

Innovation in Indian Handloom Weaving

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Abstract

Handloom weaving is the second most important livelihood in rural India after farming. Improving handloom technologies and practices thus will directly affect the lives of millions of Indians, and this is similar for many other communities in the global South and East. By analyzing handloom weaving as a socio-technology, we will show how weaving communities are constantly innovating their technologies, designs, markets and social organization—often without calling it innovation. This demonstration of innovation in handloom contradicts the received image of handloom as a pre-modern and traditional craft that is unsustainable in current societies and that one should strive to eliminate: by mechanization and/or by putting it into a museum.

Keywords

Handloom weaving, innovation, craft, development policy, India, social constructivism, socio-technology

Setting the stage: The case of jamdani weaving

How do contemporary handloom weavers in India innovate their livelihoods, in the face of oppositional framings of tradition and modernity embedded in dominant ideas about craft production in an industrialized world?¹ Are tradition and innovation, authenticity and novelty, productivity and artistry inevitably opposed? This article examines the interplay of these value-laden terms while showing how innovation takes place in contemporary handloom weaving craft in India. To do this, we study the recent emergence of *jamdani* weaving as a response to the crisis in handloom weaver livelihoods triggered by an unprecedented increase in the price of cotton yarn. Our aim is twofold: to contribute to the discussion about innovation, industrialization and craft in the historiography of technology and to provide an alternative perspective on development policies for sustainable livelihoods of craftspeople.

Against the backdrop of the innovation trajectory in Indian industrialization from the eighteenth century to the contemporary period, we will demonstrate the continuity, relevance and future promise that craft knowledge in India bears. Rather than picturing handloom weaving as a sunset industry that is a burden to the welfare state or a niche-consumer product that enjoys the patronage of the elite, we will provide an alternative view that takes craft seriously within knowledge, market and policy domains: as an

¹ We are grateful for the valuable comments we received to various drafts of this paper from two anonymous reviewers, Suzanne Moon, Lars Heide, Rosalind Williams, Uzamma, Dagmar Schaeffer, Francesca Bray, Karin Bijsterveld, Thomas Brandt. The initial research was part of a project on Jamdani weaving of the NGO Dastkar Andhra, we are grateful to Yasoda Ramesh for her research inputs, as well as for the photographs and maps.

innovating socio-technical ensemble that can sustain livelihoods.

Using a history of technology approach, we attempt to shed light on handloom's persistence in the face of 200 years of mechanization and industrialization in the textile industry.² Rather than using the vocabulary of preservation or modernization, by studying socio-technical change that sustains livelihoods of traditional handloom weavers as innovation, we reciprocally argue for a broadening of the concept of innovation.³ Current national innovation policies in India focus on the strengthening of scientific and technological capabilities which are understood to be the drivers of innovation, building on the 'standard' images of technology as applied science and innovation as linear sequel to invention.⁴ In contrast, we will plead for acknowledging technological innovation as a fundamentally social and cultural knowledge practice. We suggest that an improved understanding of innovation in handloom weaving can inform an inclusive politics of development that affords more promising futures for vulnerable

² D.E. Haynes and T. Roy, "Conceiving Mobility: Weavers' Migrations in Pre-Colonial and Colonial India," *Indian economic & social history review* 36, no. 1 (1999).

³ In general, 'innovation' is seen as closely connected to science and as happening in industry. Narrative histories of industrialization operate on the assumption that the real innovation is taking place in the industrial factory, and crafts people like hand weavers resist change to protect the old way of doing things. Specifically, contemporary innovation policies of the Indian Government stress on non-innovation of handloom as the reason for its decline. Benoît Godin, "The Linear Model of Innovation. The Historical Construction of an Analytical Framework," *Science, Technology & Human Values* 31, no. 6 (2006). "Technological Innovation. On the Origins and Development of an Inclusive Concept," *Technology and Culture* 57, no. 3 (2016).

⁴ For more on Indian Innovation Policy, see <http://www.dst.gov.in/sites/default/files/STI%20Policy%202013-English.pdf>, and <https://www.innovationpolicyplatform.org/content/india>, last accessed on 25/02/2018.

yet innovative craft practitioners.⁵

Modernization or Preservation: Perspectives on Handloom Weaving

Some ten thousand weavers make their home in and around the village of Uppada, in the district of East Godavari on the coast of Andhra Pradesh. The weavers were previously known to weave a fine cotton saree with simple borders. These products, once well known, now only sell locally. But recently weavers in Uppada started making a very special kind of fine saree—woven with the technique of *jamdani* and using cotton, silk and gold—which has gained a following in local as well as distant markets as the *Uppada Jamdani* saree.⁶

Said to be of East Indian origin, where temperatures are high and the climate humid for the better part of the year, the *jamdani* saree is a fine and delicate length of hand-woven cotton fabric, embellished with beautiful flowered motifs in gold, silver or silk yarn. *Jamdani* is a technique of weaving discontinuous supplementary motifs, usually in heavier threads than those in the warp and weft, by using small spindles that are moved through the warp by hand (see figures 2,3). The *jamdani* technique has been long associated with the fine cottons from Dhaka in Bangladesh, referred to as figured muslin.⁷ *Jamdani* textiles have a long textual and material history.⁸ They first gained the

⁵ The archival research and field work for this article were part of Annapurna Mamidipudi's PhD at the University of Maastricht: Annapurna Mamidipudi, *Towards a Theory of Innovation for Handloom Weaving in India* (Maastricht: Maastricht University, 2016).

⁶ A saree is a length of unsewn cloth, worn draped around the body—the quintessential Indian female garment.

⁷ George Christopher Molesworth Birdwood, *The Industrial Arts of India* (London: Chapman and Hall, 1880).

designation of *jamdani* during the Mughal period, (1556-1627). *Jamdani*s were on view at the Delhi Arts Exhibition of 1902-1903, part of the Delhi Durbar, organized by Lord Curzon. A catalogue published for this exhibition describes in detail the *jamdani*s in the early twentieth century. *Jamdani* weavers were counted within handloom weaving as “masters” or skill-leaders: *jamdani* weaving is “the yield of concentration, the moment in which planning melts into performance, and attention focuses precisely upon the little act in which the past and future merge.”⁹ Contemporary *jamdani* in and around Uppada combine the established weaving techniques with computer-aided design to produce large floral patterns that repeat all over the saree.

Jamdani is thus a sophisticated and labor-intensive technique that allows the weaving of finely shaped motifs (see figure 1, left and middle). By convention, saree types in handloom typically carry the name of the place in which they are made.¹⁰ As the product gains identity in the market, the name is associated with a particular

⁸ Megasthenes, Greek ambassador to the Mauryan court (c.321-185 BCE) speaks of costumes of the people of India as “robes worked in gold, and flowered garments of the finest muslin”; see Birdwood, 235.. Forbes Watson refers to the figured muslins as being the monopoly of the government because of their complex design and expensive production; see John Forbes Watson, *The Textile Manufactures and the Costumes of the People of India* (Indological Book House, 1982).. In the early 19th century, James Taylor, a British surgeon and former resident of Dacca, gives a detailed account of the *jamdani* technique as woven by two weavers in much the same manner as today’s Uppada weavers; see James Taylor, *Descriptive and Historical Account of the Cotton Manufacture of Dacca* (London, 1851). Quoted by Henry Glassie and Firoz Mahmud, “Living Traditions in Weaving: Jamdani,” in *Cultural Survey of Bangladesh, Series-Ii*, ed. SiraJul Islam (Dhaka: Asiatic Society of Bangladesh, 2007)..

⁹ Henry Glassie, *Art and Life in Bangladesh* (Bloomington and Indianapolis: Indiana University Press, 1997), 415.

