Sustainability in Jute-based Industries

Sanjoy Debnath

Abstract Jute industry is one of the oldest textile industries next to cotton, wool and silk. A large number of people are involved directly or indirectly with this jute-based industry. Present-day sustainability of this industry is being questioned in different forums. Possible facts which are responsible to sustain this industry have been discussed elaborately. This chapter also covers different segments of this industry wherein their present scenario and future requirements for sustainability have been explained. A holistic approach has been made to cover product manufacturing, machine manufacturing, ancillary manufacturing and marketing industries associated with this industry. Diversification of process and product is an important aspect for the sustenance of this industry.

Keywords Diversification of jute industry · Jute-based industry · Problems in jute industry · Sustainability

1 Introduction: *History and Present Scenario—An Overview*

Among different ancient bast fibres, jute is second to flax origins in Mediterranean region (Lord 2003), and later, it came to India. Based on the record, jute was known as '*patta*' in 800 BC. It is popular more than a century for its industrial applications such as packaging material in different sectors, geotextile application and carpet backing (Debnath et al. 2009). Since seventeenth to twentieth century, the jute industry in India was delegated by the British East India Company, which was the first jute trader (Anonymous 2016a). Palit and Kajaria (2007) documented several historical events which were evidences for the growth of the jute industry. In 1833, the Dutch government specified bags made of jute instead of flax for carrying coffee

S. Debnath (✉)
Mechanical Processing Division, ICAR—National Institute of Research on Jute & Allied Fibre Technology, 12, Regent Park, Kolkata 700040, India
e-mail: sanjoydebnath@yahoo.com; sanjoydebnath@hotmail.com

S.S. Muthu (ed.), *Sustainability in the Textile Industry*,
Textile Science and Clothing Technology, DOI 10.1007/978-981-10-2639-3_7

from the East Indies. At that time, flax fibre was imported from Russia. But the Crimean War during 1854–56 led to the stoppage of supply of flax from Russia and this forced Dundee, the famous jute manufacturing centre of UK, to move for substitute fibre. In Dundee, then, the flax mills were converted into jute mills. On the other side, the American Civil War (1861–65) gave further impetus to the jute trade, as supplies of America cotton were much restricted (Palit and Kajaria 2007). Since then, the industry did not return to flax or cotton again. The main reason behind this shift is the cost competitiveness of the substitute fibres (jute). During twentieth century, Margaret Donnelly, a mill landowner in Dundee, first set up the jute mill in India. In the year 1793, the first consignment of Jute was exported by East India Company. Beginning of 1830, Dundee spinners have determined to spinning of jute yarn by modifying their existing power-driven flax machinery. This leads to increase in the export and production of raw jute from Indian sub-continent. In the year 1854, the first jute factory in India was established at Rishira, about 20 km north of Calcutta (Anonymous 2016b). The industry made tremendous progress in the later part of the nineteenth century. Subsequently, the industry was boosted by the two world wars. Gradually, jute became the speciality of Dundee as documented by Gray (1989) and Mokyr (2003). By the 1880s, there were over 70 jute mills and factories in Dundee. The biggest factory of all was the Camperdown works, and fourteen thousand people worked there. In 1869, five mills were established with around capacity of 950 looms. The growth was very much fast that by the year 1910, and 38 companies were operating around capacity of 30,685 looms. These rendered more than a billion yards of cloth and over 450 million bags (Anonymous 2016a). In the year 1880, jute industry has acquired almost the whole of Dundee and Calcutta. Later during the nineteenth century, the manufacturing of jute has started in other countries such as France, America, Italy, Austria, Russia, Belgium and Germany. Most of the jute barons had started to quit India, leaving the set up of jute mills after Independence, and then, Indian businessmen (mostly *Marwaris*) owned most of the jute mills. Jute industry is one of the labour-intensive industries, and hence, the jute mills slowly closed down in European countries and America due to soaring labour cost.

After agriculture, textile and garment sector is the second major job provider in India and has the ability to drive economy. But for that, India needs to explore it further to present something different to the world. Jute industry, a part of textile and garment sector, has vast hidden abilities in this regard.

In recent days, jute textile industry is one of the major industries in the eastern India, particularly in West Bengal (Anonymous 2016c). This industry supports around 40 lakh farm families and provides direct employment to 2.6 lakh industrial workers and 1.4 lakh in the tertiary sector. The production process in the jute industry passes through a variety of actions, which begins with cultivation of raw jute, processing of jute fibres, spinning, weaving, bleaching, dyeing, finishing, and marketing of both the raw jute and its finished products. These indicate clearly about the labour intensiveness of the jute industry, and as such, its labour-to-output ratio is also high in spite of various difficulties being faced by the industry. Capacity

utilization of the industry is around 75 %. Jute industry contributes to the export earnings in the range of Rs. 1000–1200 crore annually.

