

THE STUDY ON THE DEPLOYMENT OF MODERN HANDLOOM TECHNOLOGIES IN THE POCHAMPALLY IKKAT HANDLOOM INDUSTRY

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Abstract

The present study examines and analyzes the extent of the deployment of modern technology in the Pochampally Ikkat handloom industry. The primary data is collected with a semi-structured interview schedule and examined the percentage of deployment of modern handloom technologies in sampled *mandals*. Results show that 30% of the respondents only deployed 100% of modern handloom technologies, but 42% of the respondents deployed none of the modern technologies. Only 35% of the respondents installed modern weaving technology. Vast of the respondents strongly agreed that old age, lack of infrastructure, and financial problems are the main reasons for the non-adoption of modern weaving technology. Some of the respondents agreed that low levels of education, lack of family labor, and lack of technical experience are the reasons for the non-adoption of modern weaving technology.

Keywords: Adoption; Deployment of technology; Likert scale; Modern weaving technology; Perception.

Introduction

The handloom sector is a village cottage industry. All the processes of handloom cloth production such as pre-loom and weaving procedures often involve more labor than automated ones. The development of technology for the handloom sector has been focused on increasing labor and machine productivity without compromising traditional human participation. This is required to maintain the industry's ability to create jobs.^[1]

Technology adoption is important for an organization or enterprise to continue the cost-effectiveness and quality enhancement of its products, which is essential for its survival and development in a competitive market condition.^[2-3] The discontinuation of the Multi-Fiber Agreement (MFA) in 2005 by India, China, Bangladesh, Sri Lanka, and others has opened up new chances while presenting new provocations of more competition in international textile industries.^[4-5] The Indian handloom sector is the second-largest unorganized sector after agriculture. It is providing 3,523 thousand employment opportunities directly to the population.^[6] The adoption of new technology in the handloom industry is expected to be an added advantage since the industry is a key employment provider to lower-income strata of many developing countries including India.^[4,7-8]

The adoption of modern handloom technology strengthens the industry to withstand market competition.^[8-10] After one and half a decade since the discontinuation of MFA, it is instructive to prove how the handloom sector has proceeded in changing itself to the new business circumstances. A certain point of interest in this condition is the

extent to which the handloom sector, which is generally tiny and small-scale, and disadvantaged in accessing finance and the market, have succeeded in overcoming the hurdles and challenges in adopting and deploying new handloom technology.

The adoption of technology and its impact on the development and performance of micro, small and medium enterprises (MSMEs) in India is quite considerable.^[11-13] Most of the studies cover the organized and formal sector enterprises and describe how the Indian formal and organized MSMEs commenced the modernization procedure, particularly the adoption of information technology to encounter market competition and challenges through innovation. As per these studies, the adoption of technology by the MSMEs in India is determined by the size of the firm, skill intensity, market share, innovative activities, and infrastructure.^[10,13-16]

On the other hand, lack of financial inclusion, lack of access to government credit, lack of capital, lack of training, lack of awareness, lack of infrastructure, separation from technology hubs, migration to another profession, and associated uncertainty and risk are the main constraints in adoption of technology in Indian MSMEs and hence required implementation of proper policies.^[17-20] These studies revealed the importance of the availability of government credit and subsidies in the exercise of the adoption and spreading of technology.^[21,10,16]

The study focuses on the adoption of modern technologies in the Pochampally Ikkat handloom industry which is distributed in the erstwhile Nalgonda district in Telangana. The Pochampally Ikkat handloom industry is playing a vital role in the handloom industry in Telangana. More than 40% of the Telangana handlooms are concentrated in the erstwhile Nalgonda district i.e. Pochampally Ikkat handloom industry. Geographically this district is closer to the state capital. In this district, the famous Pochampally Ikat design won Intellectual Property Rights protection or Geographical Indication Certification in 2004, and it is the first traditional Indian craft to receive this status of geographical branding

The current study was instigated by the necessity of analysis of what extent the modern handloom technologies deployed and the perceptions of the non-adopters regarding the non-adoption of modern weaving technology.