¹⁰ This is contrary to ownership of brands by individuals or commercial entities; rather it is owned by a place, and maintained collaboratively between producers and users, specifying the materials, skills, designs and aesthetics.

aesthetic to the discerning customer. This aesthetic identity is constituted by material, surface pattern repertoire and technique of weave. When more than one technique is used in the same weaving cluster of villages, or when more than one weaving cluster uses the same technique, the technique is appended to the name of the place—in this case ‘Uppada *Jamdani*’ (see fig. 1, right).

*Figure 1. left: Painting of Goddess Saraswati by Raja Ravi Varma (1848-1906),
with a jamdani border;*

middle: Jamdani on silk from Banaras c. 1880 (V&A Museum);

*right: a model in Uppada Jamdani saree, walking the ramp in the Bangalore fashion
week of 2015 for the designer Gaurang*

Figure 2. Arranging the shuttles for jamdani weaving

Figure 3. left: Lifting the yarn to insert a shuttle for jamdani;

right: Producing floral motifs with jamdani

Weavers in and around Uppada in South India had shifted to this specialized technique in response to the increase in yarn price that peaked in 2010, which

squeezed wage and threatened to force weavers out of weaving.¹¹ Weaving *jamdani*, though, is more labor-intensive than the plain fabric that they had been weaving earlier. All commonly held views of technological change and modernization—that an increase in efficiency can come only through mechanization and saving on labor—thus seem to be contradicted: weavers chose an older and slower technology, and so in effect innovated ‘backward’ to respond to the crisis.¹²

We frame these observations of the *jamdani* saree in Uppada in contrast with two generally accepted views of handloom weaving in India.¹³ The first is the government’s view that handloom weaving is outdated and unproductive. In this way of thinking handloom weaving must be replaced by mechanized textile production as a form of modernization. Until the transition to modernization is complete, weaving communities need to be subsidized.

The second view depicts handloom weaving as a cultural heritage, an important part of Indian identity that has to be preserved and protected from change that may lead to dilution of tradition. Thus Ritu Sethi, founder of the Craft Revival Trust and editor of

¹¹ http://www.business-standard.com/article/opinion/b-syama-sundari-m-s-sriram-collateral-effect-global-shortage-local-impact-111013000027_1.html , last accessed on 25/02/2018.

¹² For a discussion of discourses of innovation of tradition in the slow food movement, and the role of time –slowing down, or speeding up- in assessing the reciprocal compatibility of innovation and responsibility see Cristina Grasseni, "Slow Food, Fast Genes: Timescapes of Authenticity and Innovation in the Anthropology of Food," *Cambridge Anthropology* (2005). We position this shift backward as one that is driven by producers, rather than by consumers; which as in some cases of slow food, has been criticized for romanticizing traditional food ways in ways that did not necessarily work for the producers themselves. See Harry G. West and Nuno Domingos, "Gourmandizing Poverty Food: The Serpa Cheese Slow Food Presidium," *Journal of Agrarian Change* 12, no. 1 (2012).

¹³ A. Mamidipudi, B. Syamasundari, and W. Bijker, "Mobilising Discourses," *Economic & Political Weekly* 47, no. 25 (2012).

the Craft Revival Encyclopedia points to “the social and cultural significance of handlooms, the traditional knowledge associated with its production, and the entire handloom value chain that it sustains, including those who wear and value handloom.”¹⁴ This way of thinking stresses the preservation of heritage in its unchanging and presumptively authentic form, reinforcing the view of a glorious historical tradition that was once dynamic, but is now outdated.¹⁵

While the perspectives of modernization and preserving tradition seem to be in opposition to each other, they produce the same outcome for weaver livelihoods: handloom weaving is regarded as unsustainable, and unable to compete in contemporary markets. Interventions to support livelihoods have been taken up, through state bodies, NGOs and designers.¹⁶ In the case of commodities that offer substantial returns on capital, craftspeople have become active agents whose skills and engagement with tools shape their worlds.¹⁷ Yet, agendas of development, poverty alleviation and industrialization have resulted in interventions that have not always resulted in productivity gains accruing to ordinary weavers, or if they do, have stayed

¹⁴ <http://www.indianexpress.com/news/no-hands-on-the-loom/1125624/> of 06/05/13, last accessed on 25/02/2018.

¹⁵ Rajesh Shukla, the study team leader of the third Government of India Handloom Census in 2009-10, refers to rich cultural heritage of the Indian handloom sector that is to be preserved.

¹⁶ For an example of an anthropological account of such intervention by an NGO see Soumhya Venkatesan, *Craft Matters: Artisans, Development and the Indian Nation* (Hyderabad: Orient Blackswan, 2009).

¹⁷ For an example of the study of craft in an industrial factory setting, looking at skill, embodied knowledge and symbolic meaning of tools to construct particular gender identities, see Jamie Cross, "Technological Intimacy: Re-Engaging with Gender and Technology in the Global Factory," *Ethnography* 13, no. 2 (2011).

niche experiments.¹⁸ In contrast, the story of Uppada weavers, responding to the 2010 yarn-price peak, hints at another solution: innovation by weavers themselves yield economically viable livelihoods with minimal capital investment—while using ‘traditional’ technology and producing high-quality fabric. The weavers’ own potential to innovate is highlighted in the way they are using the *jamdani* technique in *tandem* with the computer and the mobile phone—rather than in competition—as new elements in what we will call the socio-technical ensemble of handloom weaving.

From revival to innovation

The introduction of the *jamdani* technique as practiced today on the looms of Uppada is credited to a master-weaver designer Ghansyam Sarode.¹⁹ Sarode started his career in Bombay, studying to be a chartered accountant.²⁰ In order to supplement his income, he decided to cater to the demand in the urban middle class for the diminishing supply of traditional *Paithani* sarees from the village of Paithan in Maharashtra. He first set up looms in his village of Narayanpet. Later, as demand for other rare types of sarees

¹⁸ For a discussion on how craftspeople’s capacities for action within development projects are enabled by historically specific relations of subordination, see Soumhya Venkatesan, "Rethinking Agency: Persons and Things in the Heterotopia of ‘Traditional Indian Craft’," *Journal of the Royal Anthropological Institute* 15, no. 1 (2009). For the particular case of high skill weavers in Benares, see Amit Basole, "Informality and Flexible Specialization: Apprenticeships and Knowledge Spillovers in an Indian Silk Weaving Cluster," *Development and Change* 47, no. 1 (2016). For the case of women embroiderers see Clare Wilkinson-Weber, "Women, Work and the Imagination of Craft in South Asia," *Contemporary South Asia* 13, no. 3 (2004). Venkatesan, *Craft Matters: Artisans, Development and the Indian Nation*.

¹⁹ Master weavers are entrepreneurs who act between weavers and the market, through investing in production. They are generally part of family firms, and in the case of Uppada and its surroundings, belong to the same caste groups as the weavers themselves.

²⁰ Interview: Ghanshyam Sarode, Master-weaver and entrepreneur, Hyderabad, 15-10-2013

increased, he travelled to Venkatagiri in search of the *jamdani* saree. The Weavers Co-operative in Venkatagiri “did not co-operate” he says, so he travelled to Uppada and set up the first loom, in the middle 1980s, with the help of a local weaver introduced to him by “a relative”.²¹ Soon, there was demand for more and more intricate work from the elite cultural customers who saw this as revival of the traditional technique of *jamdani*. Slowly other weavers in Uppada took it up, although for a long time the technique was confined to the village of Uppada. But as interest in the saree increased, designers from Hyderabad went to Uppada, and started ordering sarees directly from weavers giving the saree visibility in newer and more fashionable markets. Soon the saree with the *jamdani* technique came to be known as the “Uppada *Jamdani*’ saree.”²²

Figure 4. Map of united Andhra Pradesh and Telengana, India, Area 275000 sq km

Interestingly, the village has been accorded the Geographical Indicator (GI) mark by the Government of India, as an accreditation that gives ‘Uppada’ the status of a product with a reputation that can be attributed to the place of origin where it is manufactured. The GI makes illegal the selling of a product made in any other place under the trademarked name of Uppada and thus protects identity and uniqueness. The Uppada *Jamdani* sari, *The Hindu* reports, “was once woven exclusively for the royal

²¹ Handloom industry at the village level is made up of multiple family firms and kinship and caste groups, that network amongst each other, sometimes collaborating, at other times competing. Entry into such networks generally is through an insider claiming the new entrant as a relative, or kin.

