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From Awareness to Empowerment: A PLS-SEM Analysis of GI Tagged Silk Handloom Weavers towards Poverty Reduction (Sustainable Development Goal 1)

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ABSTRACT

This study examines the role of Geographical Indication awareness, socio-economic factors, and challenges faced by weavers in influencing weaver empowerment and poverty reduction, aligned with Sustainable Development Goal 1. Using a quantitative research design, primary data were collected from 400 GI-tagged silk handloom weavers in Arani Taluk, Tamil Nadu. The study employed Partial Least Squares Structural Equation Modelling (PLS-SEM) using SmartPLS 4 to analyze the relationships among constructs. The findings reveal that socio-economic factors (β = 0.531), challenges faced (β = 0.322), and GI awareness (β = 0.101) significantly influence weaver empowerment. Further, weaver empowerment strongly contributes to poverty reduction (β = 0.823). GI awareness (β = 0.083) and challenges faced (β = 0.265) also directly impact poverty reduction. Additionally, mediation analysis confirms that weaver empowerment significantly mediates the relationship between GI awareness and poverty reduction. The study highlights that both structural conditions and institutional awareness play a crucial role in enhancing livelihoods and reducing poverty among handloom weavers. The findings provide important policy implications for strengthening GI awareness programs, improving socio-economic conditions, and addressing industry challenges to achieve sustainable development.

Keywords: Geographical Indication, Weaver Empowerment, Poverty Reduction, PLS-SEM, Handloom Sector, Sustainable Development Goal 1
JEL Classifications: Z13, I32, O15

1. INTRODUCTION

India's handloom sector represents a vital intersection of cultural heritage and rural livelihood, serving as one of the largest sources of employment after agriculture. The sector supports over 31.45 lakh households engaged in weaving and allied activities, contributing significantly to industrial production, exports, and income generation in rural and semi-urban regions (Pujari, 2024). It accounts for nearly 14% of industrial production, 3% of the country's Gross Domestic Product (GDP), and around 17% of export earnings, while employing more than 35 million people directly and indirectly. Despite its economic and cultural importance, the handloom industry largely operates within the informal sector, where workers often lack institutional protection, stable income, and access to social security mechanisms. This informality increases their vulnerability to poverty, income instability, and socio-economic marginalization (Malik and Chaturvedi, 2018).

Among India's diverse handloom traditions, Bhagalpuri silk (Tussar silk) occupies a unique position due to its distinctive texture, durability, eco-friendly production process, and rich cultural significance. Originating from the Bhagalpur district of Bihar, this silk has historically enjoyed both domestic and international recognition due to its natural sheen and artisanal craftsmanship. To preserve its authenticity and enhance its market potential, Bhagalpuri silk has been granted Geographical Indication (GI) status. GI certification functions as a strategic

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intellectual property right that links products to their geographical origin, ensuring quality assurance, preventing imitation, and facilitating premium pricing in competitive markets (Bhardwaj, 2025; Kethan et al., 2022). From a developmental perspective, GI tagging is expected to strengthen rural economies by promoting local identity, increasing market visibility, and generating higher income opportunities for traditional artisans.

However, the anticipated benefits of GI tagging have not been fully realized at the grassroots level. One of the primary reasons is the limited awareness of GI among weavers themselves, which restricts their ability to leverage its advantages in terms of branding, product differentiation, and value addition. Studies indicate that many weavers are either unaware of the GI status of their products or lack adequate knowledge regarding its economic implications, thereby limiting its practical utility (Bhardwaj, 2025). In addition, the sector continues to face multiple structural and operational challenges, including limited access to formal credit, lack of technological advancement, inadequate infrastructure, dependence on intermediaries, and intense competition from power loom and synthetic products (Ahmed et al., 2024; Sarkar, 2016; Majeed and Swalehin, 2020). These challenges not only reduce profitability but also weaken the bargaining power of weavers, further exacerbating their economic vulnerability.

The socio-economic conditions of handloom weavers further complicate this scenario. A significant proportion of weavers belong to economically weaker sections, characterized by low levels of education, poor health conditions, and inadequate access to basic amenities. The decentralized and household-based nature of the industry, while environmentally sustainable and labor-intensive, often limits economies of scale, innovation, and access to organized markets (Paul and Goowalla, 2021). Consequently, many weaver households experience income instability, indebtedness, and poor standards of living, reflecting a state of multidimensional poverty (Vallam and Mullapudi, 2017). Moreover, occupational health issues, including musculoskeletal disorders and vision-related problems, further reduce productivity and quality of life among weavers (Sarkar, 2016). These conditions highlight the urgent need for interventions that go beyond production enhancement and address broader issues of social inclusion, capacity building, and empowerment.

In this context, weaver empowerment emerges as a crucial mechanism for transforming awareness and available resources into tangible socio-economic outcomes. Empowerment, in the present study, encompasses multiple dimensions, including enhanced decision-making capacity, improved access to markets, skill development, financial independence, and greater control over production and pricing mechanisms. It also reflects the ability of weavers to negotiate better wages, access institutional support, and participate actively in value chains. Theoretical perspectives on empowerment suggest that it acts as a critical intermediary that enables individuals to convert knowledge and resources into improved well-being outcomes. Thus, empowerment serves as a mediating construct that determines how effectively weavers can translate GI awareness, overcome structural challenges, and utilize socio-economic resources to improve their livelihoods. Without empowerment, awareness alone may not translate into meaningful economic gains or poverty alleviation.

Furthermore, the linkage between empowerment and poverty reduction aligns closely with the global development agenda, particularly Sustainable Development Goal 1 (No Poverty), which emphasizes the eradication of poverty in all its forms. The handloom sector, with its strong rural base, labor-intensive nature, and low capital requirements, holds significant potential to contribute to poverty alleviation by generating employment, promoting inclusive growth, and sustaining traditional livelihoods (Gogoi et al., 2025). However, realizing this potential requires a comprehensive understanding of the pathways through which awareness, structural challenges, and socio-economic conditions influence empowerment and, subsequently, poverty outcomes.

