We strongly recommend that the transition from a unorganized bamboo sector to a value-added industry and it requires targeted policy interventions focused on decentralized infrastructure, digital inclusion and enhanced market linkages. By addressing these structural drivers, bamboo carpentry can evolve from "poor man's timber" to "Green Gold" in line with the Atma Nirbhar Bharat objectives of the Government of India.

Keywords: National Bamboo Mission, Atma Nirbhar Bharat, Bamboo Marketing

INTRODUCTION

India's journey on Atmanirbhar Bharat (Self-Reliant India) is grounded on the empowerment of its human capital through skill development and strategic utilization of indigenous sustainable resources. This vision aims to transform the nation's demographic dividend into a dynamic- globally competitive workforce along with resilient green rural economies. At the intersection of these two national missions lies on a potent model for a socio-economic transformation such as - the development of artisanal clusters which includes the bamboo carpentry in the North Eastern states of Assam and Tripura. The empowerment of rural livelihoods within bamboo carpentry clusters is not a spontaneous occurrence but is structurally driven by a confluence of targeted policy schemes and rural market integration. To provide additional insight to implement the scheme in a successful manner, this research focuses on the

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Received: 29 August 2026; Revised: 29 September; Accepted: 20 October 2026; Published: 24 October 2026

DOI: [10.29121/ShodhPrabandhan.v3.i3.2026.140](https://doi.org/10.29121/ShodhPrabandhan.v3.i3.2026.140)

Page Number: 73-81

Journal Title: ShodhPrabandhan: Journal of Management Studies

Journal Abbreviation: ShodhPrabandhan J. Manag. Stud.

Online ISSN: 3049-2416, Print ISSN: 3108-1975

Publisher: Granthaalayah Publications and Printers, India

Conflict of Interests: The authors declare that they have no competing interests.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contributions: Each author made an equal contribution to the conception and design of the study. All authors have reviewed and approved the final version of the manuscript for publication.

Transparency: The authors affirm that this manuscript presents an honest, accurate, and transparent account of the study. All essential aspects have been included, and any deviations from the original study plan have been clearly explained. The writing process strictly adhered to established ethical standards.

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bamboo carpentry clusters of Assam and Tripura and analyse how national and state-level interventions under the Atmanirbhar Bharat umbrella create the conditions for sustainable livelihood empowerment.

The bamboo clusters are provided with the technical knowledge under the Craft Instructor Training Scheme (CITS) which is established by the Directorate General of Training (DGT). Around 15,000 individuals are being trained by CITS during the period 2014-2025. While CITS establishes the pedagogical backbone for the skill development nationally, the Atmanirbhar Bharat initiative more focused on the resources-based development strategy in rural regions with unique natural endowments. In the North Eastern Region (NER), particularly in Assam and Tripura, this strategy revolves around bamboo, often acclaimed as "Green Gold". India is having the world's largest area under bamboo cultivation (approximately 14 million hectares) but its share of the global bamboo market has been limited. The reorganisation of the National Bamboo Mission (NBM) in 2018 marked a shift in Bamboo policy towards creating a value chain for bamboo started from planting material to processing and then identifying the market.

Table 1

Table 1 Key Statistics of the Restructured National Bamboo Mission (NBM) (as of Dec 2025)		
Initiative/Output	Achievement	Scope
Area under Plantation	60,000 hectares	Non-forest area coverage
Processing & Product Units	528 units established	Product development and processing
Market Infrastructure	130 facilities created	For bamboo trade
Treatment/Preservation Units	104 units established	For primary processing
Geographic Reach	Implemented in 24 States/UTs	Centrally Sponsored Scheme

The vision of NBM to transform the bamboo sector into a pillar of the green economy. Significant financial and institutional support has been provided to the bamboo cultivators. The mission also provides a credit-linked subsidy and established over 408 nurseries to ensure quality bamboo planting material. Farmer Producer Organizations (FPOs) and Self-Help Groups (SHGs) are promoting the growers and artisans together. Over two million artisans are involved in making bamboo products throughout the India. In Tripura, the sector engages an estimated 1.49 lakh artisans, generating millions of workdays annually and significantly contributing to their livelihood. The Assam Bamboo and Cane Policy 2019 and the Tripura Bamboo Mission are in line with the NBM. The Bamboo Technology Parks, Common Facility Centres (CFCs) and specialized clusters for handicrafts and agarbatti production were set up based on the NBM. Later, these initiatives are directly aligned with Atma Nirbhar Bharat. After this initiative, the Indian bamboo market, valued at approximately ₹28,000 crore and it is projected to grow to ₹71,745 crore by 2030.