²² The association of ‘Uppada’ as a saree of some repute already existed in the past, but it was a very different saree to the saree now being touted as the Uppada *Jamdani*

houses of Pitapuram, Venkatagiri and Bobbili.”²³ In response to this, Sarode says “I got the GI accreditation for them myself”, with a twinkle in his eye, the irony of the situation not lost on him. Prior to his efforts, there had been no ‘authentic’ *jamdani* Uppada saree in the memory of Uppada weavers; he had single handedly invented it, drawing from cultural memory in the market place. Uppada *Jamdani* was now an invented tradition, through implying continuity to “a suitable historical past”.²⁴ His intervention in introducing the skill of *jamdani* weaving to weavers in Uppada, and giving it a traditional past, linked the value that traditional *jamdani* had as technique in history and cultural memory, to Uppada the place²⁵, and resulted in a new kind of textile that, as we shall show later, weavers could innovate on.

The common understanding among policymakers however, depicts handloom weaving as static and non-innovative, and associates the presumed lack of innovation to the unsustainability of livelihoods. The Indian state connects innovation to the discourse of modernization—with its focus on efficiency and mechanization—and concludes that handloom weavers then by definition cannot be fit for modern society and are in need of some welfare scheme. As early as 1954, the report of the Kanungo committee to the Government of India commented that “For the ordinary cloth, the pure

²³ <http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/Uppada-Jamdani-saris-get-gi-tag/article249034.ece> , last accessed on 25/02/2018.

²⁴ Eric J Hobsbawm, "Introduction: Inventing Traditions," in *The Invention of Tradition*, ed. Eric Hobsbawm and Terence Ranger (Cambridge: Cambridge University Press, 1983).

²⁵ This is in the continuing tradition of textile brands being owned and associated with one place, yet techniques have multiple origins and ownerships when they are mobilized to other places of weaving.

and simple handloom is and must be a relatively inefficient tool of production".²⁶ Later committees would continue in this vein, often referring to loom technology as 'primitive' and in need of technical upgrading, through "a progressive conversion of handlooms to powerlooms, over a period of 15-20 years".²⁷ They advised the government that the weaver must move into the mechanized power loom sector. Initially, the state's position towards handloom weaving, since independence and through the 1950s and 1960s had been founded on the importance that Gandhi had attributed to villages and small-scale cottage industries for India's development. Parliament accepted "the socialistic pattern of society as the objective of social and economic policy".²⁸ But post liberalization policies of the 1990s tended to separate the two agendas of growth and welfare, stressing productivity and efficiency in textile production rather than employment. Thus the political rhetoric shifted further to modernization: one of the promises to the handloom sector in the New Textile Policy of 1985 was "modernization of looms to improve handloom productivity and quality".²⁹

²⁶ The Kanungo commission or the textile enquiry commission, set up in 1952: GOI, "Report of the Textile Enquiry Commission," ed. Ministry of Commerce (New Delhi: Government of India, 1954).

²⁷ Niranjana and Vinayan, 112. Seemanthini Niranjana and Soumya Vinayan, discuss shifts of government policies towards the handloom industry. Recent efforts to modernize the textile industry include the Technology Upgradation Fund scheme of the Government of India which was launched on 01.04.1999 for 5 years. It was subsequently extended up to 31.3.2007. The Scheme had been restructured in 28.4.2011 and approved upto 31.03.2012.

(http://aphandtex.gov.in/open_record.php?ID=111 , last accessed 21/02/2018)

²⁸ GOI, "Second Five Year Plan," ed. Planning Commission of India (New Delhi: Government of India, 1956): 44

²⁹ "Report of the Expert Committee on Textiles," ed. Ministry of Textiles (New Delhi: Government of India, 1985), 4.

At the same time other policymakers supported an agenda for preserving traditional Indian culture and Indian identity through the selected revival of particular textiles. This was in line with the ideals of Indian nationalists who thoroughly espoused the ideal of crafts—as the very opposite of modern industry—even as there was intense competition to catch up with the industrial achievements of the west.³⁰ Crafts, which the British used to demonstrate the backwardness of India, had come to be the heart of the nationalist movement. In the words of Saloni Mathur, “The actual physical body of the craftsman—ruined, disfigured and enslaved by colonialism—became a powerful metaphor (..) for the state of the national body itself”.³¹ Thus the Government of India rationalized the 2010 handloom census by asserting its value for providing “programmatically decisions and planning interventions in order to preserve and develop the rich cultural heritage embedded in the Indian handloom sector”.³²

The term “innovation” acquired a positive connotation only after the mid-nineteenth century in Europe, when it became linked to notions of freedom, to technological and social progress, and to profitability in capitalistic markets.³³ In

³⁰ B. G. Tilak, Aurobindo Ghose, Lajpat Rai, and M. K. Gandhi amongst others argued in different ways for a cultural, spiritual and economic revival of India, through her craft and cottage Industries Abigail McGowan, *Crafting the Nation in Colonial India* (New York: Palgrave Macmillan, 2009)..

³¹ Saloni Mathur, *India by Design: Colonial History and Cultural Display* (Berkeley: University of California Press, 2007), 46.

³² Economic Services Group, National Productivity Council, Study to Identify the Factors Responsible for Decline in Handloom Cloth Production in India, May 2010. For the Handloom Census of India 2009-2010, see http://www.ncaer.org/publication_details.php?plD=187 (last accessed on 25/02/2018).

³³ Benoît Godin, *Innovation Contested: The Idea of Innovation over the Centuries* (New York: Routledge, 2015); Helga Nowotny, "Introduction: Cultures of Technology and the Quest for Innovation," in

contemporary Indian policy frameworks it is a term that carries enormous power; innovation is used specifically to describe socio-technical change that is explicitly planned, presumptively progressive and creating new technologies. Rather than seeing the emergence of a new technology, we demonstrate innovation within the handloom technology. This builds on Edgerton, who argues that innovation is much more prevalent in persisting “traditional” technologies than is typically assumed.³⁴ We explicate the innovative capacity—as defined by Schumpeter—in handloom weaving, focusing on the newly found sustainability of some of these weaving communities.

In Schumpeterian terms, innovation involves the creating and marketing of the new, perforce replacing the old, through new combinations of existing knowledge and resources.³⁵ Of his description of five types of innovations, we distinguish three in this case: innovation as new products, as new methods of production and as exploitation of new markets—as product, process and market innovations.³⁶ Uppada ‘*Jamdani*’ was, as we shall describe in the following sections, simultaneously a revival of an older technique that led to product innovation, an invented-traditional product that became a market innovation, and a technological innovation that could be constructed as

Cultures of Technology and the Quest for Innovation, ed. Helga Nowotny (New York: Berghahn Books, 2006).

³⁴ David Edgerton, "From Innovation to Use: Ten Eclectic Theses on the Historiography of Technology," *History and Technology* 16, no. 2 (1999).

³⁵ Economist and political scientist Schumpeter first introduced the concept ‘creative destruction’ as a precursor to economic development and the concept of ‘innovation’ as a critical dimension of economic change. For the full text see Joseph A Schumpeter, *Socialism, Capitalism and Democracy* (New York: Harper and Brothers, 1942).

³⁶ For a comprehensive guide to literature on Schumpeterian classification of innovation, see Jan Fagerberg, "Innovation: A Guide to the Literature," in *The Oxford Handbook of Innovation*, ed. Jan Fagerberg, David C Mowery, and Richard R Nelson (Oxford: Oxford University Press, 2006).

production or process innovation. Weavers skill themselves, learn *jamdani* weaving and introduce innovative products and processes through new combinations of resources and thus reshape competition in the marketplace. Weavers do not perform this combinatory activity, labeled by Schumpeter as the entrepreneurial function, in isolation; they are part of socio-technical ensembles.

