CPD

Working Paper 100

Technological Upgradation in the Jute Mills of Bangladesh

Challenges and Way Out

Khondaker Golam Moazzem
Kishore Kumer Basak
Md. Tariqur Rahman

CENTRE FOR POLICY DIALOGUE (CPD)
B A N G L A D E S H
a civil society think tank

TECHNOLOGICAL UPGRADATION IN THE JUTE MILLS OF BANGLADESH

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[*]The study for the present Working Paper was carried out by the Centre for Policy Dialogue (CPD) in association with the Katalyst under a project of the Ministry of Commerce, Government of Bangladesh (GoB). Another part of the study on technical issues related to the jute industry was carried out at the same time by the Department of Mechanical Engineering of the Bangladesh University of Engineering and Technology (BUET).

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The **Centre for Policy Dialogue (CPD)** was established in 1993 as a civil society initiative to promote an ongoing dialogue between the principal partners in the decision making and implementing process. Over the past 19 years the Centre has emerged as a globally reputed independent think-tank with local roots and global outreach. At present, CPD's two major activities relate to dialogues and research which work in a mutually reinforcing manner.

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It may be of interest to note that in recognition of the track record in research, dialogue and policy influencing, CPD was selected as one of the awardees under the Think Tank Initiative (TTI) through a globally held competitive selection process. TTI is supported by a number of governments and foundations, and is implemented by the International Development Research Centre (IDRC), Canada.

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The present paper titled **Technological Upgradation in the Jute Mills of Bangladesh: Challenges and Way Out** has been prepared jointly by *Dr Khondaker Golam Moazzem*, Senior Research Fellow, CPD; *Mr Kishore Kumer Basak*, Research Associate, CPD; and *Mr Md. Tariqur Rahman*, Former Senior Research Associate, CPD.

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Executive Summary

Rationale of the Study

The jute manufacturing sector of Bangladesh has recently started to revitalise with the rise in global demand for jute goods, thanks to the environment-friendly nature of jute, and the price hike of petroleum products, an essential raw material for its substitute, polypropylene. Nevertheless the industry has struggled with its low level of competitiveness against its substitute products in terms of cost, ability to handle bulk volume of products and diversity of product. For long-term sustainability of the industry, improvement of productivity and manufacturing of better quality and diversified products are being regarded as the most important issues. The present study titled *Technological Upgradation in the Jute Mills: Challenges and Way Out* has been carried out with this broad objective. More specifically the study has examined the market potentials of jute goods at local and international levels; investigated the current status of jute mills in terms of machines, workers, working environment and production process; analysed the productivity and efficiency of jute mills; and estimated the possible gains through improvement of efficiency in the jute mills. Based on the findings, the study put forward necessary suggestions to modernise the machineries, improve the production process, and develop human resources in the jute manufacturing sector. The study is based on the data collected from 10 sample jute mills of both spinning and composite categories which are under the authority or membership of Bangladesh Jute Mills Corporation (BJMC), Bangladesh Jute Mills Association (BJMA) and Bangladesh Jute Spinners Association (BJSA). Since it is a sample survey-based study, the findings are likely to be considered as indicative with regard to the objectives of the study.

Market Potentials for Jute Goods at Local and International Levels

With regard to the debate over market potentials of jute goods, the study has examined the *Jute Substitutability Index*, analysed market potentials in the existing and new countries, and estimated the potential demand in the domestic market. The substitutability index measuring the demand for substitute products over jute products shows that the index value hover around 70 per cent mark, which implies that polypropylene fabrics have still maintained a market share of 70 per cent of packaging, sacking and carpet backing materials. The positive thing is that since 2003, the index value has slowly declined indicating the rising demand for jute products. Likewise, the very high value of Revealed Comparative Advantage (RCA) of Bangladeshi jute products positively delineates their competitiveness over the main exporting countries such as India, Pakistan and China. Since these countries have large domestic markets for jute products, the competitiveness of Bangladeshi goods needs to be widened in the markets of these countries. Currently Bangladesh's export covers only 10 per cent of total domestic demand of jute and jute goods in India. Apart from that, a large domestic market has recently been opened up in Bangladesh with the enactment of *Mandatory Use of Jute for Packaging Products Act 2010*. The present study has estimated that the full enactment of the Act would create a total demand of 841 million jute bags in a year for packaging of selected agricultural (rice, wheat, pulses, oilseeds, potato and sugar) and non-agricultural products (cement). This would require a total amount of 504.7 thousand MT of raw jute in a year, which is equivalent to about 77 per cent of the total production of raw jute.

Status of Jute Mills in terms of Machines, Workers and Production Processes

Machines: Technology used in the jute manufacturing sector did not change much over the years, possibly owing to minimal changes in the final demand for jute products. Most of the machines in jute mills are old and have passed the usual functional period. Although the major machineries used in each of the sections are fairly similar, each of the mills apply additional machineries/techniques in order to enhance production. However, in general, there is no such drive for full replacement of old machineries as a mechanism to upgrade the machine productivity. Underutilisation of production capacity although has decreased in recent years, but there are scopes for further improvement particularly in weaving

section of composite mills, which is partly responsible for low capacity utilisation at backward and forward parts of the production chain.

Workers: There is no standard practice for the use of workers in different sections of jute mills (standard deviation in the use of workers is estimated to be 22.6 in calendaring sections to as high as 376.3 in weaving sections). Man-machine ratio is more homogenous in carding, drawing, spinning and weaving sections; but less in softening, winding and calendaring sections. Number of workers in different sections of sample jute mills is found to be less compared to what was found in a survey in 2007. This has happened most likely due to available suitable jobs in other formal and informal sectors with better wage. In the male-dominated operational practices in jute mills, female workers are found mostly in drawing, carding and softening sections where the activities are relatively less skill-oriented and less labourious in nature. However, appointing female workers in skill-oriented and labourious activities is not rare. Taking into account the scarcity of workers, manufacturers should target appointing more female workers in all sections. Since manufacturing of jute goods is mostly skill-oriented job, entrepreneurs should be ready to offer competitive wage in order to retain the skilled workers. The high labour cost due to increased remuneration to workers could be well-compensated through improvement of productivity in the jute mills.

***Production environment*:** Production environment is found to be in heterogeneous state in terms of maintenance of temperature, humidity and lighting in the workplace. While moisture content in the yarn should be kept at or above 75 per cent in order to maintain the quality of yarn, 50 per cent of sample factories maintain humidity level lower than what is required. Lack of proper maintenance of temperature, humidity and widespread dust in the factory premise has definite impact on machine productivity, quality of product and workers' health and hygiene.

Production process: Difference in ergonomic structure and lack of standard usage of machines and workers in different sections of jute mills are found to be responsible for the variation in the production process in different jute mills. Transferring process is more diverged at initial and finishing stages of production, particularly in sections such as softening, spreading for spinning mills; and winding, beaming, weaving and calendaring for composite mills. A proper set up of machines in accordance with the production chain may reduce both production time and number of workers.

Raw jute procurement: Most mills could not buy their annual requirement of raw jute during the harvest season because of limited godown capacity and credit facilities. Since cost of raw jute is the single-most important component of the overall cost structure (50-80 per cent of the total cost), and availability of better quality fibre is more likely during the harvest season, jute mills should expand the space of the godowns to procure more raw jute from the market.

***Maintenance practice*:** Instead of following the 'prevention method' for maintenance, most mills practice 'breakdown method.' There are limited cases where mills practice overhauling maintenance method. Expenditure on maintenance is usually considered as an additional burden to the mills, even though only about 4-5 per cent of total cost is attributed for that purpose (maintenance cost is about 10-15 per cent in developed countries). With a low level of understanding on maintenance practices, a high spending on maintenances of machineries would provide less return. Workshops observed in sample jute mills are not found to be at the same level in terms of required facilities, technicians and availability of raw materials. Though a local manufacturing base for machineries and spare parts is available, it is inadequate nonetheless to meet the demand.

Management: Number of engineers, professionals and staffs is not well balanced in small jute mills. In some instances, the knowledge on processing, maintenance of machineries and labour management seem to be based on an understanding which hinders the path towards necessary changes required for betterment of efficiency and productivity levels. In a number of cases, jute mill entrepreneurs are not 'enthusiastic' towards attaining higher return by making necessary investments. There is a dearth of

human resources especially engineers, accountants and managers, mainly because of narrow career prospect in the jute sector vis-à-vis other sectors (textiles sector) including unattractive salary packages.

Productivity and Efficiency Analysis of Sample Jute Mills

The study measures productivity of jute mills in a number of ways, such as (ton/hr)/kW, (ton/hr)/machine and (ton/hr)/man. Although machines in different sections are found to be identical, there are variations in productivity in different sections for different mills. One possible reason is that the machines in all the mills do not run at full capacity. Since the productivity is always higher for spreader machine than that of the softener, the use of spreader machine will be better means for enhancing productivity. On the other hand, productivity measurement in terms of (ton/hr)/man is higher for mills having a larger number of skilled workforce and use of suitable production processes. Since allocative efficiency is a major determining factor in overall efficiency, both spinning and composite jute mills should improve their cost efficiency.

Possible Gain through Upgradation

Variation of productivity among the jute mills indicates that there are ample scopes for raising productivity in different kinds of operations of jute mills. Proper balance of machines and workforce would result in significant cost cuts which could be in nominal terms be as high as Tk. 537,000 in a year for a mill. Jute procurement during the harvest season could save up to 28 per cent production cost (in nominal terms) compare to post-harvest season. The possible savings of electricity cost would be much higher in case of public sector jute mills. For private sector jute mills, the savings would range between Tk. 0.34 crore to Tk. 0.63 crore.

Recommendations

Based on the findings of the study, a number of suggestions have been put forward which needs to be taken into account by the policymakers, bureaucrats, association leaders, entrepreneurs, development partners and related non-government organisations (NGOs). A medium and long-term workplan needs to be developed on the following recommendations.

a. ***Penetrate the market potentials at domestic and international levels:*** Since global demand for jute products has been rising in recent years, Bangladesh has a high potential in both domestic and international markets. Bangladesh and India as the two major jute-exporting countries can undertake joint initiative to promote jute products at global level. This initiative should include campaigning, policy influencing, collaborative research on product development and marketing. International Jute Study Group (IJSG) should also take a lead role in this case. Regarding the potentials in the domestic market, the Ministry of Textiles and Jute should immediately finalise the action plan for the implementation of the *Mandatory Use of Jute for Packaging Products Act 2010*. The full utilisation of the Act would create a demand for 841 million jute bags for the packaging of selected agricultural and non-agricultural products.

b. ***Finalise the action plan of the Jute Policy:*** The *National Jute Policy 2011* has delineated the targets and strategies to be attained in the next decade for the sustainability of the jute sector. Based on the directions of the policy, a plan of action should be immediately finalised with appropriate timeframe, deliverables and appropriate authorities for implementing different targets of the action plan. The Ministry of Textiles and Jute has started to discuss with the concerned stakeholders with a draft action plan. It is expected that the ministry will finalise the action plan and will monitor its implementation on a regular basis.

c. ***Balancing the machinery use to attain higher level of productivity:*** With a view to ensure optimum utilisation of machines, workers and raw materials for smooth functioning of jute mills, a number of measures could be taken into consideration by the mill management. Firstly, a review of the existing

production process, techniques and operational management of different sections of jute mills is urgently needed. Secondly, section-wise monitoring of capacity utilisation is highly important. Thirdly, it is also important to set up a team of experts under the auspices of BJMA and BJSA in order to provide technical support to the jute mills with regard to machines, work environment, size of workforce, machine replacement and production process.

d. ***Balancing worker-use, mobilisation of new workers and improvement of labour productivity:*** An assessment should be undertaken in different sections based on the standard practices of machine-worker ratio for operations. To improve the productivity of the workers, mill management should provide regular in-house training and better salary to skilled workers including non-wage benefits. Given the scarcity of workforce, mill management may consider employing female workers in all sections of jute mills. In this connection, the workplace should be more gender-sensitive through appropriate sanitary, medical and housing facilities.

e. ***Improvement of production process:*** The standard practice of production process can reduce the requirement of time, machinery and workers. Jute mills should target for further mechanisation of production technologies and processes whenever possible. Examples include use of forklift or jib crane for stacking, conveyer belts in the softening section, roll-feed breaker carding machine in the carding section, baxter flyer in the spinning frame, and improved weaving looms.

f. ***Improvement of knowledge-base regarding fibre quality:*** A good knowledge of fibre quality is essential in order to obtain good output. In this context, proper training is required for the technicians and workers involved in procurement of jute, batching and selection activities, particularly for fibre-quality and batching.

g. ***Improvement of maintenance practices:*** Jute mills should assess their existing maintenance practices particularly avoiding of 'breakdown'-based maintenance practices. This requires extra training to make the staffs and technicians convinced to understand the changes required in the maintenance practices. Mill managements should be ready to invest more in maintenance such as having a fully equipped and operational workshop with skilled technicians.

h. ***Develop factory-level work environment and social compliances:*** Mill management should particularly put attention to maintain the proper level of humidity, light, air, sound and dust. Standard practice of these aspects significantly improves the production environment as well as productivity. Necessary training on the standard practice of these aspects will help to improve the production environment. In collaboration with private sector organisations such as NGOs, necessary facilities should be developed for the workers including dormitories, schools, clinics and entertainment facilities.

i. ***Targeting dynamic leadership for the jute sector:*** Jute manufacturing sector needs dynamic entrepreneurs who can take the sector forward. For this, an energetic and dynamic management, dedicated mid-level professionals, particularly engineers and junior management trainees are required.

j. ***Development of institutional capacity for better human resource:*** A full-fledged jute technology institute similar to that in India should be established. In this context, upgradation of a textile institute located in Jamalpur for jute manufacturing sector is a good initiative. Jute mills associations should develop a collaborative arrangement with the institution as regard to develop human resources and undertake necessary research and development (R&D).

k. ***Building a strong base for R&D:*** Strengthening of R&D is required for the improvement of fibre quality, texture, length and strength. In this connection, recent invention of genome sequencing of jute could be expedited further. Public-private partnership (PPP) of research (between universities/institutes and private sector) for the development of commercial jute goods needs to be

prioritised. Research and development undertaken by Bangladesh Jute Research Institute (BJRI) should be expanded with more focus on development of commercial products.

l. ***Investment for Technology Upgradation:*** Government should introduce a *Technology Upgradation Fund (TUF)*, like that of in India, in order to provide financial support to the jute manufacturing sector for necessary development and upgradation of machineries, production process and further mechanisation. Government as well as the commercial banks should take necessary measures to provide financial support in the form of low interest credit to the jute manufacturing sector for transformation such as procurement of new machineries, upgradation/replacement of existing machineries, development of factory premises and godown facilities.

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Acronyms

BBS	Bangladesh Bureau of Statistics
BJMA	Bangladesh Jute Mills Association
BJMC	Bangladesh Jute Mills Corporation
BJRI	Bangladesh Jute Research Institute
BJSA	Bangladesh Jute Spinners Association
BUET	Bangladesh University of Engineering Technology
CAGR	Compound Annual Growth Rate
CBC	Carpet Backing Cloth
CC	Cash in Credit
CPD	Centre for Policy Dialogue
CPM	Critical Path Method
DEA	Data Envelopment Analysis
DEAP	Data Envelopment Analysis Programme
EPB	Export Promotion Bureau
FAO	Food and Agriculture Organization of the United Nations
GoB	Government of Bangladesh
HS	Harmonized Commodity Description and Coding System
IJSG	International Jute Study Group
ITC	International Trade Centre
kWh	Kilowatt Hour
MT	Metric Ton
MoF	Ministry of Finance
NGO	Non-Government Organisation
PDB	Power Development Board
PPP	Public-Private Partnership
RCA	Revealed Comparative Advantage
RMG	Readymade Garments
rpm	Rotation per Minute
R&D	Research and Development
TUF	Technological Upgradation Fund
USA	United States of America
USD	United States Dollar
UNSD	United Nations Statistical Division
WITS	World Integrated Trade Solution

1. INTRODUCTION

After decades of sluggish growth, the jute manufacturing sector has recently started to revitalise, thanks to the environment-friendly nature of jute as well as the price hike of petroleum products, an essential raw material for jute's substitute, i.e. polypropylene. The growth of the jute sector strongly depends on the level of policy support provided by the government, particularly to maintain competitiveness against its substitutes. Unfortunately, lack of policy support in the earlier decades often hampered the growth of the jute industry in Bangladesh. Recently, government has undertaken a number of policy measures in order to revitalise the sector. These include, among others, preparation of the draft *Jute Policy 2011*, special mention as regards policy support for the jute sector in the *Industrial Policy 2010,* and enactment of a special act to impose mandatory use of jute bags for packaging. In this context, government support for decoding of the genetic sequence of jute fibres and innovating new genetic code of jute are important milestones for jute research in the country.

Jute mills in Bangladesh are by and large less competitive and low productive (Moazzem and Chowdhury 2009). Factors such as use of age-old low productive machines, lack of skilled workers, high cost of production and lack of diversified products make the sector less competitive. Unless jute mills sufficiently enhance the productivity and efficiency, Bangladesh's jute products would lose its market to other competing countries as well as to substitute products. The present study thus aims to analyse the productivity of the jute mills with a view to provide necessary suggestions for enhancing their competitiveness.

2. OBJECTIVES OF THE STUDY

The objective of the study is to analyse the productivity and efficiency of jute mills in order to put forward suggestions on technological upgradation, modernisation and development. The outcome of the study would help policymakers, entrepreneurs and trade bodies to take necessary measures for improving the performance.

The objectives of the study are to:

a. Assess the current performance of jute manufacturing sector (both in export and domestic markets);
b. Examine the competitiveness of Bangladeshi jute products in the global market;
c. Analyse the status of productivity and efficiency of the jute mill machinery, based on the primary data collected from the sample survey under the study;
d. Quantify the potential benefit for upgradation of different types of machineries based on the primary data collected for the study;
e. Put forward necessary recommendations particularly for the policymakers and entrepreneurs.

3. METHODOLOGY OF THE STUDY

The study focuses on three areas related with the jute manufacturing sector; these are: a) current state of jute mills of Bangladesh in terms of their competitiveness in export and domestic market; b) projection of future demand for jute and jute goods both at local and global level; and c) productivity and efficiency of jute mills. All these areas have been dealt with specific methodologies which are discussed below.

Assessment of the current performance of jute manufacturing sector in Bangladesh: In order to assess the current status of jute manufacturing sector's performance both in export and domestic markets, a secondary data analysis have been carried out on production of different kinds of jute products such as hessian, sacking, yarn/twine, carpet backing cloth (CBC), other diversified products as well as raw jute. The data required for these analyses were collected from available sources such as International Jute Study Group (IJSG), Food and Agriculture Organization of the United Nations (FAO), United Nations Statistical Division (UNSD), Bangladesh Bureau of Statistics (BBS), Bangladesh Jute Mills Corporation (BJMC), Bangladesh Jute Mills Association (BJMA), and Bangladesh Jute Spinners Association (BJSA).