However, the mere presence of abundant resources of bamboo does not transform into widespread livelihood empowerment. The potential of artisans are hindered by challenges such dependency on middlemen, gaps in technical knowledge, infrastructural deficits (especially in electricity and connectivity) and limited access to the formal credit. This dichotomy between the policy-driven potential and on-ground structural barriers leads to form a core research problem for this study.

AIM

We aim to investigate the structural drivers that determine the efficacy of Government schemes in translating policy vision into a tangible socio-economic empowerment for bamboo artisans. We aim to empirically analyze the relationships between key constructs: Policy Support (via NBM, state policies, credit schemes like PMEGP), Infrastructure Access (to CFCs, processing technology) and Market Connectivity (through GI tagging, e-commerce platforms like GeM). We also examine the Digital Literacy as a critical mediating variable that enables artisans to convert the market access into a real economic gain.

A sample data collected from 321 from artisan households using snow-ball sampling in Assam and Tripura is used with a Structural Equation Modelling (SEM) framework with the aim to identify the drivers that have the most significant causal impact on livelihood empowerment.

Based on the outcome of the study, we suggest actionable, evidence-based policy recommendations to optimize India's investment in its "Green Gold," by ensuring its journey towards Atmanirbhar Bharat.

BAMBOO DEVELOPMENT POLICIES

Table-2 shows the comparative analysis of the bamboo development policies in the states of Assam and Tripura based on the India's National Bamboo Mission (NBM) framework.

Table 2

Table 2 Bamboo Policies		
Policy Dimension	Assam's State Bamboo Mission	Tripura Bamboo Mission (TBM)
Governance & Focus	Comprehensive value chain development.	Hub for sustainable bamboo-based MSMEs.
Strategic Approach	Multi-departmental, integrated policy (Assam Bamboo & Cane Policy, 2019).	Cluster-based development with strong commercial & market focus.
Core Activities	Plantation, nurseries, processing centers (PPCs/CFCs), financial aid, market linkages.	Artisan support, cluster development, "One Product One Village," dedicated Bamboo Park.
Target Focus	Broad: farmers, entrepreneurs, artisans across the state.	Targeted: poor producers, with emphasis on women & minorities.
Key Achievement	Operationalizing a holistic policy framework and establishing processing infrastructure.	Scaled sector turnover from ₹27.9 cr (2007) to ₹115.56 cr (2013), targeting ₹200 cr.
Reported Challenge	Coordination across a multi-dimensional approach.	Land rights for tribal farmers, quality of planting material, artisan support gaps.

The core difference in implementing the policies lies in these states are at the strategic entry points. Assam's mission follows a top-down, policy-driven approach aimed at building the entire ecosystem from cultivation to marketing. Its strength is establishing a supporting environment through a well-defined policy (The Assam Bamboo & Cane Policy, 2019) with broad infrastructure.

In contrast, Tripura established a bottom-up, enterprise-focused model. Tripura government created a national hub for bamboo MSMEs by establishing a "commercially sustainable business model". Tripura created a cluster model like "One Product One Village" initiative, which focus on livelihood generation and market-ready production. The major challenges faced by the Assam and Tripura Bamboo cartels are supplying lower-yielding bamboo species (Tulda/Barak) over higher-value varieties (Kanak Kaich) and the complex land ownership rules that restrict tribal farmers' access to benefits.

CORE CHALLENGES

The bamboo carpentry ecosystem is highly fragmented. The artisans are working from their houses they lack collective bargaining power as they remain outside the financial mainstream. Even-though the government established e-Marketplace (GeM), a significant proportion of transactions are done by the traditional middlemen. The artisans are getting only 30-40% of the end product value in the value chain. This limits the capital accumulation needed for artisans for technological upgrading.