Jamdani as new product: Master-weavers and skilled weavers in the handloom ensemble

The master-weaver in Uppada is generally of the weaver caste, and head of the family firm; traditionally, he provides capital for production and acts as the intermediary to the market. Generally, he along with members of his household executes the back end of the business: yarn and cash move back and forth between yarn trader, sizer, warper, dyer, weaver; and stock and inventory is consigned to and fro between weaver, master-weaver and the market. The master-weaver understands that he is as strong as his ensemble; choosing the right weaver is the key, he says, if you want to innovate. Rambabu, a master-weaver in Mandapeta, explains the skills his weavers need: *“Because in the morning the warp behaves in one way; when the sun is beating down, it is another type; and if it rains, then it behaves in yet another way. He has to keep the tension on the pogu (weaving yarn). He needs to know these techniques.”*³⁷ Something new, an innovative product that would ‘go’ in the market, thus hinges on the skill of the weaver, the enterprise of the master-weaver, and their relationship. This becomes

³⁷ Interview Rambabu master-weaver, Mandapeta 27-1-2012

obvious when the master-weaver talks of the need for a skilled weaver who is willing to experiment.³⁸

Jonna Suribabu and his wife Ramalakshmi are a weaver couple in the village of Angara who have recently shifted successfully to *jamdani* weaving. When they speak, it is in tandem, reproducing their weaving action of passing the shuttle from one hand to the other; one sentence of the husband is followed by one by the wife in the conversation. The two young daughters sit in the background, around a low table strewn with books, finishing their school homework. In the foreground is the loom in a kind of verandah, an airy sun-lit inside-outside room. They are weavers who have always been willing to dance to the tune of the market. When the demand for *jamdani* first emerged, they decided they wanted to try their hand at it. They had already seen it being woven in Uppada, where the technique was a well-kept secret. The master-weaver from Uppada sent them a “designer”; someone who knew how to “set up” the loom, and teach them how to begin. But once they started, he recanted on the wage. The master-weaver Rambabu came to their rescue. He was a late entrant into *jamdani* (by then it had already been the local market for a year), but he grabbed the opportunity that the experimental weaver couple offered.

Ramalakshmi now prefers *jamdani* weaving to her earlier work. While the technique itself is more time-consuming, there is less continuous beating of the weft

³⁸ Most of the interviews were conducted in Telugu. Translation into English is not always straightforward (as no translation ever is). Some interviews were across two languages—English along with either Telugu, or Hindi, even sometimes Tamil. These are all languages that the first author of this article is fluent in. All the interviews were directly translated into English, during transcription. The translations have been crosschecked with other native speakers. We thank Alladi Venkatesh and M R Vikram for the Telugu checking.

threads, making it less strenuous.³⁹ The slow pace has another advantage: more time is spent on the loom doing skilled work and less on “*baita pani*” (“ancillary work”). Of course, the couple has to be on good terms, if work is to go on smoothly. If one is upset, then he or she would go away for an hour, to cool down, till ready to come back to the loom—not so different from living together. *“Figuring out a new technique takes patience, and a peaceful mind and the support of the master-weaver (“oorpu”: patience; “opika”: peaceful energy/mind).⁴⁰ It is important not to share the secret once you have figured it out. If someone comes in (into the room with the loom, to visit), we cover the loom, so that they can’t get the technique tricks” (“suluvu”: tricks/knack that ease work).⁴¹*

When they first set up the loom, Rambabu had visited the loom every two hours, to discuss how it was going, and to help facilitate progress. Even then, the first saree was spoiled, and the cost had to be shared between the weaver couple and the master-weaver. After two sarees, they were skilled enough to start making it for the market. The first experimental saree is a beautiful grey saree with elaborate sky-blue and rose-pink motifs; not an aesthetic associated with a poor weaver’s wife. But it was self-evident between the master-weaver and weavers that Ramalakshmi was the rightful owner of that experiment: the saree would be in her wardrobe.

³⁹ A beater is a weaving tool designed to push the weft yarn securely into place

⁴⁰ This article has bilingual interjections coming from the language practices of the population that we study. English translations of the weavers’ language do not completely capture the essence of what is being communicated. In this particular case, the Telugu terms and their equivalent English terms have been figured out to best express the meaning of what weavers and dyers wanted to say, through workshops where we presented intermediate findings to weavers and dyers.

⁴¹ Interview jamdani weaver Jonna Suribabu, Angara 27-1-2012

Although the master-weaver's entrepreneurial insight and his facilitating of technological change in the socio-technical ensemble of handloom stand out in this story, there was no single innovator or innovating firm that made this new product. Both master-weaver and the weaver couple (and later in this article, the computer programmer and handloom weaver) are connected through social practices and networks enabling the production of innovative knowledge.⁴² The master-weaver is the entrepreneur who acts out of market insight, while the weavers investing in the skill component are experimenting too.⁴³ While *jamdani* is a historically well-known technique, for Suribabu and Ramalakshmi it is a new skill that has been learned, new knowledge that has been acquired.

Thus this combination of skill and insight resulted in *jamdani* as an innovated new product. But for *jamdani* to help create a sustainable livelihood for the weavers, it must also succeed in the market. Who were the users of this new *jamdani* product? How was value created for an older technology, which must surely be more expensive for the customer? How was the customer drawn into the ensemble? Were new markets accessed, and if so, how?

⁴² For a discussion on the locality of innovative knowledge in the Silicon Valley see John Seely Brown and Paul Duguid, "Local Knowledge Innovation in the Networked Age," *Management Learning* 33, no. 4 (2002).

⁴³ It can be conjectured that the relatively rare harmony between weaver and masterweaver in the case of Uppada is typical to high skill weavers who have the capacity to negotiate on equal terms with master weavers, though studies of other high skill clusters show that this is not necessarily the case. See for example Basole.

Jamdani as market innovation in the handloom ensemble: Aunties, ladies and mobile phones

Peddapuram, unlike a lot of villages in East Godavari, has not yet abandoned its old lanes and tile roofed houses for mortar and concrete. The dye house is in one such house. The floor is crimson, 'red-oxide' mineral mixed into cement. In the courtyard beyond are the woodstoves where the dyeing takes place. A young man is waiting for the dyer's attention; he is a weaver collecting a warp dyed to order. There is cordiality evident in the conversation: the weaver collecting the warp acknowledges that it is the right color, even as he expresses reservations about the quality of the yarn. There is no explosive argument about who would bear the cost of the spoiled yarn. Both acknowledge the difficulty in weaving yarn that is knotted up, and the weaver is reassured about the quality of the new warp –and he pays out the money owed for dyeing the warp and they part in harmony.⁴⁴

This investment of a weaver in his own raw material, outside the control of a master-weaver, is unusual. Generally, weavers work full time, and are contracted to master-weavers or are members of producer co-operatives that provide them with yarn and pay them a wage. While weavers invest in loom accessories like reeds or jacquard attachments, they generally do not have the capital to invest in raw material or finished stock. This young weaver though, seemed able to afford the investment in the silk warp. "Out of my own profits driving an auto rickshaw" he said, as he did not weave full time, but chauffeured clients for his livelihood. From this he was able to afford the capital investment in the loom. His wife was educated, working as a teacher. In the evenings,

⁴⁴ Dyehouse Visit Peddapuram with Latha Tummuru, 29-1-2012

they would weave for three or four hours together, and make one *jamdani* saree every month. The loom was no longer in the front of the house; this was transformed into a 'modern' room, with a television and a raised table for schoolwork for children. Instead the loom was now in the backyard, out of sight of casual visitors, in the private area of the house.