Handloom technologies in the Pochampally Ikkat handloom industry

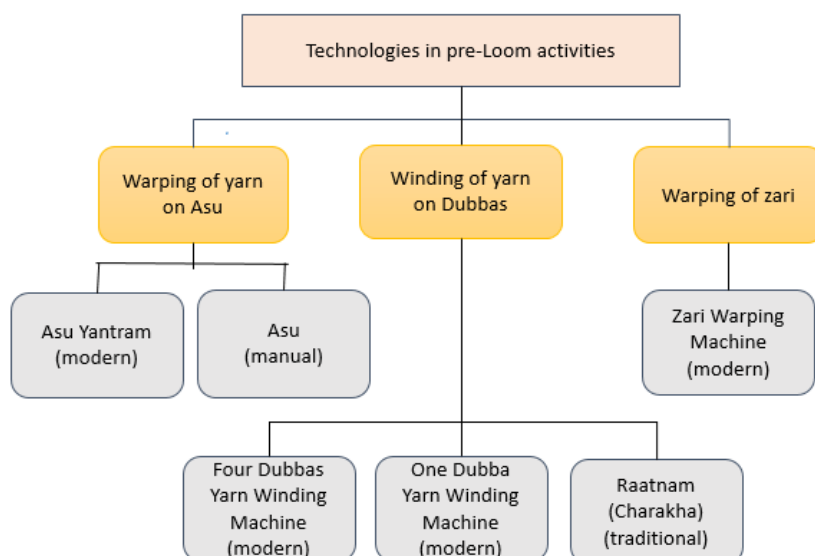
Pochampally Ikkat handloom cloth production involves different processes. The processes are classified as a pre-loom process, weaving process, and post-loom process. The pre-loom process includes bleaching of yarn, designing of warp, tie & dyeing of warp, warp joining, winding of yarn on *Dubbas*, warping of yarn on the *Asu*, designing of weft, tie & dyeing of weft, and winding of yarn on bobbins. The weaving process includes cloth manufacturing by using different types of looms. The last process is the folding of fabric under the post-loom process.

In some of the processes fully automated technologies are available such as the winding of yarn on *Dubbas*, warping of yarn on *Asu*, and warping of *zari*. In some of the processes, technologies are available but that would be operated by human power only such as weaving. But, the processes of bleaching of yarn, designing of warp and weft, tie & dyeing of warp and weft, and warp joining processes are purely involved in human labor, and no technologies are available.

The objective of this study is to examine the utilization of different technologies by handloom families and analyze the deployment of technology by applying the ratio between available technologies in different processes and the deployment of technologies by handloom families. The limited successful deployment of these technologies in the handloom micro-enterprises raises concerns, notwithstanding the sizeable adoption numbers of weaving technology in a few sample areas.^[16]

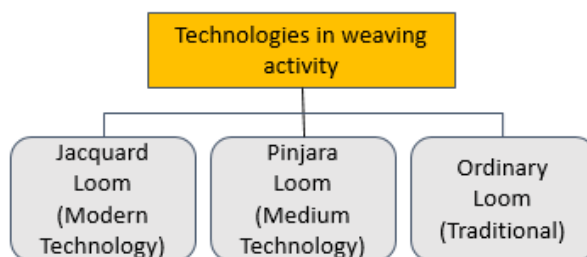
The available technologies in pre-loom activities of the Pochampally Ikkat handloom industry for cloth production are shown in Figure 1. The available modern technologies for winding yarn on *dubbas* are Four *Dubbas* Yarn Winding Machine and One *Dubba* Yarn Winding Machine. In addition to these, the traditional equipment *Raatnam* (*Charakha*) is available for winding yarn on *dubbas*. These *dubbas* are used for the preparation of weft.

Figure 1: Technologies in pre-loom processes



The weaving process is for the production of cloth on a loom by using human power. Figure 2 shows the available technologies in the weaving of handloom cloth production in the Pochampally Ikkat handloom industry. The available technologies in the weaving processes are jacquard looms, *Pinjara* looms, and ordinary looms. The traditional method used for manufacturing cloth is an ordinary loom. Basically, the Pochampally Ikkat designs are famous for tie & dye designs without using *zari* brocades. Recently, for innovation of designs as per the requirements of market changes, the jacquard looms are installed in the Pochampally Ikkat handloom industry for design innovation in addition to Ikkat designs.

Figure 2: Technologies weaving process



Materials and methods

The present study is considered both based on primary and secondary data. The Pochampally Ikkat handloom industry is distributed in the erstwhile Nalgonda District. Hence, the primary data is collected from 1575 handloom families across nine Pochampally Ikkat handloom cloth-producing Mandals in the erstwhile Nalgonda District in Telangana. The data collected *Mandals* are Chandur *Mandal*, Pochampally *Mandal*, Ramannapet *Mandal*, Narayanpur *Mandal*, Alair *Mandal*, Mothkur *Mandal*, Narketpally *Mandal*, Suryapet *Mandal*, and Thipparthy *Mandal*. The study followed a multi-stage sampling technique. As a first step, the list of handlooms in the erstwhile Nalgonda district was prepared from the Handloom weaver information system (Ministry of Textiles Portal). As a second step, purposively selected nine *mandals* from all the revenue divisions based on the geographical sides in order to capture the spatial diversity. In the third step, only two villages from each *Mandal* are selected randomly. In the fourth step, 30% of the households are selected randomly from each village. The

data is collected through a semi-structured interview schedule from selected handloom households from May 2021 to January 2022. For the analysis of the perception of weavers regarding the non-adoption of modern weaving technology, the data is collected from the non-adopters only i.e. 1026 respondents. The perception of the non-adopters for non-adoption of modern weaving technology, data is collected based on the five-point Likert scale.