Export competitiveness of jute products from Bangladesh and other competing countries: In order to analyse the competitiveness of jute and jute products from Bangladesh in the global market, a comparative advantage analysis has been carried out using the Revealed Comparative Advantage (RCA) index.[1] The RCA index is defined as follows:

[Total Bangladesh's export of a product to World/Total Bangladesh's export to World (all products)]

[Total World's export of that product to World/Total World's export to World (all products)]

Relevant data was collected from the Trade Map database developed by the International Trade Centre (ITC), and was used to conduct an RCA analysis of Bangladeshi and Indian jute products considering the fact that India is the second largest jute exporting country.

Six digit HS (Harmonized Commodity Description and Coding System) product codes have been taken into consideration for this analysis.

Possible rise in future demand for jute and jute goods: An analysis of Substitution Index has been carried out in order to examine the substitutability of jute and jute alternates. Taking into account the Substitution Index as well as policy changes at home and abroad, an indicative discussion has been conducted on the possible rise of future demand for jute and jute goods at local and international markets.

Productivity analysis: Since productivity in industrial enterprises can be shown in a number of ways, the present study has put forward a set of productivity analyses of machinery and workers in relation to power consumption, and use of labour and time.[2]

The following definitions of productivity are considered for the analysis:

a) Productivity of an individual machine is defined as

$$Productivity = \frac{Production\ rate}{Power\ consumption}\ \text{(ton/hr)/kW}$$

b) Productivity of a worker for individual machine is defined as

$$Productivity = \frac{Production\ rate}{Number\ of\ workers}\ \text{(ton/hr)/man}$$

[1]The RCA index is defined as the ratio of two shares. The numerator is the share of a country's total exports to a country of the commodity of interest in its total exports. The denominator is the share of world exports of the same commodity in total world exports. The concept of RCA is used to identify a situation when free trade allows countries to gain from increasing specialisation in activities where they have (strong) comparative advantage (Rahman and Khaled 2011). According to RCA index, RCA>1 for a product implies that the exporting country of that product holds higher export specialisation than the world average export specialisation for that product (Leung and Cai 2005).

[2]Theoretically, 'productivity' analyses the technical processes and engineering relationships such as how much of an output can be produced in a specified period of time.

c) Productivity of machines in the individual process is defined as

$$Productivity = \frac{Production\ rate}{Number\ of\ m/c}\ \text{(ton/hr)/machine}$$

d) Productivity index of the individual mill is defined as

$$Productivity\ index = \frac{Number\ of\ workers}{Total\ production\ per\ day}\ \text{(man.day/ton)}$$

e) Productivity index of the individual mill is defined as

$$Productivity\ index = \frac{Total\ energy\ consumed}{Amount\ of\ total\ production}\ \text{(kW.hr/ton)}$$

Efficiency analysis: Efficiency of a mill refers to the optimum use of resources to produce a final unit of output. In this study, data on production, labour inputs, wages and number of machines have been collected for every section in order to generate frontier functions for each of the mills. These frontier functions are then used to compare and analyse the efficiency of the mills by a method known as Data Envelopment Analysis (DEA)[3] which selects one function that is the most efficient; standardises it; and then compares it to the other frontier functions.[4] Section-wise efficiency analysis will pinpoint the low efficiency in a section of a mill compared to that of the other mills in reference to labour and machinery usage.

Analysis of possible savings of costs and return through technological upgradation: The efficient and the not-so-efficient mills are compared in terms of machinery, workforce, energy use and processes. Based on the productivity analysis of machine, labour, maintenance schedule, process time for production as well as efficiency analysis, the performance of each of the jute mill can be graded. Although differences between jute mills in terms of cost, time and energy usages are based on the available samples, however these differences could be further widened if the standard of Indian jute mills are taken into account.

Field Survey: A total of 10 mills have been selected for survey by the study team in consultation with BJSA, BJMA and BJMC, based on their size, geographical location and performance. The mills are selected from both the private and public sectors including spinning and composite types. The selected 10 mills are then visited within a span of three months (during February-April, 2011).

Among the selected 10 mills, four are BJSA-enlisted (located at Demra, Narsingdi, Dhamrai and Faridpur); four are BJMA-enlisted (two from Khulna and one each from Jamalpur and Panchagarh); and two are BJMC-enlisted (located at Narsingdi and Demra).

In addition to these 10 mills, two other mills that manufacture spare parts for jute mill machinery have also been visited by the study team. These two are: Gulfra-Habib and Karnafully Engineering Works Ltd. (both in Chittagong).

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[3]Data Envelopment Analysis (DEA) is defined as a non-parametric method in operation research and economics for the estimation of production frontiers.

[4]A fundamental assumption behind the DEA method is that if a given producer, A, is capable of producing Y(A) units of output with X(A) inputs, then other producers should also be able to do the same if they were to operate efficiently. Similarly, if producer B is capable of producing Y(B) units of output with X(B) inputs, then other producers should also be capable of the same production schedule. Producers A, B and others can then be combined to form a composite producer with composite inputs and composite outputs. Since this composite producer does not necessarily exist, it is typically called a virtual producer.

The heart of the analysis lies in finding the 'best' virtual producer for each real producer. If the virtual producer is better than the original producer by either making more output with the same input or making the same output with less input, then the original producer is inefficient. The subtleties of DEA are introduced in various ways that producers A and B can be scaled up or down and combined.

4. CURRENT STATE OF JUTE MANUFACTURING SECTOR IN BANGLADESH

4.1 Production

Production of jute items in Bangladesh has remained invariant over the last three decades hovering around 550 to 600 thousand metric tonnes (MT) per year. It was only during FY2009-10 that the total production crossed the level of 700 thousand MT. Strikingly, product composition has experienced a considerable change over the years (Figure 1); even within a decade, share of hessian in total production has decreased from 17.2 per cent in FY2000-01 to 7.3 per cent in FY2010-11, while share of yarn increased from 31.3 per cent to 58.3 per cent. Sacking was the most produced jute products in Bangladesh till the 1980s because of its global demand as a packaging item. However, the demand significantly decreased in the later years owing to the rise of bulk-scale packaging system, as well as for the rise of polypropylene products. Conversely, yarn has gradually taken the greater market share since late 1990s because of its global demand as an intermediate product. Total yarn production during FY2009-10 stood at more than 300 thousand MT, having doubled within a decade. On the other hand, yearly production of sacking has come down to half from over 300 thousand MT to about 170 thousand MT since early 1980s. The production of CBC and carpet has also gradually decreased over the years. Production of carpet became zero in recent years, although it was once a profitable exporting product of Bangladesh during the early 1980s till late 1990s. In fact, lower competitiveness over synthetic variety made the jute carpets an unattractive item. Consequently the production of jute carpets has gone down to almost zero in Bangladesh although global demand for carpets and 'textile floor covering' (HS code 570500) has gradually increased over time.[5] Growth in production has linkages with capacity utilisation of machines overall. Capacity utilisation in terms of using looms for the production remained at 80 per cent before 1990s, and kept declining with time. However, capacity utilisation of hessian, sacking and 'others' products show marginal rise in recent years (Figure 2).

Figure 1: Production of Jute Products: FY1994-95 to FY2010-11

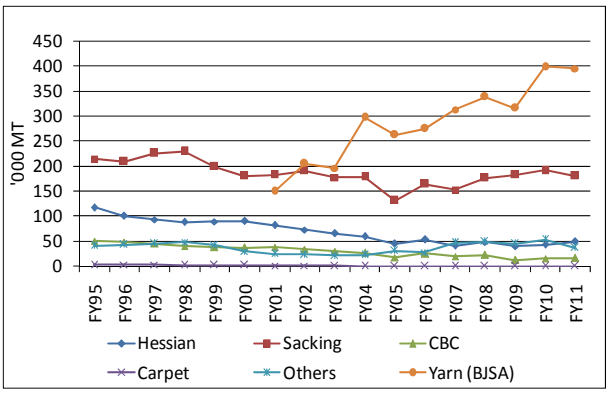
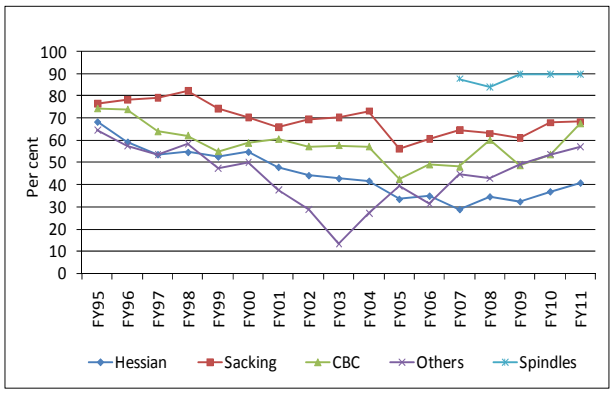


Figure 2: Capacity Utilisation of BJMC and BJMA Mills: FY1994-95 to FY2010-11



Source: BJMA (up to May 2011); BJMC, BJSA (provisional).

India and Bangladesh are the major producers of jute goods, and they collectively produced about 2.2 million MT during 2009.[6] However, growth of production during 1992-2009 was merely 0.96 per cent, which portrays low growth in the demand for jute and jute goods at the global level, particularly outside India. The largest market for jute products is in India which depends on their domestic production. Unlike that of India, consumption of jute products in Bangladesh has not

[5]Data collected from Trade Map database developed by the International Trade Centre (ITC).

[6]International Jute Study Group (IJSG) Database.

experienced any considerable rise over the years (Figures 3 and 4). However, prospect for Bangladesh's jute manufacturing industry depends on how the industry will respond with the changes in policies and actions at local and global levels.

Figure 3: Bangladesh Export and Local Consumption

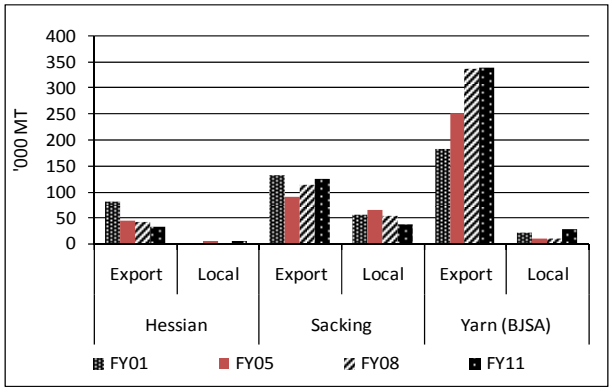
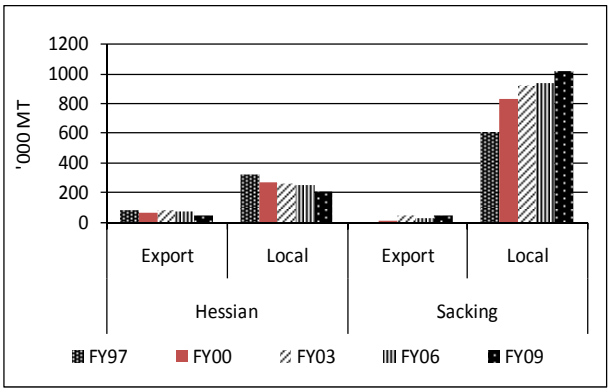


Figure 4: India Export and Local Consumption



Source: BJMA (up to May 2011); BJMC, BJSA (provisional); and IJSG.

4.2 Export

Bangladesh's jute industry is overwhelmingly dependent on export market, with more than 85 per cent of its total production exported every year. But export of jute products has had marginal contribution in total export share of Bangladesh since 1990s. Jute has recently become the third most exported item after knitwear and woven garments overtaking frozen foods. According to the Export Promotion Bureau (EPB) of Bangladesh, during FY2011-12, export of jute and jute products accounted for USD 974 million with about 40 per cent growth both in terms of value and volume than the previous year. This rise can mainly be attributed to rise in export of yarn.

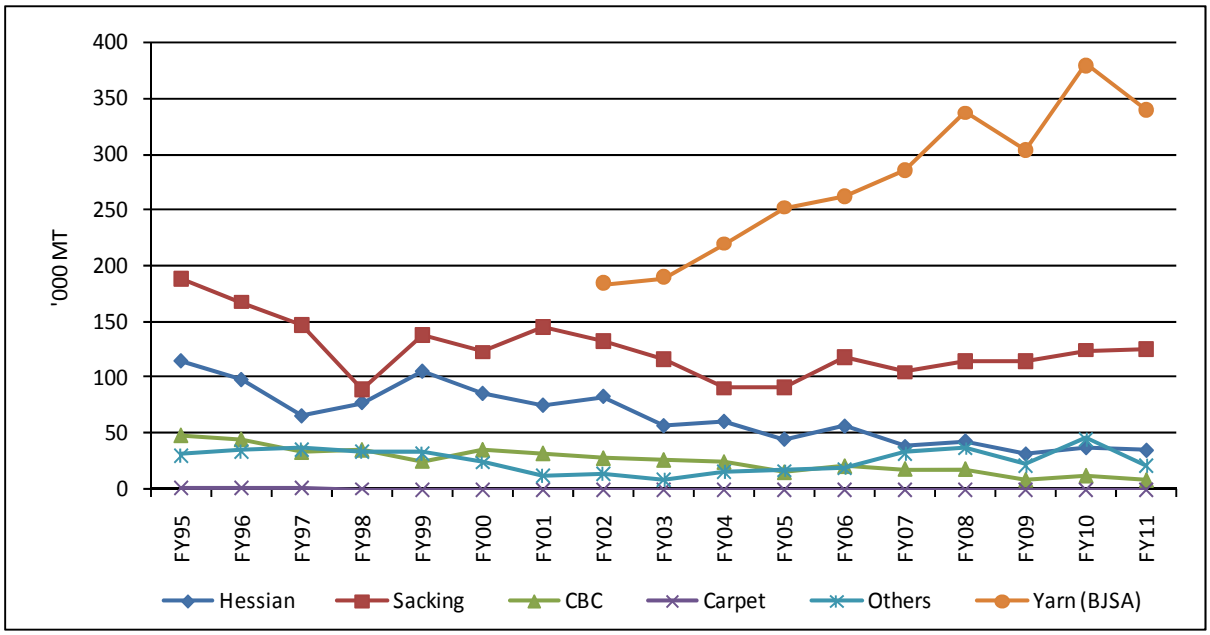
Yarn export has increased at a compound annual growth rate (CAGR) of 4.5 per cent over the last six years.[7] Sacking had a sluggish trend of growth of 1 per cent per year during the same period. The export of other jute products has been decreasing over the last two decades (Figure 5). In case of CBC and carpet products, with good marketing strategies, Bangladesh still has a good chance of increasing its export to global market.

Recent export performance of jute industry can be attributed to the rise in the price of jute products in the global market (Figure 6). Per MT price of different categories of products in FY2010-11 was as follows: Tk. 109,778 for hessian, Tk. 74,041 for sacking and Tk. 73,835 for yarn which was 34, 26 and 9 per cent higher compared to that in FY2009-10. Over the last six years, prices for sacking, yarn and hessian increased by 14 per cent, 8.8 per cent and 11.1 per cent respectively, while volume of export has increased by 1 per cent and 4.5 per cent respectively, and conversely declined in case of hessian products (-7.8 per cent). A part of this price rise is cost-push which is transferred from high cost of production, owing to high price of raw jute.

[7]CAGR is a business and investment-specific term for the smoothed annualised gain of an investment over a given time period. CAGR is not an accounting term, but remains widely used, particularly in growth industries or to compare the growth rates of two investments because CAGR dampens the effect of volatility of periodic returns that can render arithmetic means irrelevant. CAGR can be computed by the following formula:

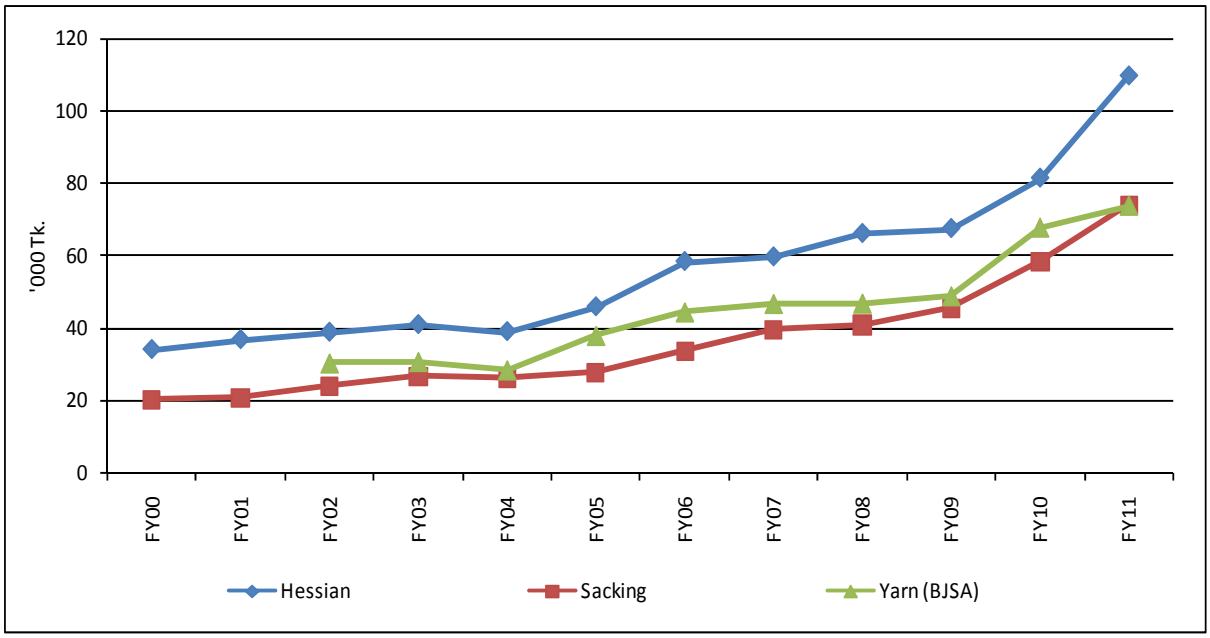
$$CAGR = \left(\frac{Ending\ value}{Beginning\ value}\right)^{\frac{1}{Number\ of\ years}} - 1$$

Figure 5: Export of Different Jute Products: FY1994-95 to FY2010-11



Source: BJMA (up to May 2011); BJMC, BJSA (provisional).

Figure 6: Unit Price of Export of Jute Products



Source: BJMA (up to May 2001); BJMC, BJSA (provisional).

4.3 Domestic Consumption

Domestic market for jute products is very limited in Bangladesh with a share of less than 15 per cent of total production which accounts for about 90,000 MT of raw jute. There has been minimal change in domestic demand over the years. This is a sharp contrast to the domestic consumption in India, where more than 80 per cent of total production is consumed locally, and registered rise every year (e.g. sacking). Indian government's direct policy intervention through enactment of the *Jute*

Packaging Materials Act 1987 for foodgrains and other products has made significant contribution towards rise in domestic consumption of jute goods.