The absence of the master-weaver meant not only that they invested in their own raw material, but also that they had to market the product themselves. This too was no longer a problem, he said. The weaver had the phone numbers of thirty weavers like himself, who each had numbers of another thirty weavers. When his saree was ready, he would call weavers in his network and collect twenty to thirty more sarees, and head out to the city of Hyderabad on the night bus. Once there, he would call customers using his mobile phone: "ladies" who would be willing to invite him to their home, and browse the merchandise. If they found the sarees to their taste, they would instantly pay cash. Of the thirty sarees, he would typically sell around five, at a 100% profit. He would then meet the "Aunties"—a different category of clients—again in their home, usually chaperoned by an older member of the family or a domestic servant. These Aunties would have their own network of women interested in luxury, custom-made sarees. From these sarees, he would make less of a profit. The Aunty would pay only 20% more than the cost price, but would take at least five sarees. Before leaving the sarees with her, he would call and check with the weavers back at home; and decide if he would leave the sarees behind. If not, he would carry them back to Peddapuram, to become part of the consignment of the next weaver travelling to the next city.

The mobile phone had connected and created networks of weavers and

networks of customers. There were no retail costs; instead there was a relationship, a new one, of an Aunty who would mediate between her network and that of the weavers. These generally affluent women lived in the suburbs and satellite towns around the large cities. Living in close contact with each other preserved a sense of identity against the eroding anonymity of the city. Generally they were part of kinship networks or immigrant communities from the same districts that were also home to the weavers. The women still recalled from memory or from family stories the exclusivity of *jamdani* sarees; and experienced the personal attention of weavers as familiar and socially acceptable. They could exercise aesthetic choice and be taken seriously by the weaver producers. Most importantly, the price could be negotiated to suit the purse of the buyer—if not this time, then the next. In the market the Ladies and Aunties are cultural experts who appropriate consumer goods to perform identity.⁴⁵ They can guarantee the authenticity of the invented tradition Uppada *Jamdani*, recalling it from their own roots, as it were. Buying and selling a *jamdani* saree in this kind of environment is substantially different from buying something in the mall or bazaar. It is a distinctively personalized shopping experience, in which the aesthetic of the consumer is valued as much as her buying power.

The association of traditional techniques with high-end luxury and culture is therefore maintained through the cultural practices of the doyennes of craft and handloom. The website of Ghansyam Sarode strategically plays on the association with the icons of craft and handloom of yester year: “Since 2003 Mrs. Gandhi using the white

⁴⁵ For the role of cultural intermediaries who mediate production and consumption see Paul Du Gay, *Doing Cultural Studies: The Story of the Sony Walkman* (London: Sage/Open University Press, 1997).

Khadi sarees with interlock border with intricate *jamdani buties* (motifs)".⁴⁶ He refers to Sonia Gandhi, the head of the Indian National Congress Party, and the white *Khadi* saree referred to is the iconic saree worn by women in the freedom struggle. A broad enough identity had been constructed in the customer's mind for the Uppada *Jamdani*, allowing for a multitude of product improvisations and incremental innovations to flood the market; and all through the personalized interactions between weavers and their new found "traditional" customers.

The mobile phone was undoubtedly an innovative technological addition to the ensemble; but as a communicative device, it at once disrupted existing social relations between weavers and master-weaver, while facilitating social interaction between the *jamdani* weaver and the customers. It recalled the form of the face-to-face marketing between weaver and customer which had been part of traditional practices of transacting cloth, leaving out the master-weaver-trader. Until recently, in village communities weavers and women customers had long-standing transactional relationships. Clothes had important ritual meaning and weavers were invited to the homes of their female customers so that they could produce-to-order the clothes that the household needed, very often using the yarn spun in that very household. With the disruption of these economic relationships, master weavers linked to formal retail spaces had displaced these sites of interaction. It was no longer respectable for women of higher social class and caste to privately meet men of lower social status and caste. By entering the ensemble, the mobile telephone remade these older ensembles across distant geographies, and newly "shaped the way financial counterparts addressed one

⁴⁶ Interview Ghansyam Sarode, Master-weaver Hyderabad 6/2/2015

another, and the way trade interactions are enacted."⁴⁷ In addition, on the mobile phone the traditional caste and class hierarchies were re-shaped by creating lists of phone numbers that were named with the more egalitarian labels of "Aunties" and "Ladies".⁴⁸

The mobile phone did not stop with the creation of new market infrastructure; it succeeded in shifting market access away from control by master weavers and the large retail agencies with their own interests. It was also a new forum for product feedback from users directly to producers, as well as allowing better price negotiation.⁴⁹ On the production side, weavers built on the flexible time and work that the loom at home provides, to learn new weaving skills that earned substantial incomes for both men and women, while working more inflexible day jobs.⁵⁰ Yet in order that value was created in the market, not just the new products but the new skills too had to be made visible to the intended consumers by the weavers. Aunties and ladies who acted as opinion leaders had to be taught how to judge quality and make evaluations of the skill involved in producing this new textile.

This was an important innovation in the market for the livelihood of handloom. It built on the original innovation of *jamdani* as a new product. Coupled with the flexibility

⁴⁷ For a concept of telephones as devices that shape market interactions see Fabian Muniesa, "Trading-Room Telephones and the Identification of Counterparts," in *Living in a Material World*, ed. T Pinch and R Swedberg (Cambridge MA: The MIT Press, 2008), 293.

⁴⁸ This also explains the ease of entry that the first author of this article gained to the *jamdani* production and customer network. She is the archetypical 'aunty' personified: from a cultural background that recognizes the saree, from the geographical area where the sarees are being made, and belonging to the newly rising aspirational middle class with disposable income.

⁴⁹ For a discussion on user-led technological innovations, see Nelly Oudshoorn and Trevor Pinch, "User-Technology Relationships: Some Recent Developments," in *The Handbook of Science and Technology Studies. 3rd Edition.*, ed. E.J. Hackett, et al. (Cambridge MA: MIT Press, 2008).

⁵⁰ Interview with Ramesh, Auto rickshaw driver, Dyehouse Peddapuram, 29-1-2012

of the *jamdani* loom and skilled weavers' ability to customize new products to order, the weavers now had created a feedback loop that ensured market success. It allowed for effective and efficient turnaround of capital since capital was not locked up as inventory—“waiting *undadu*.” (“there is no delay”). As soon as sarees had been made, they could be sold. The mobile phone was a technological adoption by the handloom industry, which made the promise of economic progress through new technologies true even for handloom weaving.

However, some might still argue that this leaves the process of weaving, narrowly construed, untouched and traditional. Would it be possible to also identify a process innovation—an innovation that happens closer to the actual loom technology and the process of producing the *jamdani* fabric? This question takes us to Vellasavaram, another village in East Godavari, to the *jamdani* designer and computer programmer Balaji.

Jamdani as process innovation: the digital loom in the socio-technical ensemble:

In the weavers' co-operative in the village of Angara, a few miles from Vellasavaram, the secretary of the weavers' co-operative proudly showed off a silk *jamdani* saree woven by a weaver of their village. Again, it was referred to as the 'Uppada' saree. The beautiful motif that dominated the saree was the paisley, a traditional motif that has been part of the design repertoire of the Indian sub-continent for the last thousand years (see figure 5). The paisley motif, originally from Persia, is named after the weaving center in Scotland of the same name. It is shaped like a twisted teardrop and referred to as '*Kairi*' (raw mango) in Hindi—the curved shape

reminiscent of the elongated raw fruit. Here it was seen in the style generally described as ‘all-over’ (referring to a pattern that was a connected repeat, woven all over the saree) to differentiate it from the less labor-intensive style where the paisley was seen as ‘*buta*’ or extra weft pattern dropped onto the saree in disconnected but evenly spaced intervals.

Figure 5. left: Paisley motif in jamdani on silk from Banaras c. 1880. (V&A Museum);

right: Paisley motif with leaves in jamdani on silk from East Godavari c 2011 (Weaver Vellasavaram)

But visually the paisley on this saree showed an inconsistency; closer examination revealed that the curvature of the motif was rather jerkier than one expected when the *jamdani* technique was employed. It did not seem to be the inexperience of the weaver; subsequent sarees we were shown all carried the same jerkiness.