The primary data is analyzed with percentages and graphs for the estimation of the deployment of technology. For the analysis of the extent of deployment of modern technologies, the ratio between the available modern technologies and deployed modern technologies. The perception of non-adopters for non-adoption of modern weaving technology, data is analyzed with the weighted average method, which is collected based on the Likert scale.

Results and discussions

Deployment of modern handloom technologies:

Though the scope of this thesis establishes a linkage between two variables namely modern weaving technology and profitability, we explored the availability of different technologies in different processes and how many respondents installed those technologies for the completion of those processes. Table 1 shows the deployment of various traditional and modern handloom technologies which are available in pre-loom and weaving processes in the Pochampally Ikkat handloom industry among the respondents in the sampled *mandals* in the erstwhile Nalgonda district.

Table 1: Deployment of handloom technologies among the respondents in sampled *mandals*

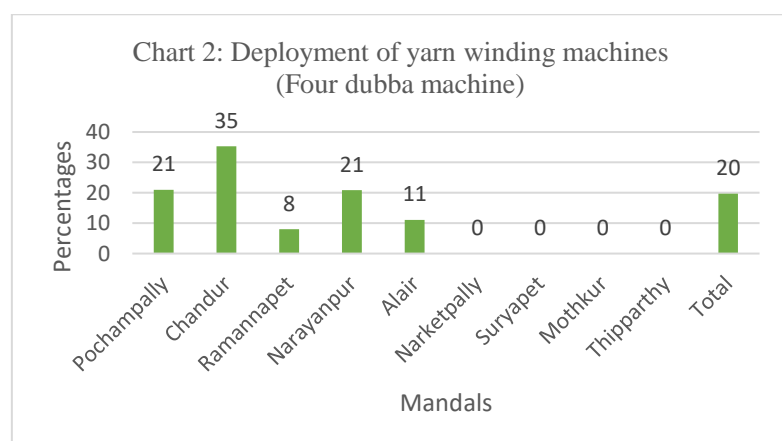
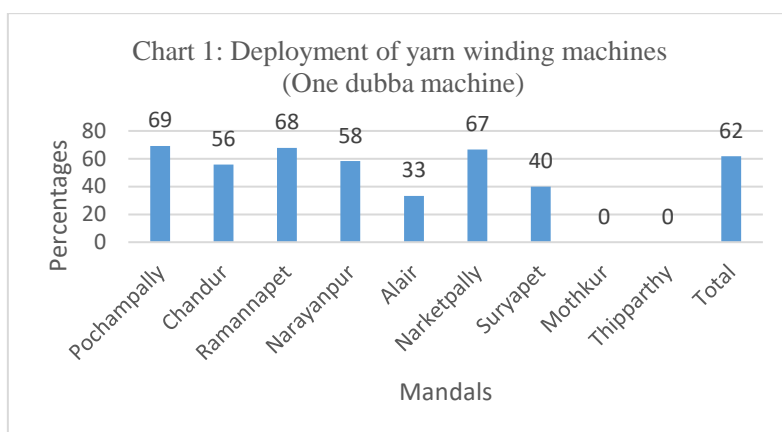
Mandals	Pochampally	Chan dur	Ramanapet	Narayanpur	Alair	Narketpally	Surya pet	Moth kur	Thip parthy	Total
Sample size	402	342	306	237	141	48	45	42	12	1575
Modern technologies										
Yarn winding machine (one <i>dubba</i>)	99 (69)	57 (56)	76 (68)	42 (58)	9 (33)	6 (67)	2 (40)	0	0	291 (62)
Yarn winding machine (four <i>dubba</i>)	30 (21)	36 (35)	9 (8)	15 (21)	3 (11)	0	0	0	0	93 (20)
<i>Asu yantram</i>	138 (97)	100 (98)	82 (73)	69 (96)	23 (85)	9 (44)	4 (60)	0	0	426 (90)
<i>Zari</i> warping machine	9 (6)	6 (6)	6 (5)	0	0	0		0	0	21 (4)
Jacquard loom	174 (43)	171 (50)	62 (20)	77 (32)	39 (28)	12 (24)	7 (16)	6 (14)	1 (9)	549 (35)

Source: Primary data.

Note: Figures in parentheses are the percentages.

