

Digital Inclusion and Socio-Economic Development of Handloom Weavers: A Study of Nuapatna Cluster

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Abstract

The aim of this study is to find the connection between the concept of digital inclusion and the socio-economic development of the handloom weavers of Nuapatna cluster of Odisha, one of the most culturally rich textile heritage hubs of India with their unique art of fine Khandua silk weaving and Ikat weaving. The study adopts a holistic approach to understanding the determinants of digitally related access, financial inclusion, e-commerce use, gender gap, and institutional support mechanisms that can explain how they influence the livelihood outcomes of a historically marginalized community of artisans in the context of the rapidly expanding digital economy in India and the national policy commitments under the Digital India programme. Secondary data sources like government reports, national surveys, ministry publications and previous research are systematically examined in the study to analyse the 5 dimensions of digital inclusion and the measurable impacts of 5 dimensions on the welfare, income security and market participation of weavers. The findings suggest that access to digital technologies offers great potential for economic empowerment, but that this potential is not distributed equally, and that a lack of suitable infrastructure, digital literacy and gender-based exclusion, together with low levels of integration of implementing institutions across the sectors are major challenges to achieving the potential. While the potential of e-commerce and digital financial services to enhance the income of weavers and minimize intermediaries' dependency is significant, adoption in the handloom sector is still severely low in the country. The study suggests that sustainable socio-economic change for Nuapatna weavers would be achieved by having integrated policy frameworks, which would not focus on digital literacy as an isolated technological solution but as an integral part of broader Nuapatna artisan development that aims to ensure livelihood security, preservation of their culture, gender equality, and institutional fortification.

Keywords

Digital inclusion, Socio-economic development, Nuapatna cluster, Handloom weavers, E-commerce platforms, Digital financial inclusion, Government schemes, Gender disparities, Digital literacy

Research Background

Handloom weaving industry is one of the oldest and traditional cottage industries of India and in which millions of people are involved throughout the country. Nuapatna town in Orissa is one of the few weaving villages in the country where the people are still promoting the weaving skill and products that includes intricate weaving skill and products of Khandua silk sarees, Ikat tie dye textiles etc. (Guru et al., 2023). However, this is not sufficient to insulate the weavers of Nuapatna from the longstanding socio-economic

vulnerabilities that they face due to lack of access to markets, institutional protection, structural inequalities, and exploitative middlemen networks.

The last decades have seen a surge of digital technologies, which bring new opportunities to marginalised communities to engage more equitably with economic processes. In general, "digital inclusion" is a concept of equal access to and engagement with digital tools, platforms and literacy, and is now a policy agenda in developing countries like India. Digital platforms have the potential to revolutionise supply chains, cut out middlemen, reach markets and also improve livelihood security for artisan communities (Sindakis & Showkat, 2024). Although the government has taken several initiatives to reduce the digital divide in the handloom industry such as introduction of Digital India, GeM and Craftsvilla e-marketplaces, the impact of these measures has not been equitable and is not well documented in the ground level.

The Nuapatna cluster in this regard is an interesting case study to look into and analyse the impact of digital inclusion for the traditional weavers, and how much impact it has on their measurable socio-economic development. A handful of studies have explored questions of access to digital resources, literacy in digital resources, usability of these platforms, gender differences in technology adoption, and the sustainability of digital interventions (Vasanthan et al. 2024). In this context, this study seeks to address that major gap and examine the impact of digital inclusion on the socio-economic conditions of the handloom weavers of Nuapatna to assist in the academic research and policy formulation aimed at the development of handloom artisans.

Literature Review

The traditional craft industries and cultural heritage as a source of rural employment and socio-economic development have had a new spotlight on them due to the recent scholarly interest in the relationship between digital inclusion and socio-economic development amongst people in the artisan communities (Sindakis & Showkat, 2024). The ability of digital technologies to transform economic participation, mitigate informational inequalities and provide alternative pathways for income generation and market integration has been consistently pointed out by researchers when digital technologies are accessible and meaningful to marginalised communities.

Research by Nath et al (2024) on the handloom and textile industries in South and Southeast Asian countries has shown that handloom artisans in the traditional cluster economies are often structurally disadvantaged as they are subjected to exploitative middlemen, weak price discovery, lack of formal credit, and limited information about the government's welfare schemes. Current socio-economic inequalities are worsened by several vulnerabilities that weave communities experience, including poor education, geographic isolation and a lack of infrastructure.