Domestically the most consumed jute product is sacking which accounts for 49.6 per cent of the total domestic demand. Data from FY1994-95 to FY2010-11 reveal that domestic consumption of sacking fluctuated over time, and demand for hessian products remained constant during that period (Figures 7 and 8). CBC exhibited a slow but steady growth in quantity over the last decade explaining stable demand in the local market. Demand for jute-made carpets in the local market remained always very insignificant and came down to almost nil in the recent years. One promising part is growing domestic demand of yarn in the local market. In the last few years, domestic demand for yarn has registered an average growth of 10 per cent while it was as high as 90 per cent in FY2010-11.[8] Domestic demand for sacking product has experienced ups and downs since it reached the highest level in FY1997-98 (72,000 MT).[9] In value terms, local demand for sacking experienced sharp rise over the last five years; in fact, all categories of products have experienced positive changes during the same period. A part of this high growth in the value of production is related with rise in the price of jute products; during 2007-2011, price per ton of sacking and hessian increased by 21 per cent and 18 per cent respectively. Price of yarn has experienced a decline during most of the part of that period. It should be noted here that sacking and yarn are actually consumed by only a marginal share of their total potential market. So, it is expected that with the implementation of a new Act by the Government of Bangladesh (GoB) (namely *Mandatory Use of Jute for Packaging Products Act 2010)*, domestic consumption of jute products, particularly sacking products, would be considerably increased.

Figure 7: Domestic Consumption of Jute Products (Volume)

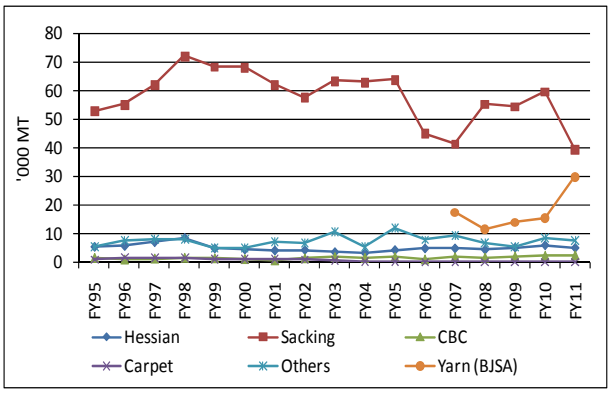
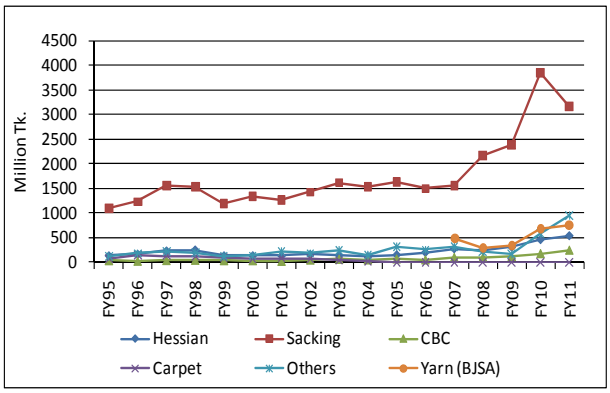


Figure 8: Domestic Consumption of Jute Products (Value)



Source: BJMA (up to May 2011); BJMC, BJSA (provisional).

Low price of jute products at domestic market is not so encouraging for the manufacturers. High differentials in export returns vis-à-vis domestic return discourage manufacturers from selling at the local market. Export is always considered to be attractive as entrepreneurs receive higher value and cash incentives over the export price of jute products at 10 per cent over the export value.

5. COMPETITIVENESS OF JUTE PRODUCTS OF BANGLADESH IN THE GLOBAL MARKET

The competitiveness of jute products is measured using the RCA index for Bangladesh and India. According to Table 1, the RCA index for all major jute products exported from Bangladesh is substantially higher than 1, thereby indicating their strong competitiveness in the global market.

[8]Calculated based on the data provided by the Bangladesh Jute Spinners Association (BJSA).

[9]One possible reason could be government buying of sacks for relief work during the 1998 flood in Bangladesh.

Although RCA value for India's jute products are not as high as that of Bangladesh, their values nonetheless are higher than 1. Differences in RCA values of major products between Bangladesh and India are wide in favour of Bangladesh. However, over the years these differences have marginally decelerated. There are some products where Bangladesh's comparative advantage has increased while India's declined (e.g. carpets); in case of some products, both Bangladesh and India have experienced gradual fall of their comparative advantages (e.g. yarn, twine). For a country like India which is the largest producer as well as consumer of jute products, RCA analysis would not provide a good view on competitiveness.[10]

Table 1: Revealed Comparative Advantage Index of Selected Jute Items for Bangladesh and India

HS Code	Description	Bangladesh			India		
		2002	2006	2010	2002	2006	2010
530310	Jute and other textile bastfibres, raw or retted	616.9	945.2	574.7	1.5	0.8	19.0
530390	Jute and other texbastfib,notspun,nes;tow and waste of these fibres	367.3	616.0	383.4	1.1	0.3	4.0
530710	Yarn of jute or of other textile bastfibres, single	1191.6	1710.8	689.3	18.3	6.5	8.9
530720	Yarn of jute or of oth textile bastfibres, multiple (folded) or cabled	244.0	122.9	539.4	32.5	29.0	23.9
531010	Woven fabrics of jute or of other textile bastfibres, unbleached	534.0	372.5	185.8	48.6	45.8	54.7
531090	Woven fabrics of jute or of other textile bastfibres, o/t unbleached	159.4	588.7	103.1	4.1	2.6	22.4
560710	Twine, cordage, ropes and cables, of jute or other textile bastfibres	902.9	966.2	58.8	10.2	19.3	3.7
570500	Carpets and other textile floor coverings, nes	0.6	2.9	0.1	31.6	33.5	9.1
630510	Sacks and bags, for package of goods, of jute or of other textile bastfibres	1079.0	402.6	206.4	29.4	33.0	24.1

Source: Authors' calculation using UN Comtrade Database through World Integrated Trade Solution (WITS) of the World Bank.

The RCA for jute-made carpet is very low for Bangladesh unlike that of India. This reveals that Bangladesh has the potential to increase the export of jute-made carpets through proper marketing strategy as it has the price advantage. A study by Rahman and Khaled (2011) reveals that per ton production of jute carpet costs USD 6,658 for India whereas for Bangladesh it stands at USD 3,594.

6. PROJECTION OF DEMAND FOR JUTE PRODUCTS

Analysis of domestic and international market predicts a rise in the demand for jute and jute goods in the future. Changes in domestic policies and actions towards raising awareness of natural fibres at global level, and announcing 2009 as the *Year of Natural Fibre*, as well as corporate initiatives against the use of polythene and polypropylene products signal an expansion of market for jute goods.

6.1 Substitutability of Traditional Jute Goods

Since the prospect of jute goods depends on their substitutability over alternative products, an exercise has been carried out in order to derive the extent of substitution of traditional jute goods namely fabric goods with that of synthetic fabrics. In this case, the synthetic fibre in question is

[10]Since RCA index does not take into account domestic consumption, only a part of total production has been covered under the RCA analysis.

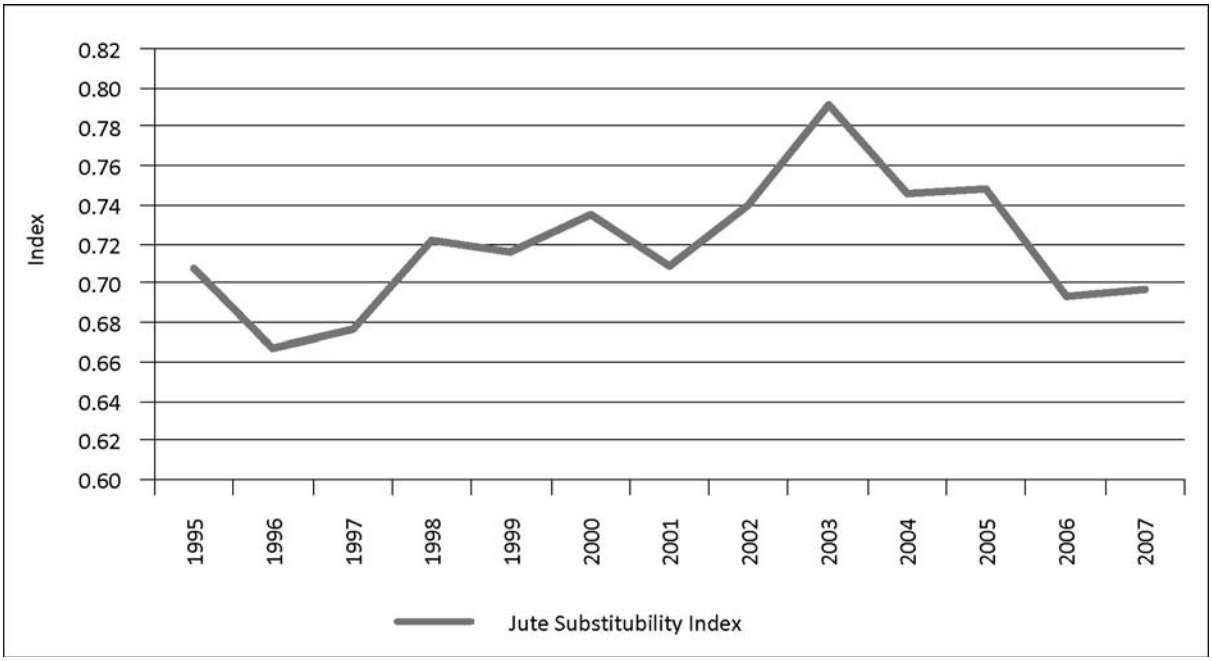
denoted as PP (polypropylene) film fibre.[11] The Jute Substitutability Index aims to assess substitution effect of synthetic goods, i.e. polypropylene goods on jute goods in this case.[12] The Jute Substitutability Index can be computed by:

$$JSI = \frac{\text{Actual PP Film Fibre Production (in a particular year)}}{\text{Actual PP Film Fibre Production + Actual Jute Fabric Production (in a particular year)}} \times 100$$

Thus, the degree of 'encroachment' into jute market by PP fabrics can be estimated.[13]

Figure 9 shows the Jute Substitutability Index for the period of 1995-2007. It hovers around the 70 per cent mark which implies that PP fabrics have maintained a vast share of the market for packaging and sacks as well as carpet backing materials. Jute Substitutability Index had a positive trend until 2003, which implies the increasing preference of consumers for polypropylene goods

Figure 9: Jute Substitutability Index



Source: Authors' estimation.

[11]The methodology utilised in this exercise is largely derived from that used in the International Development Ireland Limited report titled, *The Jute Manufacturing Sector of Bangladesh*.

[12]This has been done so by first assuming, if polypropylene polymer technology were not to exist, then it would only be rational to assume that the demand for polypropylene goods would be filled in by jute goods. In this hypothetical scenario, the jute goods market comes to envelop the market for polypropylene products, as now polypropylene production is absent. Thus, from the previous figure, for say, 1998, in absence of polymer technology, jute production would have swelled to sum of actual jute production and actual polypropylene film fabric production.

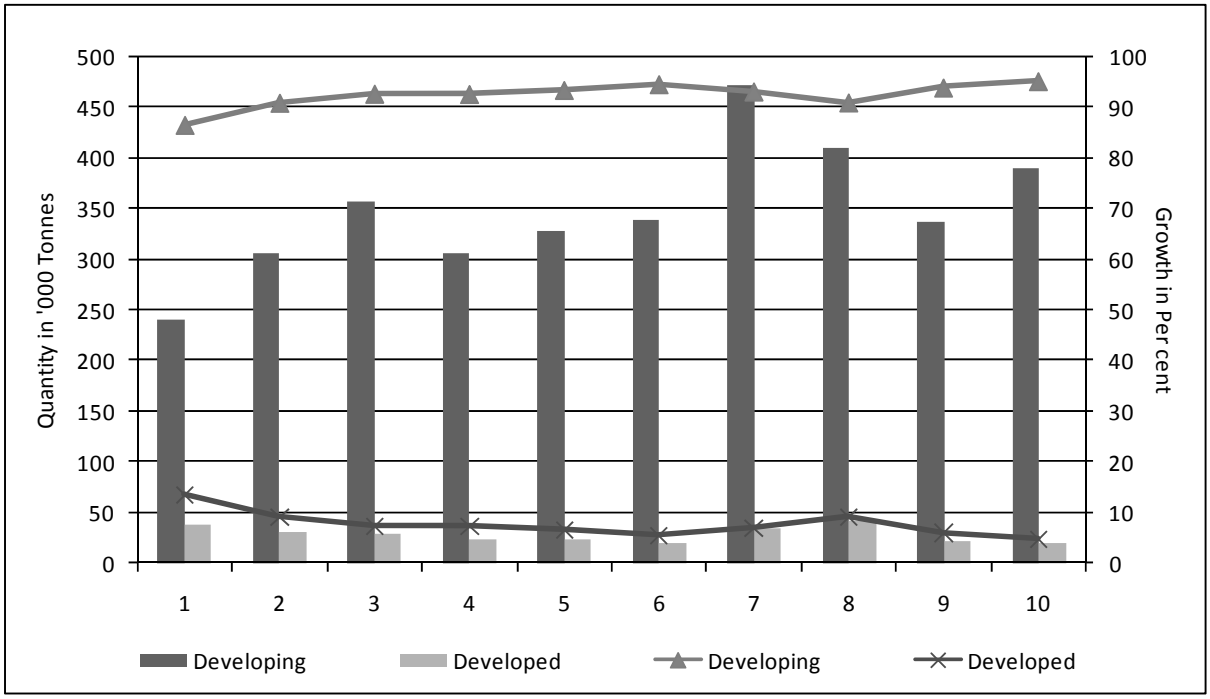
[13]It must be stated here that production of jute fibres has been approximated as production of jute goods for the purpose of the study. Furthermore, in deriving the PP fibre production data, as no sufficient data source was found for worldwide production, what was done for this purpose was, first find out yearly proportion of PP film fibre production to total PP polymer production for the years 1980 to 1989, with the necessary data derived from a study report (International Development Ireland Limited 1992). Then for these 10 years, average is calculated from the PP film fibre shares which have been previously calculated for each year. This average PP film fibre share has been later applied to the yearly PP polymer production for the years 1995-2007. Data for world production of polypropylene fibres have been sourced from the UNSD. Thus we have arrived at an approximation of production for PP film fibre for these 12 years, as data directly related to world production of PP fabrics have been hard to locate.

over jute goods. However, since then there has been a declining trend in the index – which can be attributed to a variety of factors. Polypropylene goods are losing its foothold among consumers, and this apparent shift in consumer tastes can be attributed to an increasing awareness of the harmful aspects of polypropylene production and its enormous potential for environment pollution due to its non-bio-degradable nature. On the other hand, jute is highly environment-friendly and is also bio-degradable; thus, getting increasingly popular. Another possible reason could be the rise in petroleum price during 2007-2008, which is the main raw material for polypropylene production. This perceived downturn for polypropylene fabrics, which in the 1990s and 2000s have steadily supplanted jute in many markets worldwide, can be seen as a boon for jute products and jute producers in general.

6.2 Potentials in International Market

Global market for jute products is overwhelmingly dependent upon developing countries. More than 90 per cent of the demand for jute goods originates from a handful of Asian countries (Figure 10). While demand for jute goods in developing countries has gone up, demand for jute goods in developed countries indicates a decreasing trend. India, China and Pakistan accounted for more than 75 per cent of the global import of jute goods (312,000 MT in 2009), primarily because of the demand for packaging of foodgrains and other consumer goods. Bangladesh should primarily target these markets as part of its strategy to expand market where at present Bangladesh exports only 36.6 per cent of the total exports of jute goods. There are a number of markets sparsely located in Europe, Africa, Latin America and North America where Bangladesh exports a sizable share of its jute products. The list includes Turkey (16.6 per cent of total export of jute goods), Belgium (3.7 per cent), Russia (1.8 per cent) and Netherlands (1.3 per cent) in Europe; Iran (8.9 per cent), Indonesia (1.0 per cent), Syria (3.2 per cent) and Vietnam (1.1 per cent) in Asia; Egypt (3.8 per cent) and Sudan (6.2 per cent) in Africa; Brazil (1.6 per cent) in South America; and USA (1.6 per cent) in North America. Recent rise of global awareness on jute products may create new demand particularly in developed countries such as USA, Canada, Australia and Japan, where consumer groups are becoming

Figure 10: Import of Jute Goods



Source: International Jute Study Group (IJSG) website.

increasingly conscious of carbon footprint of consumer goods (Rahman and Khaled 2011). With a good marketing plan Bangladesh can take the opportunity to get a hold on these markets.

6.3 Potentials in Local Market

In October 2010, the National Parliament has approved a new act titled *Mandatory Use of Jute for Packaging Products Act 2010* in order to reduce the use of artificial packaging materials for supply and distribution of products. According to the Act, all kinds of products must be packed using jute-based packaging materials.[14] Such an Act, if properly implemented, will create a huge domestic demand for jute products. Jute products are commercially used mostly for packaging agro-products such as rice, wheat, pulses, oilseeds, potato and sugar. This Act would also increase use of jute sacks (with some modifications) for packaging cement and seeds. A huge market for packaging of different kinds of processed consumer goods may be the next target.[15]

To project the possible rise in demand for jute-based packaging materials in the domestic market, an analysis has been carried out by using production data of major agricultural products which would be the first targets for ensuring 100 per cent use of jute-based materials for packaging. In this analysis, production data on FY2009-10 has been used, particularly for agricultural products such as Aus, Aman and Boro rice, potato, wheat and sugar. It is assumed here that if the Act is fully enacted, packaging of all these products will be replaced by jute bags.

CPD estimates show that full utilisation of jute bags for packaging of those products may create a market for 841 million jute bags of the size 50 kg per bag (Table 2).[16] This huge demand requires about 504.7 thousand MT of raw jute. During FY2009-10 total raw jute used by BJMC, BJMA and BJSA for manufacturing products for domestic market was about 90 thousand MT which indicates a substantial domestic requirement of raw jute in the future to meet the additional requirements. According to anecdotal information, 20 per cent of total requirement of packaging has been met by jute bags particularly for rice, wheat and sugar mills; on the other hand, packaging of cement still takes place through traditional paper bags. Thus enactment of the *Mandatory Use of Jute for Packaging Products Act 2010* would increase consumption of raw jute by more than 450 per cent. A similar level of growth is likely in the case of jute bags.

Table 2: Requirement of Jute Bags under the Enactment of *Mandatory Use of Jute for Packaging Products Act 2010*

Component	Aus	Aman	Boro	Wheat	Pulses	Oilseeds	Potato	Sugar	Total
Production ('000 MT)	1709.0	12207.0	18341.0	969.0	221.0	377.0	8168.0	62.2	42054.2
No. of jute bags required ('000)	34180	244140	366820	19380	4420	7540	163360	1244	841084
Quantity of jute required ('000 MT)	20.5	146.5	220.1	11.6	2.7	4.5	98.1	0.7	504.7

Source: Estimated on the basis of Ministry of Finance (MoF) data.
Note: Based on the production data for FY2009-10.

