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FACTORS INFLUENCINGTHE ADOPTION OF MODERN HANDLOOM WEAVING TECHNOLOGY WITH SPECIAL REFERENCE TO ERSTWHILE NALGONDA DISTRICT, TELANGANA

Gunti Amaravathi[1]* & Balanagalakshmi B[2]

[1]*Gunti Amaravathi, Research Scholar, Department of Commerce, KLEF (Deemed to be University) - 522 502, Andhra Pradesh, and Assistant Professor, Government Degree College, Kukatpally – 500 072, Telangana -India ORCID ID https://orcid.org/0000-0003-4834-8252

[2]Balanagalakshmi, Assistant Professor, KLH Business School, Hyderabad, R.R. Dist. – 500 075, Telangana, India. ORCID ID: https://orcid.org/0000-0002-0170-0303

Abstract

The present study recognizes and analyzes the factors influencing the modern weaving technology adoption in the handloom industry in the erstwhile Nalgonda District. The primary data is collected with a semi-structured interview schedule and analyzed the factors influencing the target variable (modern weaving technology adoption) by using a binary logistic regression model. The analysis is made separately for entrepreneurs and contract weavers. Results show that family labor, annual income, and *pucca* house playedan important positive role in the adoption of modern technology by entrepreneurs and contract weavers' households. Age has exhibited a significant negative role in the adoption of modern technology by both entrepreneurs and contract weavers. The factors which have an insignificant influence on modern technology adoption are education in the case of entrepreneurs, experience in the case of contract weavers, and access to government credit for both groups. This paper urges the government for providing pucca houses, and access to credit to the handloom households for an increase in the modern technology adoption rate.

Keywords: Adoption of modern weaving technology; Binary logistic regression; Deployment of technology, Jacquard loom.

Introduction

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 (Fu *et al.,* 2011; Tripathi *et al.,* 2013). 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(Ministry of Textile, 2015; Tewari, 2006). The Indian handloom sector is the second-largest unorganized sector after agriculture. It is providing 3,523 thousand employment opportunities directly to the population (Ministry of Textiles, 2019-20).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 (Bortamuly *et al.,* 2013; NCAER, 2010; Ministry of Textile, 2015).

The adoption of modern handloom technology strengthens the industry to withstand market competition(Ministry of Textiles, 2017-18; NCAER, 2010; Goswami & Choudary, 2015). 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 (Dangayach & Deshmukh, 2005; Todd and Javalgi, 2007; Kannabiran & Dharmalingam, 2012). 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 (Lal, 1999; Subrahmanya, 2006; Kannabiran & Dharmalingam, 2012; Bortamuly & Goswami, 2014; Hazarika *et al.,* 2016).

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 (Ansari& Tripathi, 2018; Latif, 1988; Varukolu, 2007; Tripathi *et al.,* 2013).These studies revealed the importance of the availability of government credit and subsidies in the exercise of the adoption and spreading of technology (Rajesh, 2012; Bortamuly & Goswami, 2014; Hazarika *et al.,* 2016). There are some mixed outcomes relating to age, education, and experience (Bortamuly & Goswami, 2014; Hazarika *et al.,* 2016). Some of the factors such as family labor, years of experience, and housing status were not considered in existing studies. There is a need to analyze a comprehensive set of factors across demographic, institutional and infrastructural domains on the adoption of technology decisions. The current study was instigated by the necessity of analysis of what factors influence the adoption of technology and the extent of technology deployment in rural, informal, and nonfarm sectors in a developing country.

The study focuses on the factors that influence the adoption of weaving technology in the handloom sector of the erstwhile Nalgonda District in Telangana. Erstwhile Nalgonda District is

playing a vital role in the handloom industry in Telangana. More than 40% of the Telangana handloom industry is concentrated in the erstwhile Nalgonda District. Geographically this district is closer to the state capital. In this district, the famous Pochampally Ikat design has 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 present study a) analyzes the extent of deployment of technology, b) analyzes the factors determining the adoption decision by the entrepreneurs, and c) analyzes the factors determining the adoption decision by the contract weavers

Adoption of technology in the Indian handloom industry

The Indian handloom industry has a vital role in the Indian economy and is the second-largest employment provider after agriculture i.e. 35.23 lakhs. India's share in the world's hand-woven fabric is 95% (Ministry of Textile, 2019-20). The Indian handloom industry is decentralized, dispersed, family-based, labor-intensive, eco-friendly and mainly concentrated in rural areas. Hence, it is important to adopt modern weaving technology in order to achieve quality production, cost-effectiveness, competitiveness, and balanced regional development.