Digital financial inclusion has been recognised as a key driver of change and a way for artisans to connect with formal financial institutions and institutions without having to go through traditional intermediaries, especially through the use of mobile banking, digital payment methods, and microfinance (Meher et al. 2024). But the same, e-commerce has also emerged as a new promising channel to connect the weavers to the domestic and international markets, which would enhance their bargaining power and hence the returns of their labour intensive craft production.

Gender issues in digital inclusion in the artisanal sectors are also becoming a force to reckon with and are also being documented as such, through studies that reveal multiple disadvantages affecting the weavers; for instance, women weavers lack digital skills, mobility, and social barriers that impede them from interacting with technology independently (Banerjee, 2025). Further studies of government-led digital interventions suggest that designing policy, readiness of the local infrastructure and community-level training are key factors in shaping real and lasting socio-economic benefits for vulnerable weaving communities due to digital access.

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Research Methods

The research design for this study will be a mixed method design which will be used to study impact of digital inclusion on the socio-economic development of handloom weavers in Nuapatna cluster. Participants will be chosen by purposive sampling and the sample will be spread across various age groups, gender and weaving households. Structured surveys and semi-structured interviews will be used to collect primary data on three aspects: digital literacy, access to online platforms, income changes and market expansion. Secondary data will be collected from government Reports, Academic papers on the topic Digital empowerment in Artisans Communities, and NGO publications on the topic. The analysis of quantitative data will be descriptive statistics and correlation test, to detect patterns and the qualitative response will be thematically coded and identify lived experiences. All ethical issues such as consent to participate and confidentiality will be observed. The use of this method leads to an even balance between measurable outcomes and context.

Results

1. Digital Access and Infrastructure Gaps Among Nuapatna Handloom Weavers

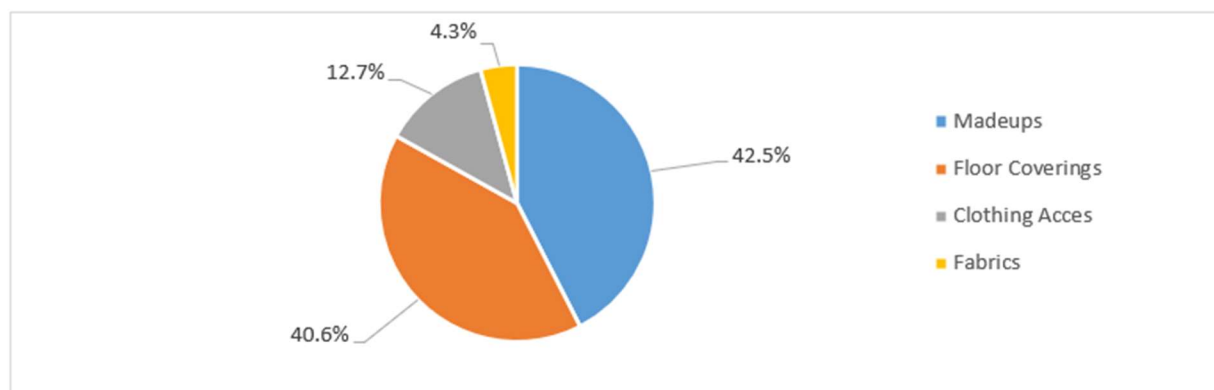
Nuapatna is an archetypal case of the general lack of structural quality in digital infrastructure in rural artisan clusters in India. The national agenda has been chalked out with the Digital India initiative, though the connectivity among the handloom artisans is very low as compared to the urban artisans. According to Telecom Regulatory Authority of India data, internet penetration in the rural areas of Odisha is around 31 per cent, which is much lower than the national rural average of 37 per cent in 2022. As per the data available in 2022, the internet penetration rate in rural areas of Odisha is around 31 per cent, which is lower than the national average of 37 per cent, indicating that the state still has connectivity challenges, particularly in districts where most of the population are involved in the weaving process (Sahoo & Rout, 2026). Research studies conducted in eastern India have revealed that despite the increasing deployment of the Smartphone among the weavers, affordability issues and low digital literacy are still limiting the use of the Smartphone among the weavers. In clusters like Nuapatna, people with simple feature phones, that can't handle e-commerce platforms or digital financial services, make up a lot of the population. According to the data, the internet was also not used by any rural households for business purposes if they used non-farm enterprises in 2021 (17%).

The access problem is worsened by power supply problems, poor internet connectivity in the villages and absence of digital facilitation centers in the villages. Similar studies in the same region of Odisha have found that though such devices and connectivity are available, there is functional exclusion wherein weavers who are only able to read and write in Odia are not able to access the devices and language versions of its interfaces (Chaudhary & Sharma, 2023). Overall, these findings point towards a multi-dimensional challenge of digital access, not just related to devices, but requiring targeted policy action on issues other than providing connectivity.