[14]The Act will not be enforceable on products which government removes through specific gazettes taking into account difficulties and constraints for using jute for packaging.

[15]Significant improvement will be required in existing type of jute-based packaging materials.

[16]According to the survey, one bale (180 kg) of raw jute is used for production of 300 jute bags.

7. STATUS OF SAMPLE JUTE MILLS: MACHINERY, WORKERS, RAW MATERIALS, MAINTENANCE WORKS AND MANAGEMENT

This section highlights the state of 10 sample jute mills relative to machinery, workers, raw materials, maintenance works and management (see Table 3 for a summary). The findings of the sample mills by and large resemble the national level data.

Table 3: Summarised General Information of the Visited Mills

Criteria	Mill									
	1	2	3	4	5	6	7	8	9	10
Year of establishment	Before 1971	1966	1983	1981	1969	1968	1967	2003	1962	1953
Location	Narayanganj	Narsingdi	Dhamrai	Faridpur	Khulna	Khulna	Jamalpur	Panchagarh	Narsingdi	Demra
Total floor space (m^2)	18902	46548	6000	12141	52609	49614	145687	20234	89031	254952
Total area (m^2)	52040	185737	17500	68797	76890	226624	157827	137593	222577	339936
Available free land (m^2)	9290	29925	6500	56656	27114	178062	12141	-	133546	84984

Source: BUET Survey (2011).

7.1 Machinery Installed and Operated in Different Sections

Machinery use in a jute mill largely depends on its nature and volume of operation as well as the kind of processing activity the mill specialises in. For example, the extent of machinery use is higher for spinning and weaving sections as opposed to the other sections of the mill. Although it is advisable to maintain a balance in the machinery use amongst different sections of the mill, such is not the case in any of the sample jute mills (Table 4). Average number of machines in sample jute mills is 317 – with BJMC at the peak (708), followed by BJMA (321), and BJSA (117). Because of the composite nature, number of machines is relatively high in BJMC and BJMA mills; yet, there is a large gap between that of the BJMC and BJMA mills mainly due to the difference in the size of their operation.

Table 4: Average Number of Machines in Sample Jute Mills

Section	Spinning	Composite	Public	Overall
Softening	4	3	6	4
Carding	20	15	37	22
Drawing	29	23	45	30
Spinning	33	36	89	45
Winding	31	11	18	20
Beaming		5	8	6
Weaving		228	503	320
Calendaring		2	4	3

Source: CPD Survey (2011).

Technology used in the jute manufacturing sector did not change much over the years, possibly owing to minimal changes in the final demand of products. Most of the machines in jute mills are old and are running beyond the usual functional period. By means of proper maintenance and replacement of parts, these machines can perform as good as new ones. Most sample mills use

machines which are manufactured by Mackie, Fraser, as well as Logan, an Indian company.[17] Local jute mill machinery companies manufacture machines and spare parts mostly following the blue-prints of Mackie and Fraser companies since the main machine frames in most jute mills are from those companies.

Although the major machineries used in each of the sections are fairly similar, sample mills apply additional machineries in order to enhance production. For example, some composite mills are found to use both softener and spreader machines in the production process; some mills use trolley for handling output in spreading and carding sections; some mills use overhead blowers in spinning frame for cleaning and smooth operations; some use flyers and bobbins to increase production; and yet some have replaced ring flyers with baxter flyers for attaining higher rotation per minute (rpm). Similarly, new techniques are applied by the mills. For example, operations of drawing of some sample mills take place at four stages; similarly, 110 spindles frame is being used in some mills; yarn teasers and teaser card machines are used to recycle the wasted fibres; dust shakers are used in some mills; use of hydrometer at the collecting zone to measure the humidity ratio of raw jute is another example; rail tracks are available in the premises for the transportation of raw materials. While old machines predominate the overall composition of machinery used, installation of new machines either for replacement or expansion of operations is becoming more apparent now-a-days.[18] Such machines are manufactured in China (Janying Mackie, GETM) and India (Logan). In general, entrepreneurs are yet to consider full replacement of old machineries as a mechanism to upgrade productivity.

Underutilisation of machine capacity has been a longstanding concern for the jute mills of Bangladesh. There has been significant improvements in capacity utilisation of the mills in recent years as found in the sample jute mills (Table 5). Although only one sample mill is fully efficient in capacity utilisation of resources, average capacity utilisation has increased compared to what was observed several years back (Moazzem *et al*. 2009). With high global demand for yarn, BJSA mills are more efficient in capacity utilisation. In contrast, low rise in the global demand for hessian and sacking products may be the reason for underutilisaiton in BJMA and BJMC mills. Capacity underutilisation is most prominent in weaving section of all composite mills, which is partly reflected in low capacity utilisation of backward and forward parts of the production chain (Table 6). In other words, ensuring higher capacity utilisation in the main sections of the production chain (e.g. spinning and weaving section) will have a positive impact in the capacity utilisation in other parts.

[17]Anecdotal information reveals that recently prototype machines of Mackie and Fraser companies are being manufactured in China.

[18]For example, new spinning frames are installed in some jute mills in order to get better productivity.

Table 5: Operational State of Installed Machines

(in Per cent)

Mill Category	Sample Mill	Softener	Spreader	Breaker Card	Finisher Card	First Drawing Machine	Second Drawing Machine	Third Drawing Machine	Spinning Machine	Winding Machine	Beaming Machine	Weaving Machine	Calendaring Machine
Spinning	1	100	100	100	100	100	100	100	100	100	-	-	-
	2	100	100	100	60	100	100	100	45	50	-	-	-
	3	100	100	100	100	100	100	92	100	86	-	-	-
	4	50	-	100	100	100	100	100	100	91	-	-	-
Composite (BJMA)	5	67	-	100	100	90	88	100	100	100	100	76	100
	6	-	100	100	100	100	100	100	94	100	100	92	-
	7	67	-	67	80	63	71	73	51	69	60	60	100
	8	75	-	100	86	78	80	73	76	80	57	63	50
Composite (BJMC)	9	100	100	93	94	100	100	100	99	94	71	79	100
	10	75	100	94	100	100	100	100	98	88	89	84	100

Source: CPD Survey (2011).

Table 6: Section-wise Capacity Utilisation of Machines

Mill Category	Softening	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring
Spinning	1.00	1.00	1.00	1.00	1.00	-	-	-
	0.75	0.58	0.75	0.45	0.75	-	-	-
	1.00	1.00	0.97	1.00	0.86	-	-	-
	0.50	1.00	1.00	1.00	0.91	-	-	-
Composite	0.67	1.00	0.94	1.00	1.00	1.00	0.76	1.00
	1.00	1.00	1.00	0.94	1.00	1.00	0.92	-
	0.44	0.75	0.69	0.51	0.69	0.40	0.40	1.00
	0.75	0.88	0.76	0.76	0.80	0.38	0.42	0.33
Public	1.00	0.94	1.00	0.99	0.94	0.48	0.53	0.67
	0.80	0.98	1.00	0.98	0.88	0.89	0.84	1.00

Source: CPD Survey (2011).
Note: Value of '1' denotes optimum utilisation.

7.2 Workers

Manufacture of jute goods is a highly labour-intensive activity. About 1,000 workers are employed in each of the sample jute mills, on average. Number of workers in BJSA mills is lower than in the BJMA or BJMC mills, perhaps due to lower operational requirement of workers in spinning mills. BJMC mills use twice as much as workers compared to that of the BJMA mills though they have the same number of machines. Higher number of machines and labour in BJMC mills could be justified by a higher level of production. However, that is not the case for the sample jute mills.

There is no standard practice for the use of workforce in different sections of jute mills (Figure 11). Numbers of workers employed in different sections widely vary amongst the sample jute mills, which is reflected in the high value for standard deviation in different sections of jute mills (from 22.6 in calendaring sections to as high as 376.3 in weaving sections). This difference is partly related to the size of operation, number of shifts in daily operation and types of products produced.[19] Man-machine ratio is more homogenous in carding, drawing, spinning and weaving sections, but less so in softening, winding and calendaring sections (Figure 12).

Figure 11: Number of Workers in Different Sections

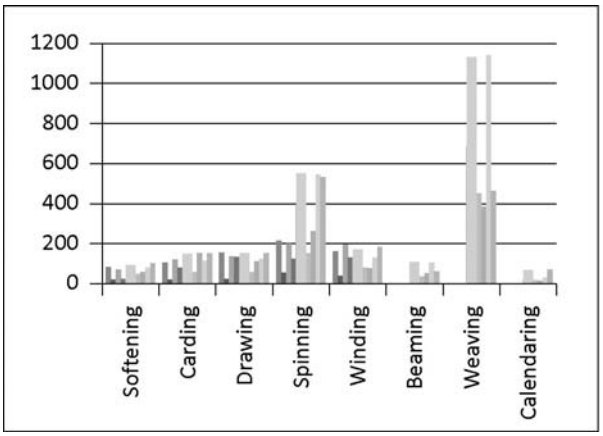
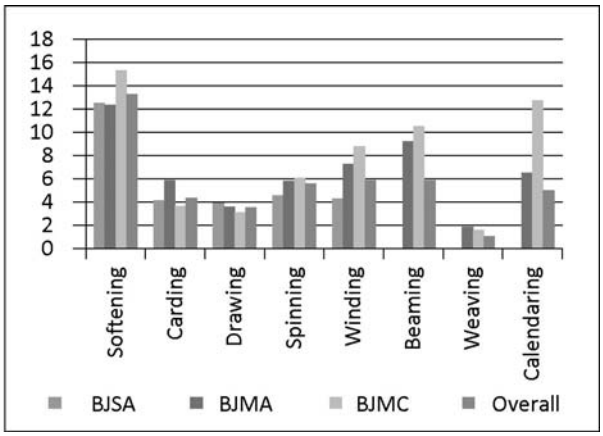


Figure 12: Worker-Machine Ratio



Source: CPD Survey (2011).

[19]Variation of products in case of yarn/twine and hessian/sacking is limited.

It is important to note that the average number of workers employed in sample jute mills was found to be about 39 per cent less compared to what was found in a sample survey in 2007 (Moazzem *et al*. 2009); the reduction of employment was as high as 44 per cent in case of spinning mills (Table 7). With less use of workers in a state of better capacity utilisation of machineries, output per worker is likely to be significantly higher in sample jute mills in 2011. This is reflected in the production per worker, which is 33.4 MT per day in 2011 as opposed to 11.8 MT in 2007. Although part of the rise in labour productivity can be attributed to higher capacity utilisation of machines, the extent of rise in productivity nonetheless appears to be exaggerated due to the small size of samples.

Table 7: Average Number of Workers in Different Sections in Sample Mills

Mill Category	Average Number of Workers								Total Workers (2007)	Total Workers (2011)	% Change between 2007 and 2011
	Softening	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring			
BJSA	50	82	113	150	133	-	-	-	949	528	-44.3
BJMA	37	88	83	209	80	46	425	13	1234	979	-20.7
BJMC	92	134	140	540	158	84	801	51	2434	1998	-17.9
Overall	53	95	106	251	117	35	330	15	1629	1002	-38.5

Source: CPD Survey (2011).

Jute manufacturing in Bangladesh has always been male-driven activity because of the labourious work in most sections. The presence of male workers is relatively high especially in spinning, weaving and calendaring operations (Table 8). A number of sample mills, particularly BJMC mills are found to be entirely male-dominant for all operations. Female employment is mostly found in drawing, carding and softening sections where the activities are relatively less skill-oriented and less labourious in nature. However, hiring female workers in skill-oriented and labourious activities is not absolutely rare; a number of mills appoint females in spinning and weaving sections which indicates scope for female employment in skill-based activities as well. Given the scarcity of skilled male workers, increasing the number of female employment in the jute mills is a plausible option.[20]

Table 8: Share of Male and Female Workers in Sample Jute mills

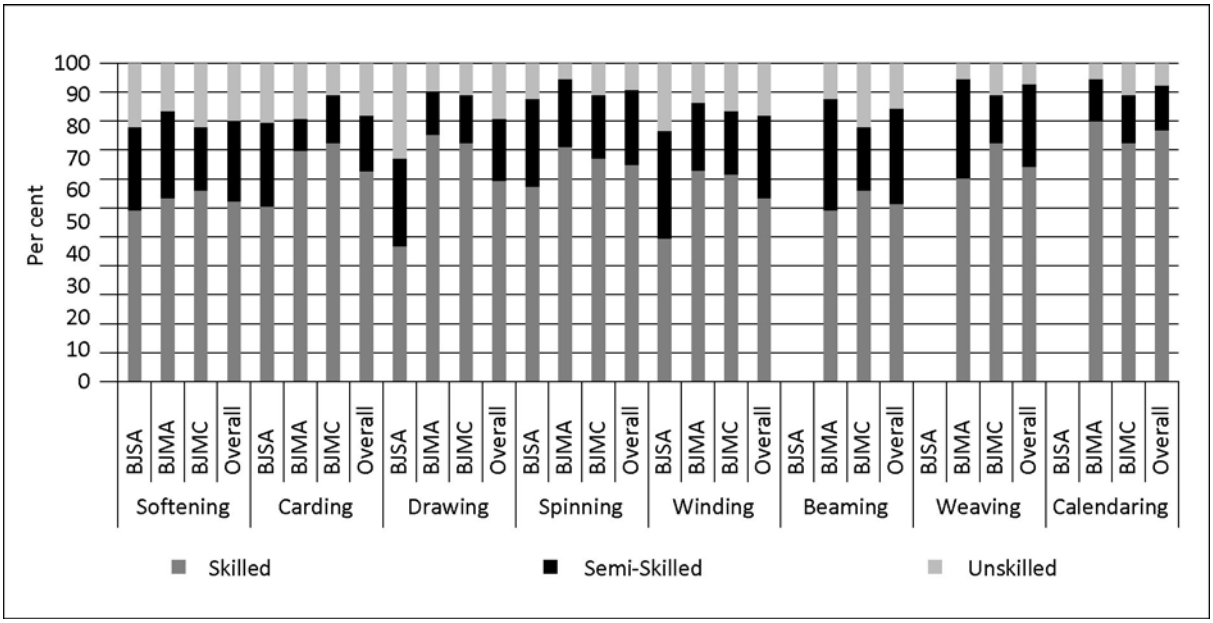
Sample Mill	Softening		Carding		Drawing		Spinning		Winding		Beaming		Weaving		Calendaring	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1	60.7	39.3	60.0	40.0	59.6	40.4	59.7	40.3	61.1	38.9						
2	70.0	30.0	60.0	40.0	66.7	33.3	78.6	21.4	90.0	10.0						
3	25.0	75.0	19.5	80.5	26.1	73.9	49.3	50.7	66.7	33.3						
4	75.0	25.0	55.6	44.4	57.8	42.2	61.9	38.1	63.6	36.4						
5	87.5	12.5	40.5	59.5	66.7	33.3	91.5	8.5	76.7	23.3	100.0	0.0	100.0	0.0	83.3	16.7
6	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0		
7	25.0	75.0	50.0	50.0	50.0	50.0	60.8	39.2	55.6	44.4	66.7	33.3	100.0	0.0	100.0	0.0
8	80.0	20.0	58.8	41.2	45.9	54.1	90.9	9.1	100.0	0.0	70.6	29.4	78.1	21.9	60.0	40.0
9	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
10	91.2	8.8	88.2	11.8	88.2	11.8	89.9	10.1	90.2	9.8	100.0	0.0	100.0	0.0	91.7	8.3

Source: CPD Survey (2011).

Manufacturing of jute products is by and large a skill-driven activity; about 60-80 per cent of total workers are skilled, 15-25 per cent semi-skilled, and rest are unskilled workers (Figure 13). Skill-based works are mostly in spinning, weaving and calendaring sections, while the number of unskilled workers is relatively high in the softening, carding and drawing sections. Female workers are mostly found in the latter sections as well.

[20]Young female workers find better jobs in other manufacturing sectors, particularly in readymade garments (RMG), which also might make them less interested to work in jute manufacturing sector.

Figure 13: Composition of Workers according to Skills



Source: CPD Survey (2011).

Scarcity of workers is a major concern in the jute manufacturing sector; difference in wages between the jute manufacturing sector and the other sectors being the main reason. Large differences in wages were observed in the agriculture sector during the peak seasons, off-farm jobs in rural areas, and jobs in the informal sector. Average wage of jute mill workers is about Tk. 153 per day; if wages for BJMC workers excluded, it was a mere Tk. 143; and wages of unskilled workers (mostly temporary workers) is about Tk. 90-120. Conversely, average wage of agricultural workers in December 2010 is estimated to be Tk. 163[21]; some workers mentioned that pulling rickshaw/van would ensure a daily return of Tk. 300. Although workers in jute mills are compensated by means of in-kind benefits in terms of housing facilities, schooling facilities, etc., those are not considered to be adequate compared to high-paid off-farm jobs. In order to create a large pool of potential workers and to retain them, some mills pay higher wages (Tk. 210 per day).[22] Therefore, revision of existing payment structure needs to be considered in the jute manufacturing sector.

A major reason for low wages according to the mill management is the pressure for high labour cost per unit of output. Labour cost for manufacturing one MT of jute products is about Tk. 14,000 and varies between mills – from as low as Tk. 3,750 in BJSA mill to as high as Tk. 26,862 in BJMC mills. Although differences in the size of operations (relatively less in BJSA mills) partly account for the higher labour costs, a large part of it is associated with wide differences in labour productivity. Per ton labour cost is found to be the highest in most sections of BJMC mills (Table 9). This high labour cost can be mainly attributed to low machine and labour productivity and higher wages. Relatively lower wage cost in BJSA mills in comparable section appears to be associated with better productivity in machines and workers, particularly in spinning operations. Skilled workforce in key activities with better wages is likely to ensure higher productivity in jute mills.[23]

[21]Estimated on the basis of Bangladesh Bureau of Statistics (BBS) data, October 2010.
[22] Even a sample mill maintained 10 per cent extra workers in case regular workers are not available.
[23]Labour cost seems to be weakly linked with the labour productivity, particularly in spinning and weaving sections.

Table 9: Per Ton Labour Cost (Average)

(in Taka)

Mill	Softening	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring
BJSA	200	347	531	798	691	-	-	-
BJMA	205	416	466	1153	574	323	3387	105
BJMC	472	695	717	3165	1097	499	8384	378

Source: CPD Survey (2011).

7.3 Production Environment

Production environment in jute mills is found to be in heterogeneous states in terms of maintenance of temperature, humidity and lighting (Table 10). While moisture content in the yarn should be kept at or above 75 per cent in order to maintain the quality, five out of 10 sample factories maintain humidity level lower than what is required. Some of the mills have water spraying system, but those are not properly placed to maintain moisture content. While it is not highly expensive to install humidifiers, water sprinkling machines, exhausters or bulbs in order to maintain the optimum conditions, such measures are not properly maintained. Lighting is insufficient in softening and spreading sections. Lack of maintenance of temperature, humidity and widespread dust in the factory premise has definite impact on machine productivity, product quality and workers' health and hygiene.