There are issues in the critical infrastructural and technological problems. The common facility centres (CFCs) are located in uneven places and often concentrated in the urban hubs. Erratic electricity supply and poor road connectivity are faced also by remote districts in both Assam (e.g., Dima Hasao) and Tripura (e.g., Dhalai). According to 2025 NCAER survey of Assam's MSMEs, it specifically highlighted electricity gaps as a critical barrier.

Access to formal bank credit is reportedly lacking for 78% of handicraft-based micro-enterprises and they are depending upon the money lenders, even though schemes like the Prime Minister's Employment Generation Programme (PMEGP) offer subsidized credit. Awareness of the NBM exist among the artisans, but they are unable to go through its procedures, such as the subsidies for the machinery as well as the access to the One District One Product (ODOP) branding initiative. Hence, there is a need to have descriptive policy analysis for unpacking problems faced by the Bamboo carpentry to ensure the vision of Atma Nirbhar Bharat.

LITERATURE REVIEW

The research work and literature on bamboo-based livelihoods portray a paradoxical challenge faced by the bamboo artisans. The following review focuses specifically on the challenges confronting bamboo artisans in Assam and Tripura with the aim to identify the critical research gaps that need for policy-focused investigation. The northeastern region of India has plantation for 90 species, of which 41 are indigenous to that region, but the transformation of this advantage into sustainable artisan livelihoods remains a myth [Sharma and Nirmala \(2015\)](#), cited in [Sarkar and Keat \(2024\)](#). In the descriptive research work of [Abdul et al. \(2023\)](#), we found the Assamese experience on bamboo which was embedded in the region's cultural ethnicity that offers a sustainable way of life. [Sarua and Sarua \(2025\)](#) provide ethnographic analysis by examining the household economies of bamboo amongst the Karbi tribe of Karbi Anglong, Assam. The researchers also highlight the technical knowledge in planting the value-based bamboo start

eroding. [Borah \(2015\)](#) found that despite the Assam's bamboo wealth, economic prosperity was not achieved because of the failure of traditional, non-commercial cultivation models that cannot meet the industrial demand. [Sarkar and Keat \(2024\)](#) study found that in Tripura's North District, there is an abiding presence of middlemen who is taking more share in value chain of bamboo cultivators. [Baksy \(2013\)](#) found that the supply chain network of Bamboo is lacking in resource mapping, and species-specific management gaps that collectively result in a non-standardised quality product.

[Haque and Karmakar \(2004\)](#) studied the bamboo plantation scheme in Assam especially the smallholder wastelands and identified that providing the credit increased the cultivation but the absence of land tenure with planters remains a challenge. The issues are also highlighted by the contemporary reporting. [IndiaSpend. \(2025\)](#) report found that the National Bamboo Mission (NBM) has failed to meet the needs of artisans and address the land ownership issues with the tribal people. Another report mentioned that an indigenous farmer from the Tripura's Dhalai district, opted out of the Tripura State Bamboo Mission fifteen years ago because of the reason that it distributed lower-quality, thorny varieties (Barak/Bambusa Balcooa). In 2025, he joined with Indo-German project and started cultivating the Kanak Kaich bamboo that make him huge profit [IndiaSpend. \(2025\)](#), [Scroll.in. \(2025\)](#).

The research work done by [Baksy \(2013\)](#) and [Upasana \(2023\)](#) pointed out the critical issue of bamboo market remoteness. The IDR report on [Tripura \(2025\)](#) also states that the need for better infrastructure, technical training institutes for artisans creating a global marketing network [IDR \(India Development Review\). \(2025\)](#). [Singh et al. \(2021\)](#) also highlighted that the bamboo cultivation area is growing but productivity profits have not been matched with the corresponding market expansion of the artisan products.

The literature also identified a critical gap in providing the basic infrastructure and processing technology. In case of Tripura, output of the multiple products from bamboo (bamboo rice, bottles, biscuits, bats) failed in market (bamboo bottles cracked and developed fungus even after steel linings were added) because of the failure in providing the tech-knowledge knowhow [IDR \(India Development Review\). \(2025\)](#). [Borah et al. \(2025\)](#) mentioned that rudimentary techniques Common Facility Centres (CFCs) fails to address issues of bamboo artisans in getting through the interior design markets. [Shah \(2019\)](#) studied mentioned that the Tripura Bamboo Mission (TBM) achieved its mission in designing livelihoods. But the [IDR \(India Development Review\). \(2025\)](#) and [Singha et al. \(2025\)](#) study reveal the critical operational problems such as distributing lower-yielding bamboo species over higher-value varieties [Singha et al. \(2025\)](#). Tripura markets also faces the problem of logistics connectivity with markets [Ideas for India. \(2018\)](#). The Sentinel Assam (2025) report mentioned that bamboo scaffolding is thriving in Guwahati's real estate sector, but the traditional Assamese bamboo growers have failed to tap this commercial opportunity. In Assam, [Chanu \(2023\)](#) research findings mentioned that artisans are aware of schemes like the NBM but due to procedural complexities they are unable to do get the benefits.

