



## Adoption of modern weaving technology in the handloom micro-enterprises in Assam: A Double Hurdle approach



Bhabesh Hazarika<sup>a</sup>, Madhurjya Prashad Bezbaruah<sup>b</sup>, Kishor Goswami<sup>a,\*</sup>

<sup>a</sup> Department of Humanities & Social Sciences, Indian Institute of Technology Kharagpur, West Bengal 721 302, India

<sup>b</sup> Department of Economics, Gauhati University, Gauhati, Assam 781 014, India

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### ABSTRACT

Technological uplift is imperative for enterprises to achieve and sustain competitiveness in terms of both cost and quality of products. While the literature on technology adoption is voluminous, studies focused on adoption related issues concerning rural, nonfarm, and informal micro-entrepreneurs in developing economies are few and far between. In view of significance of these enterprises in employment and income generation at the lower end of income distribution in developing countries, a study of factors influencing adoption of modern technology in such enterprises assumes importance. Using firm-level data collected through a primary survey, the present paper analyses the determinants of adoption and extent of deployment of weaving technologies in the handloom micro-enterprises in rural areas of Assam. The results of the Cragg's Double Hurdle model reveal the significance of financial inclusion, availability of family labor, and social network on adoption and extent of deployment of weaving technologies. The presence of proper market linkages also appears to be crucial for adoption and use of such technologies in the rural areas. The study urges for a comprehensive policy framework to tackle the existing bottlenecks related to access to credit/capital, market linkages, and extension services to promote the technology adoption among the rural micro-entrepreneurs.

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### 1. Introduction

Technology acquisition and adaptation are crucial for an enterprise for sustaining cost effectiveness and quality improvement of its products, which is imperative for its survival and growth in a competitive market situation (Fu et al., 2011; Tripathi et al., 2013). Phasing out of the Multi Fiber Agreement (MFA) by the first day of January 2005 has opened up new opportunities while posing new challenge of more open competition in textile industries across countries such as China, India, Bangladesh, Sri Lanka, Vietnam, and others (Ministry of Textile, 2015; Tewari, 2006). Given this environment, adoption of modern technology in handloom segment of the textile sector has assumed added importance as the segment have been providing income and employment to a sizable population in the lower end of income distribution in many developing countries including India (Bortamuly et al., 2013; NCAER, 2010; Ministry of Textile, 2015).

Indeed a significant response of the Indian handloom industry to intensified market competition has been in the form of adoption of modern weaving technologies (NCAER, 2010; Ministry of Textile, 2015; Bortamuly and Goswami, 2015). A decade down the line since

phasing out of MFA, it is now instructive to probe how the handloom industry has fared in adapting itself to the new business environment. A particular point of interest in this context is the extent to which the handloom enterprises, which are typically small-scale and disadvantaged in accessing market and finance, have succeeded in standing up to the challenges of adopting and deploying modern technologies.

The literature on technology adoption in general is voluminous. Even the segment of technology adoption and its impact on performance and development of micro, small, and medium enterprises (MSMEs) in India in particular is quite substantial (Bailey, 1993; Lal, 1999; Dangayach and Deshmukh, 2005; Subrahmanya, 2006; Todd and Javalgi, 2007; Beddig, 2008; Gomez and Vargas, 2012; Kannabiran and Dharmalingam, 2012). However, available studies mostly cover the enterprises in formal and organized sector and explain how Indian formal MSMEs initiated the modernization process through the innovation and adoption of technology especially the information technology to meet the market challenges. According to these studies, technology adoption by the Indian MSMEs is influenced by attitude towards innovative activities, size of operations, market share, skill intensity, experience, and infrastructure (Lal, 1999; Subrahmanya, 2006; Kannabiran and Dharmalingam, 2012). On the other hand, credit constraint, lack of awareness, lack of human capital, isolation from technology hubs, and associated risk and uncertainty appear as substantial hurdles in technology adoption in Indian MSMEs and thus need proper policy interventions (Tripathi et al., 2013).

\* Corresponding author.

E-mail addresses: bhabesh86@hss.iitkgp.ernet.in (B. Hazarika), bezbaruah.mp@gmail.com (M.P. Bezbaruah), kishor@hss.iitkgp.ernet.in, kishor\_00@yahoo.com (K. Goswami).

Studies which have tried to address the issue of technology adoption in the decentralized, informal, and rural nonfarm silk (textile) industries (Bortamuly and Goswami, 2015; Latif, 1988; Varukolu, 2007; Rajesh, 2012) are relatively fewer in number. These studies brought the importance of credit availability in the process of technology adoption and diffusion. It is found that higher cost on modern technology may force the marginal and financially unsound micro-entrepreneurs in rural areas to stay with traditional and obsolete technology (Bortamuly and Goswami, 2015). The size of operation does also play a critical role in modern technology adoption resulting economies of scale (Varukolu, 2007; Rajesh, 2012). There are some mixed results with respect to demographic factors such as age, educational attainment, and experience in the Indian context (Bortamuly and Goswami, 2015; Varukolu, 2007; Rajesh, 2012). However, the issue of social capital was not addressed in these studies. Social capital results in social learning that speed up the adoption–diffusion process through information and knowledge sharing. The recent works of Bortamuly and Goswami (2015), focused only on adoption decision, lacks a conceptual/operational framework addressing the impact of social capital, family capital, and financial inclusion, and a rigorous econometric analysis. This is particularly important in the rural areas where the access to information, awareness, and knowledge is limited which may hamper the technology adoption–diffusion process. There is need to bring into analysis the impact of these factors on adoption and use of modern technology. Moreover, as many micro-entrepreneurs have adopted modern production technology, effective deployment of these technologies in their work premises appears to have remained limited. Hence, there is a need to understand not just what determine the adoption of modern technology but also what restrict/promotes the extent of its deployment in the rural micro-enterprises. The present study was induced by this necessity of a fuller analysis of what influences technology adoption and extent of deployment in the context of rural, nonfarm, and informal sector in a developing country.