Table 10: Summarised Information on Environmental Condition

Sample Mill		Temp (ºC)	Humidity (%)	Sound Level (dBA)	Skylight	Lighting Condition (Sufficiency)	Pollution Condition	Protective Measures
BJSA	1	29	68	88	Yes	No (selection spreading, softening, winding)	Jute fibre dust	No mask and apron
	2	30.5	70	86	Yes	No (softening, spreading)	Jute fibre dust	No mask and apron
	3	33.5	65	87	Yes	No (softening, piling)	Jute fibre dust	No mask and apron
	4	35	78	88	Yes	No (sewing, bundling)	Jute fibre dust	No mask and apron
BJMA	5	27	63	86	Yes	Yes	Jute fibre dust	No mask and apron
	6	32	77	88	Yes	No (softening, winding)	Jute fibre dust	No mask and apron
	7	30	84	86	Yes	No (softening, carding, drawing)	Jute fibre dust	No mask and apron
	8	30.5	79	84	Yes	No (spinning, winding)	Jute fibre dust	No mask
BJMC	9	28	70	88	Yes	No (softening, spreading, spinning, finishing)	Jute fibre dust	No mask and apron
	10	31.5	75	88	Yes	No (almost all processes)	Jute fibre dust	No mask and apron

Source: CPD Survey (2011).

7.4 Production Process Followed in Different Sections

The process of transferring semi-finished outputs from one stage to another is different in mills in terms of distance, amount of time required and output transferred (Table 11). Transferring process is more diverged at initial and finishing stages of production, particularly in softening and spreading sections for spinning mills, and winding, beaming, weaving and calendaring for composite mills.

Table 11: Average Quantity, Distance and Time Required in the Production Process

Component	Softening	Spreading	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring
Travel quantity (kg)	22	20	15	20	31	22	62	57	57
Travel distance (ft)	51	28	25	11	10	24	27	29	27
Travel time (min.)	3	1	1	1	1	1	2	1	1

Source: CPD Survey (2011).

Figure 14 (A-I) below details the quantity, distance and time required for various sections of production processes in the sample jute mills (spinning and composite). As it shows, in the softening section, average quantity, distance and time required for transferring products maintain a ratio of 22:51:3 (Figure 14A). The relatively long time and distance required in softening section is primarily attributed to the location of the godown. The quantity and distance can be reduced by using alternative techniques. BJSA mills are found to be at diverge state in case of transferring products from softening to spreading sections (Figure 14B). Travel distance between spreading and carding sections are also found to be not maintaining standard (Figure 14C). Production processes in drawing, spinning and winding sections are marginally varied between mills mainly because of similar kind of ergonomic structure in the sample mills (Figures 14D, 14E and 14F). In case of composite mills of BJMA and BJSA, production processes in beaming, weaving and calendaring sections are diverse, owing to the differences in machinery structures (Figures 14G, 14H and 14I). Travel time required for beaming, weaving and calendaring seems to be high compared to that in other sections.

Figure 14: Production Process in Various Sections: Quantity, Distance and Time

Explanatory Notes for Figure 14A – Figure 14I:

- The horizontal axis(s) indicates Sample Mills.
- The left hand side vertical axis(s) indicates Quantity (in kg) and Distance (in ft).
- The right hand side vertical axis(s) indicates Time (in sec).
- Sample Mills 1, 2, 3 and 4 are spinning mills (BJSA); Sample Mills 5, 6, 7 and 8 are composite mills (BJMA); and Sample Mills 9 and 10 are composite mills (BJMC).

Figure 14A: Softening Section

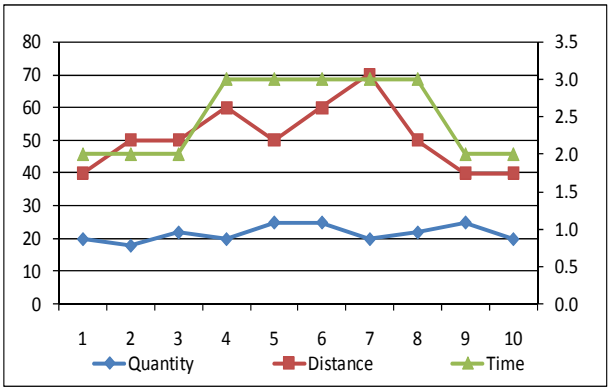


Figure 14B: Spreading Section

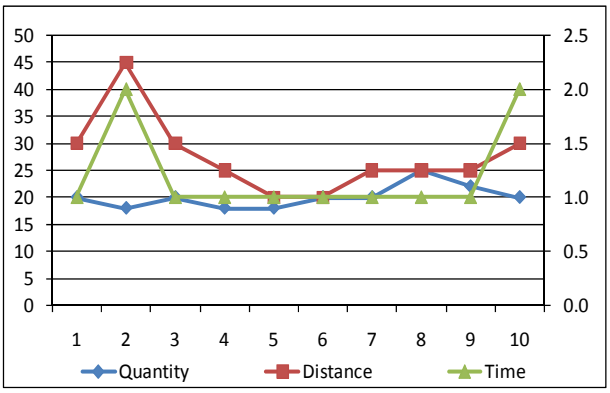


Figure 14C: Carding Section

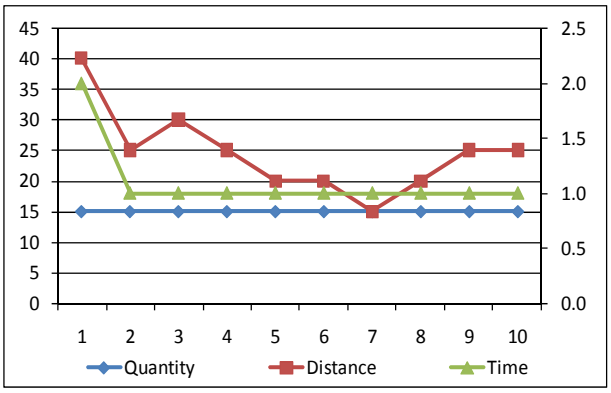


Figure 14D: Drawing Section

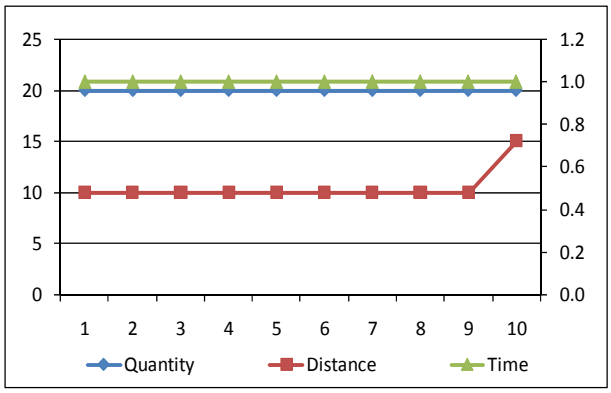


Figure 14E: Spinning Section

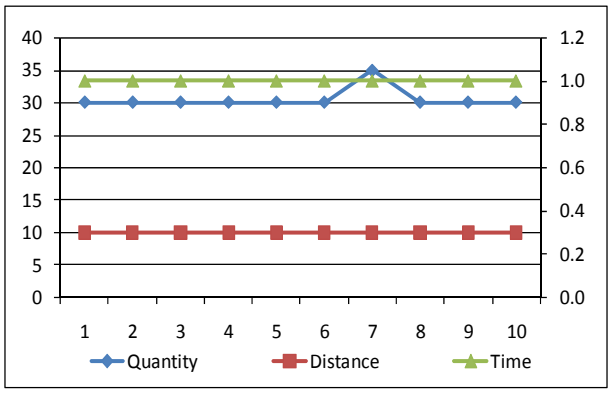


Figure 14F: Winding Section

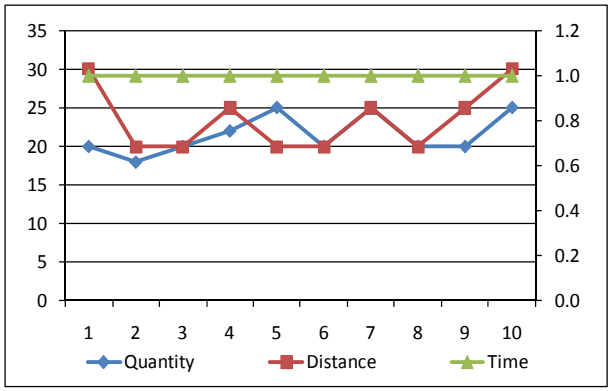


Figure 14G: Beaming Section

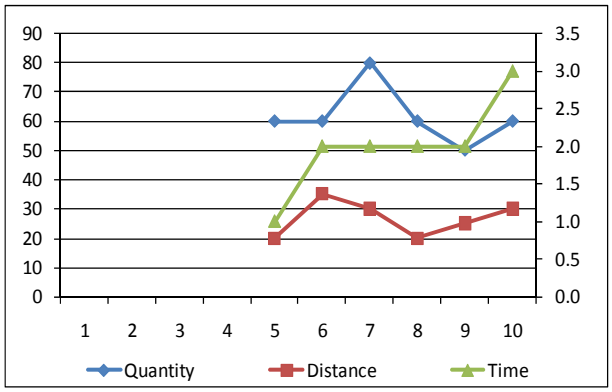


Figure 14H: Weaving Section

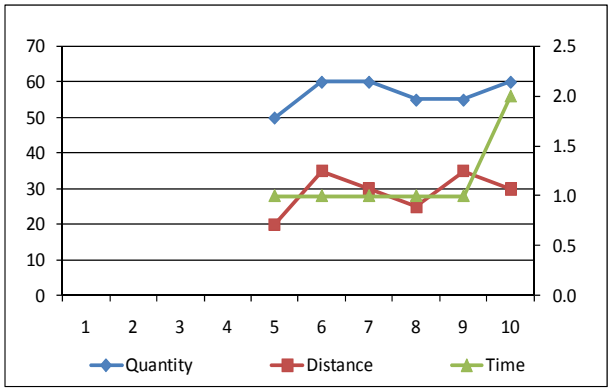
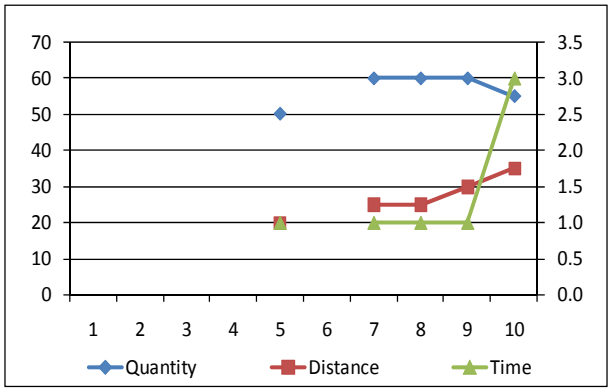


Figure 14I: Calendaring Section



Source: CPD Survey (2011).

Difference in ergonomic structure of factories is a major factor behind the differences in maintaining required space, machines and workers at backward and forward linkage activities. Lack of standard usages of machines and workers in different sections of jute mills is another reason for the variation in the production process. Mill management should properly examine the production process in case of transferring outputs between sections. Taking precedence of better practices in the production process in sample jute mills, a number of alternate techniques/machineries/tools have been suggested for improvement in the production process in the later section of the present paper.

There is no unique process for carrying raw materials from selection process to softening/spreading process. Although trolley is widely used for carrying materials in softening/spreading sections, if structure permits factories may consider setting up conveyor belts to reduce time and labour use

there. A properly setup machines chain may reduce amount of time and workers required. For example, piling activity is done in the opposite side of carding activity in a number of mills, which if properly arranged, would reduce number of workers required. Spreading machines should be used in order to reduce stacks before the output is transferred from softening to carding process.[24] If spreaders are used, number of labourers can be curtailed. There are incidences that time taken for changing bobbins in spinning frames is quite high (approximately 6 minutes) partly because of the unskilled workers and improper arrangement of machinery. So, appointing skilled workers may reduce time use to change bobbins.

7.5 Raw Materials (Raw Jute)

Availability of raw jute throughout the year is essential for smooth operation of jute mills. Raw jute consumption widely varies between firms due to differences in the size of operation – from as low as 2,300 MT to as high as 28,000 MT (Table 12). Although raw jute was sufficiently available during 2011, price was significantly high even in the harvest season. Most mills could not buy the yearly requirement of raw jute during the harvest season because of limited godown spaces. About 75 per cent jute mills have godown facility which can stack only one-third of their total annual raw jute requirement. This indicates that most of the mills procure during the post-harvest seasons taking the burden of higher price of raw jute (about 30 per cent high during 2010).[25] Since high price differences between harvest and post-harvest season is a regular phenomenon, jute mills should consider additional measures for procuring larger amount of raw jute during harvest season. This includes expansion of godown spaces, renting spaces in jute growing regions, and forward purchase contract with the suppliers.[26]

Table 12: Raw Jute Procurement by Sample Jute Mills

Item	1	2	3	4	5	6	7	8	9	10
Raw jute consumption (MT)	28080	2291	19916	10366	25165	2910	7049	9030	11256	22418
Capacity of godown (MT)	10000	600	6400	-	8958	2600	5126	3200	-	8240
Godown capacity in terms of percentage of raw jute requirement in a year	35.6	26.2	32.1		35.6	89.3	72.7	35.4	-	36.8
Type of transportation	Land and river	Land and river	Land	Land and river	Land and river	Land and river	Land and river	Land	Land and river	Land and river
Availability of quality raw jute	Available	Available	Available	Available	Available	Available	Available	Available	Available	Available

Source: CPD Survey (2011).

Although proper maintenance of godown is important in retaining the quality of jute fibre, a number of godowns in sample jute mills is found to be in poor condition in terms of air circulation, distance between piles and moisture levels, etc. Besides, godowns are found to be poorly protected from fire although incidences of fire in jute mills are often reported in the newspapers. Most firms do not have sufficient number of fire extinguishers, sand buckets and water supply lines inside and outside

[24]After the carding process, jute fibre is passed through drawing and doubling machines. If size of fibres is different, rubber rollers and steel rollers get jammed with fibres. Most sample mills are found to have this kind of problem in drawing machines.

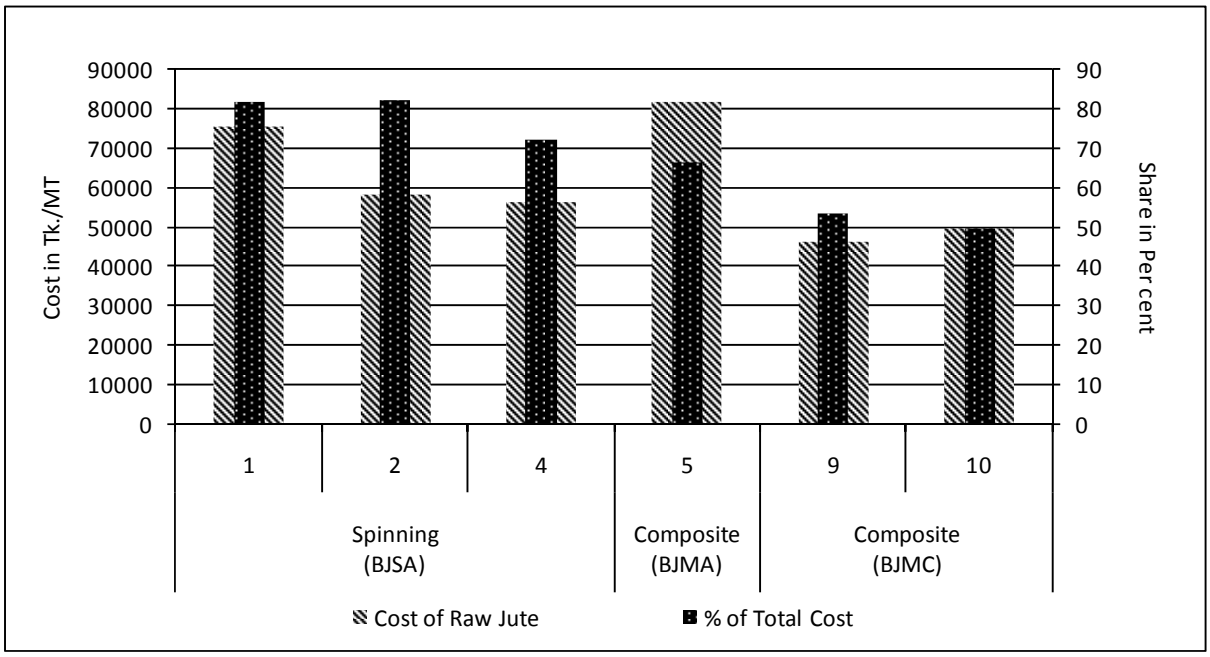
[25]According to mill management of some sample mills, price of raw jute during the harvest season of 2011 was Tk. 1,700-1,800 which increased to Tk. 2,200-2,300 in post-harvest season.

[26]Jute mills usually procure raw jute under CC (cash in credit) arrangements with the commercial banks. Large procurement during harvest season with money borrowed from banks is likely to have impact on additional expenditure because of high amount of interest payments. Without substantive price difference relative to the interest burden, mills may not be convinced to procure raw jute in addition to the available spaces.

the godown. Although raw jute stored in jute mills usually has fire insurance, the incidences of fire may interrupt normal production activity, and this incurs high costs. Establishment of fire protection system for godowns as well as maintenance of optimum environment is highly important for the year-round operation of jute mills.

Cost of raw jute is the most important component of the overall cost structure as it accounts for about 50-80 per cent of the total cost of production in sample jute mills (Figure 15). Better quality fibre, i.e. deshi white, which is largely used for making yarn, are more costly and involve about 70-80 per cent of total cost of production of the BJSA mills. On the other hand, average type fibre (e.g. tosha) used in composite mills for making sacking and hessian products cover more than 50 per cent of total cost. Rise in the price of raw jute in the recent years have significantly increased its proportionate share in total cost of production. Between 2007 and 2010, price of raw jute has increased from Tk. 858 per maund to Tk. 2,300 per maund which causes a rise in its share in total cost of production from 51.6 per cent in 2007 to 62.6 per cent in 2011. Such a high share of raw jute in overall cost reduces the entrepreneurs' space for adjustment of costs. Availability of raw jute at a manageable price is essential for maintaining cost competitiveness.

Figure 15: Cost of Raw Jute and its Share in Total Cost



Source: CPD Survey (2011).

7.6 Maintenance Operations in Different Sections

Although machines are regularly maintained as claimed by the mill managements, however their overall performance level suggests otherwise, owing to the lack of proper understanding and practice of maintenance. Instead of following the prevention method for maintenance, most mills practice breakdown method. There are limited cases where mills practice overhauling maintenance. To maintain uninterrupted production, three categories of maintenance should be practiced; i.e. daily, weekly and overhauling. Lack of uninterrupted electricity supply could be a reason for poor maintenance although most of the mills have their own captive power generator facility. In order to improve the quality of power supply, some firms use power factor improver which contributes to a better availability of electricity in the factory.