The Government of India implemented the Technology Up-gradation Fund Scheme (TUFS) in 1999, in order to develop a technological upliftment in the textile industry. The objective of the scheme is to provide financial assistance to textile units for technology up-gradation to enhance competitiveness in the markets by improving productivity and quality, as well as reducing cost and waste across the value chain. The scheme is now changed to the Amended Technology Up-gradation Fund Scheme (ATUFS). Under this scheme, the government gives a 10% capital subsidy on the value of the permitted machines subject to a maximum of ₹20 crores (Ministry of Textile, 2017-18). Despite various efforts for the up-gradation of technology, the Indian handloom industry is still backward in technology up-gradation. This is evident from the fact that in 2019-20, out of 2.7 million looms, only 40% of looms were technologically upgraded. (NCAER, 2010; Ministry of Textiles, 2019-20).

The handloom industry of Telangana occupies a unique place in the country for its exclusive art and artifacts of handloom weavers. Ethnic handloom designs of Telangana State promote the cultural glory of Indian heritage and culture. The design patterns of Pochampally Ikkat, Gadwal Sarees, Narayanpet sarees, Warangal Durries, and Karimnagar Bedsheets & Furnishings show the outstanding skills of handloom weavers. In Telangana, the Pochampally Ikat design, Gadwal sarees, Siddipet Gollabhama sarees, Narayanpet sarees, and Warangal Durries have been registered under the Geographical Indication Act, 1999 (Department of handloom & textiles, 2019).Erstwhile Nalgonda District is playing a vital role in the Telangana handloom industry.

More than 40% of the Telangana handloom industry is concentrated in the erstwhile Nalgonda District. In this district, the famous Pochampally Ikkat design has 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. However, the question arises as to why the adoption of modern weaving technology is low and what kind of factors determine the technology adoption decision in this district.

Sampling strategy and sources of data

In the current study, two types of handloom workers who are capable of adopting modern weaving technologies are examined. They are entrepreneurs and contract weavers. The entrepreneurs included both sub-master weavers and independent weavers. The sub-master weavers are those who produce cloth by engaging the contract weavers and/or allied workers. Independent weavers are those who involve in all the activities of production including weaving. Contract weavers are those who produce cloth by taking the wage on a piece (warp) rate basis. The analysis is done separately for entrepreneurs, and contract weavers. The study is conducted on primary data collected from 400 handloom household sacross fiveMandals namely Chandur Mandal, Pochampally Mandal, Choutuppal Mandal, Ramannapet Mandal, and Narayanpur Mandal, from October 2021 to March 2022 (Table 1).

The study followed a multi-stage sampling technique. As a first step, the Mandal-wise list of handlooms in the erstwhile Nalgonda District was prepared from the Handloom weaver information system, Ministry of Textiles portal in March 2019. Asa second step, the top five Mandals based on the high concentration of handlooms were selected. As a third step, two villages from each Mandal were selected intentionally based on the high concentration of handlooms. As a fourth step, the lists of silk handlooms of selected villages were prepared, because our study is mainly on the jacquard looms which are used for *zari* designs in silk cloth production in the erstwhile Nalgonda District. From the prepared lists, the sample handlooms were selected in proportion to the total handlooms from each selected village based on the simple random method. The primary data was collected by using a semi-structured interview schedule at handloom households.

Modern handloom technologies are used to facilitate the different processes in handloom cloth production like the pre-loom processes and weaving process. The pre-loom processes are winding, warping, tie & dyeing, joining of yarn, etc. The available modern technologies for winding yarn on Dubbas are Four *Dubbas* Yarn Winding Machine, and One *Dubbas* Yarn Winding Machine. For the warping of yarn on *Asu*, the *Asu yantram* facilitates the work. Zari warping machine facilitates the work of warping of *zari*. The *Pinjara* machine is the intermediate weaving

technology that facilitates *zari*line designs. The jacquard machine is the modern weaving technology used for intricate designs with *zari*.

Table 1 shows the distribution of the adoption of various modern handloom technology among the respondents in sampled Mandalas in the erstwhile Nalgonda District. In the sample, 37.25% of the handloom workers adopt at least one jacquard loom in their work premises. The highest weaving technology adoption percentage is in Chandur Mandal (54%), followed by Pochampally Mandal(45%), Narayanpur Mandal (32%), Choutuppal Mandal (28%), and the lowest is in Ramannapet Mandal (15%).

Table 2 presents the extent of deployment and distribution of technology among the respondents in the sampled Mandals in the erstwhile Nalgonda District. The extent of deployment of technology is computed as a ratio between the total installed machines to the total available machines for the particular operation. As per our analysis, 28.75% of the respondents have deployed 100% of the technology while 11.75% of the respondents deployed 70% of the technology. A staggering 49.25% of the respondents deployed no technology.