Today, most of the jute mills in the country are of composite mills comprising spinning and weaving (power loom) sectors (Anonymous 2016d). The Indian jute industries are largely dominated and owed by private sector ownership having 93 % mills (84 out of 90 mills) owned by private companies. The Indian Government ownership is only to extent of balance 7 % through ownership by *NJMC ()*. Presently, there are 90 jute mills in India, of which 67 mills are located in West Bengal, 9 mills located in Andhra Pradesh, 3 each in Uttar Pradesh, Bihar and Orissa, 2 each in Assam and Chhattisgarh and 1 in Tripura. Kaur (2014) stated that as on 1 April 2014, the jute industry provides direct employment to 215,000 workers in organized mills and indirect employment to 150,000 workers. It provides livelihood to near about four million farm families who are engaged in the cultivation of jute. As per as the production of jute is concerned, the total production of raw jute during 2013–2014 was 11,416.4 thousand bales (1 bale 180 kg) or 2.05 MT, whereas production of jute goods was 15.3 lakh MT. For the past three years, there is no major change in the production of raw material and goods. As far as the export of jute is concerned, India exported about 1.3 lakh MT worth Rs. 1593.6 crore jute and jute products during April–December 2013. The USA, the UK, Saudi Arabia, Germany, Egypt and Turkey are the major importing countries. Table 1 presented the total installed capacity of the jute industry.

It is clear from Table 1 that 75 % of the jute goods produced are used as packaging materials, hessian and sack fabrics. The other products are carpet yarn, cordage, felts, padding, twine, ropes, decorative fabrics, geotextile fabrics and miscellaneous items for industrial uses. The productions (in 000 MT) of hessian fabric, sacking fabric, carpet backing cloth (CBC) and other jute goods during the last five years are shown in Table 2.

It is clear from the table that the overall production of hessian, sacking, CBC and yarn consumption/demand shows decreasing trend, and for other jute products, the trend remains unchanged. Many of the jute industries still use jute batching oil which contains some harmful chemical compounds. The export market today is

Table 1 Aggregated installed capacity in jute industry (Anonymous 2016d)

Processing stage	Product type	Spindles (numbers)	Looms (numbers)	Total installed capacity (000 TPA)
Spinning	Fine yarn	630,776	–	2732
	Coarse yarn	132,904	–	
Weaving	Hessian	–	18,637	
	Sacking	–	28,592	
	CBC*	–	905	
	Others	–	3223	
Total		763,680	51,357	

*Carpet backing cloth

Table 2 Production of jute goods in India (Anonymous 2016d)

Period (April–March)	Hessian	Sacking	CBC	Yarn	Others	Total
2010–11	244.4	1076.9	4.7	177.3	62.4	1565.7
2011–12	239.9	1165.1	3.9	123.4	50.4	1582.4
2012–13	210.0	1218.2	2.7	114.1	46.3	1591.3
2013–14	202.5	1150.4	3.2	109.0	62.6	1527.4
2014–15	211.3	901.8	2.7	90.6	60.8	1267.2

Table 3 Export trend of jute goods from India (Anonymous 2016d)

Product	2010–11	2011–12	2012–13	2013–14	2014–15
Hessian	7405	9788	9033	8610	7696
Sacking	2239	4189	4165	5270	2966
Yarn	5310	2820	2212	1436	1387
JDPs	2697	3199	3636	4839	5086
Others	890	954	872	1064	1003
Total	18,541	20,950	19,918	21,219	18,138

emphasizing more on the eco-friendliness process. This may be one of the probable reasons to show decreasing trend. Another possible reason is the stiff competition with the similar synthetic counterpart whose market strongly dominated by the synthetic industrial lobby apart from the cost competitiveness while compared to jute. Further, if we move in detailed search, this study also shows the export trend of jute goods in India (Table 3).

It is depicted from Table 3 that the hessian fabric export trend fluctuates and the trend of jute sacking and yarn reduces drastically. However, the non-traditional products such as jute non-woven, geotextile, agrotextile and insulation material which come under other categories, show an increasing trend. The jute being the natural material has more acceptability in ecosystem, and hence in the recent times, the demand of such environmentally friendly product demand increases. The study (Anonymous 2016d) shows that there are more export demands in the area of JDPs (jute diversified products) in India. India being the major producer of jute fibre, the many self-help groups (SHGs) and NGO (non-governmental organization) are being started to produce the jute diversified products and export them in European market. This generates more revenue generation, and with time, the companies involving with this business are progressing well. Further, to establish these facts, Table 4 presents the exports (value in INR Million) of JDPs from India.