Described in digital terms, the curve of the motif appeared as if it had been drawn on a low-resolution scale, with the pixilation visible on the curve when seen at close quarters. This was a startling contradiction. One did not associate a low-resolution computer screen image with a motif on an exquisite hand-woven saree. But indeed the secretary confirmed that it was a computer design by a “young and dynamic” computer programmer who lived in the village of Vellasavaram. Was this an example of an

external technology being imposed on hapless *jamdani* weavers in the spirit of modernization, which could only result in turning these weavers into mindless production units churning out lower quality cloth? Craft activists generally perceive computerization much like mechanization: as a depression of craft products' unique handmade value.⁵¹ Additionally, it is implicitly assumed by them that once the labor component of hand production is taken over by machines and the design component by computers, there is nothing left of economic value to recommend craft modes of production. What is more, the pixellation seemed to point to an awkward application of computer design technology, presumably the result of outdated software.

When one walks into any weaving village, it is to the accompanying humming of the winding wheels and clacking looms that emanates as if from a giant organism. People are friendly and willing to help, as in Vellasavaram, and the home of the computer programmer was easily found. A smiling young man in his twenties dressed in trousers and shirt, Balaji introduced himself as the computer designer who had designed the sarees woven in Angara. The room was a study in technological time travel: at the far end was an older man, Balaji's father, seated at the pit loom; closer by stood the jacquard punching machine; then a desktop computer with 'Shadhana Creations' on the screen; and closest to the entrance sits the young designer, with his cell phone (see figure 6).

⁵¹ "A fatal combination of mechanization, computerization and globalization has ruined the handloom work" from The Hindu Feb 1 2009, <http://www.thehindu.com/todays-paper/tp-features/tp-sundaymagazine/as-the-looms-go-silent-in-benaras/article661265.ece> , last accessed on 25/02/2018.

Figure 6. Balaji's house with loom in the background and computer in the foreground

Balaji demonstrated in detail how he used the software program to design motifs for the sarees. The original design was “art” he said, indicating that it was drawn by hand. The software converted the patterns into a scaled graph. For example, the motifs of the paisley, the “*chakram*” (wheel), or the “*hamsa*” (swan) were well known and available on the software’s repertoire, but sometimes one had to draw new motifs and these could be done easily by using the mouse. This explained another disconcerting element in the design: the paisley though pixelated was finely proportioned, but the leaf accompanying it (see figure 5), on the other hand was smooth edged but less detailed. The more finely proportioned paisley, when viewed on the screen, showed the same jerky pixelated curve that could be observed in the paisley on the saree. The leaf was not pixelated: since it was drawn with the mouse using the software program, the designer was able to control the extent of the curve so that that it stays smooth and did not pixelate jerkily. Both elements were attractive enough, but they did not match.

The pixelation itself was puzzling; *jamdani* was a technique that allowed insertion of extra weft threads into the warp threads one by one, which meant that the motif could be transferred as is, from the screen to the saree. So why did the computer designer design a motif with a pixelated edge, rather than a smooth one?⁵² This became clear in a next interaction between a visiting master weaver and Balaji. “A mango with two leaves” said the master-weaver, and Balaji pulled out a folder with mango motifs from the stored memory of the computer. “Not more than 3 ‘bends’ and 100 ‘turns’” the

⁵² Interview with Balaji, Designer for handloom, in Vellasavaram, 27-1-2012.

master-weaver further specified, and Balaji immediately reduced the resolution and the mango pixelated.

How did the criteria of bends and turns affect resolution of the motif? Each discontinuous motif along the width of the saree being woven requires that a separate spindle be inserted into the weft, referred to as 'bend'. In figure 7 the number of bends can be seen to be seven, as seven discontinuous spindles would need to be inserted at that point, to make up the motifs across the width of the loom, in the direction of the weft. Since each motif also requires the spindle to be turned as many times as the length of the motif along the warp; specifying 100 turns defined exactly the scale of the motif along the warp. Thus the master-weaver was quantifying the labor that would make up each motif into bends along the weft and turns along the warp; this translated the resolution along the x-y axes on the screen onto the loom. Balaji's job was to design a motif that was aesthetic at that resolution. So rather than size of motif, it was the labor in weaving it, that decided the resolution. The master-weaver and weaver were in control of the decision, rather than Balaji, and therefore the decision to change was not made on the screen, but on the loom.

Figure 7. 'a' points to the line in this pattern with the maximum number of spindles that would have to 'bend'. In this case 7 spindles would have to be inserted into the weft to make the pattern.

Once the resolution was fixed, the weaver would translate this resolution onto the

loom. Depending on how labor-intensive the weaver's choice was, each pixel in a graph would represent one warp thread, referred to as 'an end', and one weft thread referred to as 'a pick', on the x-y axis, or be bunched into two or three or even four threads of warp in the same pixel (see figure 8).

Figure 8. Graph 1 above shows a single end flower. Graph 2 shows a flower woven with two ends bunched together with three picks. Graph 3 shows a flower woven with three ends bunched together with three picks. Graph 4 shows a flower woven with six ends bunched together with three picks. One can notice how the pattern turns into a lower resolution version of itself with the decision to reduce labor.

In the instance of the pixelated paisley, the weaver had worked on blocks of 4 by 4 ends and picks, rather than one end and one pick. That is, rather than lifting every thread to insert the extra weft bobbin, four threads were grouped together and lifted—thus resulting in pixelation of the woven motif, rather than a smooth curve. This reduced the labor and time of weaving and brought the cost down to a competitive price in the market. In the interaction between computer programmer and master-weaver, this was the information that affected the

Figure 9. left: Making a printout of the pattern to be repeated for setting the loom; right: Smoothing out the pattern for ease of weaving on the graph.

Figure 10. Using the Graph to tie the repeat pattern into the jalari

Figure 11. Two views of the loom. The gold warp is wound on one side and the graph is pasted above. The second view is from the perspective of where the weaver sits, the graph is visible at eye-level on the other side, for ease of weaving.

decision on pattern. Clearly, it was not the loom that was in the service of the computer, it was the computer programmer in service to the master-weaver. Once recognized, this reversal of roles became apparent across all the different stages where the computer acted in the socio-technical ensemble of the handloom weaver.

Visually the computer digitized on the x-y axis much as the loom did on the warp and weft. So at every stage—designing the motifs, planning the layout on the five and half meter length for repeats of the design, setting up the loom so that the right threads from the warp would be lifted, printing out the design onto graph paper as aid to memory while weaving—for all these functions the computer played a role. As a consequence, the labor could be decided prior to weaving, the price estimated, and the visualization of the layout could be simulated, reducing real-time risks on the loom.

Further, the weaving action works on binary logic; at any point of time a thread can be lifted up or pressed down, with the shuttle passing in between in sequence to complete the weaving. To pick out a pattern, certain threads of the warp are lifted and smaller shuttles carrying extra weft threads pass between them, in an embroidering

motion. The weft shuttle fixes the pattern in place. This requires a setting of the loom using a *jalari* (a loom device that picks up warp ends according to the design repeats). A graphic printout of the design to be repeated was printed out, which used the same count of blocks per inch as threads per inch to be woven (see figures 9,10,11). Threads to be lifted were marked in black and to be pressed down left blank. The weaver set up the *jalari* to perform the action of 'remembering' and lifting the warp threads following the graph pattern. While the *jalari* had to be tied by hand, on the loom, the action could be coded in binary (thread up black spot, thread down blank spot), using the print of the computer software in a graph form. Using this insight, any new design could be converted to a digital graph and printed out and the loom-setting time came down by more than half.