Table 1: Adoption of handloom technologies among the respondents

Mandals Sample size	**Chandur 103**	**Pochampally 99**	**Ramannapet 78**	**Choutuppal 60**	**Narayanpur 60**	**Total 400**
Traditional technologies:						
Ratnam (Spinning Charaka)	100(97)	96(97)	71(91)	57(95)	58(97)	382(96)
Asu	79(77)	80(81)	69(88)	49(82)	51(85)	328(82)
Ordinary loom	28(27)	30(30)	44(56)	28(47)	27(45)	157(39)
Pinjara loom (designing)	15(15)	19(19)	16(21)	12(20)	10(17)	72(18)
Modern technologies:						
Yarn winding machine	17(17)	15(15)	12(15)	11(18)	10(17)	65(16)

(One *Dubba*)						
Yarn winding machine (Four *Dubba*)	11(11)	6(6)	0	3(5)	3(5)	23(6)
Asu Yantram	27(27)	21(21)	12(15)	14(23)	13(22)	87(22)
Zari warping machine	2(2)	1(1)	0	0	0	3(1)
Jacquard loom (designing)	56(54)	45(45)	12(15)	17(28)	19(32)	149(37)

Note: Figures in parentheses are the percentages.

Table 2: Extent of deployment of modern handloom technologies among the respondents

Extent of deployment	Chandur	Pochampally	Ramannapet	Choutuppal	Narayanpur	Total
0.00	34	42	56	35	30	197
0.25	1	0	0	1	1	3
0.50	10	7	7	6	8	38
0.75	16	13	5	8	165	47
1.00	42	37	10	10	16	115
Total	103	99	78	60	60	400

Operational framework

The adoption of technology can be explained as a phase of making an option as the best way of action with regard to utilizing the available technology in the production process (Rogers, 2003; Feder *et al.,* 1985). It can be recognized that a result of the adoption of technology can be perceived only after an individual makes two decisions (a) whether to adopt or not and if yes (b) to what extent. In the next part of the study, the adoption of technology is related to the installation of Jacquard machines (modern weaving technology) in handlooms. The jacquard machines are used in facilitating the *zari* designs through the network drafting in addition to the *Ikkat* designs in the erstwhile Nalgonda District.

The theoretical framework of the adoption of modern technology in the handloom industry is based on the available literature (Hazarika *et al.,* 2016; Bortamuly & Goswami, 2014; Tambo & Abdoulaye, 2012; Kassie *et al.,* 2013; Rogers, 2003; Noltze *et al.,* 2012; Hayami & Ruttan, 1971; Goswami & Choudhury, 2015).Existing literature on adoption shows that it is hard to elucidate the individuals' behavior on adoption through a single model. The current study is based on different factors which influence the adoption decision. The factors are classified as economic and access-related variables, institutional variables, infrastructural variables, and human variables.

The inaccessibility to credit is the main hurdle in the adoption of technology and its deployment in informal sectors (Hazarika *et al.,* 2016; Noltze *et al*., 2012; Rogers, 2003; Beltran *et al.,* 2013; Shiferaw *et al.,* 2008). The handloom industry is more prone to capital and credit limitations. The high initial investment would likely hinder the adoption of technology. In such circumstances, access to government credit may boost the adoption of technology in the handloom sector.

The contribution of family labor to adoption is relatively less significant (Shiferaw *et al.,* 2008; Goswami & Choudhury, 2015; Marenya & Barrett, 2007). Generally, for the family-based and labor-based industries, family labor inclusion is very important in adoption. The family labor contribution helps in overcoming the lack of labor and lessens the labor cost and problems related to engaging labor (Noltze *et al.,* 2012; Paswel & Christopher*,* 2007). The household assets and complementary inputs motivate the adoption decision (Tambo & Abdoulaye, 2012; Shiferaw *et al.,* 2008).In the handloom industry, a pucca house is an important resource for the weaving operation, since the handloom industry is family-based and labor-based.

Personal factors such as age, experience, and education of micro-entrepreneurs playa vital role in the adoption and deployment of technology. As per some studies, the age and experience of the individuals are insignificant factors (Kassie *et al.,* 2013; Shieraw *et al.,* 2008; Noltze *et al.,* 2012). As per another study, the same factors are useful in estimating the cost and benefits of technology utilization, thereby enhancing the odds of adoption(Bortamuly & Goswami, 2015; Beltran *et al.,* 2013). In another study, Age has a negative effect on adopting technology due to the risk of high investment thereby decreasing the odds of adoption (Hazarika *et al.,* 2016). The education of an individual is a positive influence on technology adoption and the extent of deployment since it is easier to access and acquire the knowledge, information, and benefits of technologies(Bortamuly & Goswami, 2014). Various studies found that the firm size positively impacts the adoption and extent of deployment of technology (Rajesh, 2012; Feder *et al.,* 1985; Hall & Khan, 2003; Peltier *et al.,* 2012; Varukolu, 2009; Langyintuo & Mungoma, 2008).