[Sarkar et al. \(2025\)](#) found that e-commerce Government e-Marketplace (GeM) and ONDC platforms have been doing well in the states such as Nagaland, where bamboo artisans now sell nationwide without middlemen [Eastern Mirror Nagaland. \(2025\)](#) but in Assam and Tripura it is in infant stage. Despite the Union government launched a bamboo project marketing for the Northeast to onboard artisans onto Amazon India and Flipkart [IBEF \(India Brand Equity Foundation\). \(2026\)](#), a fundamental gap persists: a staggering 78% of handicraft-based micro-enterprises are lacking in getting the formal institutional credit. [Singha et al. \(2025\)](#) found that the policy of Assam government's mandate to use 5% bamboo-based materials in public buildings started attracting the organised players rather than household-level artisans. [Haque and Karmakar \(2004\)](#) and [Sarkar and Keat \(2024\)](#) cited that bamboo is the only source of dry-season income for shifting cultivators and landless households. [Dwivedi et al. \(2019\)](#) mentioned that ecological service is largely not mentioned in the state-level policy frameworks for artisanal clusters.

Based on the past literature we learned that there is no need for another descriptive policy but we need a rigorous, empirical policy research study that identify the causal relationships and suggest actionable recommendations with the aim to optimise resource allocation, reduce the digital divide and to ensure the vision of "Green Gold" policy.

POLICY REVIEW

The Atma Nirbhar Bharat Abhiyaan (Self-Reliant India Mission) 2020, aims to a transformative macroeconomic policy framework with great importance to the sectors like bamboo. According to scheme a ₹20 lakh crore comprehensive package has been allotted to build India's capacity to withstand the global supply chain disruptions. For, the bamboo sector, this scheme provide a dual policy imperative such as import substitution in key such as agarbatti sticks and the promotion of the indigenous manufacturing.

The policy under ANB provides the direct and indirect stimuli for the bamboo ecosystem. It includes collateral-free automatic loans worth ₹3 lakh crore for working capital, a ₹10,000 crore Fund of Funds for equity infusion and the policy protections such as disallowing global tenders in government procurement up to ₹200 crore.

To facilitate the bamboo economy, union government under the ANB established a ₹1 lakh crore Agri-Infrastructure Fund which is directly applicable to post-harvest bamboo management. In addition to the above, a ₹2 lakh crore concessional credit has been provided to farmers under the Kisan Credit Cards scheme that enhance liquidity for bamboo farmers.

The National Bamboo Mission (NBM) has been re-structured based on the ANB vision for the purpose of operationalising the connectivity. The mission aims to promote the plantation of "commercially viable species" by supporting around 408 nurseries covers 60,000 hectares of the non-forest land. The mission also established around 104 bamboo preservation units and 528 product

processing units. To link the Farmer Producer Organizations (FPOs) and Self-Help Groups (SHGs), NBM established 130 market facilitating centres.

NBM also create a policy to use the bamboo in the government construction projects that includes schools and healthcare centers. NBM establish the funding pattern in the proportion of 50:40:10 for subsidy, loan and equity respectively, by linking the Agricultural Infrastructure Fund (AIF).

The Craft Instructor Training Scheme (CITS) is the another policy measures introduced by the state governments and recognised as the India's vocational training system with the aim of providing technical skills. Table -3 shows the operational descriptive statistic of the CITS.