Yarn winding machines:

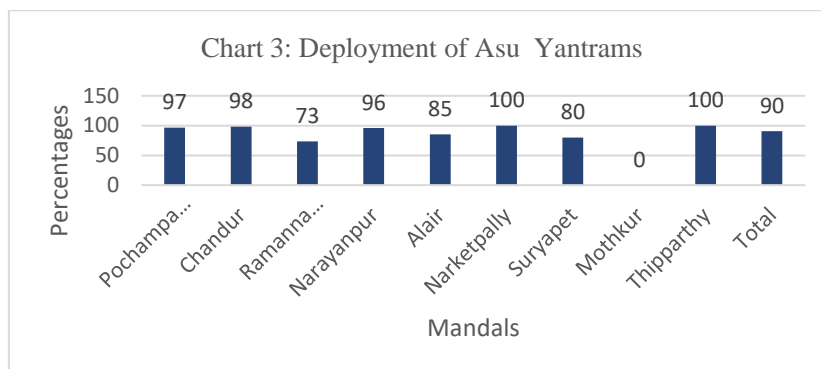
The winding of yarn on *dubbas* is the pre-loom process. In the process of winding yarn on *dubbas*, there are two modern technologies available, they are One *dubba* yarn winding machine and Four *dubba* yarn winding machines. These machines work with electric power. The traditional method for performing the same process is the *Ratnam* which is operated by human power. At the time of personal interviews, the owners expressed that the One *dubba* yarn winding machines are useful for the small owners, whereas the Four *dubba* yarn winding machines are useful for the large owners for winding yarn on *dubbas*. The winding of yarn on *dubbas* is used to prepare weft by warping this yarn on *Asu* equipment. These machines are required for the owners only for performing the pre-loom process of winding yarn on *dubbas*. Among the owner respondents, 291 owner handloom households installed One *dubba* yarn winding machine i.e. 62% (Table 1 and Chart 1), and 93 owner handloom households installed Four *dubba* yarn winding machines i.e. 20% (Table 1 and Chart 2). The deployment of either of these two machines is zero in Mothkur Mandal and Thipparthi Mandals, in addition to that in Narketpally Mandal and Suryapet Mandals, the deployment of Four *dubba* yarn winding machines is zero. The deployment of Four *dubba* yarn winding machines is very low compared to One *dubba* yarn winding machine. It revealed that a large number of entrepreneurs is very low in the Pochampally Ikkat handloom industry.



Asu Yantram:

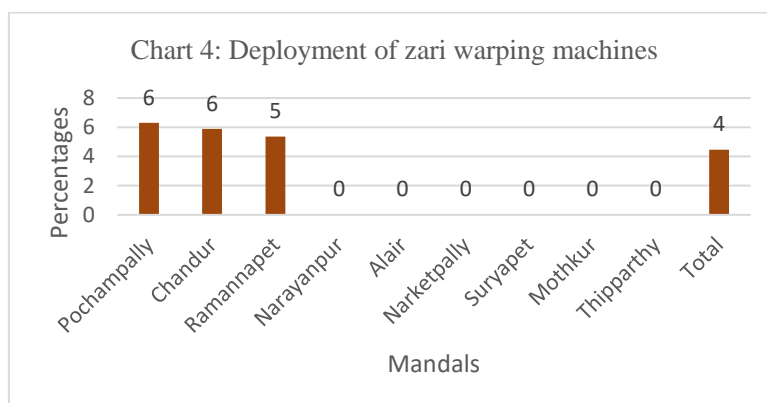
The modern technology *Asu Yantram* is installed by 90% (Table 1 and Chart 3) of the owners' respondents which is used for the warping yarn on *Asu*. This pre-loom process is related to the owners only. The process of warping yarn on *Asu* in the Pochampally Ikkat handloom industry is done for the preparation of weft. The available modern technology in the process of warping yarn on *Asu* is the *Asu Yantram* which works with electric power. Another method for warping yarn on *Asu* is manually and it is a traditional method. This weft on *Asu* is used for designing,

and tie & dyeing the weft which is the specialty of the Pochampally Ikkat handloom industry. Only in Mothkur Mandal, the percentage of deployment of this technology is zero, and in all other *mandals*, it is at a remarkable level.



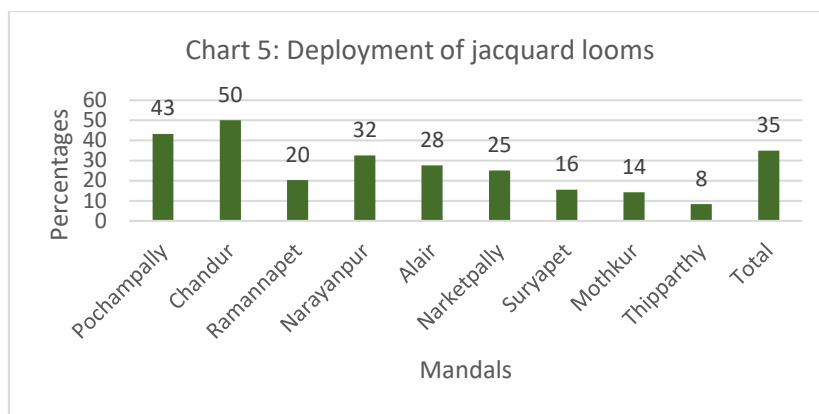
Zari warping machine:

The warping of *zari* is the pre-loom process that is related to the owners only. In the process of warping *zari* from the bobbins, the available modern technology is the *Zari* warping machine. This machine is used for the warping of *zari* which is used in the weaving process. The modern technology *Zari* warping machine is used by 1% of the respondents only. As per the opinion of owners, this machine is useful for large entrepreneurs only, and it is very costly. The percentage of deployment of *Zari* warping machines is very low i.e. 4% only (Table 1 and Chart 4). The percentage of deployment of this machine is almost zero in all the *mandals* except in Pochampally Mandal, Chandur Mandal, and Ramannapet Mandals. It reveals that the large owners are high in the above *mandals*, and they are very less in other *mandals*.



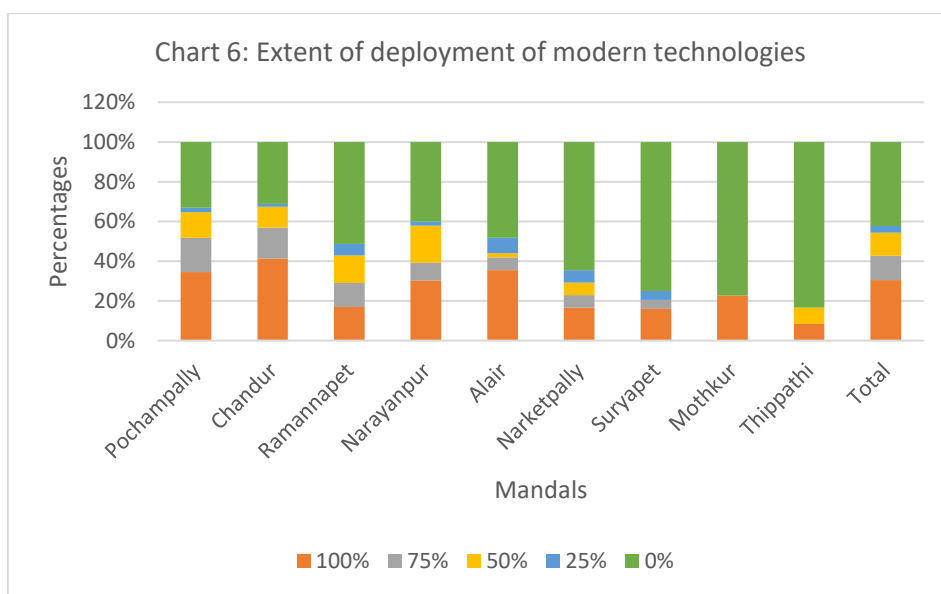
Jacquard loom:

The jacquard loom is the modern weaving technology for designing brocades with *zari* on the cloth at the time of weaving. The jacquard loom is a loom that has a jacquard machine set up on top of the ordinary loom. The jacquard machine designs the brocades on fabric with *zari* at the time of weaving of cloth as per the prepared punch card design. This jacquard loom is a modern technology for producing different modern designs as per the market changes and requirements. In the Pochampally Ikkat handloom industry, the jacquard looms are installed for innovative designs in addition to the Ikkat designs to compete in the market. Among the respondents, 549 handloom households installed jacquard looms i.e. 35%. The highest percentage of deployment of Jacquard looms is in Chandur Mandal i.e. 50%, next is in Pochampally Mandal i.e. 43%, 32% in Narayanpur Mandal, 28% in Alair Mandal, 25% in Narketpally Mandal, 20% in Ramannapet Mandal, 16% in Suryapet Mandal, 14% in Mothkur Mandal, and the least is in Thipparthi Mandal i.e. 8% (Table 1 and Chart 5).



Extent of deployment of modern handloom technologies

Table 2 and Chart 6 presents the extent of deployment and distribution of modern handloom technologies among the respondents in the sampled *mandals* in the Pochampally Ikkat handloom industry. The extent of deployment of modern technology is computed as a percentage between the total deployed modern machines to the total availability of modern machines in different operations. As per the analysis, 30% of the respondents deployed 100% of modern technologies, 12% of the respondents deployed 75% of modern technologies, 11% of the respondents deployed 50% of modern technologies, 3% of the respondents deployed 25% of the modern technologies, but 42% of the respondents deployed no modern technologies.



If we observed the Mandal-wise deployment of modern technology, the highest percentage of respondents who deployed 100% modern technology is in Chandur Mandal, whereas the lowest percentage of respondents who deployed 100% is in Thipparthi Mandal. In Chandur Mandal, 41% of the respondents installed 100% modern technology, but 31% of the respondent deployed zero modern technology. 35% of the respondents in Pochampally Mandal deployed 100% of modern handloom technologies, but in the same *Mandal*, 33% of the respondents deployed zero modern technology. In Alair Mandal, 35% of the respondents deployed 100% modern technology, but 48% of the respondents deployed zero modern technology. In Narayanpur Mandal, only 30% of the respondents deployed 100% modern technology, whereas 40% deployed no modern technology. In the rest of the *mandals*, the majority of the respondents i.e. more than 50% deployed zero modern technology, and less than 30% of the respondents installed 100% modern technology (Table 2 and Chart 6).