For operational focus, the study concentrated on adoption of weaving technologies by micro-entrepreneurs in the handloom industry in Assam, a state in the geographically and economically peripheral but strategically significant northeast region of India. Apart from the choice of the infrequently studied location, the novelty of the present study lies in (a) analyzing not only the factors related to the adoption decision, but also those impacting extent of deployment of modern weaving technologies in the handloom micro-enterprises; (b) bringing in the contribution of family labor towards fostering technology adoption in these enterprises; and (c) accounting for the role of context specific social capital/network in technology adoption.

## 2. Technology adoption in the Indian handloom industry

The handloom industry has a unique place in Indian economy facilitating the second largest employment after agriculture (Bortamuly et al., 2013; NCAER, 2010; Ministry of Textile, 2015; Goswami, 2009; Hazarika and Goswami, 2014). The industry is dispersed, decentralized, labor intensive, and the production has been taking place mostly in the rural areas. Therefore, adoption of modern weaving technologies to achieve competitiveness, cost effectiveness, and quality production is important not only for the growth of the industry but also for the local economic development. Among the available modern handloom technologies in India, the use of high-speed jacquard, dobby machines, pit looms, sophisticated reeling machines, network drafting, pattern weaving, new and blended raw materials, new designs, new production techniques, improved management practices, etc., are frequently used. A few traditional technologies include throw-shuttle loom, fly-shuttle loom, loin loom, hand-operated spinning/reeling instruments, small-size drum, punching plate, etc. However, there exists technological backwardness in the industry across the country and a major segment of the handloom households still operates with obsolete technologies.

In order to bring a technological uplift in the textile industry, the government of India introduced Technology Upgradation Fund Scheme (TUFS) in 1999. The scheme aimed at providing financial assistance for technology upgradation in the textile units to enhance the viability and competitiveness in the markets. TUFS had facilitated improved productivity and quality, and helped in reducing cost and waste across the value chain but with uneven benefits distribution across the textile segments. In order to achieve more balanced growth in value chain across the segments, the scheme was restructured in 2011 (Ministry of Textile, 2015). Despite such efforts, technology adoption and deployment in the handloom industry still remains poor. Out of the 2.38 million looms in the country in 2009–2010, only 19% were installed with dobby/jacquard machine (NCAER, 2010). It indicates that the industry is lagging behind in sustaining cost effectiveness and quality improvement of its production in the market competition compared to the sophisticated mill/powerloom industry. From the market share point of view, the industry has fallen far behind its rival powerloom sector in the last few years. The share of the handloom industry in total cloth production stood at 11% against the powerloom industry's 59% in 2014–2015 (Ministry of Textile, 2015).

Assam, known as the reservoir of Indian handloom activities, occupies a unique place in Indian handloom industry by producing all four varieties of natural silks such as *Muga*, *Tassar*, *Mulberry*, and *Eri* (Goswami, 2009; Hazarika and Goswami, 2014). The state accounted for nearly 1.24 million (44.30%) handloom households and 1.11 million (46.87%) looms in 2009–2010. The industry is a rural industry as most of the production activities take place in rural areas. Almost 98.50% of the working looms are found in the rural areas. In addition, the handloom activities are mostly unorganized, informal, and operated in small scale (Bortamuly et al., 2013; NCAER, 2010; Bortamuly and Goswami, 2015; Goswami, 2009; Hazarika and Goswami, 2014; Bortamuly and Goswami, 2012). Despite this, the industry is providing employment and income to a significant segment of the rural population. In the matter of technology adoption in the weaving sector of the state, however, the status has not been quite impressive (NCAER, 2010; Bortamuly and Goswami, 2015). In terms of types of looms, the percentage of pit loom is very less (0.34%) compared to rest of India (74%) which is mostly used with weaving machines (NCAER, 2010). Efforts have been initiated at both micro and macro levels for inducing adoption and diffusion of handloom technology, and perhaps in response to such initiatives, up-gradation of production technology in handloom micro enterprises has picked up in the recent years. Yet, the industry continues to be by and large traditional and with most enterprises primarily saddled with the traditional technology (Bortamuly and Goswami, 2015; Beddig, 2008; Tewari, 2006). Thus, the question remains why the weaving technology adoption is poor and how different factors affect adoption of such technologies in the state.

Adoption and diffusion of weaving technology in the state seems to be influenced by a set of macro characteristics such as government policies, market competition, cultural and social values, and micro characteristics such as experiences, access to capital, risk attitude, etc. Lack of market linkage, access to credit, exposure, training and skill, awareness and knowledge about modern technologies are the prevailing barriers towards technology adoption in the handloom micro-enterprise (Beddig, 2008; Tewari, 2006). Understanding the key characteristics and obstacles in handloom technology adoption and diffusion is important from policy perspective. It is of particular interest due to its impact on performance and growth of the industry and thereby the overall local economic development.

## 3. Sampling strategy and sources of data

The study is based on primary data collected from 328 handloom micro-entrepreneurs spread over six districts namely *Kokrajhar*, *Baksa*, *Kamrup*, *Udalguri*, *Lakhimpur*, and *Dhemaji* of Assam during January 2013 to June 2013 (Fig. 1). The study used a multi-stage sampling

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