While a number of studies have focused on the economic importance of the handloom sector and the value addition potential of the GI to the product and the perception of consumers (Singh, 2025; Joshi and Rahman, 2019), the study of handloom sector from the producer's side is still lacking from the literature, especially in terms of empowerment and poverty reduction. Most existing research focuses on consumer behavior, branding, and purchase intention, with limited attention given to how GI awareness influences the socio-economic conditions of weavers themselves. Furthermore, there is a lack of empirical studies that integrate GI awareness, challenges, and socio-economic factors into a unified analytical framework using advanced techniques such as Partial Least Squares Structural Equation Modeling (PLS-SEM).

Therefore, the present study seeks to address this research gap by proposing a structured model that captures the transition from awareness to empowerment and its subsequent impact on poverty reduction among GI-tagged silk handloom weavers. By employing PLS-SEM, the study examines the direct effects of GI awareness, challenges, and socio-economic factors on weaver empowerment, as well as the mediating role of empowerment in influencing poverty reduction. The study enriches the existing body of knowledge by considering the economic, social and institutional dimensions within a holistic framework and offers policy, industry and development agency recommendations to assist in taking action. These insights can aid in designing targeted interventions that enhance the effectiveness of GI initiatives, strengthen weaver empowerment, and promote sustainable and inclusive development within the handloom sector.

Despite the recognition of Geographical Indication tagging as a tool for protecting traditional knowledge and enhancing market value, its impact on the socio-economic empowerment of handloom weavers remains underexplored. In regions like Arani Taluk, where silk weaving is a primary livelihood, limited awareness of GI benefits, along with institutional challenges and socio-economic constraints, continues to hinder effective poverty reduction. Many weavers are unable to fully utilize GI advantages due to lack of access to information, financial resources, and organized market linkages.

Moreover, existing studies have largely focused on the legal and marketing aspects of GI products, with limited attention to how awareness and structural factors jointly influence empowerment and livelihood outcomes. Therefore, this study aims to examine how GI awareness, socio-economic conditions, and challenges faced by weavers contribute to their empowerment and ultimately support poverty reduction.

2. LITERATURE REVIEW

2.1. Geographical Indication Awareness

GI are recognized as a significant form of intellectual property that links products to their specific geographical origin, ensuring distinct quality, reputation, and authenticity. In the context of traditional industries such as handloom, GI certification serves as a strategic mechanism for preserving indigenous knowledge systems, protecting cultural heritage, and enhancing market competitiveness. Beyond economic benefits, GI indicators are also associated with broader dimensions of sustainable development, as they contribute to socio-economic advancement, environmental sustainability, and cultural preservation by promoting region-specific resources and traditional practices (Elizbarashvili et al., 2019).

India has witnessed substantial growth in GI registration, particularly in the handloom sector, where region-specific products embody unique craftsmanship. Karnataka, for instance, stands as a prominent example with nearly 20 GI-tagged handloom and handicraft products, including Mysore Silk, Ilkal Sarees, Molakalmuru Sarees, Guledgudd Khana, Navalgund Durries, and Lambani Embroidery (Verma, 2025). These GI certifications have significantly strengthened the market positioning of such products by enhancing their authenticity, visibility, and demand in both domestic and international markets. As a result, GI tagging has contributed to increased income opportunities for local weavers, safeguarded traditional weaving techniques, and fostered the growth of local craft-based enterprises by enabling product differentiation and premium pricing.

However, the effectiveness of GI certification is highly contingent upon the level of awareness among stakeholders, particularly producers and artisans. Empirical evidence suggests that limited awareness of GI restricts its practical benefits, as many weavers lack the knowledge and capacity to utilize GI for branding, value addition, and market expansion (Bhardwaj, 2025). This gap between certification and utilization often results in underperformance of GI initiatives at the grassroots level. Furthermore, awareness plays a crucial role not only among producers but also among consumers. Das and Dileep (2023) found that higher awareness of GI-tagged products positively influences consumer preferences and purchasing behavior, thereby enhancing rural development outcomes, especially in tourism-oriented regions such as Kerala where GI products serve as cultural and economic assets.

In the case of Bhagalpuri silk (Tussar silk), which holds a prestigious position in India's handloom heritage, GI status has strengthened legal protection and ensured product authenticity. However, its full economic potential remains underutilized due to inadequate awareness, fragmented branding strategies, inconsistent quality standards, and weak integration into global value chains (Bhardwaj, 2025). The study further emphasizes that without strategic branding, digital promotion, and institutional support, GI certification alone is insufficient to enhance global competitiveness and ensure sustainable livelihoods for weavers.

Thus, existing literature clearly indicates that while GI certification provides a strong institutional framework for value creation, its success largely depends on the level of awareness among producers and consumers. Inadequate awareness limits the ability of weavers to capitalize on GI benefits, thereby restricting its role in improving livelihoods and socio-economic conditions. This highlights the critical importance of GI awareness as a key determinant in translating institutional recognition into tangible economic and developmental outcomes.

2.2. Challenges Faced by Handloom Weavers

Handloom industry is one of the most significant unorganized sectors in India, with nearly forty lakh people employed in the sector and it's also a part of the Indian's cultural and economic heritage (Mukhopadhyay, 2022). Despite its significance, the sector faces severe structural, economic, and institutional challenges that threaten its sustainability.

One big problem is that the power loom and synthetic textile industries are very competitive. They make cheaper, mass-produced options to traditional handloom goods, which makes people less interested in buying them (Tanusree, 2015). Globalisation and technological advancements have further marginalised traditional weaving practices, making it challenging for weavers to compete in modern markets. Additionally, multinational corporations and mechanized production systems have weakened the economic position of handloom artisans, pushing many towards poverty and livelihood insecurity.