Theory and analytical model

Modern technology adoption includes risk, it is not an easy binary (yes or no) response. The decision of adoption needs to be analyzed in the conceptual framework. Studies frequently explain the methodology of adoption through a logistic regression model (Griliches, 1957; Lionberger, 1960). Both binary and multinomial logistic models are considerably used to describe the features related to adoption behavior. The logitmodel is used by Bortamuly & Goswami (2014), to explore the factors that determine the adoption of weaving technology in Assam, Adesina *et al.,* (2000), to explain the factors influencing the farmers' decision towards adoption of alloy farming variants in Southwest Cameroon. The multinomial logit model is used by Bortamuly *et al.* (2013), to analyze the factors influencing the occupational choice of handloom workers in Assam. Different researchers used the logit and multinomial logit models for analyzing the computer adoption decision (Batte *et al,* 1990; Putler & Zilberman, 1988).Hence, most of the studies used the logit models relating to the adoption of technology for analysis.

Based on the previous studies, the current study focused on variables such as age, education, experience, family labor, firm size, access to government credit, and pucca house that determines the adoption of modern weaving technology in the erstwhile Nalgonda District. Python programming language is used for the analysis of primary data. The utility obtained from the modern handloom weaving technology adoption may differ across individuals (i) at a specific point of time (t).According to the estimated utility hypothesis, an adopter's decision is influenced by her/his utility maximization attitude. If he/she finds the estimated utility of adoption of modern weaving technology (U_{1i}) is higher than the estimated utility of non-adoption (U_{0i}), then the latent random variable $A^*_i = (U_{1i} - U_{0i}) > 0$. The noticeable result of this probability process can be as follows, i.e.,

$$A_i = \begin{cases} 1, if\ U_{1i} > U_{0i} (the\ modern\ technology\ is\ adopted) \\ 0, if\ U_{1i} < U_{0i}\ (\ the\ modern\ technology\ is\ not\ adopted) \end{cases} \quad (1)$$

$$U_{ti} = \beta_i F_i(I_{ti}, E_{ti}, In_{ti}, H_{ti}) + €_{ti};\ t = 1 \text{ or } 0; \text{ and } i = 1,2,3,\ldots\ldots,N \quad (2)$$

Where, t is the binary variable, that is 1 if the handloom families adopted modern weaving technology, and that is 0, if it is not adopted; $U_i$is the underlying utility function which line liking of the ith respondent; $B_i$is a vector of the coefficient; I_{ti} represent institutional variables (such as firm size, worker type, owner type); E_{ti} represents economic variables (such as annual income, access to government credit); In_{ti} represents infrastructure variables (such as a pucca house); H_{ti} represents human variables (such as age, education, experience, family labor), and$€_{ti}$ is an error term.The factors of technology adoption in the handloom industry are studied with the following binary logistic model in which the predicted variable (modern weaving technology adoption) is bifurcated as adoption or non-adoption.

The factors of technology adoption in the handloom industry are studied with the following binary logistic model in which the predicted variable (modern weaving technology adoption) is bifurcated as adoption or non-adoption. Presuming P_i is the likelihood that the modern weaving technology is adopted, 1-P_i implies the likelihood of non-adopting modern weaving technology. Hence, the logit model for the current analysis is described as:

$$P_i = \left[\frac{P_i}{1-P_i}\right] = MTA_i = \beta_1 + \beta_2 Age_i + \beta_3 Edu_i + \beta_4 Exp_i + \beta_5 FL_i$$

$$+\beta_6 FS_i + \beta_7 ET_i + \beta_8 AI_i + \beta_9 AGC_i + \beta_{10} PH_i + €_i \qquad (3)$$

Where,$MTA_i$is 1 if modern weaving technology is adopted, and 0 if not adopted; Age_i is the age of the ith respondent in years; $Edu_i$is the education of ith respondent in years; $Exp_i$is the working experience of ith respondent in years; $FL_i$is a number of family labor in ith respondent's house; FS_i is the firm size of the ith respondent in numbers; ET_i is an entrepreneur type of the ith respondent, 1 for the sub-master weaver, 0 for the independent weaver; AI_i is an average annual income of the ith respondent in thousand rupees (INR); $AGC_i$is access to government credit of the ith respondent, 1 for yes, 0 for no; PH_i is a *pucca* house of the ith respondent, 1 for yes, 0 for no; and $€_i$ is an error term.

Table 4 illustrates the descriptive statistics of the variables used in the analysis of the determinants of the adoption of modern weaving technology by entrepreneurs' and contract weavers' households in the erstwhile Nalgonda District. The rate of adoption of modern technology by entrepreneurs is 44%, and contract weavers is 34%.