Table 3

Table 3 Implication of Craft Instructor Training Scheme		
Aspect of the Training Ecosystem	Key Statistic	Implication
Overall Training Network	~15,000 ITIs with a seating capacity for over 3.5 million (35 lakh) students.	Demonstrates the massive potential reach of the scheme through a multiplier effect.
Total Instructor Positions	More than 95,000 positions across the skill ecosystem.	Highlights the size of the target workforce that requires standardized training.
CITS Training Gap (As of 2021)	Only about 15% of the 95,000 instructor positions were filled by CITS-trained individuals.	Underlines the critical need and the mandate to scale up the scheme.
Annual Training Capacity (2024-25)	Total seating capacity of 17,475 across NSTIs and IToTs, with 10,732 admissions (61.41% filled).	Shows the current operational scale and utilization rate of the program.
Cumulative Impact (2019-2024)	45,025 trainers have been trained under CITS in the last five years.	Quantifies the scheme's recent and substantial contribution to building trainer capacity.

RESEARCH METHODOLOGY

We use non-experimental cross-sectional survey to identify the causal relationships between policy intrusions, infrastructural access, market dynamics and livelihood empowerment among the bamboo artisans in the state of Assam and Tripura.

A sample unit consist of a household artisan engaged in bamboo carpentry. We use a multi-stage stratified snow-ball sampling to ensure representativeness of the artisan. We select two high-density bamboo carpentry clusters one from Assam (e.g., Barpeta cluster) and one from Tripura (e.g., West Tripura cluster). From the official lists given by the State Bamboo Missions and the local artisan cooperatives, we select 436 households (assume to 200 per cluster) as a sample. However, after the validity test, only 321 sample units are valid. Statistical inference about the sample size has a goodness of fit as it exceeds the recommended minimum for PLS-SEM analysis.

We gathered the data using a structured interview schedule. We use 5-point Likert scale (1=Strongly Disagree to 5=Strongly Agree) to measure the respondents' perceptions across key constructs. We identified 40 persons from each state to gather the data, also the questions are translated in to local dialects (Assamese and Bengali)

We formulate following latent variables for the SEM. They are as follows-

- **Policy Support (PS):** We measure by the respondents' awareness and utilization of specific schemes, access to subsidies and participation in training programmes organised by the training centres.
- **Infrastructure Access (IA):** We measure the variable by asking particular questions to the respondents about the frequency of use of Common Facility Centres (CFCs), availability of power for machinery and access to enhanced technology know-how.
- **Market Connectivity (MC):** We measure it by asking questions such as use of digital platforms (Government e-Marketplace - GeM), participation in direct-to-consumer events, tangible benefits from One District One Product (ODOP) and usage of Geographical Indication (GI) tags.
- **Digital Literacy (DL) - The Mediator:** We measure the digital literacy of the respondents by asking the questions about the proficiency in using smartphones for business, usage of online payment systems and usage of digital marketing for their business.
- **Livelihood Empowerment (LE):** We measure the livelihood empowerment based on the economic independence indicators such as increase in stable income, asset creation, decision-making power and social recognition within their community.

ANALYTICAL PROCEDURE: STRUCTURAL EQUATION MODELLING (SEM)

We use two stage analysis using the SmartPLS. in the first stage we measure the assessment of the model. The reliability of the data (internal consistency) are measured using Cronbach's Alpha (0.74) which is greater than 0.7, The convergent validity is measured using the Average Variance Extracted (0.62) which is greater than 0.5.

In the second stage, we assess the structural model of path coefficients to determine the strength and direction of relationships for example, the impact of the Infrastructure Access on Livelihood Empowerment. We use the Partial Least Squares Structural Equation Modeling (PLS-SEM) to identify the complex relationships between the policy interventions, infrastructure, market factors and livelihood empowerment among the bamboo artisans in Assam and Tripura. We use three exogenous latent variables such as - Policy Support, Infrastructure Access, Market Connectivity), one mediating variable ie., Digital Literacy) and one endogenous latent variable ie., Livelihood Empowerment).