Another critical issue is the poor socio-economic condition of weavers. Studies conducted in regions such as Varanasi have revealed that handloom workers face problems including low income, a lack of technological advancements, yarn breakage, irregular raw material supply, and inadequate storage facilities (Dwivedi et al., 2019). Financial constraints, lack of institutional credit, and dependence on intermediaries (master weavers or Gaddidars) further reduce their bargaining power and profitability. As a result, many weavers remain trapped in a cycle of low productivity and economic vulnerability.

Marketing inefficiencies and a lack of strategic planning also hinder the sector's growth. Limited access to markets, absence of branding initiatives, and poor awareness about consumer trends restrict the expansion of handloom products. Although initiatives like Urban Haat attempt to bridge the gap between producers and consumers, their effectiveness remains limited due to pricing issues and changing consumer preferences.

Furthermore, traditional knowledge, which forms the backbone of the handloom industry, is inadequately protected under existing intellectual property systems. However, GI have emerged as an

important legal tool for preserving and promoting region-specific handloom products, thereby enhancing their market value and protecting artisans' rights.

Recent studies also highlight emerging challenges such as declining interest among younger generations, lack of digital literacy, and limited access to market information (Nikhilraj and Thomas, 2024). Women weavers, in particular, face issues of low wages, long working hours, and financial insecurity. External shocks like the COVID-19 pandemic have further intensified these vulnerabilities, leading to income loss and increased indebtedness.

Overall, these challenges create a persistent cycle of socio-economic insecurity, low income, and declining productivity, which directly affects the sustainability and future growth of the Indian handloom sector. While these challenges often constrain productivity, income, and market access, they may also stimulate adaptive responses among weavers, such as skill enhancement, resource mobilization, and increased engagement with institutional support systems. In certain contexts, overcoming occupational challenges can foster resilience, self-reliance, and empowerment among weavers. Against this backdrop, the present study examines the extent to which challenges faced by GI-tagged silk handloom weavers significantly influence both weaver empowerment and poverty reduction outcomes.

2.3. Socio-Economic Factors

The socio-economic conditions of handloom weavers significantly influence their livelihoods and overall well-being. A majority of weavers belong to economically weaker and socially marginalized groups, characterized by low levels of education, limited healthcare access, and poor living standards (Majeed and Swalehin, 2020). These constraints contribute to multidimensional poverty and limit their ability to adopt modern technologies and access broader markets.

Empirical studies highlight the depth of these challenges. Ahmed et al. (2024) found that most weavers in Uttar Pradesh have low-income levels (often below ₹5,000/month), limited formal education, and poor housing conditions, particularly in rural areas. The study also reveals high dependence on loans and intermediaries, along with significant gender disparities in financial inclusion. Similarly, Khan (2020) identified both economic and non-economic difficulties among weavers in Andhra Pradesh, including financial instability, rising living costs, and occupational insecurity in the face of industrial competition.

Evidence from related sectors further shows that artisans face issues such as illiteracy, lack of financial resources, and weak market linkages (Khan and Mishra, 2012). The decentralized, household-based nature of handloom production, while sustainable, limits scalability and market access, leading to income instability and reduced bargaining power.

Overall, these socio-economic challenges highlight the need for targeted interventions focusing on education, financial inclusion, skill development, and improved market access to enhance the resilience and livelihoods of handloom weavers.

2.4. Weaver Empowerment

Weaver empowerment is a multidimensional concept that encompasses economic independence, skill enhancement, decision-making capacity, and access to institutional support. It plays a critical role in transforming traditional livelihoods into sustainable and resilient economic activities.

Capacity-building initiatives, such as training programs, business development support, and institutional strengthening, have been found to significantly enhance the empowerment of weaver communities (Suriyani et al., 2023). These programs improve productivity, innovation, and market participation, enabling weavers to compete more effectively in modern markets.

In the Indian context, the role of cooperatives has been particularly significant in promoting empowerment. Borgohain and Molankal (2023) highlight that cooperative societies provide weavers with access to raw materials, credit, training, and market linkages, thereby improving their socio-economic conditions. Financial independence, in particular, emerges as a key dimension of empowerment, enabling weavers to contribute to household income and improve their social status.

Similarly, microfinance initiatives have been shown to enhance the socio-economic empowerment of women weavers by providing access to credit and encouraging entrepreneurship (Baishya, 2019). In Assam, the silk industry has played a vital role in empowering women by generating employment and preserving traditional skills (Singha and Singha, 2020).

However, challenges such as inadequate institutional support, poor management of cooperatives, and lack of continuous skill development limit the effectiveness of empowerment initiatives. This indicates that empowerment is not only dependent on resource availability but also on effective implementation and governance mechanisms.

2.5. Poverty Reduction

The relationship between the handloom sector and poverty reduction has been widely acknowledged in the literature. As a labor-intensive and low-capital industry, handloom weaving provides employment opportunities to rural populations, thereby contributing to income generation and poverty alleviation (Raihan, 2010).

However, empirical studies suggest that despite its potential, the sector has not significantly improved the living conditions of weavers. Mohapatra and Raha (2012) found that the socio-economic conditions of weavers in Odisha have remained stagnant over time, with persistent issues including low income, poor bargaining power, and limited access to technology.

Multidimensional poverty analysis further reveals that a significant proportion of weaver households suffer from deprivations in health, education, and living standards (Meher et al., 2024).

Factors such as low income, large household size, limited skills, and social marginalization significantly influence poverty levels among weavers.

Similarly, Rahman and Noman (2019) highlight that low wages and inadequate food consumption are major concerns among handloom weaver households, indicating a direct link between income instability and poverty. These findings suggest that poverty in the handloom sector is not merely income-based but multidimensional in nature.