Table 5 exhibits the variables determining the adoption of modern weaving technology by entrepreneurs' and contract weavers' households in the erstwhile Nalgonda District. The outcomes are based on a binary logit model by using 1 for the adoption of technology, and 0 for non-adoption of technology as the predicted variable. The table explores the probability of adopting modern technology by entrepreneurs' and contract weavers' households. By exponential of the estimated coefficient value, we get the odds ratio, which exhibits how much the odds increase/decrease multiplicatively (predicted variable) with one unit change in the predictor variables.

Table 3: Variables of the determinants of adoption of modern handloom weaving technology and their hypothesised relationship

Variables	Description	Measurement unit	Hypothesis relation
Modern weaving technology adoption	Adoption of the Jacquard loom	Yes for 1, No for 0	

Age	Age of the household head	Years	-
Education	Education of the household head	Years	+
Experience	Working experience of the household head	Years	+
Family labour	Involvement of family members in handloom work	Numbers	+
Firm size	Number of looms	Numbers	+
Entrepreneur type (dummy)	Sub-master weavers and Independent weavers	1 for Sub-master weaver, 0 for Independent weaver	+
Annual income	Income of handloom household from handloom works	Thousand rupees (INR 000's)	+
Access to government credit (dummy)	Access to government credit	1 for Yes, 0 for No	+
Pucca house (dummy)	House status is solid and permanent	1 for Yes, 0 for No	+

Table 4: Descriptive statistics of variables used in the analysis of the adoption of modern handloom weaving technology

Variables	Entrepreneurs				Contract Weavers			
	Mean (n=113)	Standard deviation	Minimum	Maximum	Mean (n=287)	Standard deviation	Minimum	Maximum
Age	47.11	6.48	32	60	50.40	9.38	28	68
Education	7.90	3.89	0	16	6.20	3.76	0	15
Experience	26.42	8.92	5	48	28.10	12.54	2	55
Family labour	2.25	0.62	1	4	2.02	0.34	1	4
Firm size	14.69	11.69	1	60	-	-	-	-
Entrepreneur type	0.69	0.46	0	1	-	-	-	-
Annual income	1577.22	1204.44	195	5750	192.54	74.44	72	420
Access to government credit	0.13	0.34	0	1	0.07	0.25	0	1

Pucca house	0.49	0.50	0	1	0.21	0.41	0	1
Weaving technology	0.44	0.50	0	1	0.34	0.48	0	1

Table 5 reveals that the increase in the age of the handloom worker plays a vital role in adopting modern weaving technology. Age has a 1% and 5% level of significance on entrepreneurs and contract weavers respectively. The estimated coefficients of age indicate a notable negative influence on the adoption of new technology. The chance of choosing a weaving technology decreases by 2.46% or a factor of 0.4338 for every year increase in the age of the entrepreneur, and it decreases by 0.55% for every year increase in the age of contract weavers. This indicates that, if the age of the handloom worker increases, their elderliness does not initiate them to adopt new technology. They tend to be more cautious regarding the cost of modern technology and fear of return and losses from new technology. Similar outcomes were also found in the studies on the adoption of modern weaving technology in Assam (Bortamuly & Goswami, 2014);the adoption of land protection practices in Niger (Baidu-Forson, 1999); the adoption of hybrid cocoa in Ghana (Boahene *et al.,* 1999).

Table 5: Estimations of Binary logit model for adoption of modern weaving technology

Variables	Entrepreneurs				Contract Weavers			
	Coefficient	Std. Error	Odds Ratio	Marginal effect	Coefficient	Std. Error	Odds Ratio	Marginal effect
Age	-0.8351**	0.430	0.4338	-0.0246	-0.1574**	0.079	0.8544	-0.0055
Education	-0.2171	0.257	0.8048	-0.0061	0.2982***	0.117	1.3474	0.0104
Experience	0.5316**	0.249	1.7016	0.0150	0.0864	0.053	1.0902	0.0030
Family labour	3.0560**	1.521	21.2428	0.0933	3.2904***	1.048	26.8536	0.1144
Firm size	0.7241**	0.372	2.0629	0.0204	-	-	-	-
Entrepreneur type	-14.1971**	6.522	0.0000	-0.3999	-	-	-	-

Annual income	0.0059**	0.003	1.0060	0.0002	0.0804***	0.015	1.0837	0.0028
Access to government credit	2.0087	1.735	7.4535	0.0566	2.5348	2.223	12.6134	0.0881
Pucca house	5.1354**	2.556	169.9367	0.1446	1.9705**	0.837	7.1744	0.0685
Intercept	10.7054	13.564	44595.94		-20.9145***	5.779		
Pseudo R^2	0.8593				0.8176			
Log – Likelihood	-10.913				-33.733			
LL – Null	-77.576				-184.90			
LLR P - value	0.00				0.00			
Number of observations	113				287			

Note: ***1%, ** 5%, and *10% level of significance is considered.