It is clear from the trend of Table 4 that the different JDPs (floor coverings, carry bags and other JDPs) increase which show that the future sustenance of this jute-based industry lies on the diversification through various JDPs. Since the raw material used is the natural product, the final product is also natural, provided the industry must go for substitute of JBO (jute batching oil) which is extracted from the petroleum-based industries. Today some of the mills have adopted RBO

Table 4 Export trend of JDPs from India (Anonymous 2016d)

Products	2010–11	2011–12	2012–13	2013–14	2014–15
Floor coverings	1342	1420	1790	2161	2389
Carry bags	1264	1637	1697	2448	2518
Other JDPs	91	142	158	230	179
Total	2697	3199	3636	4839	5086

(rice bran oil), a plant extract used as substitute of JBO to make the process an well as the product green and sustainable.

2 Problems in Jute-based Industries

In India, this industry suffered a serious setback in 1947 due to the partition of the subcontinent (Anonymous 2016b). After partition, about 80 % of the jute-growing areas went to East Pakistan (Bangladesh), while nearly 90 % jute mills remained in India. In 1959, the international demand of jute products decreased substantially as a result of which 112 jute factories were closed down. At present, there are only 60 jute-producing mills in India. Most of these mills are along the Hooghly River, especially to the north of Kolkata.

Most of the jute-based industries still today are being producing the age-old products such as jute sacking and hessian as packaging material and to some extent carpet backing. These products in total account around 95 % of the total production of the industry. Only countable industries are involved in diversified product development process for commercial purposes. These products are mostly laminated jute fabric, geotextile, industrial textiles, etc. In present days, lot of awareness have been taken place in the area of eco-friendliness. In this regard, the traditionally practiced jute batching oil used during spinning is found to have some carcinogenic components which may be contaminated during packaging as food grain. Efforts have been made to replace this jute batching oil, but till date, no such substitute has been developed. Researchers have tried with eco-friendly vegetable oil (rice bran oil (RBO), linseed oil, jute seed oil, castor oil, etc.) based emulsion for jute spinning, but none of them are found similar/better spinning performance in all respect compared to traditional jute batching oil (Basu et al. 2009). In spite of different spinning problems with other than jute batching oil, some of the jute industries are using RBO in export products especially in the area of food grain packaging to eliminate the carcinogenic component contamination during food grain packaging.

According to the Jute Packaging Norms and Legal Protection to Jute Cultivators the Parliament of India had enacted the JPM (Jute Packaging Mandatory) Act 1987 with an objective to protect the jute industry (Anonymous 2016c). As per this act, the food grain and sugar produced are reserved and mandatorily packed in jute bags manufactured every year. The Government of India recently found that the jute industry could not match demands in 2011–2012 for supply of 13 lakh bales or 4.33

lakh tons of gunny bags for Rabi crop supply of 2012–2013. Government said that with 10 mills remaining closed, the jute industry is short in capacity by 1.5 lakh ton. Presently, it can produce 11 lakh tons of jute sacks/gunny bags. Its installed capacity, however, is 15.02 lakh tons, and assuming a 83 % utilization, its stated capacity is 12.47 lakh tons. The industry earns a business of around Rs. 10,000 crore by selling its entire produce to FCI (Food Corporation of India), sugar mills, and co-operatives in the Indian market apart from the export. FCI makes a bulk purchase of almost 35–40 % of jute mills produce. In 2012–2013, FCI is expected to purchase 6.34 lakh tons and 4.33 lakh jute/gunny bags (Anonymous 2016c).

Apart from the above problems, in India, jute industry suffers lot from different political interference, labour problem, jute mills owner are mostly headed by business community rather than entrepreneurs, and shortage of jute fibre supply due to low rainfall, which also lead against the sustainability of the jute industry (Kundu et al. 1959).

3 Sustainability: Diversification of Product and Process

Jute is also known as the 'golden fibre', a plant that produces a fibre mainly used for sacking and cordage and carpet backing (Anonymous 2016b). This raw material is used for sacks globally which is one of the most versatile fibres of nature. Still jute is cheaper and plays an important among all textile fibres next to cotton. The jute mills are integrated units consisting of both spinning and weaving units. The main products of jute industry are gunny bags, canvas, pack sheets, cotton–jute, paper-lined hessians, hessian cloth, carpets, carpet backings, rugs, cordage and twines.