2.6. Research Gap

Although many studies have discussed the importance of the handloom sector, GI, and the problems faced by weavers, some important gaps still exist. Most research explains GI from a legal or theoretical perspective, but very few studies focus on the actual level of awareness among weavers and how this awareness contributes to improving their income, livelihood, and overall well-being. In many cases, GI remains underutilized because weavers lack proper knowledge, training, and institutional support to benefit from it.

At the same time, key challenges such as financial constraints, lack of modern technology, dependence on intermediaries, and limited market access are often studied separately. However, their combined impact on weavers' empowerment and poverty reduction has not been adequately explored. There is also limited research on emerging aspects such as digital marketing, branding strategies, and integration into global markets, especially in the context of GI-tagged handloom products.

Furthermore, most existing studies are region-specific and do not provide a holistic understanding by linking GI awareness, socio-economic conditions, empowerment, and poverty reduction in a single framework. Therefore, the overall scenario of the interaction of these factors and their impact on the sustainability of the handloom sector is still unclear. Hence, this study is an attempt to fill in the gaps by analyzing the role of GI awareness and other socio-economic and institutional issues in improving the livelihood, empowerment and overall welfare of handloomeers.

2.7. Research Objectives

To examine the influence of GI awareness, challenges faced, and socio-economic factors on the empowerment of GI-tagged silk handloom weavers and their contribution towards poverty reduction (SDG 1) in Arani Taluk, Tiruvannamalai District, Tamil Nadu.

2.8. Research Hypothesis

- H_1: GI awareness positively influences weaver empowerment
- H_2: Socio-economic factors positively influences weaver empowerment
- H_3: Challenges faced significantly influence weaver empowerment
- H_4: Weaver empowerment positively influence poverty reduction
- H_5: GI awareness positively influence poverty reduction
- H_6: Challenges faced significantly influence poverty reduction
- H_7: Weaver empowerment mediates the relationship between GI awareness and poverty reduction.

3. RESEARCH METHODOLOGY

3.1. Research Design

The present study adopts a quantitative research design to examine the relationship between Geographical Indication Awareness (GIA), Challenges faced by weavers (CH), and Socio-Economic Factors (SEF), and their influence on Weaver Empowerment (WEMP), which in turn contributes to Poverty Reduction (PR) aligned with Sustainable Development Goal 1. The study employs a descriptive and explanatory research approach, as it seeks to describe the characteristics of GI-tagged silk handloom weavers and to analyze the causal and mediating relationships among the constructs." The conceptual model illustrating the proposed relationships among GI awareness, challenges faced by weavers, socio – economic factors, weaver empowerment, and poverty reduction is presented in Figure 1.

3.2. Research Area

The study is conducted in Arani Taluk of Tiruvannamalai District, Tamil Nadu, a well-known traditional handloom cluster recognized for its GI-tagged Arani silk sarees. The region holds significant cultural and economic importance due to the high concentration of skilled silk handloom weavers, the strong presence of cooperative societies supporting weaving activities, its valuable contribution to preserving traditional textile heritage, and its crucial role in sustaining rural livelihoods and employment opportunities.

3.3. Target Population

The target population of the study comprises GI-tagged silk handloom weavers engaged in the production of Arani silk sarees in Arani Taluk," Tiruvannamalai District, Tamil Nadu. The study includes individual weavers, household weavers, cooperative members, and those working under master weavers. These respondents were selected due to their direct involvement and experience in GI-related weaving practices.

3.4. Sampling Design

The study uses purposive stratified sampling technique for respondents from the target population. Initially, major weaving clusters and cooperative societies in Arani Taluk were identified and treated as strata. From these strata, GI-tagged silk handloom weavers were purposively selected based on their active involvement in silk weaving activities. The total population of 400 respondents was deemed to be sufficient for analysis of the study and maintain statistical reliability. This sampling approach is appropriate as it focuses on a specific occupational group possessing specialized knowledge related to GI-tagged products.

3.5. Data Collection

Primary data were collected using a structured questionnaire designed in accordance with the research objectives. The questionnaire consists of demographic variables and construct-based items measured using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5)."

3.6. Data Analysis Tools and Software

The collected data were analyzed using SmartPLS 4 software, which is widely used for Partial Least Squares Structural Equation Modeling (PLS-SEM). Descriptive statistics were analyzed using SPSS (Statistical Package for the Social Sciences) to summarize demographic characteristics of the respondents." SmartPLS was used to evaluate reliability, validity and path coefficients among constructs through bootstrapping techniques.

4. RESULTS AND INTERPRETATION

4.1. Demographic Analysis

"The demographic profile of the respondents provides an overview of the socio-economic characteristics of the GI-tagged silk handloom weavers included in the study." Understanding these characteristics is essential, as they influence awareness levels, challenges faced, and the degree of empowerment among weavers.

Table 1 demographic results show that the majority of respondents are male and fall within the 25-45 age group, indicating active workforce participation in weaving. Most weavers have secondary-level education and possess significant experience of over 10 years, reflecting strong traditional skills. The income levels are moderate, with most households earning between Rs. 10,001 and Rs. 20,000/ month. Additionally, a majority of respondents are aware of the GI tag, although a considerable proportion still lacks awareness.

4.2. Reliability and Validity

The assessment of reliability and validity is a crucial step in Structural Equation Modeling (SEM) to ensure the consistency and accuracy of the measurement model (Hair et al., 2014). Reliability refers to the internal consistency of the constructs, while validity examines whether the constructs measure what they are intended to measure (Fornell and Larcker, 1981)."