Expenditure on maintenance is usually considered as an additional burden to the mills even though only about 4-5 per cent unit production cost (measured in tonnes) is attributed to maintenance cost (Table 13). In contrast, in developed countries, about 10-15 per cent of total yearly investment is spent for maintenance. With such a low level of understanding on maintenance practices, excessive spending (either high or low) does not have any meaningful implication on overall machinery maintenance (Figure 16 and Table 14). Rather the investment on machinery maintenance needs to be substantially increased in all jute mills.

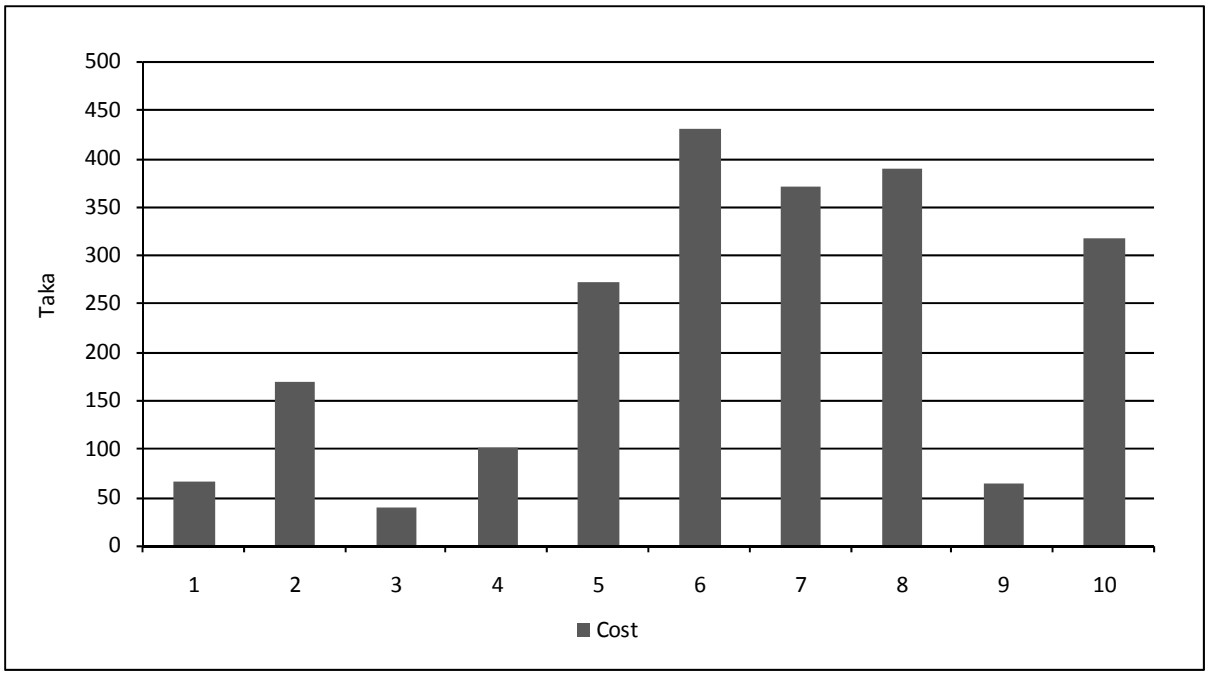
Table 13: Weekly Average Maintenance Cost

(in Taka)

Mill	Softening	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring
BJSA	543	542	600	592	500			
BJMA	889	975	878	1465	1611	819	1041	595
BJMC	425	875	875	1063	415	438	1150	325

Source: CPD Survey (2011).

Figure 16: Weekly Maintenance Cost in Sample Mills



Source: CPD Survey (2011).

Table 14: Section-wise Maintenance Cost per Ton

(Tk./MT)

Mill Category	Softening	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring
Spinning	1.88	1.88	1.88	1.88	1.88	-	-	-
	3.90	3.90	5.84	6.49	3.90	-	-	-
	1.14	1.14	1.32	1.14	0.77	-	-	-
	2.86	2.86	2.86	2.86	2.86	-	-	-
Composite	4.42	4.42	4.42	5.63	5.49	5.63	4.24	4.42
	8.79	8.79	8.79	8.79	8.79	8.79	8.79	-
	3.08	6.16	6.16	7.50	5.36	5.36	16.07	3.08
	6.56	6.56	4.97	12.83	16.33	3.27	3.27	1.84
Public	0.95	0.95	0.95	1.59	0.57	1.59	0.95	1.59
	3.02	7.97	7.97	8.93	3.57	2.06	10.99	0.82

Source: CPD Survey (2011).

A fully-equipped workshop in the factory is an integral part of operation of jute mills. Workshops observed in sample jute mills are not found to be at the same level in terms of required facilities, technicians and availability of raw materials. Though a local manufacturing base for machineries and spare parts is available, it is inadequate. Two local companies, namely Gulfra Habib Ltd. (operated under BJMC) and Karnafully Engineering Works Ltd. (a private entity) manufacture machineries and spare parts which are sold mostly in the local market. While Gulfra Habib Ltd. operates below capacity, i.e. at 48 per cent of the total capacity, Karnafully Engineering Works Ltd. does not, which is reflected in their increasing work orders owing to rising demand for spare parts and machineries. Gulfra Habib Ltd., on the other hand, is held back by lack of resources as well as poor operation and maintenance although its base is suitable for manufacturing most of the machineries. There is no CNC machine in Gulfra Habib Ltd. due to the lack of skilled operators. Existing facilities allow for the investigation of dimensional accuracy, hardness and alignment of the finished products. Although 90 per cent of total capacity of Gulfra Habib Ltd. is utilised for supplying machineries to the BJMC mills, a huge amount of overdue payments (approximately Tk. 9 crore) from these mills results in constraints on the necessary resources. In most of the cases the mill owners have procured the old machinery from different abandoned mills and installed in their own mill premises without proper planning; as a result the appropriate process balance and critical path method (CPM) could not be followed, which is one of the causes of lower productivity of the mills. Production balancing is not maintained throughout the production process.

7.7 Management of Jute Mills

The management of jute mills comprises of professionals, engineers and other support staff (Table 15). Number of engineers, professionals and other staff is not well balanced in small jute mills; some firms have no engineers and they operate through technicians. Mills should examine the distribution of management personnel in the operation of different sections.

Table 15: Sample Jute Mills: Engineers, Professionals and Workers

Employee	1	2	3	4	5	6	7	8	9	10
Engineers	11	2	-	14	44	7	14	-	-	-
Professionals	32	58	-	135	207	106	166	-	-	930
Workers	-	287	335	3273	4358	645	3472	-	-	4977

Source: BUET Survey (2011).

Managers of most of the sample firms have had years of work experience in the jute sector (Tables 16, 17 and 18). Other than in the BJMC mills, general managers and other managers in BJMA and BJSA mills have been working at their present jute mill for a considerable period of time. However, such long working experience does not always result in operational efficiency and better productivity. The methods and processes followed by the mill management for operations and maintenance seem to be less effective for higher level of productivity and efficiency. In some instances, knowledge on processing, maintenance of machineries and labour management seem to be based on an understanding which hinders the path towards necessary changes required for betterment of level of efficiency and productivity. Besides, some mill managements also show lack of initiative in necessary changes regarding inefficient operations. Some of the entrepreneurs also bear liabilities for the inefficiency of mill management. In a number of cases, jute mill entrepreneurs are not 'enthusiastic' towards achieving higher return by making necessary investments; some of them have diverted the borrowed fund into other businesses. As discussed later, jute manufacturing is not a high-returned business venture at least compared to that of the RMG, and the revenue often fluctuates due to various reasons. Thus, a set of dedicated entrepreneurs are required to nourish, build and develop the sector.

Table 16: Years of Engagement in Jute Sector by Mill Owners

Mill	Ownership		Experience	
	Average Years of Ownership	Difference	Average Years of Experience	Difference
BJSA	26.25	16	31.50	8
BJMA	27.00	36	30.50	34
BJMC	40.00	0		

Source: CPD Survey (2011).

Table 17: Years of Engagement in Jute Sector by Project Heads

Mill	Experience		Operation in the Present Mill	
	Average Years of Experience	Difference	Average Years of Operation	Difference
BJSA	18.25	11	9.75	8
BJMA	19.75	17	10.00	24
BJMC	13.50	23	1.00	0

Source: CPD Survey (2011).

Table 18: Years of Engagement in Jute Sector by Managers (Operation and Human Resource)

Mill	Manager (Operation)		Manager (Human Resource)	
	Average Years of Experience	Difference	Average Years of Experience	Difference
BJSA	20.50	28	19.00	19
BJMA	16.50	18	16.50	31
BJMC	21.50	7	25.50	9

Source: CPD Survey (2011).

There is a dearth of human resources in the jute manufacturing sector particularly at mid-level management. This can mainly be attributed to narrow career opportunities, unattractive salary packages, and better opportunities in textiles and other sectors. Mills suffered from lack of engineers since most prospective engineers are not motivated to join in jute mills (Table 19). More importantly, there is no specialised technical engineering institution in Bangladesh for jute sector. Most of the engineers in jute mills have been trained in textile colleges. India, on the other hand, has a number of specialised institutes that offer degrees on jute technology. In some cases, mills appoint foreign engineers and/or consultants in order to get better services. Considering the lack of adequate professionals at local level, hiring high-skilled professionals from abroad would be a good option.[27] These hired engineers can provide necessary training support to local professionals and technicians.

Table 19: Perception on Sufficiency of Engineers and Skilled Workers

Perception	1	2	3	4	5	6	7	8	9	10
Availability of foreign engineers	Yes	No	No	No	No	No	No	No	No	No
Shortage of skilled workers	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: CPD Survey (2011).

[27] A good number of retired engineers experienced in jute technology are available in India who provides advisory services both within and outside the country.

7.8 Cost and Return of Jute Mills

Major component of production cost of jute goods is the cost of raw jute which accounts for 63 per cent of total cost of production. In recent years, high price of raw jute has put further pressure on overall cost of production, as share of cost of raw jute has increased by 10 per cent since 2007 (Table 20). Costs of wages and salaries have also increased over the years, which can be linked to the rise in level of wages (by about 15 per cent).[28] The case is not much different for repair and maintenance costs. Since the number of samples is very limited (information was available for only six mills) average costs of manufacturing (1 MT of sacking product, as presented in Table 20) may not be considered as 'robust' estimate for cost of production.

Table 20: Cost of Sacking Items Production in Private Sector Composite Jute Mills: 2007 and 2011

(Tk./MT)

Component	2007		2011	
	Taka	%	Taka	%
Cost of raw jute	20377.0	51.6	55028.0	62.6
Cost of other raw materials	1716.0	4.3	2317.0	2.6
Wages and salaries	8278.0	21.0	23409.0	26.6
Repair and maintenance	1505.0	3.8	4555.0	5.2
Power fuel	1526.0	3.9	967.0	1.1
Depreciation cost	1339.0	3.4	1137.0	1.3
Interest of current and earlier loans and other charges	1668.0	4.2	97.0	0.1
Others (including insurance, overhead, packing, return, store, tax)	2953.0	7.5	408.0	0.5
Work in process adjustment	83.0	0.2		
Workers' provident fund, gratuity	67.0	0.2		
Total cost	39510.0	100.0	87918.0	100.0

Source: CPD Survey (2011).

Export price of jute goods (e.g. sacking) is found to be significantly higher in 2011 compared to that in 2007. Average sales price for 1 MT of sacking products was USD 1,207 in 2011 and USD 564 in 2007. A better sales price of jute goods helped exporters adjust to a part of higher cost of production. Gross profit for 1 MT of jute goods is estimated to be negative in 2010 (Tk. -379/MT) which would increase to Tk. 8,374/MT if adjusted with 10 per cent cash incentives received for export of jute goods.

8. ANALYSIS OF PRODUCTIVITY AND EFFICIENCY IN SAMPLE JUTE MILLS

Discussion in the previous sections reveals that overall condition of machineries, workers and use of raw jutes is not in a good shape. This would have significant implications in the productivity and efficiency of sample jute mills. This section aims to present a detailed analysis of productivity and efficiency of sample jute mills.

8.1 Analysis of Productivity in Sample Jute Mills

Productivity of jute mills can be defined in several ways: first being production per kilowatt-hour. It is found from the study that average productivity (ton/hr)/kW for softener is less than that of spreader although both types of machines consume almost the same power. However, in both cases it is observed that for identical machines in different mills, the variation of productivity is remarkable even though theoretically the variation should be very insignificant. It appears that the machines of different mills do not run at full capacity, and there is also effect of improper maintenance. It is

[28] Adjustment of wages was lower than the rise in inflation which was 65 per cent between January 2006 to June 2011.

further observed that the productivity of the new spreader machine in a sample jute mill is almost the same as that of the old machine, possibly because apart from being new, the design of the machine remains unchanged.

The second way to measure productivity is production per man-hour. In general, the productivity [(ton/hr)/man] is higher for spreader machine than that for softener machines. There is a variation in productivity for different mills though the machines are identical. It could be because the machines in all the mills do not run at full capacity. The productivity of spreader machine in a sample jute mill is found to be much higher compared to that in other firms. It may happen that sample mill uses multiple spreader machines. Since the productivity is always higher for spreader machines than for softeners, the use of spreader machine will be a better means for enhancing productivity.

The third way of measuring productivity is production per hour per machine. The productivity (ton/hr)/machine for both the spreader and softener machines are similar. However, the productivity of different mills is not the same, which may be due to the fact that all the mills do not run at full capacity, and the maintenance of all the machines in different mills are not done properly.

It is apparent that spreader machines have a clear advantage over softener machines in terms of labour productivity.[29]

Productivity of Breaker Cards: There is some variation in productivity (ton/hr)/kW for breaker cards in different mills. If the machines are maintained properly and run at full capacity, this variation of productivity can be greatly minimised. It can be further noted that the breaker card machine of a sample mill shows relatively lower level of productivity. It indicates that though this machine is new, there is no improvement in the productivity. It may be due to the fact that there is no improvement in the design of this new machine. Furthermore the breaker card machine of this sample mill might not be running at its optimum level.

The productivity as measured by (ton/hr)/man of the breaker card machines of sample mills 6 and 7 are remarkably higher compared to that of the other mills. According to the study team, both mills use only spreader machines which produce output in the form of rolls. These require very small time in feeding the breaker card, thereby using a lower number of workers, which significantly increases productivity as well. In addition, the presence of skilled worker further enhances the productivity. However, for other mills, the productivity did not differ much.

There is small variation in the productivity (ton/hr)/machine of the breaker card machine of different mills. Even the new machine of sample mill no. 7 gives almost the same productivity as that of the others. It thus establishes the fact that there has been no improvement in the design of new machine procured by this sample mill.

Productivity of Finisher Card: There is a variation in the productivity of the finisher card machine of various mills except sample mill no. 6, though every mill uses identical machines. Though the machine of sample mill no. 7 is new, the productivity is still not higher, indicating that the design has not been improved. If all machines can be run with proper maintenance and at full capacity, the productivity of each mill will not be that varied.

Productivity of Drawing Machines: Variation is also observed in the productivity of first drawing at the various mills. Introduction of new drawing machine by sample mill no. 7 has not improved its productivity. Since every mill is using identical machinery, there should be no reason for the

[29] And productivity in terms of unit power input (both types) show almost the same characteristics.

variation of productivity, which arises due to the improper maintenance, weak management and unskilled workers.

It is found that there is wide variation in the consumption of power from the machines of different mills. Since the machines are identical, the only plausible reason is the lack of proper maintenance and low labour productivity. Even the new machine of sample mill no. 7 does not result in any improved productivity. Proper maintenance of machines, improved management and presence of skilled labour will possibly reduce the variations in productivity.

The productivity of the third drawing process shows a similar trend. The new machine of sample mill no. 7 gives relatively lower productivity as well. This can be explained similarly as for the second drawing process.

Productivity of Spinning Machines: There is a wide variation in the productivity of the spinning process of various mills. The new machine of sample mill no. 7 gives higher productivity (ton/hr)/man as this machine is semi-automatic and requires less workers. Moreover, sample no. 3 and 7 use double drawing during second drawing process, thereby resulting in less breakage during spinning. On the other hand, sample no. 10 uses significantly more worker per machine, thereby reducing the labour productivity. Running the machine at a lower speed pulls down the machine productivity.

Productivity of Winding Machines: There is a wide variation in the productivity of the winding (roll) process for different mills. The machine of sample no. 6 has higher productivity compared to that of the others, though it does not show improvement in consumption of power. On the other hand, the new machine procured by sample no. 7 does not show any improvement in productivity compared to that of the others.

Overall, productivity measurements in terms of (ton/hr)/kW and (ton/hr)/machine do not vary much for any particular process across the mills whether they employ new machines or not. This can be attributed to the fact that the design features of all machines remain essentially the same. On the other hand, productivity measurement in terms of (ton/hr)/man is higher for mills having a larger number of skilled worked force as well as their choice of processes, i.e. spreaders in place of softeners.[30]

8.2 Normalized Productivity

The normalized productivity of any process can be defined as the productivity with respect to the maximum productivity of the identical production process across the mills. As a result, the process of a particular mill with the highest productivity will show the Normalized Productivity Index of unity. The processes showing lower value than unity will have relatively lower productivity. Table 21 provides a list of jute mills in respect to maximum productivity indices.

In order to increase the Normalized Productivity Index, proper maintenance of machines, running them at the optimum capacity and presence of a skilled workforce are needed to be ensured.

[30]Productivity measurements for sample 2 show an unusually high value although the overall production data do not support those values.

Table 21: List of Jute Mills in respect of Maximum Productivity Indices

Name of Machine	Acronym	Maximum (ton/hr)/kW	Maximum (ton/hr)/man	Maximum (ton/hr)/machine
Softener	SFT	Sample 8	Sample 10	Sample 8
Spreader	SPR	Sample 6	Sample 1	Sample 6
Breaker card	BRC	Sample 2	Sample 6	Sample 9
Finisher card	FNC	Sample 9	Sample 6	Sample 3
1st drawing	DWG1	Sample 8	Sample 1	Sample 8
2nd drawing	DWG2	Sample 9	Sample 1	Sample 1
3rd drawing	DWG3	Sample 10	Sample 4	Sample 10
Spinning	SPN	Sample 8	Sample 7	Sample 3
Roll winding	WND(r)	Sample 7	Sample 7	Sample 8
Cop winding	WND(c)	Sample 10	Sample 9	Sample 6
Twisting	TWT	Sample 8	Sample 8	Sample 3
Precision winding	PWND	Sample 3	Sample 4	Sample 8
Weaving	WVN	Sample 8	Sample 8	Sample 6

Source: BUET Survey (2011).