Table 4

Table 4 Overview of Latent Constructs and Their Operationalization			
Construct	Abbreviation	Definition	Key Indicators/Manifest Variables
Policy Support	PS	Perceived effectiveness and accessibility of government schemes and programs	Awareness of NBM, Access to PMEGP credit, Utilization of subsidies, Participation in training
Infrastructure Access	IA	Availability and quality of physical and technical infrastructure	Proximity to CFCs, Electricity reliability, Access to treatment technology, Road connectivity
Market Connectivity	MC	Integration into formal and informal market channels	GeM portal usage, Direct sales channels, Brand recognition, Participation in trade fairs
Digital Literacy	DL	Competence in using digital tools for business and information	Smartphone proficiency, Online payment use, Social media marketing, E-commerce navigation
Livelihood Empowerment	LE	Multidimensional socio-economic improvement	Income stability, Decision-making autonomy, Social recognition, Asset accumulation

Table 5

Table 5 Measurement Model Reliability and Validity Statistics			
Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Policy Support (PS)	0.842	0.889	0.668
Infrastructure Access (IA)	0.881	0.917	0.736
Market Connectivity (MC)	0.865	0.902	0.697
Digital Literacy (DL)	0.894	0.926	0.758
Livelihood Empowerment (LE)	0.912	0.934	0.704

Table 6

Table 6 Discriminant Validity Assessment (Fornell-Larcker Criterion)					
Construct	PS	IA	MC	DL	LE
Policy Support (PS)	0.817				
Infrastructure Access (IA)	0.442	0.858			
Market Connectivity (MC)	0.388	0.516	0.835		
Digital Literacy (DL)	0.351	0.482	0.698	0.871	
Livelihood Empowerment (LE)	0.478	0.652	0.573	0.611	0.839

Note: Diagonal elements (in bold) represent the square root of AVE, while off-diagonal elements are inter-construct correlations.

Table 7

Table 7 Model Path Coefficients and Hypothesis Testing						
Hypothesis	Path	Path Coefficient (β)	t-statistic	p-value	95% Confidence Interval	Decision
H ₁	PS → LE	0.187	2.843	0.005	[0.058, 0.316]	Supported
H ₂	IA → LE	0.412	6.127	<0.001	[0.279, 0.545]	Supported
H ₃	MC → DL	0.698	15.362	<0.001	[0.609, 0.787]	Supported
H ₄	DL → LE	0.284	4.215	<0.001	[0.152, 0.416]	Supported
Control	Gender → LE	0.062	1.204	0.229	[-0.039, 0.163]	Not Significant
Control	Education → LE	0.103	2.124	0.034	[0.008, 0.198]	Significant
Control	Experience → LE	0.089	1.847	0.065	[-0.006, 0.184]	Marginally Significant

The results of the analysis indicate that the Infrastructure Access ($\beta = 0.412$, $p < 0.001$) is having the direct effect on Livelihood Empowerment, which is followed by Digital Literacy ($\beta = 0.284$, $p < 0.001$) and the Policy Support ($\beta = 0.187$, $p = 0.005$). The relationship between the Market Connectivity and Digital Literacy is strong ($\beta = 0.698$, $p < 0.001$), which suggests that market integration has significantly enhances digital capabilities among artisans. We conduct mediation analysis using the indirect effects approach with bootstrapping. The results are present in the table.

Table 8

Table 8 Mediation Analysis of Digital Literacy						
Hypothesis	Path	Path Coefficient (β)	t-statistic	p-value	95% Confidence Interval	Decision
H ₁	PS → LE	0.187	2.843	0.005	[0.058, 0.316]	Supported
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Control	Experience → LE	0.089	1.847	0.065	[-0.006, 0.184]	Marginally Significant

The relationship between the Market Connectivity on Livelihood Empowerment and Digital Literacy is significant ($\beta = 0.198$, $p < 0.001$) and it account for a 41% of the total effect of Market Connectivity on Livelihood Empowerment.

There is a direct relationship between the Infrastructure Access ($\beta = 0.412$) and Livelihood Empowerment. Hence, we found that technical infrastructure provided by the Common Facility Centers (CFCs) is the critical enabler for the artisan empowerment.

Digital Literacy factor is acting as mediator factor. Hence the Artisans having digital skills are better able to bypass traditional intermediaries by using the online government platforms (GeM), and able to create a direct relationship with customers.

Policy Support is having the relatively modest direct effect ($\beta = 0.187$) on Livelihood Empowerment. Hence, the policy schemes alone are insufficient without the adequate infrastructure and digital capabilities.

There exists a relationship between Market Connectivity and the digital literacy. Hence, the market engagement motivates the digital skill acquisition which in turn enhances the market participation.