Table 2: Extent of deployment of modern handloom technologies across the sampled mandals

	Pochampally	Chandur	Ramanapet	Narayanpur	Alair	Narketpally	Suryapet	Mothkur	Thipathi	Total
100%	139 (35)	141 (41)	52 (17)	72 (30)	50 (35)	8 (17)	7 (16)	10 (23)	1 (8)	480 (30)
75%	69 (17)	53 (16)	37 (12)	21 (9)	9 (6)	3 (6)	2 (5)	0	0	194 (12)
50%	52 (13)	36 (11)	42 (14)	44 (19)	3 (2)	3 (6)	0	0	1 (9)	181 (11)
25%	9 (2)	5 (1)	18 (6)	5 (2)	11 (8)	3 (6)	2 (5)	0	0	53 (3)
0%	133 (33)	106 (31)	157 (51)	95 (40)	68 (48)	31 (65)	33 (75)	34 (77)	10 (83)	667 (42)
Total	402	341	306	237	141	48	44	44	12	1575

Source: Primary data.

Note: Figures in parentheses are the percentages.

Perception of non-adopters for non-adoption of modern weaving technology

Among the handloom processes, the weaving process is the most important one. Because the production of fabric is performed in the weaving process. In the weaving process, different technology looms are available. These technology looms included the traditional technology looms i.e. ordinary looms, medium technology looms i.e. *Pinjara* looms, and modern technology looms i.e. Jacquard looms. Nevertheless, the scope of this thesis is confined only to assessing the impact of adopting modern weaving technology on the profitability of the weavers, it is felt appropriate also to dwell on the reasons for not adopting the modern weaving technology, as 65% of the respondents representing the vast proportion of the sample size have not adopted modern weaving technology (Table 3). Though, the scope of this thesis establishes a linkage between two variables namely modern weaving technology and profitability it is found from the personal interviews from the non-adopters of modern weaving technology that old age, low level of education, non-availability of family labor, lack of infrastructure, financial issues, and other bottlenecks have prevented the majority of the weavers from adopting modern technology.

The data is collected from the non-adopters of modern weaving technology. The data is collected from 1026 respondents (non-adopters) for the reasons for non-adoption of modern weaving technology. These attributes are taken on the five-point Likert Scale for the collection of data regarding the perception of non-adopted weavers for the reasons for non-adoption of modern weaving technology. A vivid picture of the responses from the non-adopters of modern weaving technology is given in Table 3.

Table 3: Perception of weavers (non-adopters) for non-adoption of modern weaving technology among the respondents

Attributes	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Weighted Average Mean
a) Old age is a hindrance to the adoption of modern weaving technology.	78 (8)	120 (12)	61 (6)	115 (11)	652 (64)	4.11
b) A low level of education is a constraint to the adoption of modern weaving technology.	54 (5)	141 (14)	65 (6)	555 (54)	211 (21)	3.71
c) The lack of family labor involvement in the weaving activity is an obstruction to the adoption of modern weaving technology.	114 (11)	154 (15)	98 (10)	457 (45)	203 (20)	3.47
d) A lack of infrastructure is an impediment to the adoption of modern weaving technology.	75 (7)	110 (11)	58 (6)	256 (25)	527 (51)	4.02
e) The financial problem is obstructing the adoption of modern weaving technology.	78 (8)	71 (7)	61 (6)	115 (11)	701 (68)	4.26
f) Lack of technical experience to operate modern weaving technology (jacquard loom) is an obstruct to adopting it.	184 (18)	189 (18)	167 (16)	307 (30)	179 (17)	3.10
g) The small firm size is a barrier to adopting modern weaving technology.	267 (26)	238 (23)	249 (24)	164 (16)	108 (11)	2.62

Source: Primary data

Old age is a hindrance to the adoption of modern weaving technology:

It is found from the Likert data the respondents have strongly agreed that old age is one of the strong reasons why they are not venturing to adopt modern weaving technology. The 652 respondents among the 1026 sample have attributed the highest weightage of 5 to the given statement i.e. nearly 64% (Table 3) of the respondents have unanimously agreed that old age is the constraint of bringing modern weaving technology into their routine paragraph. The non-adopters of the technology have felt the reasons for non-adopting the modern weaving technology that they are senior citizens, and the modern weaving technology (jacquard loom) requires more physical strength to operate compared to ordinary looms though they are aware of the fact that such modern technology enhances the profits. So, it revealed that the lack of physical strength of the aged ones is the main problem for them to adopt the technology because generally, aged ones do not have the strong physical strength to operate this modern technology loom.