Table 1: Demographic analysis

Variables	Categories	Frequency	Percentage
Gender	Male	245	61.2
	Female	155	38.8
Age	Below 25	34	8.5
	25-35	116	29.0
	36-45	140	35.0
	46-55	76	19.0
	Above 55	34	8.5
Educational qualification	No formal education	53	13.3
	Primary education	90	22.5
	Secondary education	126	31.5
	Higher secondary	91	22.7
	Undergraduate and above	40	10.0
Years of weaving experience	<5 years	41	10.3
	5-10 years	86	21.5
	11-20 years	142	35.5
	Above 20 years	131	32.7
Monthly household income	Below Rs. 10,000	112	28.0
	Rs. 10,001-Rs. 20,000	164	41.0
	Rs. 20,001-Rs. 30,000	88	22.0
	Above Rs. 30,000	36	9.0
Awareness of GI tag	Yes	268	67.0
	No	132	33.0

Table 2, "the Cronbach's alpha values for all constructs—Geographical Indication Awareness, Challenges faced by weavers, Socio-Economic Factors, and their influence on Weaver Empowerment, which in turn contributes to Poverty Reduction range from 0.899 to 0.936, which are well above the recommended threshold of 0.70, indicating strong internal consistency.

Similarly, Composite Reliability values (rho_a and rho_c) for all constructs exceed the acceptable limit of 0.70, confirming high construct reliability (Hair et al., 2014). The Average Variance Extracted (AVE) values range between 0.713 and 0.796, surpassing the minimum threshold of 0.50, which establishes adequate convergent validity (Fornell and Larcker, 1981)."

The overall results validate the reliability of the measurement model and satisfactory convergent validity, suggesting that the constructs are well measured and appropriate for further analysis.

4.3. Outer Loading

Outer loadings are the correlation between the observed indicators and their corresponding latent constructs and it is an indicator of indicator reliability in SEM (Hair et al., 2014). The loading value is typically acceptable when it is 0.70 or greater, where the indicator accounts for a large amount of variance of the construct.

As shown in Table 3, all indicator "loadings for CH, GI, PR, SEF, and WEMP exceed the recommended threshold of 0.70, ranging from 0.823 to 0.903. This indicates that all items have strong loadings on their respective constructs and make significant contributions to the measurement model."

For instance, the indicators of Poverty Reduction exhibit particularly high loadings (above 0.87), suggesting strong representation of the construct. Similarly, Weaver Empowerment and Socio-economic factors constructs also show consistently high loadings, indicating robust measurement properties.

Thus, no indicator removal is required, and the results confirm strong indicator reliability and construct validity.

4.4. Discriminant Validity

Discriminant validity is the degree of separation between a construct and other constructs in the model (Fornell and Larcker, 1981). It is widely accepted that the square root of AVE should exceed the correlation of each construct with the others (Fornell-Larcker criterion).

Table 2: Reliability and validity

Factors	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
CH	0.899	0.900	0.926	0.713
GI	0.909	0.909	0.932	0.733
PR	0.936	0.936	0.951	0.796
SEF	0.922	0.923	0.941	0.761
WEMP	0.929	0.929	0.946	0.778

Source: Smart PLS 4.0

Table 3: Outer loading

Indicator	Outer loadings
CH 1<-CH	0.851
CH 2<-CH	0.866
CH 3<-CH	0.823
CH 4<-CH	0.840
CH 5<-CH	0.841
GIA 1<-GI	0.847
GIA 2<-GI	0.864
GIA 3<-GI	0.848
GIA 4<-GI	0.863
GIA 5<-GI	0.858
PR 1<-PR	0.901
PR 2<-PR	0.879
PR 3<-PR	0.903
PR 4<-PR	0.890
PR 5<-PR	0.888
SEF 1<-SEF	0.886
SEF 2<-SEF	0.862
SEF 3<-SEF	0.876
SEF 4<-SEF	0.862
SEF 5<-SEF	0.876
WEMP 1<-WEMP	0.881
WEMP 2<-WEMP	0.871
WEMP 3<-WEMP	0.884
WEMP 4<-WEMP	0.888
WEMP 5<-WEMP	0.887

Source: Smart PLS 4.0

Table 4: Discriminant validity

	CH	GI	PR	SEF	WEMP
CH	0.844				
GI	0.609	0.856			
PR	0.696	0.654	0.892		
SEF	0.721	0.751	0.820	0.873	
WEMP	0.766	0.696	0.823	0.839	0.882

Source: Smart PLS 4.0

As "depicted in Table 4, the diagonal values (square root of AVE) for all constructs—CH (0.844), GI (0.856), PR (0.892), SEF (0.873), and WEMP (0.882) are higher than the corresponding inter-construct correlations. This indicates that each construct shares more variance with its own indicators than with other constructs."

Although some correlations, such as between SEF and WEMP (0.839) and PR and WEMP (0.823), are relatively high, they remain lower than the respective square root of AVE values, thereby satisfying the discriminant validity condition.

Therefore, the results confirm that all constructs are empirically distinct and free from multicollinearity issues, establishing adequate discriminant validity.

4.5. Model Fitness

Model fit evaluation plays a crucial role in SEM to assess the appropriateness of the model for the observed data. Henseler et al. (2016) suggest the use of model fit indexes in PLS-SEM, including the Standardized Root Mean Square Residual (SRMR), Normed Fit Index (NFI) and discrepancy measures (d_ULS and d_G) to evaluate the adequacy of the model.

Table 5: Model fitness

	Saturated model	Estimated model
SRMR	0.032	0.048
d_ULS	0.342	0.756
d_G	0.241	0.279
Chi-square	554.736	611.381
NFI	0.938	0.932

Source: Smart PLS 4.0

"Table 5 SRMR values for both the saturated model (0.032) and the estimated model (0.048) are below the threshold of 0.08, indicating a good model fit. The NFI values (0.938 and 0.932) are above 0.90, confirming an acceptable fit of the model.

The d_ULS and d_G values are relatively low, suggesting minimal discrepancy between the observed and model-implied matrices. Although the Chi-square values appear moderately high, this is acceptable as the statistic is sensitive to sample size (Kline, 2023).

Overall, the results indicate that the model demonstrates a good and acceptable fit, making it suitable for further analysis."