2. Impact of Digital Financial Inclusion on Weaver Livelihoods and Income Security

Digital financial inclusion has emerged as one of the most powerful initiatives of the digital financial inclusion agenda for the artisan community, which has had significant implications for income security, credit access and economic resilience of handloom weavers.

Category-wise share of handlooms export revenue (FY25)



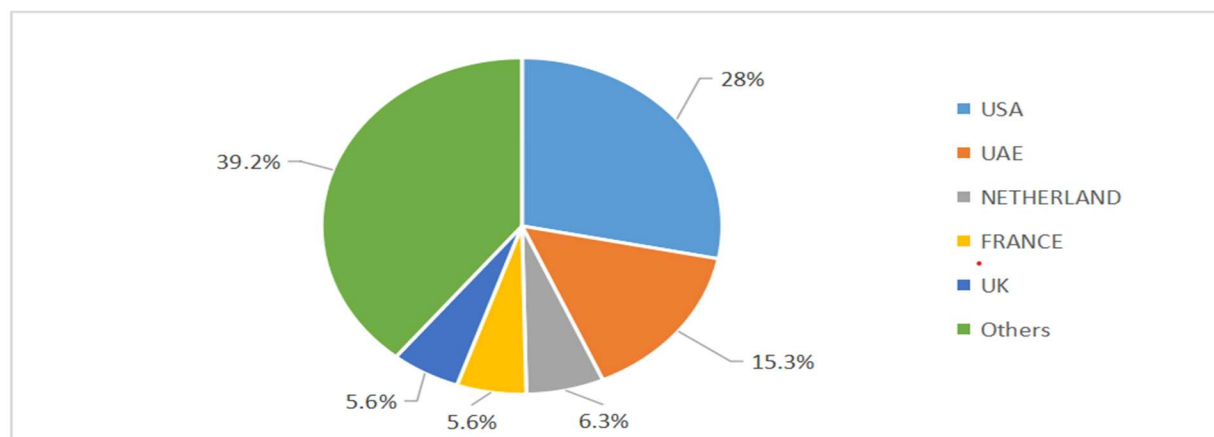
Source: The Handloom Export Promotion Council (HEPC)

Figure 1: Income revenue from Indian Handloom Industry in 2025

(Source: ibef.org, 2025)

The Pradhan Mantri Jan Dhan Yojana, operational since 2014, has facilitated the registration of over 500 million accounts nationwide, with Odisha registering a considerable number of accounts from various rural communities, including weavers (Gupta, 2023). The study by the National Bank for Agriculture and Rural Development (Nbr) has shown that spreading financial inclusion through digital has minimised the reliance of weavers on the informal money-lenders who usually paid between 36 and 60 per cent annual interest on their loans. With UPI, the direct payment transaction route with weavers has reduced cash-based transactions and the payment cycle of the weavers, thereby cutting down the transaction costs (Vidani, 2024). Studies on models in the handloom sector have found that digital banking has benefited the timely delivery of welfare payments, input subsidy and insurance for handloom welfare schemes like Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY).

Country-wise exports share (FY25)



Source: The Handloom Export Promotion Council (HEPC)

Figure 2: Number of exports of Indian Handloom industry to international markets

(Source: ibef.org, 2025)

The financial inclusion index shows a significant improvement from 43.4 to 60.1 between 2021 and 2023, indicating the growing formal financial mobility of the unbanked. Between 2021 and 2023, RBI's financial inclusion index has improved from 43.4 to 60.1, reflecting financial mobility of the unbanked population becoming more formal. However, researchers have raised concerns that simply having an account doesn't

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imply active and educated financial involvement, and low frequency of transactions and inactivity of accounts remains a challenge for the elderly and women weavers in rural cluster areas of Odisha.

3. E-Commerce Adoption and Market Linkage Outcomes for Handloom Artisans

Traditional craft products are distributed to consumers by embedding handloom weavers into digital marketplace ecosystems, which has been documented to bring structurally important changes in price autonomy, market diversification and income improvement. The Government has created digital platforms to facilitate the selling of handlooms without depending on intermediaries like Government e-Marketplace, Tribes India Online and Government Portal of the Office of Development Commissioner (Handlooms) by the weavers and the weaver cooperatives (Khatoon & Iffat, 2022). According to data from the Ministry of Textiles, the online sales of handloom products through government-run craft portals rose by about 34 per cent during 2019-22 and Odisha-based Sambalpuri and Ikat products saw significant growth in the number of transactions in the digital space.