A low level of education is a constraint to the adoption of modern weaving technology:

Table 3 shows that the respondents have agreed that a low level of education is one of the causes why they are not advanced to adopt modern weaving technology. Most of the respondents are of the opinion that they are not properly and formally educated to use modern equipment. The 555 respondents among the 1026 respondents have attributed the highest weightage of 4 to the given statement nearly 54%. So, there is a need to reduce this impact of assumption and educate them that literacy has nothing to do with the adoption of technology.

The lack of family labor involvement in the weaving activity is an obstruction to the adoption of modern weaving technology:

Surprisingly it is found that 75% of non-adopters of technology are worried that the adoption of new technology makes family labor an obvious requirement to institute new technology (Table 3). Among the 1026 respondents, 457 respondents i.e. 45% agreed that a low level of education or illiteracy is one of the reasons for the non-adoption of modern weaving technology and they have given the highest weightage of 4. Therefore they distanced them from modern equipment. There is a dire need to enhance the cognitive level of such non-adopters so that non-availability of family labor might not be a hindrance in the adoption of technology, provided the existing weavers undergo nominal training in operating the modern equipment. 26% of non-adopters have however expressed that family labor is not an exogenous factor that determines the rate of adoption of modern technology.

A lack of infrastructure is an impediment to the adoption of modern weaving technology:

Among 1026 respondents who have not adopted modern weaving technology, a vast majority of the respondents i.e. 527 respondents strongly agreed and gave 5 weights that lack of infrastructure is one of the reasons for the non-adoption of modern weaving technology. Lack of infrastructure such as weaving space, and shelter to accommodate the machinery and other equipment stood as the primary reasons for not adopting the technology (Table 3). A few of them have also expressed during the personal interview that the lack of a *pucca* house causes moisture and makes it difficult for operating the equipment which is one of the strong reasons and constraints for not adopting which is also one of the reasons for not adopting modern technology.

The financial problem is obstructing the adoption of modern weaving technology:

It is learned from the personal interview that adoption of modern technology requires a very nominal amount of ₹60K to ₹80K which is also not existing within the affordable limits of the weavers who have not adopted modern technology. As 68% of the respondents i.e. 701 respondents among 1026 strongly agreed the financial problem is the strong reason for not adopting modern weaving technology (Table 3). This problem can be addressed by providing micro-credit or small-scale credit by government agencies. The deployment of modern equipment requires a minimal amount but the operation of which requires regular working capital that also created second thoughts among the non-adopters of technology.

Lack of technical experience to operate modern weaving technology (jacquard loom) is an obstruct to adopting it:

Among 1026 respondents, 307 respondents i.e. 30% of non-adopters agreed and they have given the 4 weights that they lack technical experience in operating modern weaving technology and seem to have been afraid of operating the modern equipment, as they revealed that they do not have sufficient experience in operating the modern equipment due to which they are away from adopting the modern technology. This is a serious problem to be addressed by the state agencies through conducting short-term training programs and creating a hands-on experience for the weavers and motivating them to adopt modern equipment. However, 36% of the respondents

have mentioned that either they have exposure or prior experience in operating modern equipment but could not adopt the same due to other factors like weak infrastructure and financial inability (Table 3).

The small firm size is a barrier to adopting modern weaving technology:

Among the 1026 respondents, 267 respondents i.e. have given 1 weight for the attribute of small firm size, 249 respondents have given 3 weights for the attribute and 238 respondents have given 2 weights for the attribute. It shows that the small firm size is not the main reason for the non-adoption of modern weaving technology. But somehow it is one of the reasons for the non-adoption of modern weaving technology because the respondents gave a 2.62 weighted average mean to this attribute. Some of them expressed that only bigger firms can afford to adopt modern technology in the handloom industry. 24% of the respondents stood on neither side of the determinants of firm size, as they have revealed the adoption of modern technology has got nothing to do with the size of the firm (Table 3).

Conclusion

It is concluded from the above outcomes that the deployment of the jacquard loom which is used for the production of cloth for design innovation is somehow better compared to the deployment of other modern handloom technologies. The installation of the *zari* warping machine is very low i.e.1% only. The extent of deployment of technology which is calculated as the ratio of deployment of modern technology to the available modern technologies in the required processes, that the percentage of deployment is very low i.e. 30% only deployed 100% of required technology, and a vast number of respondents i.e. 42% of them are not adopted a single modern technology. The vast majority of the non-adopters of modern weaving technology have expressed their opinion by giving 5 weights that they strongly agreed that old age, lack of infrastructure, and financial problems are the main reasons for the non-adoption of modern weaving technology. Some of them gave 4 weights to the attributes of low levels of education, insufficient family labor, and lack of technical experience. They are agreed that these attributes are the main reasons for the non-adoption of modern weaving technology.