4.6. Structural Equation Model

Figure 2 presents the structural model illustrating the relationships among Geographical Indication Awareness, Challenges, and Socio-Economic Factors in influencing Weaver Empowerment, and further its impact on Poverty Reduction. "The R^2 value for WEMP is 0.762, indicating that GIA, CH, and SEF collectively explain 76.2% of the variance, reflecting strong predictive power. Similarly, the R^2 value for PR is 0.677, suggesting that WEMP explains 67.7% of the variation in poverty reduction, indicating a substantial effect. Among the predictors, SEF have the strongest positive influence on WEMP ($\beta = 0.531$), followed by CH ($\beta = 0.322$), while GIA has a relatively weaker impact ($\beta = 0.101$). Furthermore, WEMP shows a very strong positive effect on Poverty Reduction ($\beta = 0.823$)." Overall, the model demonstrates that socio-economic factors and challenges significantly enhance weaver empowerment, which in turn plays a crucial role in achieving poverty reduction.

4.7. Structural Model Assessment

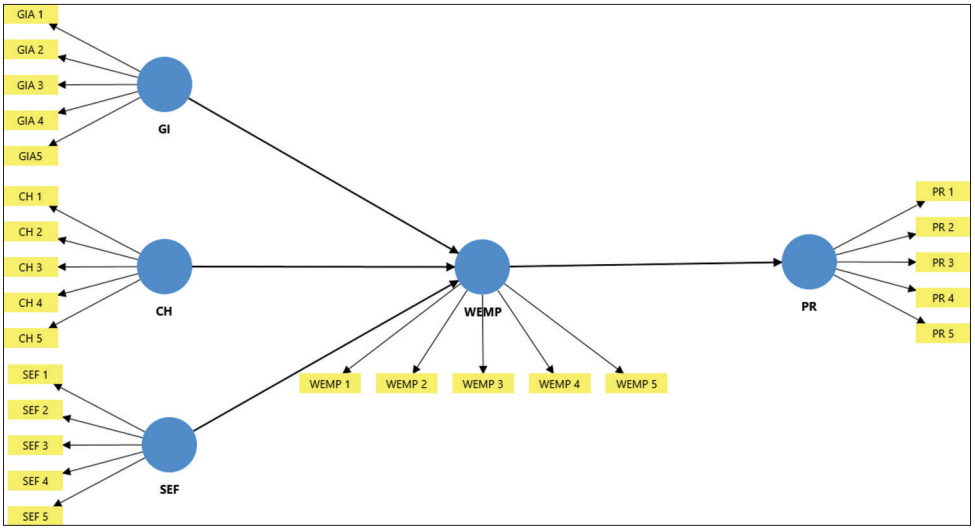
Figure 3 presents the structural model assessment based on the bootstrapping results. The bootstrapping results confirm the statistical significance of the relationships in the model. The paths from CH to WEMP, SEF to WEMP, and WEMP to PR all have p-values of 0.000, indicating highly significant relationships. The path from GI to WEMP has a P = 0.007, which is also statistically significant at the 1% level, although its effect size is relatively weak. Additionally, all outer loadings are significant (P = 0.000), confirming the reliability of the measurement model. These findings indicate that the proposed relationships in the model are statistically supported, with self-efficacy and challenges emerging as key determinants of WEMP, and women empowerment serving as a significant predictor of poverty reduction.

4.8. Hypothesis Testing

- GIA positively and significantly influences WEMP ($\beta = 0.101$), indicating that awareness of GI tags contributes to improving the empowerment level of weavers.

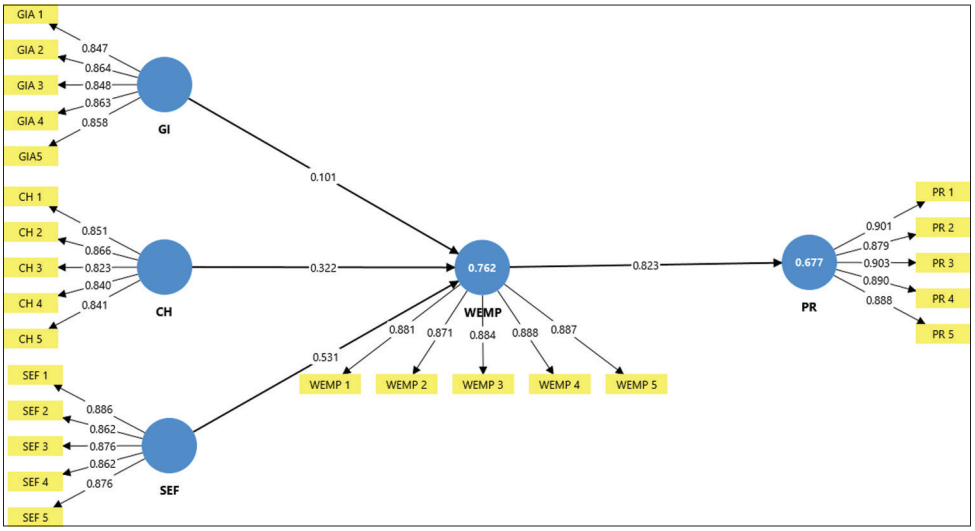
Hypothesis ID	Hypothesis statement	Path	Results	Decision
H_1	GI awareness positively influences weaver empowerment	GI->WEMP	β=0.101 P=0.007	Significant
H_2	Socio-economic factors positively influences weaver empowerment	SEF->WEMP	β=0.531 P=0.000	Significant
H_3	Challenges faced significantly influence weaver empowerment	CH->WEMP	β=0.322 P=0.000	Significant
H_4	Weaver empowerment positively influence poverty reduction	WEMP->PR	β=0.823 P=0.000	Significant
H_5	GI awareness positively influence poverty reduction	GI->PR	β=0.083 P=0.007	Significant
H_6	Challenges faced significantly influence poverty reduction	CH->PR	β=0.265 P=0.000	Significant
H_7	Weaver empowerment mediates the relationship between GI awareness and poverty reduction	GI->WEMP->PR	β=0.083 P=0.007	Significant