The Indian jute industry has been expanding really fast, spanning from a wide range of lifestyle consumer products, with courtesy to the versatility of jute. By the innovative ways of bleaching, dyeing, and finished goods processes, the jute industry now provides finished jute products that are softer and have lustre with aesthetic appeal. Today, jute has been defined as eco-friendly natural fibre with utmost versatility ranging from low-value geotextiles to high-value carpets, decorative, apparels (Debnath et al. 2007a, b), composites, upholstery furnishings, etc. (Debnath et al. 2009). In the same line of development, Sengupta and Debnath (2010, 2012) documented jute-based products for upholstery application. They also compared their developed jute-based products with commercial non-jute similar products. Debnath et al. (2007a, b) developed jute and hollow-polyester-blended bulked yarn for warm fabrics such as knitted sweater and jacket, and they found that the bulkiness of the jute-polyester-bulked yarn is superior to jute yarn.

There are several research institutes whose researches are mostly concentrated on agricultural development of jute fibre in India (ICAR Central Research Institute of Research on Jute & Allied Fibres, Barrackpore, West Bengal) and Bangladesh (Bangladesh Jute Research Institute, Dhaka). These researches lead to good varietal development for fine yarn spinning, improvement in yield and productivity of jute, and improved retting process and technology. Globally, it has been accepted that

good and fine jute fibre is essential for the development of diversified value-added products. One can look into the important properties of jute fibre since it has huge diversifying potentiality. Advantages of jute include good insulating and antistatic properties, as well as having low thermal conductivity and a moderate moisture regain (Anonymous 2016e). It includes acoustic insulating properties and manufacture with no skin irritations. Jute has the ability to be blended with other fibres, both synthetic and natural, and accepts cellulosic dye classes such as natural, basic, vat, sulphur, reactive, and pigment dyes. While relatively cheap synthetic materials in many uses are replacing jute, jute's biodegradable nature is suitable for the storage of food materials, where synthetics would be unsuitable.

4 Sustainability and Sustenance of Jute-based Industries

The jute industry occupies significant place in the Indian economy (Anonymous 2016a). The Indian jute industry is a very old and predominant in the eastern part of India. The Government of India has included the jute industry for special attention in its National Common Minimum Programme. It forms an integral part of the Indian textile industry. Further, the jute industry contributes to the national exchequer from exports and taxes (Bhattacharya 2013).

As per the sustenance and sustainability of jute industry are concerned, there come some of the following important aspects: there are lot of changes required to be implemented in the present jute industries, and this may certainly help in diversification. Majority of the industries are using the age-old machinery. Even the new jute industries installed in Bangladesh and India are also using the used jute spinning machinery either from India or China. The old machinery consumes more energy for the production of same quantity of yarn. The old machinery is also having lesser productivity and requires frequent maintenance. This caused increase in production cost or, in other term, increase the conversion cost from fibre to yarn. Almost all the jute industries are still concentrating on the traditional products such as jute sacks and hessian. In the era of synthetics, similar synthetic products are offering in the market of at least few folds lesser in price. This creates stiffer competition in the existing market. The probable solution is to move towards diversification from the conventional products. It has been proven that through diversification, there is always higher cost-to-benefit ratio. Day by day, the cost of fibre production (cultivation and fibre extraction) becomes increasing, as a result the jute mill owners find difficult to push their products in the competitive market. Unlike other agricultural produces, the cultivable land is reducing due to the expansion of the urbanization. On the other hand, the farming community is also shifting from jute to other crops due to uncertainty of the rain. The jute retting process requires a huge quantity of water. Due to the climate change and change in the rainfall pattern, the farmers are suffering from scarcity of water during the retting season of jute fibre. As a result, the cost of fibre is increasing every day.

On the contrary, due to advancement of science and technology, the synthetic products are becoming cheaper at the cost of environmental. Many of the jute industries are being closed few months of a year due to shortage of raw material (jute fibre). Even the quality of the fibre produced in low water retting decreases the quality of the retted jute fibre. On the one hand, industry finds stiff competition with similar synthetic products in the market with lower cost, and on the other hand, the existing jute fibre is not sufficiently in good quality.