The influence of education on technology adoption by entrepreneurs is not showing a significant influence (Table 5).It indicates that education is not an effective factor in the adoption of technology. The alike outcomes were found among the contract workers in the Assam handloom industry (Bortamuly & Goswami, 2014) and in other research (Shieraw *et al.,* 2008; Noltez *et al.,* 2012).In the case of contract weavers, the likelihood of technology adoption increases with the increase in their education. The probability of adoption of new technology by the contract weaver increases by 1.04% (Table 5)for every one year increase in schooling. It specifies that education motivates to learn new things, and techniques and also adopt new technology. Similar outcomes were found among the farmers in Kenya relating to the adoption of improved natural resources management (Paswel *et al.,* 2007), relating to sustainable agricultural practices in Tanzania (Kassie *et al.,* 2013), among the industry entrepreneurs in Assam (Bortamuly & Goswamy, 2016), and among small retailers (Peltier *et al.,* 2012).

Experience has a profound influence on the adoption of modern weaving technology by entrepreneurs. However, experience has very little effect on contract weavers. The probability of adoption of technology increases by 1.5% (Table 5) for every year increase in the experience of the entrepreneur. It indicates that the experience motivates them to adopt new technology for

getting more benefits. The outcome is in line with the study in Assam among handloom households (Hazarika *et al.,* 2016).

The influence of family labor contribution is showing a significant positive influence on the chance of adoption of modern technology by handloom households. For an increase in a family member's involvement in the handloom work, the odds of adoption of weaving technology increase by 9.33% in the case of entrepreneurs, and by 1.44% in the case of contract weavers (Table 5). The handloom industry is mainly family-based and labor-based. It requires skill and hard labor in every process of production. In the past decade, the number of handloom workers decreased by 19% from 4.33 million (Ministry of Textiles, 2019-20) to 3.52 million (NCAER, 2010). Youth are not interested in taking the handloom as a profession due to the involvement of hard labor and low income (Status Quo, Ministry of Textiles, 2014**).**If the involvement of youth increases in the handloom, then there is a possibility of an increase in the adoption of technology. The increase in family members' involvement in the handloom work motivates them to adopt modern technology thereby increasing the per capita income. Similar outcomes were found among the farmers in the adoption of system technologies (Noltze *et al.,* 2012), sustainable agricultural management(Paswel *et al.,* 2007), Jatropha adoption, and continuation (Goswami & Chowdhury, 2015).

The firm size has a significant positive influence on the adoption of weaving technology by entrepreneurs. The chance of adoption of technology increase by 2.04% (Table 5) for every unit increase in the firm size.It implies that large entrepreneurs are willing to take risks in the adoption of new technology. The homogeneous results were found among handloom households on the adoption of weaving technology (Hazarika *et al.,* 2016), on the technology adoption in Indian garment manufacturing firms (Varukolu, 2009), and in other research (Rajesh, 2012; Marenya and Barrett, 2007; Kassie *et al.,* 2013). The firm size is not taken in the analysis of contract weavers because it is one for all the contract weavers.

Entrepreneurs are classified as sub-master weavers and independent weavers. In the erstwhile Nalgonda District, the sub-master weavers are large entrepreneurs, and they are involved in all the production processes with or without engaging the allied workers except the weaving process. They produce the cloth by engaging the contract weavers on a piece-rate basis. The independent weavers are the weavers who are involved in all the production processes including the weaving process. The probability of adoption of new technology by master weavers is 40% (Table 5) less compared to independent weavers. It indicates that independent weavers are more prone to adopt modern technology compared to sub-master weavers.

The results show that annual income has a significant positive influence on the adoption of recent technology by handloom households. For every thousand rupees (INR) per annum increase in the earnings from handloom-related work, the odds of adoption of current technology increase by

0.02% in the case of entrepreneurs, and by 0.28% (Table 5) in the case of contract weavers. Profit or income is the main motivator for every business or profession. The increase inincome or profit increases the preserves and curiosity in learning new technology and risk-taking ability. The alike results were found in other studies (Boratamuly & Goswami, 2014; Hazarika *et al.,* 2016).

Having a *pucca* house by the handloom household increases the choice of modern technology adoption by 14.46% by the entrepreneur, and 6.85% by the contract weaver compared to not having the pucca houses. *Pucca* house is one of the basic infrastructures for the handloom industry, particularly for the installation of the jacquard looms because the moisture in the house makes it difficult to operate the looms. It indicates that the *pucca* houses motivate the handloom households to adopt modern technology. The connected results were found among the farmers (Kassie *et al.,* 2013; Shieraw *et al.,* 2008; Beltran *et al.,* 2012).