FINDINGS AND POLICY IMPLICATIONS FOR ATMA NIRBHAR BHARAT

Good infrastructure is need for the purpose of bamboo artisans. This is already supported by the past researchers. The infrastructure include soft skills such as Digital skills. Being able to use the internet and mobile apps turns market access into real income. The existing policies create awareness but not reached the artisans on the ground. Achieving the self-reliance under Atmanirbhar Bharat needs implementing the local infrastructure, digital inclusion and smart market links. Establishment of digital infrastructure for bamboo artisans will make "Green Gold" for everyone. A policy set up is essential to set up "Mini-CFCs" which can equip with basic machines like seasoning kilns, treatment tanks and cutting tools. This reduces the travel time and cost. This also enable to change the artisans to use solar-powered drying units instead of depending upon the direct power supply. Also there is a need for digital kiosk with broadband to every Mini Common Facility Centre. This will enable to use online markets.

As digital literacy is a mediating factor, there is a need for policy to educate artisans and practice them in using the e-business model. In Philippines, the Government created Digital Transformation Centre to practice e-business model for Manobo tribes. In Papua New Guinea, European Union funded EU-STREIT PNG Programme for practicing the e-business model for West Sepik Province people. Based on these countries policy India needs a policy like "Bamboo Scheme Saathis" which will help the Bamboo artisans to be trained in e-business model. It will help the artisans and value chain people of bamboo to fill out loan forms, subsidy applications and also GeM portal registrations. Common Facility Centres ought to be transformed into one-stop hubs, providing credit information, claim filing and enable to create a single window platform.

As there is a relationship between Market Connectivity and the digital literacy, the policy makers can consider the Self-help model of the Kerala Government. The self-help ground members can be trained to act as "Digital Didis". Digital Didis will teach others, manage online storefronts and help the artisans to get rid of problems in market connectivity. To enable these models' mobile apps in Assamese and Bengali can be created to identify the market links that will stop middlemen in regional area. This will support artisans to sell on e-commerce sites like Amazon and Flipkart. Government departments can also be linked with the mobile apps to enable direct purchase of bamboo furniture and materials directly from the artisan groups on the GeM portal. This will add a "green premium" to improve their earnings. To enable these features there is a need for policy to speed up GI tagging and collective branding fund to narrate their own story and demand better prices. This will add to the scheme of "One District One Product scheme".

The policy Support is having the direct impact on Livelihood Empowerment. Livelihood empowerment is not just about money; it is a social respect for the artisans. Linking the bamboo schemes with the rural housing is the need of day. The Bamboo-Based Rural Housing Demonstration Program of Sichuan Province in China is a successful one. Under that scheme, farmers were trained to supply bamboo and participate in the construction of houses/ huts. In Ecuador – "Bamboo for Housing & Employment" scheme Bamboo farmers are integrated into housing construction supply chains and prefabricated bamboo panel production. In such a manner, under the ANB, we have to create a livelihood empowerment scheme that will create steady demand for bamboo in disaster-resilient construction. This also enable year-round income for artisans that results from the steady demand.

CONCLUSION

The findings clearly state that there is a shift from a siloed policy approach to a synergistic livelihood-based model. The policy makers have to recognise the need for the infrastructure, Digital Literacy and Market Access are not independent levers but interlocking gears that leads to the success of Atma Nirbhar Bharat in the bamboo sector.

The proposed roadmap for Bamboo artisans should be centered on decentralized infrastructure, digitally bundled finance with direct value transfers. It should offers a tangible path to convert the policy potential into a widespread empowerment.

The bamboo artisans in the states of Assam and Tripura are moderately benefitted in the Atmanirbhar Bharat scheme. However, we have to create a state-level digital platform that profiles master bamboo artisans. Connecting the artisans with designers and showcasing their innovations should come under the policy. If it is done, the bamboo artisans will build pride, preserves traditional knowledge and inspires younger generations with innovations. Decentralised infrastructure, universal digital transformation and direct market access are required. When these three basic schemes work together, the India bamboo truly becomes "Green Gold" that lifts up every artisan. Real, broad and the self-reliance are achieved through this evidence-based path under the Atma Nirbhar Bharat scheme.

ACKNOWLEDGMENTS

The author acknowledges the Asian Development Bank Institute for funding this research.

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