Researches conducted on e-commerce adoption by similar artisan clusters have found that D2C digital commerce can help the weavers to increase their profits by 20 – 40 % compared to the traditional brokerage-based supply chain. Studies done on Craftsville and Amazon Karigar have found that women weavers who have actively transitioned to digital selling have mentioned that their income had become more predictable and felt that the income had not experienced as many fluctuations throughout the year. But there are also major constraints in the use of e-commerce by Nuapatna-type clusters, such as problems in taking photos of products, cataloguing them digitally, arranging logistics and ensuring quality standards that buyers are making online demands (Pradhan, 2026).

4. Gender Disparities in Digital Inclusion Within Handloom Weaving Communities

One of the most important and widely documented forms of inequality in the study of digital inclusion is gender, and handloom weaving communities have some of the extreme examples of inequality. Women also make up a large proportion of weavers who do most of the weaving, but have much less access and control over digital tools than men do and also do most of the preparatory activities, such as yarn dyeing and warp setting. According to the report entitled 'Digital India 2022' released by Internet and Mobile Association of India (IAMAI), the gender gap in internet usage in rural India is 33 per cent and women in villages are even less likely to use a mobile phone or have functional digital literacy (Sindakis & Showkat, 2024). Research conducted in the State of Odisha and other eastern states of India have shown that restricting women's mobility, financial resources and access to technology are structural barriers, which cannot be solved by just providing access to devices.

Gender	Type of handloom worker	Rural	Percent	Urban	Percent	Total	Percent
Male	Weavers	73,184	70.1	31,185	29.9	1,04,369	42.8
	Allied workers	9,513	75.2	3,143	24.8	12,656	5.2
Female	Weavers	62,682	67.1	30,766	32.9	93,448	38.3
	Allied workers	24,777	74.9	8,324	25.1	33,101	13.6
Total		1,70,156	69.9	73,418	30.1	2,43,574	100.0

Figure 3: Gender wise distribution of Total Workforce of Tamil Nadu Handloom Workers

(Source: irjet.net, 2024)

Digital financial literacy program has been proved to engage women with mobile financial services when they participate in SHG group, however, some male family members are preventing women to access digital financial services (a gate keeping phenomenon) has been found during the research work with the weavers. The NFHS data further shows that women in rural Odisha are significantly more vulnerable than men in the same category of occupation with regard to owning a cell phone and making financial decisions on their own accord (Kshatri et al. 2025). Women weavers have benefitted from gender responsive digital inclusion programmes, like the Deen Dayal Antyodaya Yojana, which have helped build their confidence in digital, but consistent research has been calling for not only the improvement of patriarchal structures but also the enhancement of technical capacity building for a more sustained engagement.

5. Role of Government Schemes and Institutional Support in Enabling Digital Socio-Economic Transformation

The policy architecture plays an important role in determining whether or not digital inclusion programmes will lead to socio-economic transformation of the handloom weaving community. Indian policy formulation for handlooms is multi-layered and includes of national scheme, state level scheme, cluster development, which all aim to modernize handloom production, extend handloom markets and artists welfare. Institutional support for the weavers has been provided through the National Handloom Development Programme, the Comprehensive Handloom Cluster Development Scheme and the Yarn Supply Scheme, and during the recent handloom policy cycles, there has been increasing emphasis on digital aspects like e-registration, training in digital marketing and online delivery of benefits (pib.gov.in, 2020). The Ministry of Textiles has registered over 4.3 lakh weavers in the country on the Handloom Weavers Comprehensive Welfare Scheme portal, which enables them to receive insurance and social security benefits digitally.

Interventions that were clustered and were most socio-economically impactful also involved investments in digital infrastructure, combined with continued capacity building and co-operative strengthening, and with reorganisation of supply chains, rather than merely digital technology. The study carried out by MoT on the Weavers Service Centres (WSC) has highlighted that the WSC has served as a key support in terms of design inputs, market intelligence etc., but the study has revealed that the digital outreach of WSC has not been that successful as compared to the scattered weaving population in geographical terms and the same has been found to be deficient (pib.gov.in, 2021). It demonstrates that convergence and synergy between policy-making institutions (central schemes, state level implementation agencies, civil society institutions and weaver institutions) is essential to ensure the success of policy in contributing to digital socio-economic transformation and that there is an increased benefit from policies that take digital inclusion as one strand of a wider policy for artisan development, such as in Nuapatna-type clusters.