The results show that access to government credit is not showing a significant influence on the adoption of technology by handloom households. Access to government credit in the erstwhile Nalgonda District is only 13% and 7% (Table 4) for entrepreneurs and contract weavers respectively. The adoption of technology increases capital expenditure and revenue expenditure. Similar outcomes were found in other research (Noltze *et al.,* 2012). The results specify that the adoption of technology is related to the latest and augmented trade practices (Varukolu, 2009). If access to government credit increases the handloom households, the chance of adoption of technology by them also may be increased.

Conclusion

It is concluded from the above outcomes that in the case of entrepreneurs, experience, family labor, firm size, entrepreneur type, and annual income plays a vital role in the adoption of modern weaving technology. In the case of contract weavers, the outcomes show that they are more inquisitive in the adoption of modern technology to earn more income. Education, family labor, annual income, and *pucca* houses playa positive role in the adoption of modern technology by contract weavers. So, in all cases, annual income, family labor, and *pucca* houses playan important positive role in the adoption of modern weaving technology. The piece rate of the product which is produced with the use of modern technology is very high compared to traditional technology due to the design and quality variance. As a result, it increases the income of the handloom households. An increase in family labor in handloom work increases the technology adoption rate by handloom households. The infrastructure is very important for every business especially a *pucca* house is a prerequisite for family-based industries such as the handloom industry. In all cases, age plays an important negative role in modern weaving technology adoption. The increase in age decreases the rate of technology adoption, because, aging results in a lack of physical strength, technical skill, awareness, and risk profile. In all cases, access to government credit is not a significant factor in technology adoption, because the rate of access to government credit is

very low in handloom households. Hence, this paper urges the government on the viability of providing pucca houses, access to government credit, and also semi-automation of modern looms (Jacquard looms) to overcome the constraints in the adoption of modern weaving technology by handloom households.

References:

Adesina A.A., Mbila D., Nkamleu G.B., Endamana D., 2000. Econometric analysis of the determinants of adoption of alley farming by farmers in the forest zone of Southwest Cameroon. Agric. Ecosyst. Environ. 80 (3): 255–265.

Ansari Md.S., Tripathi A., 2018. Bridging Digital Divide Among Weavers of Banaras India: A Frame Work. International Journal of Information Studies & Libraries (3(1): 41-48.

Baidu-Forson J., 1999. Factors influencing adoption of land-enhancing technology in the Sahel: lessons from a case study in Niger, J. Agric. Econ. 20 (3): 231–239.

Batte M.T., Jones E., Schnitkey G.D., 1990. Computer use by Ohio commercial farmers. Am. J. Agric. Econ. 72 (4): 935–945.

Beltran J.C., White B., Burton M., Doole G.J., 2013. Pannell, D.J. Determinants of herbicide use in rice production in the Philippines. Agric. Econ. 44: 45–55.

Boahene K., Snijders T.A.B., Folmer H., 1999. An integrated socio-economic analysis of innovation adoption: the case of hybrid cocoa in Ghana, J. Policy Model 21 (2): 167–184]

Bortamuly A.B., Goswami K., 2014. Determinants of the adoption of modern technology in the handloom industry in Assam. Technological forecasting and social change 90: 400–409.

Bortamuly A.B., Goswami K., Hazarika B., 2013. Determinants of occupational choice of workers in handloom industry in Assam. Int. J. Soc. Econ, 40 (12): 1041–1057.

Caffey R.H., Kazmierczak Jr. R.F., 1994. Factors influencing adoption in a Louisiana aquaculture system, J. Agric. Appl. Econ. 26 (1): 264–274.

Dangayach G.S., Deshmukh S.G., 2005. Advanced manufacturing technology implementation: evidence from Indian small and medium enterprises (SMEs). J. Manuf. Technol. Manag. 16 (5): 483–496.

Data collected in April 2019 from: http://handloomcensus.gov.in/aboutus.php.

Department of Handlooms & Textiles, Government of Telangana, 2019. Comprahensive Departmental Note. https://drive.google.com/drive/u/0/folders/1K7-QOh6rYGG69ur6t6wii4WVmRpj9ujj.

Feder G., Just R.E., Zilberman D., 1985. Adoption of agricultural innovations in developing countries: a survey. Econ. Dev. Cult. Chang. 33 (2): 255–298.

Fourth All India Handloom Census 2019-20, Ministry of Textiles, Government of India.

Fu X., Pietrobelli C., Soete L., 2011. The role of foreign technology and indigenous innovation in the emerging economies: technological change and catching-up. World Dev, 39 (7): 1204–1212.

Goswami K., Choudhury H.K., 2015. To grow or not to grow? Factors influencing the adoption of and continuation with Jatropha in North East India. Renew. Energy 81: 627–638.

Griliches Z., 1957. Hybrid corn: an exploration in the economics of technological change. Econometrica 25 (4): 501–522.