Figure 1: Conceptual model



Source: Smart PLS 4.0

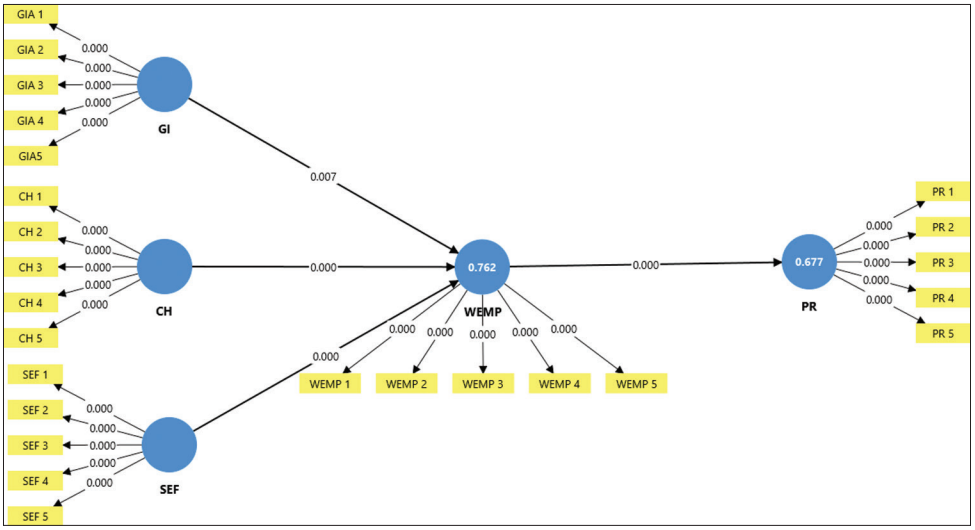
Figure 2: SEM model



Source: Smart PLS 4.0

- "SEF have a strong positive and significant impact on WEMP (β = 0.531), suggesting that better socio-economic conditions play a crucial role in enhancing the empowerment of weavers.
- CH faced by weavers significantly influence WEMP

Figure 3: Structural model assessment



Source: Smart PLS 4.0

(β = 0.322), indicating that overcoming challenges may strengthen resilience and empowerment among weavers.

- WEMP has a very strong positive and significant effect on PR (β = 0.823), highlighting that empowered weavers are more likely to experience improved economic conditions and reduced poverty.
- GIA positively and significantly influences PR (β = 0.083), suggesting that GI awareness contributes to poverty alleviation, though the impact is modest.
- CH also have a significant effect on PR (β = 0.265), indicating that effectively managing or overcoming challenges can contribute to better economic outcomes."
- "WEMP significantly mediates the relationship between GIA and PR (β = 0.083), implying that GI awareness enhances empowerment, which in turn leads to poverty reduction."

5. DISCUSSION

The findings highlight key factors influencing weaver empowerment and poverty reduction in the GI-tagged handloom sector. GI awareness has a positive but relatively impact on empowerment (β = 0.101), indicating that awareness alone is not sufficient without proper training, institutional support, and market access.

Socio-economic factors emerge as the strongest determinant (β = 0.531), emphasizing the importance of income, education, and financial access in enhancing empowerment. Challenges faced by weavers also show a influence (β = 0.322), suggesting that overcoming difficulties can build resilience and adaptive capacity.

Weaver empowerment has a strong effect on poverty reduction (β = 0.823), making it the most crucial factor in improving livelihoods. Additionally, GI awareness (β = 0.083) and challenges (β = 0.265) also directly contribute to poverty reduction.

The mediation results confirm that empowerment plays a central role, linking GI awareness to poverty reduction. Overall, the study shows that improving socio-economic conditions, strengthening GI awareness, and addressing challenges are essential for sustainable development in the handloom sector.

6. CONCLUSION

The study concludes that achieving poverty reduction among GI-tagged silk handloom weavers requires a multidimensional approach that goes beyond mere certification and recognition. While GI awareness plays a significant role, its impact is relatively limited unless complemented by improvements in socio-economic conditions and effective institutional support. Socio-economic factors are identified as the most influential driver of empowerment, emphasizing the need for policies focused on education, financial inclusion, and livelihood security.

The findings also reveal that challenges faced by weavers, although often perceived, can contribute to both empowerment and poverty reduction by fostering resilience and adaptive capacity. Most importantly, weaver empowerment emerges as the key determinant of poverty reduction, acting as a bridge between various influencing factors and development outcomes.

The study highlights the importance of strengthening GI awareness programs, enhancing access to training and digital marketing, improving financial and institutional support, and addressing structural challenges within the handloom sector. Policymakers should focus on integrated interventions that simultaneously improve awareness, socio-economic conditions, and empowerment opportunities.

In conclusion, the research provides empirical evidence that empowering weavers is essential for translating GI recognition into tangible economic benefits and achieving Sustainable Development Goal 1. A holistic and inclusive development strategy is necessary to ensure the long-term sustainability and growth of the handloom sector.

REFERENCES

Ahmed, P., Sheereen, Z., Rahman, A. (2024), Problems faced by the silk handloom weavers in Azamgarh and Varanasi Districts of Uttar Pradesh. International Journal of Convergent Research, 1(1), 108-119.

Baishya, D. (2019), Empowering women weavers by up-gradation of handloom industry of Assam through microfinance. International Journal of Innovative Technology and Exploring Engineering, 8(12), 1511-1513.

Bhardwaj, A. (2025), Branding, geographical indication (GI) and global competitiveness of Bhagalpuri (Tussar) silk. International Journal of Research in Academic World, 4(12), 48-51.

Borgohain, R., Molankal, G.M. (2023), Handloom weavers' cooperative societies in Assam: Prospects & current challenges for empowerment of women weavers. GUINEIS Journal, 10(1), 200-214.