The results reveal that the modern handloom technologies adoption rate is very low, and there is a need to upgrade the technology for the development and sustainability of the handloom industry. The study urges the state authorities to take initiation for semi-automation of looms, conduct training programs on modern technologies, provide infrastructure, access to government credit, etc. to overcome the hurdles to the adoption of modern weaving technology.

References

1. Dr. M Soundarapandian. Growth and prospects of Handloom sector in India, NABARD. Occasional paper 22, 2002.
2. Fu X., Pietrobelli C, Soete L. The role of foreign technology and indigenous innovation in the emerging economies: technological change and catching-up. *World Dev.* 2011; 39 (7): 1204–1212.
3. Tripathi R, Shastri RK, Agarwal S. Survival and growth strategies for small and medium scale enterprises in India: a key for sustainable development. In: Subrahmanya, M.H.B., Balachandra. *Driving the Economy through Innovation and Entrepreneurship*. Springer, New Delhi. Ed. 127: 163-174; 2013. DOI: 10.1007/978-81-322-0746-7_14.
4. Ministry of Textiles, Government of India. Annual Report 2015-16. http://texmin.nic.in/sites/default/files/ar_15_16_ENG.pdf.
5. Tewari M. Adjustment in India's textile and apparel industry: reworking historical legacies in a post-MFA world. *Environ. Plan.* 2006; 38: 2325–2344.
6. Ministry of Textiles, Government of India. *All India Handloom Census 2019-20*. <http://handlooms.nic.in/writereaddata/3736.pdf>.
7. Bortamuly AB, Goswami K, Hazarika, B. Determinants of occupational choice of workers in handloom industry in Assam. *Int. J. Soc. Econ.* 2013; 40 (12): 1041–1057.

8. NCAER, 2010. Handloom Census of India 2009–10. Ministry of Textiles, Government of India. <http://handlooms.nic.in/Writereaddata/Handloom%20report.pdf>.
9. Ministry of Textiles, Government of India. Annual Report 2017-18. <http://texmin.nic.in/sites/default/files/AnnualReport2017-18%28English%29.pdf>
10. Bortamuly AB, Goswami K. Determinants of the adoption of modern technology in the handloom industry in Assam. *Technol. Forecast. Soc. Change.* 2014; 90: 400–409.
11. Dangayach GS, Deshmukh SG. Advanced manufacturing technology implementation: evidence from Indian small and medium enterprises (SMEs). *J. Manuf. Technol. Manag.* 2005;16 (5): 483–496.
12. Todd PR, Javalgi R. Internationalization of SMEs in India: fostering entrepreneurship by leveraging information technology. *Int. J. Emerg. Mark.* 2007; 2 (2): 160–188,
13. Kannabiran G, Dharmalingam P. Enablers and inhibitors of advanced information technologies adoption by SMEs: an empirical study of auto ancillaries in India. *J. Enterp. Inf. Manag.* 2012; 25 (2): 186–209.
14. Lal K. Determinants of the adoption of information technology: a case study of electrical and electronic goods manufacturing firms in India. *Res. Policy.* 1999; 28 (7): 667–680.
15. Subrahmanya MHB. Technological innovations in Indian small and medium enterprises (SMEs) sector: does firm size matter? *Int. J. Innov. Learn.* 2006; 3 (5): 499–517.
16. Bhabesh Hazarika, Madhrjya Prashad Bezbaruah, Kishor Goswami. Adoption of modern weaving technology in the handloom micro-enterprises in Assam: A Double Hurdle approach. *Technol. Forecast. Soc. Change.* 2016; 102: 344-356.
17. Mohd Shoaib Ansari, Aditya Tripathi. Bridging Digital Divide Among Weavers of Banaras India: A Frame Work. *Int. J. Lib. Inf. Sci.* 2018; (3(1): 41-48.
18. Latif MA. Towards technological, transition in the Bangladesh handloom industry: a project proposal on replacement of the ordinary fly-shuttle loom by Chittaranjan Loom. Bangladesh Institute of Development Studies, Bangladesh. 1988.
19. Varukolu V. Technology Adoption of Indian Garment Manufacturing Firms MS Thesis, Louisiana State University, USA. 2007.
20. Tripathi R, Shastri RK, Agarwal S. Survival and growth strategies for small and medium scale enterprises in India: a key for sustainable development In: Subrahmanya, M.H.B., Balachandra, P., Srinivasan, R. (Eds.), *Driving the Economy through Innovation and Entrepreneurship*. Springer, New Delhi, 2013; Ed. 127: 163-174. DOI: 10.1007/978-81-322-0746-7_14.
21. Rajesh GK. Diffusion of agricultural innovations in India the case of Bivoltine hybrid technology in South Indian sericulture. *Int. J. Agron. Plant Prod.* 2012; 3 (10): 374–384.