6. Digital Language and Technology Difficulty Perception Among Nuapatna Weavers

How difficult is digital language/technology for you?

	Frequency	Percent	Valid Percent	Cumulative Percent
	19	11.9	11.9	11.9
A) Very difficult	44	27.7	27.7	39.6
B) Difficult	32	20.1	20.1	59.7
C) Easy	35	22.0	22.0	81.8
D) Very easy	29	18.2	18.2	100.0
Total	159	100.0	100.0	

Figure 4: Issues of digital technology for the handloom industry in India

Frequency distribution of digital language and digital technology difficulty level among 159 respondents shows that most of Nuapatna handloom weavers had a great difficulty with the use of digital tools. Nearly half of the weavers (47.8%) rated digital technology as either very difficult or difficult, showing that there is significant difficulty in the weavers community to engage with digital platforms meaningfully. Forty percent of respondents (22.0 percent easy and 18.2 percent very easy) found technology easy. Overall, this distribution confirms the study's conclusions that functional digital exclusion continues to exist in the local context despite physical accessibility, a result of a variety of language barriers, unknown digital contexts, and limited prior experience with digital environments, all of which can present significant usability barriers and reduce the socio-economic empowerment of digital inclusion efforts for this traditional artisan community.

7. Smartphone Business Usage Capability Among Nuapatna Handloom Weavers

How would you rate your ability to use smartphones for business?

	Frequency	Percent	Valid Percent	Cumulative Percent
A) Advanced	58	36.5	36.5	36.5
B) Intermediate	55	34.6	34.6	71.1
Valid C) Basic	36	22.6	22.6	93.7
D) None	10	6.3	6.3	100.0
Total	159	100.0	100.0	

Figure 5: Rate of smartphone users of handloom workers in India

The frequency distribution that views the ability of the same 159 respondents in terms of using their smartphone for business use offers a somewhat more positive but complicated understanding of digital skills among Nuapatna's weavers. Significant 71.1 percent (36.5 percent advanced, 34.6 percent intermediate) rated themselves as competent users of their smartphones for business. But, 22.6 percent had basic skills and 6.3 percent reported to have no ability at all for their smartphones. This distribution indicates that although there is a significant population of weavers familiar with how to use their smartphones in meaningful ways, there is a need for specific skill development interventions beyond just knowing how to operate the device that would enable them to use the smartphone productively in their businesses, such as through e-commerce, effective digital marketing, and use of online financial transaction platforms.

Discussion

The findings of this study provide a glimpse of the multifaceted and multidimensional nature of digital inclusion as well as their interconnections with the socio-economic situation of handloom weavers from Nuapatna cluster. Indeed, the evidence reveals that opportunities created by digital technologies are never without structural inequalities, gaps and deep-rooted social hierarchies that constitute who is empowered to access digital technologies, how, and for what purpose.

Every other issue of digital inclusion needs to be tackled in the context of this basic barrier: lack of infrastructure and affordability. Although weavers are connected, there is functional exclusion due to language barriers, a lack of digital literacy, and representation of the interface that is not in accordance with the user context. However, the results indicate that there is a positive association between access to accounts and financial agency for women and elderly weavers, as the dormant account holders and the account holders who conduct smaller transactions demonstrate.

Ecommerce represents a concrete transformative opportunity to create positive changes in the life and expand the market. However, the results clearly indicate that less than one in eight registered weavers has

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used digital marketplaces without any external support. All other causes of digital exclusion are compounded by gender inequality, as women are faced by both a household-level gatekeeping issue and systemic barriers to the technological solutions that are suggested. A key component of the successful implementation of digital transformation is convergent implementation, which takes digital inclusion as part of development for the artisans and not as a stand-alone technological solution and has been facilitated by the government's implementation by providing an important form of institutional scaffolding.

Conclusion

The study points out that Digital inclusion holds transformative potential for handloom weavers of the Nuapatna cluster, but the impact of this digital inclusion on the socio-economic aspects is uneven and inconsistent owing to structural challenges that handloom weavers face such as gender bias and disunity of institutions and also the lack of infrastructure to enable handloom weavers to access the digital market. The overwhelming evidence is that digital inclusion is not only about providing devices and expanding connectivity, but also about digital literacy, financial empowerment, and support for market linkages with a coordinated convergence line of sight approach. Government schemes provide an important (though limited) foundation, which should be put in place in a more coherent way between the central, state and community level. However, an integrated policy approach that puts digital inclusion at the centre of a wider policy on artisan welfare, cultural preservation and rural livelihood is needed to ensure the sustainable socio-economic development of the Nuapatna weavers.

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