Das, D., Dileep, M.R. (2023), Geographical Indication and Tourism: A study on the awareness, factors influence, and the scope of GI tagging in Kerala as a Rural Tourism development tool. International Journal of Hospitality and Tourism Systems, 16(4), 26.

Dwivedi, D.I., Kesarwani, P.R., Singh, M.O. (2019), Study on problems of handloom weavers of Varanasi district. International Journal of Applied Social Science, 6(7), 1798-1802.

Elizbarashvili, N., Meladze, G., Yeghyan, M., Elizbarashvili, R. (2019), Geographical indicators of sustainable development and assessment of the impact on the environment. IOP Conference Series: Earth and Environmental Science, 381(1), 012022.

Fornell, C., Larcker, D.F. (1981), Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50.

Gogoi, N., Bhuyan, S., Boruah, S. (2025), Empowering women through handloom weaving: A focus on Northeast Indias' heritage and opportunities for sustainability. In: Women Empowerment in Agriculture: A Pathway towards Sustainable Development. United States: Acadmic Press. p296.

Hair, J.F., Henseler, J., Dijkstra, T.K., Sarstedt, M., Ringle, C.M., Diamantopoulos, A., Straub, D.W., Ketchen, D.J., Hult, T.M., Calantone, R.J. (2014), Common beliefs and reality about partial least squares: Comments on Rönkkö and Evermann. Organizational Research Methods, 17(2), 182-209.

Henseler, J., Hubona, G., Ray, P.A. (2016), Using PLS path modeling in new technology research: Updated guidelines. Industrial Management and Data Systems, 116(1), 2-20.

Joshi, Y., Rahman, Z. (2019), Consumers' sustainable purchase behaviour: Modeling the impact of psychological factors. Ecological Economics, 159, 235-243.

Kethan, M., Khizerulla, M., Sekhar, S.C., Basha, M. (2022), A study on issues and challenges on production of handloom sector with special reference to Rayalaseema and costal region of Andhra Pradesh. International Journal of Applied Research, 8(6), 89-95.

Khan, M. (2020), Socio-economic condition of handloom weavers-a case study of ChiralaMandal, Andhra Pradesh. IOSR Journal of Economics and Finance, 11, 66-75.

22. Khan, W. A., & Misra, S. (2012). Impact of economic slowdown on carpet business in India with special reference to Bhadohi, UP. Integral Review Journal of Management, 1. 121-128.

Kline, R.B. (2023), Principles and Practice of Structural Equation Modeling. Oxford: Guilford Publications.

Majeed, I., Swalehin, M. (2020), Carpet weaving occupation in Kashmir: An analysis of socio-economic conditions of carpet weavers of Pulwama district. Asian Journal of Economics, Business and Accounting, 16(1), 41-49.

Malik, M.R., Chaturvedi, B. (2018), Problems and prospects in the marketing of Kota Doria. International Journal of Trend in Scientific Research and Development, 2(3), 776-790.

Meher, A.K., Venkatachalapathy, T.K., Panda, P.K., Mishra, P.K. (2024), Multi-dimensional poverty among the handloom weavers in Odisha, India: Prevalence and determinants. Indian Journal of Human Development, 18(2), 340-355.

Mohapatra, S., Raha, N. (2012), Poverty alleviation of weavers through sustainable low-cost technology-based solution. International Journal of Enterprise Network Management, 5(3), 281-303.

Mukhopadhyay, T.P. (2022), Issues and challenges of the Indian handloom sector: A legal perspective. Rupkatha Journal, 14(3), 1-12.

Nikhilraj, K., Thomas, J. (2024), Textile Tourism and the challenges of the indigenous handloom sector in Northern Kerala. In: Examining Tourist Behaviours and Community Involvement in Destination Rejuvenation. United States: IGI Global. p194-206.

Paul, R., Goowalla, H. (2021), A study on consumer awareness of handloom products with special reference to Dimapur district-Nagaland. International Journal of Management Studies (IJMS), 5(2(3), 1-8.

Pujari, S. (2024), Impact of handloom sector towards sustainable development goals. Journal of Emerging Technologies and Innovative Research, 11, 5162.

Rahman, M.A., Noman, S.M.H. (2019), Poverty and food security analysis of handloom weaver households in a selected area of Bangladesh. Journal of the Bangladesh Agricultural University, 17(1), 80-85.

Raihan, M.A. (2010), Handloom: An option to fight rural poverty in Bangladesh. Asia-Pacific Journal of Rural Development, 20(1), 113-130.

Sarkar, K. (2016), A study on health issues of weavers (handloom weaving). International Journal of Technology Research and Management, 3(11), 1-4.

Singh, N. (2025), Intention to purchase sustainable handloom textile products: A planned behaviour theory-based, moderated mediation analysis of antecedents influencing purchase intention of young consumers. International Journal of Sustainable Fashion and Textiles, 4(2), 203-232.

Singha, R., Singha, S. (2020), Women's empowerment through the silk industry of Assam, India, and its underlying economy. Journal of International Women's Studies, 21(5), 9-31.

Suriyani, A., Saleh, S., Akhmad, A. (2023), Capacity building empowerment of weaver groups through weaving business innovation at the ikat jata kapa weaving center in sikka regency, east nusa tenggara province, indonesia, indonesia. European Journal of Development Studies, 3(2), 59-68.

Tanusree, S. (2015), A study of the present situation of the traditional handloom weavers of Varanasi, Uttar Pradesh, India. International Research Journal of Social Sciences, 4(3), 48-53.

Vallam, G.R., Mullapudi, R.S. (2017), Poverty and health conditions of handloom weavers. International Journal of Applied Research, 3(6), 1473-1479.

Verma, S. (2025), Weaving prosperity: Problems of handloom workers in Karnataka and leveraging geographical indications to enhance their socio-economic condition. International Journal of Law and Social Sciences, 11, 139-148.