Hall B.H., Khan B., 2003. Adoption of new technology. In: Jones, D.C. (Ed.), New Economy Handbook. Academic Press, San Diego, CA.

Hayami Y., Ruttan V., 1971. Agricultural Development: An International Perspective. John Hopkins University Press, Baltimore, MD.

Hazarika B**.,** Bezbaruah M.P., Goswami K., 2016. Adoption of modern weaving technology in the handloom micro-enterprises in Assam: A Double Hurdle approach. Technological forecasting and social change 102: 344-356.

Kannabiran G., Dharmalingam P.. 2012. Enablers and inhibitors of advanced information technologies adoption by SMEs: an empirical study of auto ancillaries in India. J. Enterp. Inf. Manag. 25 (2): 186–209.

Kassie M., Jaleta M., Shiferaw B., Mmbando F., Mekuria M., 2013. Adoption of interrelated sustainable agricultural practices in smallholder systems: evidence from rural Tanzania. Technol. Forecast. Soc. Chang. 80 (3): 525–540.

Lal K., 1999. Determinants of the adoption of information technology: a case study of electrical and electronic goods manufacturing firms in India. Res. Policy 28 (7): 667–680.

Langyintuo A.S., Mungoma C., 2008. The effect of household wealth on the adoption of improved maize varieties in Zambia. Food Policy 33 (6): 550–559.

Latif M.A., 1988. 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.

Lionberger H.F.. 1960. Adoption of New Ideas and Practices, Iowa State University Press, Iowa.

Marenya P.P., Barrett C.B., 2007. Household-level determinants of adoption of improved natural resources management practices among smallholder farmers in western Kenya. Food Policy 32: 515–536.

Ministry of Textiles, Government of India, 2014. Status Quo in the Definition of Handloom under Handloom Reservation Act, 2012, Press information bureau. https://pib.gov.in/newsite/PrintRelease.aspx?relid=102376.

Ministry of Textiles, Government of India. *All India Handloom Census 2019-20*. http://handlooms.nic.in/writereaddata/3736.pdf.

Ministry of Textiles, Government of India. *Annual Report 2015-16*. http://texmin.nic.in/sites/default/files/ar_15_16_ENG.pdf.

Ministry of Textiles, Government of India. *Annual Report 2017-18*. http://texmin.nic.in/sites/default/files/AnnualReport2017-18%28English%29.pdf.

NCAER, 2010. Handloom Census of India 2009–10. Ministry of Textiles, Government of India. http://handlooms.nic.in/Writereaddata/Handloom%20report.pdf.

Noltze M., Schwarze S., Qaim M., 2012. Understanding the adoption of system technologies in smallholder agriculture: the system of rice intensification (SRI) in Timor Leste. Agric. Syst. 108: 64–73.

Paswel M., Christopher B.B., 2007. Household-level determinants of adoption of improved natural resources management practices among smallholder farmers in Western Kenya. Food Policy 32 (4): 515-536.

Peltier J.W., Zhao Y., Schibrowsky J.A., 2012. Technology adoption by small businesses: an exploratory study of the interrelationships of entrepreneur and environmental factors. Int. Small Bus. J. 30 (4): 406–431

Putler D.S., Zilberman D., 1988. Computer use in agriculture: evidence from Tulare County, California, Am. J. Agric. Econ. 70 (4): 790–802.

Rajesh G.K., 2012. Diffusion of agricultural innovations in India the case of Bivoltine hybrid technology in South Indian sericulture. Int. J. Agron. Plant Prod. 3 (10): 374–384.

Rogers E.M., 2003. Diffusion of Innovations. 5th eds. Free Press, New York.

Shiferaw B., Kebede T., You L., 2008. Technology adoption under seed access constraints and the economic impacts of improved pigeon pea varieties in Tanzania. Agric. Econ. 39 (3): 309–323.

Subrahmanya M.H.B., 2006. Technological innovations in Indian small and medium enterprises (SMEs) sector: does firm size matter? Int. J. Innov. Learn. 3 (5): 499–517.

Tambo J.A., Abdoulaye T., 2012. Climate change and agricultural technology adoption: the case of drought tolerant maize in rural Nigeria. Mitig. Adapt. Strateg. Glob. Chang. 17: 277–292.

Tewari M., 2006. Adjustment in India's textile and apparel industry: reworking historical legacies in a post-MFA world. Environ. Plan. 38: 2325–2344.

Todd P.R., Javalgi R., 2007. Internationalization of SMEs in India: fostering entrepreneurship by leveraging information technology. Int. J. Emerg. Mark. 2 (2): 160–188.

Tripathi R., Shastri R.K., Agarwal S., 2013. 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, 163–174.

Varukolu V., 2007. Technology Adoption of Indian Garment Manufacturing Firms. MS Thesis, Louisiana State University, USA.