8.3 Process-wise Productivity

There is a significant imbalance in production processes. In case of sample 5, if the first and second drawing processes are overlooked, a balance of production has been maintained in the other processes. In case of sample 7, except for the winding and twisting processes, the other processes reveal an approximate production balance. Then again, the productivity of all the machines in different processes is not at the same level though the machines are identical. If all these machinery can be run at their full capacity, there will be remarkable improvement in the production balance, which will ultimately increase the overall efficiency and productivity of the mills. Had there been a proper line balance in the production processes, the productivity would have increased by around 20 per cent (Table 22).

Table 22: Requirement of Workers per Shift at the Optimum Level and Average Number of Workers Currently Involved in Sample Jute Mills

Section	Optimum Number of Workers per Shift	Sample Mills (Number of Workers per Shift in Different Sections)									
		1	2	3	4	5	6	7	8	9	10
Softener	4	6	6	4.5	6	4.5	0	6	6	6	3
Spreader	3 (without side feed), 4 (with side feed)	2	4	3	4	4.5	5	0	0	1.5	0
Breaker card	2 (roll feed) 3 (manual feed)	2.8	2.5	4	2	4.5	1	3	2.5	2.5	3.5
Finisher card	1	1.5	1	1.5	1	0.83	0.5	1	1.5	1	3
1st drawing	1	1	1	1	1	1	1	1	1	1	2
2nd drawing	1	1	1	1	1	1	1	1	1	1	2
3rd drawing	1	1	1	1	1	1	1	1	1	1	2
Spinning frame	1	1.5	2	1.5	1	1	0.5	1	1.5	1	1.7
Roll winding	2	4	2	4	2	2	2	2	4	2	5
Cop winding	4	0	0	0	6	0	4	4	6	4	5
Twisting	3	2.5	3	4	1.5	2	0	3	2	0	3
Precision winding	0.125	0.125	0.166	0.125	0.083	0.125	0	0.166	0.166	0	0
Weaving	1	0	0	0	1	0	1	1	0.5	1	1

Source: BUET Survey (2011).

From mill visits and discussions with the management, it appears that most of the machines have been procured from the laid-off or abandoned government mills. 'Line-balancing' was not considered while deciding on the number of machines to be used for a particular process. As a result, a lack of production line balance in most mills is found, which results in underutilisation of machineries and workforce.

In order to balance the production line, more machines should be in operation in order to prevent misuse, which in turn, will increase the production in three ways. Firstly, all machines can be run at full capacity which in turn will reduce machine idle-time and worker idle-time. Secondly, it will generate additional job openings for workers; and lastly, the profitability of the mill will increase from increased production.

8.4 Overall Productivity

In Figure 17.1, productivity indices [(kWh)/ton] for different jute mills have been presented for both spinning and weaving. This index signifies the energy consumed per ton of jute product. The figure reveals a satisfactory variation in the power consumption for spinning in different jute mills. The mills consume relatively higher amount of energy per ton of jute product, possibly because of improper maintenance of machinery. From the above mentioned figure it can also be seen that for weaving, except for BJMC sample mills, the energy consumption for other jute mills are not varied much. Productivity indices for BJMC mills are not much higher than that of other mills. It may be mentioned that sample no. 9 (one of the BJMC sample mills) was running at about 60 per cent of its full capacity at the time of visit.[31]

The graph of productivity index (man-day/ton) for various mills as shown in Figure 17.2, reveals a production index of around 15 (man-day/ton) for the spinning section except for BJMC mills. This index is best for sample 6 amongst all the mills, because it produces only CBC and the number of workers is significantly lower. As a result, the management can take care of the workers and utilise the potentials of workers effectively. On the other hand, BJMC mills perform poorly in the production index [(man-day)/ton], possibly owing to factors such as large number of workers, inefficient utilisation of machinery and labour, and labour unrest.

Controlled humid environment is essential for a jute mill in order to produce good quality products. Most of the jute mills have managed to control humidity under the acceptable limit inside the factory floor (Figure 17.3). Data shows that sample jute mills no. 7, 8 and 10 faced difficulties in controlling humidity under the acceptable level. Acceptable sound level is another criteria of efficient workplace. It is evident that jute mills are very noisy places and the collected data have also shown the same result (Figure 17.4). Sound level has exceeded the earplug limit for every jute mill, and in most cases it has crossed the maximum limit.

[31]It is worth mentioning that samples 9 and 10, being public-owned mills, cannot buy spare parts from companies other than Gulfra Habib Ltd., another enterprise of BJMC. Since the quality of spare parts as well as scheduled delivery cannot be maintained properly by this company, the productivity in BJMC mills is adversely affected.

Figure 17.1: Productivity Index [(kWh)/ton] of Different Mills

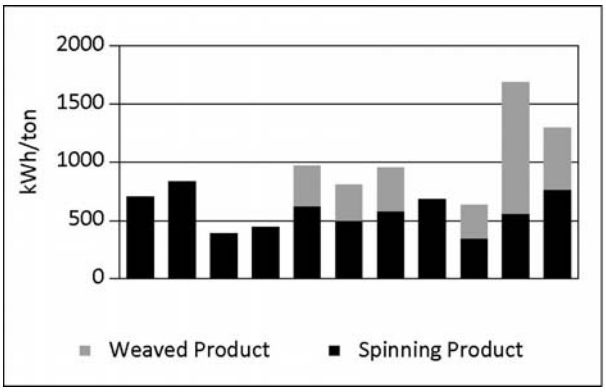


Figure 17.2: Productivity Index [(man-day)/ton] of Different Mills

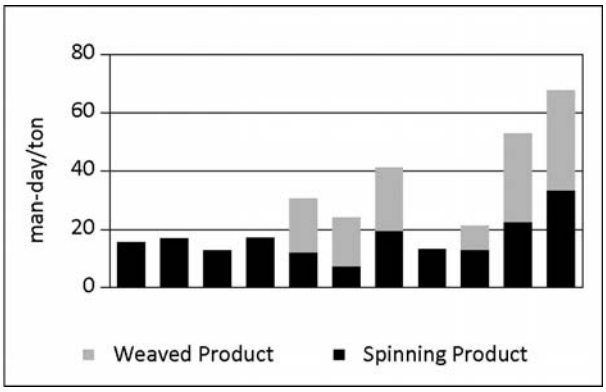


Figure 17.3: Humidity of Spinning Section of Different Mills

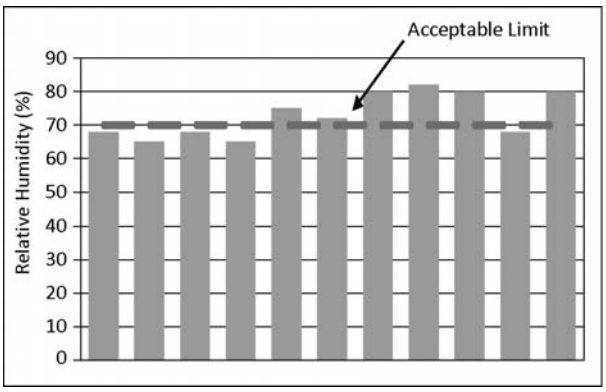
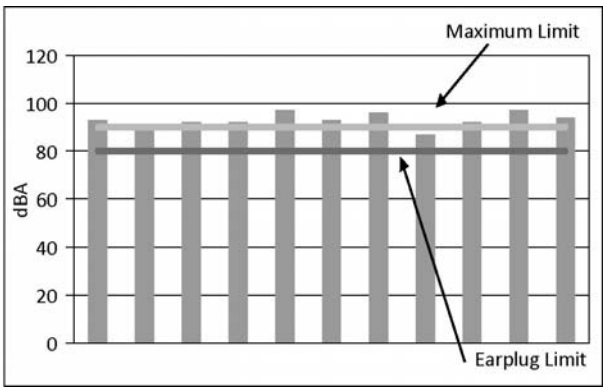


Figure 17.4: Maximum Sound Level of Different Mills



Source: BUET Survey (2011).

8.5 Technical Efficiency

The efficiency of a firm consists of two components: *technical efficiency*, which reflects the ability of firm to obtain maximum output from a given set of inputs; and *allocative efficiency*, which reflects the ability of a firm to use the inputs as optimal proportions, given their respective prices. These two are then combined to provide the measure of total cost efficiency. Efficiency of sample firms in terms of technical, allocative and cost is measured using Data Envelopment Analysis Programme (DEAP). While the DEAP analysis reveals comparative performance amongst the sample firms, performance of all the firms is checked based on the performance of the most efficient firm.

Tables 23-25 show that about 63 per cent firms are technically efficient at a high level, while only 25 per cent of firms are found to have allocative efficiency at the similar level. Firms appear to be efficient in machine use to some extent, but not so much in labour use (Table 23). Since allocative efficiency is a major determining factor in overall efficiency, most mills are found to be less cost-efficient (Tables 24 and 25). Overall efficiency shows that both spinning and composite jute mills have wide differences in terms of the level of efficiency, and thus require substantive improvement in cost efficiency.

Table 23: Technical, Allocative and Cost Efficiency in Overall Operations of Sample Spinning Mills

Sample Mill	Technical Efficiency	Allocative Efficiency	Cost Efficiency
1	1.00	0.89	0.89
2	0.41	0.34	0.14
3	1.00	1.00	1.00
4	0.52	0.83	0.44

Source: CPD Survey (2011).

Table 24: Technical, Allocative and Cost Efficiency in Overall Operations of Sample Composite Mills

Mill Category	Technical Efficiency	Allocative Efficiency	Cost Efficiency
Composite	1.00	0.75	0.75
	1.00	1.00	1.00
	0.57	0.75	0.43
	1.00	0.84	0.84
Public	0.99	0.64	0.64
	0.53	0.71	0.37

Source: CPD Survey (2011).

Table 25: Section-wise Technical Efficiency of the Sample Mills

Mill Category	Softening	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring
Spinning	0.615	0.646	0.752	1.000	0.821			
	0.338	0.395	0.399	0.660	0.051			
	1.000	1.000	1.000	0.975	1.000			
	0.462	0.485	0.508	0.429	0.277			
Composite	0.656	0.470	0.560	0.447	0.537	0.889	0.754	0.457
	0.615	0.538	0.635	0.353	0.462	0.370	0.895	
	0.328	0.323	0.451	0.417	0.328	0.593	0.573	0.229
	0.538	0.665	0.935	0.750	0.538	0.972	1.000	1.000
Public	0.462	0.469	0.586	0.310	0.489	1.000	0.636	0.321
	0.320	0.195	0.259	0.179	0.320	0.361	0.317	0.786

Source: CPD Survey (2011).

9. POTENTIAL GAIN THROUGH UPGRADATION OF MACHINERIES, CHANGING PRACTICES OF LABOUR USE, CHANGES IN PRODUCTION PROCESSES AND MAINTENANCES

9.1 Raising Productivity

Variation of productivity among the jute mills indicates that there are ample scopes for raising productivity in different kinds of operations. In softening operation, the scope of improvement of productivity ranges between 38 kg per machine per hour to as high as 184 kg; it lies in the 5-49 kg range for the carding section; 2-30 kg range for the drawing section; 10-28 kg range for the spinning section; and in the 0.9-3.0 kg range for the weaving section (Table 26). These differences would have been much higher if the benchmarks were set at the maximum productivity level in each of the sections (Table 27). The possible rise in productivity level in different sections would then be increased further. For example, softening: 10-406 kg; carding: 31-103 kg; drawing: 5-61 kg; spinning: 0.7-57 kg; winding: 41-209 kg; beaming: 10-240 kg; weaving: 0.8-5 kg; and calendaring: 790-1187 kg. Since productivity in most of the sections of public sector jute mills is low compared to that of the average level, there are ample opportunities for improvements in productivity in most of the sections there.

Table 26: Raising Productivity by Changing Practices in Machinery Use – I

Mill	Difference with Average Output							
	Softening (454.86)	Carding (74.63)	Drawing (51.57)	Spinning (40.63)	Winding (109.41)	Beaming (261.57)	Weaving (5.40)	Calendaring (439.58)
1	-38.19							
2	-111.11		-2.47		-92.22			
3								
4		-12.13	-9.91	-10.86	-46.91			
5		-14.02	-5.60	-9.62				
6	-38.19	-5.18		-16.12	-5.24	-122.69		
7	-121.53	-19.07	-14.54	-11.64	-35.33	-39.35	-0.95	-306.25
8	-142.36	-9.97	-3.50	-19.07	0.89	113.43	-0.46	-170.83
9	-184.03	-48.84	-30.33	-28.17	-37.18	-126.16	-2.94	-368.75
10								

Source: CPD Survey (2011).
Note: Figures in parentheses refer to average output. Blank cells denote mill running in optimum productivity.

Table 27: Raising Productivity by Changing Practices in Machinery Use – II

Mill	Difference with Maximum Output							
	Softening (677.08)	Carding (128.97)	Drawing (82.07)	Spinning (69.44)	Winding (225.69)	Beaming (375.00)	Weaving (7.76)	Calendaring (1458.33)
1	-260.42	-45.63	-20.34		-40.51			
2	-333.33	-30.75	-32.96	-0.69	-208.51			
3				-1.74				
4	-52.08	-66.47	-40.40	-39.68	-163.19			
5	-10.42	-68.36	-36.09	-38.44	-104.48	-41.67	-1.91	-791.66
6	-260.42	-59.52	-29.99	-44.93	-121.53	-236.11	-0.81	
7	-343.75	-73.41	-45.03	-40.46	-151.62	-152.78	-3.31	-1125.00
8	-364.58	-64.31	-33.99	-47.89	-115.40		-2.82	-989.58
9	-406.25	-103.17	-60.83	-56.99	-153.47	-239.58	-5.30	-1187.50
10	-190.97	-31.75	-5.32	-17.36	-104.17	-10.42		

Source: CPD Survey (2011).
Note: Figures in parentheses refer to maximum output. Blank cells denote mill running in optimum productivity.

9.2 Saving Labour Costs

Inefficient use of machine and worker results in higher cost of production (in terms of Tk. per minute per machine). The wide differences in machine and labour productivity between mills indicate that additional cost is being incurred by inefficient mills (Table 28). The unit cost for use of machine in

Table 28: Labour Cost (Tk./Minute/Machine)

Mill Category	Softening	Carding	Drawing	Spinning	Winding	Beaming	Weaving	Calendaring
Spinning	1.02	0.26	0.28	0.59	1.19	-	-	-
	1.25	0.36	0.21	0.82	0.14	-	-	-
	1.50	0.49	0.39	0.49	1.55	-	-	-
	2.00	0.68	0.81	0.58	1.28	-	-	-
Composite	1.38	0.66	0.61	1.34	2.08	2.30	0.49	1.47
	1.25	0.17	0.27	0.15	0.80	1.07	0.33	-
	1.92	0.40	0.27	0.37	0.72	1.00	0.31	0.75
	1.39	0.71	0.41	0.75	0.45	0.89	0.18	1.15
Public	1.55	0.45	0.37	0.87	1.19	3.06	0.46	1.15
	2.92	0.42	0.34	0.81	1.86	1.15	0.46	2.75

Source: CPD Survey (2011).

different sections vary as such: Tk. 1.0-Tk. 2.9 per minute per machine for softening; Tk. 0.2-Tk. 0.7 for carding; Tk. 0.2-Tk. 0.8 for drawing; Tk. 0.2-Tk. 1.3 for spinning; Tk. 0.1-Tk. 2.1 for winding; Tk. 0.9-Tk. 3.1 for beaming; Tk. 0.2-Tk. 0.5 for weaving; and Tk. 0.8-Tk. 2.8 for calendaring. Proper balance of machine and workforce would result in significant cost cuts which could be as high as Tk. 537,000 per annum (Table 29).

Table 29: Total Possible Savings through Efficient Labour Allocation

(in Taka)

Mill Category	Carding	Drawing	Spinning	Weaving	Monthly Total	Yearly Total
Spinning	0.00	0.00	0.00	-	0.00	0.00
	0.00	0.00	5170.00	-	5170.00	62044.00
	1150.00	0.00	0.00	-	1150.00	13798.00
	8148.00	15554.00	0.00	-	23702.00	284419.00
Composite	7446.00	8131.00	24814.00	4374.36	44764.00	537169.00
	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
	9396.00	324.00	2786.00	0.00	12505.00	150058.00
Public	0.00	0.00	7229.00	3204.36	10433.00	125198.00
	0.00	0.00	4916.00	3204.36	8120.00	97441.00

Source: CPD Survey (2011).

9.3 Saving the Cost of Raw Materials

The low level of return earned by jute mills because of their high expenses on raw jute indicates that there are opportunities for cost reduction, and the jute mills can take initiatives in a number of ways. Firstly, jute procurement should be conducted during the harvest season as price differentials with that of the post-harvest season were as high as about 28 per cent in 2011.

Batching would be another way of reducing overall costs of raw jute. As can be seen, sample jute mills follow their own standards for batching of the fibres (Table 30). There are wide differences in batching practices amongst the sample jute mills which indicate possibilities for maintaining standard batching practices. If mills follow batching, fibre strength as well as machine productivity will most likely increase.

Table 30: Batching Methods Followed by the Sample Mills

Product	Jute Quality	Yarn/Twine				Hessian/Sacking				
		1	2	3	4	5	6	7	9	10
Yarn/Twine/ Hessian	BTC	30								
	BTC(bott)					9			54	15
	BTX(bott)									35
	BTD	30		36						
	BTE	40		64						
	BWB					18				
	BWC					18	18			
	BWD						37			20
	BWX (cut)								19	
	BWX								27	
	BMB (bott)					9				
	BMC(bott)					10				10

(Table 30 contd.)

(Table 30 contd.)

Product	Jute Quality	Yarn/Twine				Hessian/Sacking				
		1	2	3	4	5	6	7	9	10
	BKB					18				
	BKC					18	18			
	BKD						27			
	SMR									10
	Cutting									10
Sacking	BMX								18	
	BTX							18		
	SMR					36	18	13	27	22
	HJR/CR					10		16	15	11
	Cutting					27	46	26	19	67
	Thread					27		27	21	
	L Sliver						36			

Source: CPD Survey (2011).

9.4 Saving the Cost of Electricity

Cost of production can also be reduced by saving energy. Sample mills use electricity which is sourced either from the Power Development Board (PDB) or captive power generators. Usually captive power generators are operated by using diesel and gas. There is a huge difference between the unit cost of electricity sourced from national grid (usually Tk. 4.17-Tk. 4.81 per kWh) and that from generators (Tk. 12-Tk. 16 per kwh). Since fuel cost amounts to 1-5 per cent of the total cost of production, any possible saving of electricity would substantially reduce the overall cost. Analysis shows that supply of electricity from national grid would save cost of electricity up to Tk. 1.2 core per year (Table 31). Using gas-based generators would also reduce cost. The possible savings would be much higher in case of public sector jute mills. For private sector jute mills, the savings would range between Tk. 0.34 crore to Tk. 0.63 crore.