Table 1. functions in the weaving ensemble and how the computer effects their execution speed: → is speeding up and ← is slowing down

For each of these functions in the ensemble, the computer was used as a tool to speed up the calculative component by translating it into a digital output that the weaver could use. Using computer outputs as graphic visualizing devices across weaving functions is a process innovation. The loom *had* moved to a slower technique, but the computer had speeded up the calculative digital functions. These calculative functions

had been framed in turn by the capabilities of the loom.⁵³ As a result of the interaction, some functions had speeded up so that the loom could be slowed down, in order to reach an optimum match with regard to labor and value in the market (see table 1).

Indeed, today the computer is ubiquitous. Yet, its presence in the handloom ensemble seems surprising in a linear understanding of the time line of technologies, in which mechanization and digitization are supposed to substitute older—hand-driven and analog—technologies. But rather than viewing the computer as a modern technology that displaced skill at the loom, weavers saw the computer and the loom as two technologies that work on similar principles of digital counting. The digital character of the loom in fact facilitated the advent of computers into the ensemble (see figure 12 for the socio-technical ensemble of handloom weaving).⁵⁴ When working together with the loom and the computer, the computer did not represent a radical innovation for the handloom weaver; the digital technology recalled to the weaver the programmability of the loom, as in the case of the master-weaver who decreed that his motif was worth “3 bends and 100 turns” in order to tailor labor to price. Instead of competing with each other, as is generally the case between technologies deemed high tech and low tech, in this case, as a result of the understanding of the underlying principles of digitization in computer programming that the weaver acquired, as well as the understanding of the

⁵³ For a concept of calculativeness that separates or individualizes objects into transactable entities within a ‘frame of calculation’, see Michel Callon, *The Laws of the Market* (Oxford UK: Blackwell Publishers, 1998).

⁵⁴ It is a well-known historical detail that the cards that Charles Babbage planned to use to store programs in his analytical machine were inspired by the cards of the jacquard loom, an important predecessor to the development of computer programming. See Brian Randell, "The Origins of Computer Programming," *Annals of the History of Computing, IEEE* 16, no. 4 (1994).

loom that the computer programmer acquired, both weaver and programmer worked together to produce an innovation that stabilized livelihoods in the handloom ensemble.

Figure 12. The socio-technical ensemble of jamdani with the loom, mobile phone and computer. The figure represents the sustained circulation of material in the socio technical ensemble of handloom weaving: yarn to colored yarn, to sized and warped yarn, which is woven into fabric, aggregated and dispersed again to customers, where it is transformed to capital, that in turn finances input costs, in this case yarn.

Conclusion: From history of technology to handloom innovation policy?

History of technology accounts that do not assume the norms of western modernity stimulate a greater concern with technology's local context and with the interactive relationships between innovation and practice.⁵⁵ Scholars have questioned dominant accounts of technology and innovation that assume linear development and specific interpretations of modernity.⁵⁶ Alternative views offer ways to grasp innovations that *circulate* in time, in contrast to innovations as ever progressing away from the past in *linear* time. David Edgerton for example critiques modernist studies of innovation that

⁵⁵ See, for example, David Arnold, "Europe, Technology, and Colonialism in the 20th Century," *History and Technology* 21, no. 1 (2005).

⁵⁶ Thomas J Misa, Philip Brey, and Andrew Feenberg, *Modernity and Technology* (Cambridge, Massachusetts: MIT Press, 2004).

focus too much on what changes in an invention and forget what is stable: “our future-oriented rhetoric has underestimated the past and overestimated the power of the present.”⁵⁷ He argues for a use-based perspective and disproves grand narratives of progress. In a similar vein, we use the case of handloom weaving to question the concept of innovation as exclusively linked to mechanization and modernization. This results in a broadening of the concept of tradition too, which allows for innovation that stabilizes ‘traditional’ craft technology. This enables us to position craft livelihoods within a framework of technological innovation, rather than in a discourse of traditional technology that needs either modernization or preservation. Such broadened concepts of innovation and tradition, we want to argue, can also spur a more inclusive politics of development.

Handloom weavers across East Godavari assimilated the modern computer into their ensemble of production in order to sustain their traditional loom.⁵⁸ To what extent is this indeed innovation as we suggest? Are we re-casting what was a circumstance of misfortune into a considered innovative choice? If so, it would seem that handloom was recycling old practices and things and serving them up as new innovations, while these “backward” technological changes were really not choices made by weavers but forced on to them in their struggle to survive. To answer this, we will examine the nature of the weaver’s choices. Can we describe this choice process convincingly as innovation,

⁵⁷ David Edgerton, *Shock of the Old: Technology and Global History since 1900* (London: Profile Books, 2006): 206

⁵⁸ Don Slater demonstrates how Trinidadian communities similarly use (internet) technologies that allow them to participate at once in global modernity as well as in traditional family functions. Don Slater, "Modernity under Construction: Building the Internet in Trinidad," in *Modernity and Technology*, ed. Thomas Misa, Philip Brey, and Andrew Feenburg (Cambridge, Massachusetts MIT Press, 2003).

even if it allowed the loom to stay static? Can we draw lessons in the form of an innovation policy for handloom?

In this *jamdani* case we have seen how weavers deliberately escaped the horns of the dilemma between mechanization that would make the handloom extinct and tradition that would fossilize it. They did not choose productivity over beauty, change over stability, tradition over technology, old over new, or even market over identity; instead they consistently chose to negotiate a balance between these various opposites. The computer and loom do not co-exist next to each other as oppositional paradigms; they *worked together* in the socio-technical ensemble. To realize this working together, the weaver and the programmer chose to innovate the socio-technical ensemble by changing the functions of the loom and the computer *vis à vis* each other. What is involved in such innovation of the socio-technical ensemble of handloom? A focus on the creative capacities of skilled workers will help us answer this question.

The weaver innovated his craft of weaving, as much as the computer programmer innovated his craft of programming. To make these innovations work in the socio-technical ensemble of handloom, both had to have some understanding of the other's craft and innovate across technologies. For this to succeed, it surely helped that Balaji, the innovative computer programmer, was the son of a weaver and understood the creative capacities of both sets of skills, including their graphic and mathematical commonalities. And Balaji is not an isolated case; where livelihoods of weavers are stable, children of weavers are educated and take up modern technologies—in this

case computer programming—and often bring them back into the handloom socio-technical ensemble.⁵⁹

The turn to *jamdani* solved the problem of increasing capital costs of yarn and the resulting decreasing returns on labor. Through adopting *jamdani*, weavers created value for their weaving labor, which became value in the market and thus could absorb the rising capital costs while yarn prices increased. The weavers turned the problem from a crisis into an opportunity. For making the most of this opportunity, the weavers had to innovate the handloom socio-technical ensemble by casting a new balance between productivity and skill—and this is what the shift to *jamdani* amounted to.

This innovation could only succeed because the users in the ensemble also participated in the innovation, as we described. Quite similarly, in her study of eighteenth century artisanal and industrial manufacturing in London, Liliane Hilaire-Pérez describes products that acquired meaning within networks that were at the crossroads of utility (functional usefulness) and beauty (pleasure giving).⁶⁰ The new saree users, aunts and ladies, who have the necessary cultural memory and recognize the value of *jamdani* as a finer product, stand in a long tradition of linking cultural values to economic activity. Amartya Sen has investigated how Indian identity matters in firing innovation and he identifies the influence of values and cultural identities on economic behavior “over and above the general discipline that is provided

⁵⁹ Focus group discussion with weavers, at Mandapeta 23.1.2012

⁶⁰ Liliane Hilaire-Pérez, *La Pièce Et Le Geste: Artisans, Marchands Et Savoir Techniques À Londres Au XVIIIe Siècle*, L'évolution De L'humanité (Paris: Éditions Albin Michel, 2013).

by economic feasibility and commercial viability”.⁶¹ While handloom cloth is an economic commodity, cloth and clothes have always played important other roles in Indian society too. During the Indian struggle for independence, Gandhi used handloom cloth to “evoke powerful symbols of community and right conduct” through the swadesi movement.⁶²

The producers and users were innovators, but they were also innovated; in other words, they too changed as result of innovation of the sociotechnical ensemble. The evolving meaning of cloth in society affects the identities of producers and users of that cloth; the complexity of Indian social order imparts unusual variety to the symbolism. For instance, weavers across religions and castes could improve on their social standing by “creating finer and purer commodities”, as a tactic for raising status.⁶³ Thus, when the value of the cloth in the market decreased in Uppada, it had a lowering effect on the status of the weavers, as well as their livelihoods. The shift to *jamdani* countered this effect, resulting in status elevation for both producer and user. Thus the innovative lead weavers who shifted to *jamdani*, although disrupting existing market conditions for handloom weaving, displayed a kind of stability: a prospect of improvement in status while staying in weaving. Resisting the move to mechanized productivity, these weavers innovated their technical skill and specialized it—and gained recognition through calling on collective cultural memory and creating a valued identity in the customer’s mind.