Only countable industries are involved in diversified product development process for commercial purposes. These products are mostly polyethylene-/polypropylene-laminated jute fabric (raw hessian fabric, bleached fabric, printed fabric, dyes fabric, etc.). Compared to these products, much lesser quantity of jute-cotton-blended fine fabric dyed, designed, laminated or non-laminated fabrics are being produced. These decorative fabrics are mostly used for diversified fashion bag and utility bags (water bottle bag, win bottle bag, tea coaster, shopping bag, school bag, backpack, soft luggage bag, etc.), material for home decoration (window/door curtain, table cover, lamp shed, furnishing material, etc.), car inter lining (seat cover, inner roof top, foot mat/carpet, inner lining of door, etc.) and other fashion products. Jute non-woven and woven materials are used for the development of polyester resin fibre-reinforced composite material for different industrial applications in automobile industry as car door panel, dash board, etc.

5 Conclusions and Impending

Application of jute area must be increased. India needs to work on quality by adopting new technologies (Kaur 2014). Jute Research Association, such as ICAR–NIRJAFT, Kolkata, IJIRA, Kolkata, Department of Jute and Fibre Technology, Kolkata, must work together to utilize resources for the betterment of the industry. Government must make efforts in R&D to strengthen the crisis-stricken but one of the oldest industries in India that is the jute industry.

Furthermore, jute industry should concentrate more towards diversification from its existing products. These will fetch more profit and has less market competitor (synthetic counterpart). The jute mill owners should also need to change their mindset to overcome the present situation and move towards the sustenance of this traditional industry. Still today, a majority portion of people is involved directly/indirectly with this jute industry wherever it exists. Last but not the least, the modernization in jute industry is foremost part as per as the sustainability of this jute industry is concerned. Lastly, the application of plant based substitute jute conditioning oil in place of JBO will lead towards greener process and product. Overall, the JDPs and geotextile made from these eco-friendly substitute of JBO may sustain the jute industry rather than the traditional sacks and hessian fabrics.

References

Anonymous (2016a) http://www.indianmirror.com/indian-industries/jute.html. Dated 03 Feb 2016
Anonymous (2016b) http://www.vajiramandravi.in/jute-textile-in-india.html. Dated 03 Feb 2016
Anonymous (2016c) http://www.gktoday.in/jute-industry-of-india/. Dated 03 Feb 2016
Anonymous (2016d) Sonar Beni-the golden fibre: success stories. National Jute Board, Kolkata, pp 12–17
Anonymous (2016e) http://www.worldjute.com/about_jute/abj_intro.html, Dated 03 Feb 2016
Basu G, De SS, Samanta AK (2009) Effect of bio-friendly conditioning agents on jute fibre spinning. Ind Crops Prod 2(9):281–288
Bhattacharya B (2013) Marketing of raw jute. In: Advances in jute agronomy, processing and marketing of raw jute. PHI Learning Limited, New Delhi, pp 144–154, ISBN: 978-81-203-4670-3
Debnath S, Sengupta S, Singh US (2007a) Properties of jute and hollow-polyester blended bulked yarn. Journal of The Institution of Engineers (India). Text Eng 87(2):11–15
Debnath S, Sengupta S, Singh US (2007b) Comparative study on the physical properties of jute, jute-viscose and jute-polyester (hollow) blended yarns. Journal of The Institution of Engineers (India). Text Eng 88(1):5–9
Debnath S, Roy AN, Basu G, Chattopadhyay SN (2009) NIRJAFT's technologies for rural development. In: Shukla JP (ed) New technologies for rural development having potential of commercialisation. Allied Publishers Private Limited, Delhi, pp 136–142, ISBN: 978-81-8424-442-7
Gray A (1989) A history of Scotland: Modern times. Book five. Oxford University Press, Oxford, New York, pp 3–4
Kaur R (2014) http://www.mapsofindia.com/my-india/india/one-of-the-oldest-but-crisis-stricken-jute-industry-in-india. Dated 03 Feb 2016
Kundu BC, Basak KC, Sarcar PB (1959) Jute in India. The Indian Central Jute Committee, Calcutta, pp 1–395
Lord PR (2003) Handbook of yarn production: Technology, Science ane Economics. Woodhead Publishing Limited, Cambridge, England, p 2, ISBN: 9781855736962
Mokyr J (2003) The Oxford encyclopedia of economic history. Oxford University Press, Oxford, New York, p 213
Palit S, Kajaria S (2007) Jute industry—a historical perspective. Firma KLM Private Limited, Kolkata, pp 1–546
Sengupta S, Debnath S (2010) A new approach for jute industry to produce fancy blended yarn for upholstery. J Sci Ind Res 69(12):961–965
Sengupta S, Debnath S (2012) Studies on jute-based ternary blended yarn. Indian J Fibre Text Res 37(3):217–223