Table 31: Saving the Cost of Electricity

Mill	Fuel Cost (Tk./ton)	% of Total Cost	Electricity Generation Cost (Tk./kWh)	Additional Fuel Cost (Tk./ton) over Most Efficient Use (Tk. 967)	Yearly Total Production	Yearly Additional Fuel Cost
BJSA	1150	1.2	2.4, 14	183	25040	4582320
	2800	3.9	16	1833	3443	6311019
			12.5			
	1699	2.2	16	732	4695	3436740
BJMA	967	1.1	2.5			
			15			
	1804		1.8, 14	837	5008	4191696
			13.5			
BJMC	2500	2.9		1533	8138	12475554
	4909	4.9		3942	10955	43184610
Average	2261			1294	9546.5	12353171

Source: CPD Survey (2011).

10. SUGGESTIONS FOR IMPROVEMENT OF PRODUCTIVITY IN JUTE MILLS

Jute manufacturing sector in Bangladesh involves traditional thoughts and practices to such an extent that it severely hampers the productivity. Lately, jute mills have been gearing towards higher utilisation of production capacity in order to meet the growing demand for jute products. However, such efforts have had limited effect because the mills have been functioning below capacity for a long time. The

study quantifies the possible gain through improvement of higher productivity of machinery and labour, reduction of cost by better use of raw materials, and possible savings of costs by changing practices of electricity use in the jute mills. These findings are by and large, compelling to undertake necessary upgradation of jute mills for higher productivity in order to strengthen its competitiveness. Regardless, the rise in productivity can be attained by the following means:

a) Improvement of machine efficiency and productivity;
b) Improvement of labour efficiency and productivity;
c) Reduction of cost of major raw materials, e.g. raw jute, electricity;
d) Ensuring availability of better fibre through increased production of better quality jute (deshi white);
e) Improved production through better maintenance activities of machineries;
f) Following an integrated production process and dynamic management system and target-oriented activities;
g) Strengthening human resource base for jute manufacturing sector;
h) Initiatives for expansion of production of other traditional products, particularly jute carpets, jute mats, geo-textiles;
i) Further research and development (R&D) initiatives for jute-based consumer goods which could substitute similar products (e.g. polypropylene based);
j) Expansion of markets for traditional and diversified jute products.

The potential areas of change for high productivity have been discussed in the ensuing sub-sections.

10.1 Targeting Global and Local Demand for Jute Products

a) Since global demand for jute products has been rising in the recent years, Bangladesh possesses high potential in the export of jute and jute products. Given that jute comprises of almost one-third of the demand for packaging, effective enforcement of bans on the use of polypropylene products will open doors for the use of jute products for packaging instead. Since Bangladesh and India are the major jute-exporting countries, a joint initiative can be undertaken in order to promote the use of jute products for packaging. This initiative should include campaigning, policy influencing, collaborative research on product development and marketing. International Jute Study Group (IJSG) should also take a lead role in this case.
b) Although domestic demand for jute goods have remained low throughout the last decade, the recent enactment of *Mandatory Use of Jute for Packaging Products Act 2010*, if implemented, will most likely to open a large domestic market for jute goods. CPD estimates show that mandatory packaging of items like rice, wheat, sugar and cement will create demand for sacking (50 kg bags) to become as high as 841 million, which in turn will require about 504,700 MT of raw jute. This huge local demand will contribute to an increase in production not only in composite mills, but in spinning mills as well. Since a 50 kg jute bag costs twice as much as that of polythene bags (Tk. 70 vis-à-vis Tk. 30), jute mills should take initiative to reduce the production cost and make it available at a retail price close to that of its substitutes. Government agencies have started to procure more jute sacks particularly for packaging of rice and sugar from the BJMC, and this procurement should be made open (include BJMA mills).
c) A number of strategies have been put forward in the *National Jute Policy 2011* in order to increase the domestic use of jute and jute products. This includes the use of jute bags for packing of mineral water plants, soft drinks, chips, nursery plants, jute-based geo-textiles, sacking for road construction, and jute-related diversified products in government offices such as mats, carpets, blankets, name cards, etc. Necessary directives are required in order to make the use of jute products mandatory for all purposes, much like that of the mandatory packaging act. An effective

action plan with specific timeline for implementation should be immediately prepared for the *National Jute Policy 2011*.

10.2 Targeting Machine Use for Attaining Higher Efficiency and Higher Productivity

a) Although machine utilisation capacity in jute mills has improved in the recent years, the level of capacity utilisation still remains below optimum. Such underutilised capacity results in reduced continuity within the overall production chain. Proper use of machinery, as well as the workforce, would contribute to substantial reduction of costs. A balancing chart has been presented in Section 8 regarding the requirement of optimum number of machines, workers and optimum amount of raw materials for smooth functioning of jute mills in an eight hour-shift of operation. Jute mills should examine the situation of capacity utilisation of machines in different sections and take measures in order to establish a balance between the number of machines and workers. A team of experts should be set up by associations like BJMA and BJSA in order to provide technical support to different mills.

b) Low level of machine productivity is a major concern for the Bangladeshi jute mills, which can mainly be attributed to weak performance in terms of duration of machine-use, speed, output-worker ratio and machine-worker ratio. All jute mills should take steps for gradual improvement of machine speed in all sections. The team of experts will examine possible scopes for improvement of machine productivity and provide suggestions regarding the use of new kinds of machine, working environment, and size of workforce. This may include replacement of old machinery, changes in the structure of some components and production techniques. Upgradation of machine speed is associated with the use of better quality fibre for jute production, maintenance of humidity level in the factory premises, and use of skilled workers as well.

c) All the jute mills should review their production processes, techniques and operational management of different sections. A detailed analysis of Indian jute mills reveal that there are a number of cost-effective alternative practices which allows for short-to-medium payback period on investments required for improvement in the production process. A number of suggestions have been put forward regarding the improvement of machinery in the following discussion.

10.3 Targeting Workers for Higher Productivity and Efficiency

a) Labour efficiency is essential for improvement in overall mill-efficiency. Inefficient use of both machine and labour in jute mills have increased the production costs over the years in Bangladesh. Although jute mills use piece wage method to ensure maximum level of productivity in activities such as spinning and weaving, an inefficient labour use in those sections may reduce the benefits from such method. Jute mills should undertake an assessment of labour use in different sections based on the standard practices of machine-worker ratio for operations. For each activity, an optimum number of workers have been suggested as a benchmark. A team of experts under the auspices of the associations will examine the efficiency of labour use and make suggestions for the improvement of labour use practices.

b) Jute mills have always suffered from lack of skilled workers, which are evident in the 40 per cent decline in the number of skilled workers between 2007 and 2011. Scarcity of skilled workforce is a big threat particularly when the jute manufacturing sector has begun to revitalise. Under this circumstances, the use of semi-skilled or unskilled workers will only serve as a temporary arrangement. Historical development of Indian Jute mills reveal that inter-generational workforce play an important role in the development of skilled workforce in the jute sector. Such workforce is by and large unavailable in the jute mills of Bangladesh. Lack of availability of skilled workforce can mainly be attributed to low wage, poor non-wage benefits, non-compliance of standards for workplace safety, and absence of gender-sensitive work environment. Given such circumstances,

the management of jute mills should take a number of steps targeting these problems. *First*, workers should be provided with regular in-house training sessions in order to improve their operational efficiency and productivity. A team of trainers, under the auspices of associations could provide the training to workers. *Second*, a better salary package should be offered given that some sample mills got better response from workers after an adjustment to the wage rate. *Third*, non-wage benefits, particularly for housing facilities, education and social amenities should be improved. *Fourth*, potential workforce both from the locality and outside should be explored. In such case, mill management should consider employing female workers in all sections of jute mills. Also, given that most of the operations in jute mills are not age-sensitive, female workers of different ages can easily be employed in jute mills. The workplace can also be made more gender-sensitive through appropriate sanitary, medical and housing facilities.

c) Jute mills should aim for further mechanisation of production technologies and processes wherever possible. Given that it is difficult to attract workers on a permanent basis at low wages, the sector should also target further mechanisation using semi-automated and automated machines. An in-depth analysis of a number of jute mills in India revealed that mechanisation of some of the labour-oriented activities is profitable for operations and management. Examples include use of forklift or jib crane for stacking, changes in the material handling between godown and softening stages, and improvement in the production process in the drawing section.

10.4 Improvement of Production Process

a) *Production process:* Production processes in jute mills have wide variations in the amount of time, machinery and workers required for the transfer of outputs from one stage to another. Although full mechanisation of the production process is not possible, the use of standard practices reduces such variations. CPD estimates reveal that a substantial amount of time and resources can be saved through standardisation practices.

b) *Stacking*: Jute mills may choose alternate methods for stacking based on the internal structure of the godown, its distance from the spot of unloading as well as the road structure. Such means include: i) use of crane for stacking of raw jute; ii) use of inclined roller conveyor for the transport of jute to the godown; and iii) combination of i) and ii). Analysis of height of stack, number of workers required in the alternate processes, total jute stacked in every shift, labour productivity, amount of money saved, and required initial investment and payback period for mills in India reveal that these alternate methods are highly productive despite their lengthy payback period.

Jib Crane

Forklift

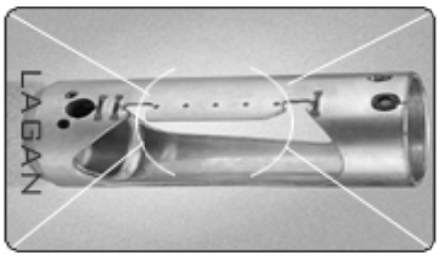
c) *Selection*: Raw jute is cut manually with heavy knives, which evidently slows down the production process and involves larger number of workers. A team of experts may review the level of productivity for selecting raw jute of different grades. The process of cutting raw jute could be made mechanised.

d) *Softening*: Conveyer belts may be used to supply raw jute to the spreader and softener sections. Jute mills may review the existing method for spreading emulsion manually or by using machines, if there is scope for further improvement in saving time. Applying emulsion by pumping through a pipeline seems to be effective for spraying directly on the roots. Introduction of spreader machines or alternate of the spinning machines could be a better option.

e) *Carding*: The production of breaker carding machine should be assessed in terms of working time, jamming, picking, mechanical problems and cleaning. Analysis of Indian jute mills show that the roll-feed breaker carding machines are more productive compared to the hand-feed breaker-carding machines. Finisher cards used in jute mills should be properly designed in order to get the expected level of output.

f) *Drawing*: The Indian study put forward a number of relevant suggestions for improvements in the drawing section. These include, replacement of the broken pin, repairing of sliver breakages at the input side and handing over the machine in running condition during the shift change.

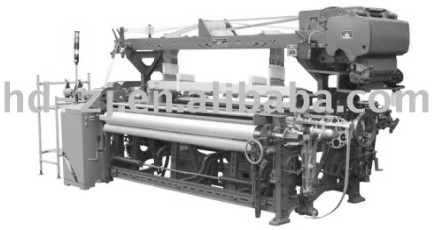
g) *Spinning*: Baxter flyer should be introduced in all spinning frames which will reduce spinning breakages, doffing, requirement of winders, and workload of bobbins (India). As suggested in a study of Indian jute mills, ring spinning can be introduced given that it has more production flexibility and a larger scale of production.



Baxter Flyer

Ring Spinning

h) *Weaving*: Weaving looms should be improved in order to reduce the required number of workers. Proper maintenance of machines and adherence to standardise processes would improve machine efficiency and reduce workload. A number of alternate looms are available which could be taken into consideration, such as shuttle loom, ecoloader loom and flexible rapier loom.



Flexible Rapier Loom

j) *Critical Path Method (CPM):* Making proper use of CPM and maintaining production balancing would contribute to different processes by raising the productivity by about 10 to 15 per cent.

10.5 Targeting Raw Jute for Better Quality Products and Better Machine Efficiency

a) Productivity of resources and the quality of products depend on the types of fibre used, its quality and the batching methods followed by jute mills. Since high quality jute fibre (e.g. deshi tosha

white) is not available in large quantities, and the relatively better jute fibres (tosha 'B' and 'C') have huge export demand, it is usually difficult to ensure the availability of sufficient amount of high quality fibre. Besides, variation of batching standards followed in jute mills indicates that there are scopes for further improvement as poor batching adversely affects productivity of machines and workers. However, the practice of batching raise doubts about mill management's adequate knowledge regarding proper batching methods for different kinds of products. A good knowledge of fibre quality is essential in order to obtain good output. In this context, a proper training is required for the technicians and workers involved in procurement of jute, batching and selection activities, particularly for fibre quality and batching.

b) Timely procurement of adequate amount of raw jute is a major issue for year-round operation of jute mills. Majority of the jute mills have limited storage capacity (storage for three-four months), resulting in expensive bulk procurement in the post-harvest season. Since most of the jute mills have sufficient open space within the mill area, expansion of storage facility would enable mills to procure more raw jute during the harvest season which would reduce cost of raw jute. Moreover, bulk purchase of raw jute during harvest season provides advantage on procurement of required quality of jute fibre unlike in post-harvest season.

10.6 Targeting Maintenance Works for Better Productivity and Efficiency

a) Negligence in regular maintenance of machineries appears to be a major weakness of jute mills in Bangladesh. To keep the machines operational throughout the whole year 'breakdown' based maintenance system should be avoided; and preventive maintenance system should be practiced. Insufficient investment for maintenance (about 4-5 per cent of total cost) makes it difficult to apply necessary maintenance practices (e.g. weekly, monthly and overhaul maintenance). Lack of technical skills required can also undermine the overall quality of maintenance. It is essential to train all relevant staff on proper maintenance practices. In addition, traditional maintenance practices followed in jute mills should be assessed and upgraded. This requires extra training to make the staff and technicians convinced to understand the changes required in the maintenance practices.

b) It is essential to have a fully equipped and operational workshop with skilled technicians, diploma engineers and sufficient supply of raw materials for repair works. There should be sufficient supply of spare parts for jute mills at the domestic markets. The two major spare parts manufacturers, Gulfra Habib Ltd. and Karnafully Engineering Works Ltd., cannot manufacture all the required machineries owing to scarcity of capital, although both have adequate potentials for expansion. Large amount of dues to BJMC mills has created obstruction to Gulfra Habib Ltd. from operating at full capacity. Thus, the company should not be confined to supply machineries to public sector jute mills only; it should also be opened to the private mills and follow the principle of 'first-come-first-serve'. Operation of Karnafully Engineering Works Ltd. should be further expanded as well. All in all both companies should expand their marketing network and adhere to commitments as regards quality of product and delivery time.

10.7 Targeting Factory Level Compliances for Better Work Environment

a) Factory level compliances are found to be at poor state. This is evident in a number of aspects – insufficiency of light and air in the factory premises, high level of dust, lack of cleanliness, poor protection capacities in case of risky operations, and lack of proper medical facilities such as nurses, doctors, etc. Absence of a gender-sensitive environment (e.g. usually employed as temporary workers; lack of dormitory facilities) is a major concern as female workers are deprived of facilities enjoyed by male workers. In this backdrop, jute mills, in collaboration with private sector and non-government organisations (NGOs) should establish necessary facilities for workers including dormitories, schools, clinics and entertainment facilities.

b) Production environment of jute mills widely vary and have definite impact on efficiency and productivity. Lack of proper maintenance of humidity level, air, light and sound control is caused by lack of awareness, and investments considered 'unnecessary' by the mill management. A team of experts can be deployed for examining the production environment while putting particular attention on the level of humidity, light, air, sound and dust. Assessment of the level of understanding of managers, engineers and other professionals regarding work environment is essential as well. Necessary training on the standard practice of these aspects will greatly help improve the production environment.

10.8 Targeting Management of Jute Mills for Building Proactive, Ready to Invest and Forward-Looking Perspective

a) Lack of professionalism of the mill management manifested by serious lack of dynamic approach has been a major limiting factor for the development of jute manufacturing sector in Bangladesh. Young, energetic and dynamic management staff is required in order to take this sector forward. Skilled mid-level management, particularly engineers and junior management trainees need to be recruited through attractive compensation packages. Absence of institutes dedicated to the development of jute mill professionals is a major deterrent in development of human resources. Thus, a full-fledged jute technology institute similar to that in India should be established. In this context, upgradation of the textile institute for jute manufacturing sector located in Jamalpur should be implemented immediately.

10.9 Targeting R&D for Better Quality and Diversified Products

a) R&D is essential for this sector, with fibre quality, texture, length and strength as the major focus. Recent invention of genome sequencing of jute could be expedited further. A number of researches undertaken by IJSG and Bangladesh Jute Research Institute (BJRI) are at experimental phases which need to be finished quickly.[32] Jute mill owners have also emphasised on further research on product development. With the ban on polythene use, ample opportunities have been created for the expansion of use for jute product, for which alternate jute products should also be developed.
b) Despite the fact that *National Jute Policy 2011* has put emphasis on expansion of domestic market through increased use of diversified products (from the existing 13 per cent of total share of market to 25 per cent by 2021), potential of diversified jute products is largely untapped. Existing facilities for jute research have little relation with commercial product development. Public-private partnership (PPP) for research on commercial jute goods development is urgently required, and collaboration between university and companies can play vital role in this regard.
c) An elaborate micro-motion study should be conducted for the jute mills to enhance the productivity at micro levels. Government with the help of private sector can make plans for this kind of studies.

10.10 Investment for Technology Upgradation

a) Modernisation and development of jute mills encompass a range of high investment measures which will be difficult without institutional financing. Majority of the jute mills are unable to invest because of their poor financial condition while the rest lack the initiative because of the costs involved. Government should introduce the *Technology Upgradation Fund (TUF)* scheme, like that of India, in order to provide financial support to the jute manufacturing sector for technological upgradation. In India, the TUF Scheme for the jute and handloom sectors provides

[32] One important project is the commercial use of jute sacks for construction of roads.

for the reimbursement of fund with 5 per cent interest for technology upgradation projects. Likewise, the GoB, as well as the commercial banks, should also provide financial support in the form of low interest credit for machineries, development of factory premises and godown facilities considering the strong growth potential of the jute sector.

b) Jute machinery producing companies such as Gulfra Habib Ltd. need financial support for upgradation, and also to deal with the financial difficulties they face because of overdue payments from the BJMC mills. The company should invest on increasing its production of machinery, spare parts and target the local demands beyond that of the BJMC mills. In this case, it should take orders from jute mills on 'first-come-first-serve' basis with advance payment, and also open retail outlets in some of the major jute-processing regions like Khulna, Narayanganj and Dhaka. Like Karnafully Engineering Works Ltd., Gulfra Habib Ltd. also needs to lower the retail price of its machinery and spare parts. For increased diversification, it should invest in manufacturing carding machines as well. Besides, the mills should appoint skilled technicians for its operation.

c) In order to expand its manufacturing base, Karnafully Engineering Works Ltd. requires financial support from banks. With the scarcity of skilled workers as a major deterrent, it needs to revise the payscale in order to attract new workers. It should also open retail outlets in major jute-processing districts. The proposed TUF could be used to finance such initiatives.

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