⁶¹ Amartya Sen, *The Argumentative Indian: Writings on Indian Culture, History and Identity* (London: Penguin, 2005), 335.

⁶² Christopher Alan Bayly, "The Origins of Swadeshi (Home Industry): Cloth and Indian Society, 1700-1930," in *The Social Life of Things: Commodities in Cultural Perspective*, ed. Arjun Appadurai (Cambridge: Cambridge University Press, 1986).

⁶³ *ibid.*

The weavers in Uppada, through patterns of repeated social interaction, are embedded in a socio-technical ensemble that is bound by a set of informal norms and levels of trust that facilitate mutually beneficial co-operation in a crisis. In his paper analyzing social capital in prosperous communities, Putnam makes similar observations about guilds, religious brotherhoods and civil militia.⁶⁴ Weavers indeed use knowledge in their ensemble in a similar way as European pre-industrial craft guilds where “the main purpose of the craft guilds was to transmit skills” and “technological invention and innovation were a significant, albeit mostly unintended effect of the crafts’ support for investment in skills.”⁶⁵ Another similarity is that guilds, like the innovative *jamdani* weavers, educated their clients to assess quality and helped craftsmen to understand market developments.⁶⁶ In Uppada, as in the case of craft guilds, the presence of more highly skilled craftspeople, larger markets and incremental innovation in the socially interactive ensemble resulted in expanded possibilities for specialization, efficiency gains in the use of labor and better economic performance.

There is one final point that we need to make in our discussion of the concept of innovation. The “innovation” that we have elaborated is an analyst’s concept and not an actor’s category. We, as analysts, identify the shift to *jamdani* as an innovation, which we use to explain developments in handloom and handloom’s capacity to sustain

⁶⁴ Robert D. Putnam, "The Prosperous Community," *The American Prospect* 4, no. 13 (1993).

⁶⁵ S.R. Epstein, "Craft Guilds, Apprenticeship, and Technological Change in Preindustrial Europe," *The Journal of Economic History* 58, no. 3 (1998): 693, 684.

⁶⁶ See Maarten Prak’s analysis of the role of guilds in the ‘Golden Age’ of 17th century Dutch painting M. Prak, "Painters, Guilds, and the Art Market During the Dutch Golden Age," in *Guilds, Innovation, and the European Economy, 1400-1800*, ed. S.R. Epstein and M. Prak (Cambridge: Cambridge University Press, 2008).

livelihoods in the modern world. However, none of the actors sees their handloom practices as innovative. On the contrary: some were initially offended when hearing our analysis, since they prefer to see their work as celebrating tradition.⁶⁷ When further discussing our analysis, weavers did confirm the detailed analyses and then also recognized the political relevance of our analyst's move to identify handloom weaving as a practice with much innovation; this in turn broadened their concept of what constitutes tradition in handloom weaving.

The understanding that we are offering is political in itself and intervenes into the world. Our new understanding of handloom establishes the agency of weavers (and others in the socio-technical ensemble) and suggests that intervention by others—development workers, NGOs, social scientists, ourselves as researchers—could be supportive and following rather than directive and leading. For this to work, our scholarly understanding would need to develop into self-understanding by the weavers. And the distance between “innovation” as an analyst's concept and as an actor's concept would have to be reduced. This would require that the new meaning of innovation be understood as different from the one generally attached to it in India—high-tech and mostly related to ICTs or biotechnology—and substituted by this broader conception as

⁶⁷ To further explore how practitioners reflect on changing and renewing their knowledge, skills and practices, which they do not identify as innovative while we as researchers do so, the first author has interviewed Indian classical musicians. See Mamidipudi (2017). When we brought together handloom weavers and musicians to discuss each other's practices, both groups found these conversations illuminating and insightful. See proceedings: Mamidipudi, A., Bijker, W. E. (eds.) 2016. *Craft and Innovation—proceedings of a workshop—SHOT, India, Chennai*. Kalakshetra Foundation. (http://fasos-research.nl/indian-loom/craft-and-innovation-proceedings/craft-and-innovation_workshop-proceedings_shot-india-2016-2/ ; last accessed on 22-2-2018)

informed by history of technology and STS.

To explore this thesis, we organized a SHOT-supported workshop in January 2016 in Chennai, India. Historians of technology and STS scholars (from India, US and Europe) met with weavers, dyers, activists, and musicians.⁶⁸ Though this indeed was an intervention, we deliberately and explicitly made this intervention *from within* the socio-technical ensemble of handloom. A complicated scheme of variously shaped sessions created symmetrical input from all groups into the conversations. The workshop thus built on the conception of innovation as changing artefacts' meanings, as changing narratives, as creating new stories and metaphors linking different social groups in the ensemble. We recognized the role of the old in innovation; and, as mirror-image, identified innovation in seemingly traditionalist practices; we used the socio-technical ensemble as unit of analysis; we therein highlighted the varied skills and expertise of all types of actors; we discussed users as a crucial element for understanding innovation, both as buyers of commodities and as citizen-consumers in the relevant culture; and we included an analysis of handloom markets and how they relate to user-producer relations and questions of knowledge ownership and the development of skills.

This resultant broadening of the concept of innovation offers a starting point for weavers to argue for an alternative policy for handloom weaving. Innovation of tradition in the handloom ensemble disrupts two associations: first the association of innovation to change and new, and second the association of tradition to stability and old. Instead of seeing innovation exclusively to increase scale and productivity as part of

⁶⁸ See the workshop's website for more information, including detailed proceedings, films and photo's: <http://fasos-research.nl/indian-loom/craft-innovation-workshop-2016/> (last accessed on 22-2-2018)

modernization, this concept of innovation proposes to recognize innovation that foregrounds beauty and sustainability as part of a continuing tradition. Such innovation seeks to stabilize livelihoods through creating value for craft skills in the market rather than through welfare schemes and to support existing weaving communities rather than expanding an industry unsustainably. Such innovation policy builds on an understanding that the new is immanent in the old, that innovation can be anchored in tradition.⁶⁹ The weaver, then, is not an outdated cultural icon, but an innovative technologist embedded in a society that continues to sustain weaving communities and to value weaving. During a Roundtable at the SHOT 2017 Conference these discussions about innovation in craft were continued with input from a weaver, a dyer, an activist and a musician. And, symmetrically, the SHOT scholars were not only detached researchers and commentators, but actively engaged “translators”, partly working within the ensemble.⁷⁰ As a result, a “Policy Centre for Handloom” is being established at the union Rashtra Chenetha Jana Samakhya in Chirala, Andhra Pradesh, with SHOT scholars as advisors. Building on a broadened conception of innovation and a symmetrical engagement of scholars and practitioners, we thus have an opportunity to recast the technologically backward and vulnerable weaver from the past into a convivial companion for the journey to a sustainable future.

⁶⁹ Ineke Sluiter, "Anchoring Innovation: A Classical Research Agenda," *European Review* 25, no. 1 (2017).

⁷⁰ See Francesca Bray's Presidential address. Francesca Bray, "SHOT: Internationalisation and the art of translation" *Technology and Culture* 58, no. 2 (2017).

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