

SUPPLY AND VALUE CHAIN ANALYSIS OF RICE MILL

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ABSTRACT

The objectives of the study were to identify the present status of rice milling in Bangladesh, supply and value chain of automatic and semi-automatic rice mills, the constraints of rice mills especially in supply and value chains and recommend priority areas of supply and value chain for interventions. Based on the growth and concentration, Dinajpur was selected as study site. The numbers of Traditional rice hullers, Husking rice mills, Semi-automatic rice mills and Automatic rice mills are 100000, 14139, 457 and 142, respectively. There are three distinct channels of supply chain in rice mill sub-sector. The channels are imported machinery channel, rice mill equipment production channel and rice processing channel. The total market size of rice milling is Taka 64854 million employing 0.26 million labour forces. In automatic rice mills, the profit margins in rice milling are estimated as Taka 768 and Taka 1105 per ton of milling whole paddy for parboiled and aromatic rice, respectively. In semi-automatic rice mills, the profit margin for per ton of aromatic rice milling is found as Taka 920. The rice milling sub-sector has great potential to modernize and to add valuable contribution in loss saving, quality milled rice production and employment generation.

Key words: Supply chain, Value chain, Rice mill

INTRODUCTION

Rice is the dominant crop and largely determines the rate of progress in the agriculture sector including non-crop agriculture sub-sectors. The huge quantity of paddy, produced in the country, is largely processed to clean rice by different types of mechanized rice mills, popularly known as Engelberg, Major and Automatic rice mills, having different capacities are spreading through the country. Besides, house hold level processing can also be found in rural communities. Pounding of paddy in a mortar with a pestle by hand or using Dheki is the traditional milling process mostly used in case of small quantities of rice milling mainly aromatic or fine rice. The milling outturn (67-70%) of traditional village milling process is quite impressive in comparison to modern rice milling. Milling is a crucial step in post-harvest processing of rice. The basic objective of a rice milling system is to remove the husk and the bran layers, and produce an edible, white rice kernel that is sufficiently milled and free of impurities. Most rice varieties are composed of roughly 20% rice hull, 11% bran layers, and 69% starchy endosperm, also referred to as the total milled rice. Total milled rice contains whole grains or head rice and broken. The by-products in rice milling are rice hull, rice germ and bran layers, and fine broken. (Farouk *et al.* 2002)

The mechanical process of modern rice milling is consists of: pre-cleaning, husking, husk aspiration, paddy separation and de-stoning, whitening, polishing, shifting, length grading, blending, weighing and bagging. Losses in the milling process are caused by poor technical performance of milling machinery, resulting in poor milling yields. Engelburg type steel hullers have been eliminated from different countries as it breaks the grain in the milling process and yields only 53% milled rice. However, in Bangladesh, the Engelburg type steel rice hullers are still predominant in rice milling. At

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present, about 95% milling is done by Engelburg steel huller in Bangladesh and at least 2 % rice is lost due to use of Engelburg steel hullers (Ali, 2002). The conversion of Engelburg rice huller to rubber roll sheller could save 2-4% of whole rice loss with no broken rice. Considering milling of about 27 million tons of paddy annually could save 0.648 million tons of milled rice, i.e. almost quarter of the total whole rice deficit of the country. Use of rubber-roll hullers also produces good quality rice and rice byproducts that can be sold at higher prices. Thus the study was undertaken to identify the present status of rice milling in Bangladesh, the supply and value chains of automatic and semi-automatic rice mills, the constraints of rice mills especially in supply and value chains, and to recommend priority areas of supply and value chains for intervention.

MATERIALS AND METHODS

Rice mills in Bangladesh consist of traditional, husking, semi-automatic and automatic rice mills. Depending on the capacity and quality of production, semi-automatic and automatic rice mills were selected for this study. The study was based on the field survey where primary data were collected for identification of supply and value chains and estimation of value addition at each level by means of personal interview of the actors of the supply and value chains.

Selection of the Study Site: Based on the growth and concentration, Dinajpur is known as the quality rice producing area and a significant number of small to large rice mills are located in this region. Considering the resource and time limitation selected rice mills of Dinajpur area have been included in the study for in-depth analysis.

Sampling Units: Key Informants, Actors in the Supply and Value chain, Service providers (commercial and embedded)

Sampling Technique: A combination of both Non-probabilistic Stratified Random Sampling and Cluster Sampling techniques were followed.

Sample Distribution: Processors or millers are the key players who primarily convert paddy into rice by mechanical processing. Various categories of rice mills were selected on the basis of operation, sources of power, and capacity of milling, initial investment of mills, technical parameters and processing technique.

Survey Questionnaire: The survey questionnaires were prepared according to the objectives of the study with active consultation with the key informants, expert from the relevant fields and secondary information.

Table 1. Distribution of respondent in the study area

Actor/Informant	Number of respondents
Paddy trader	06
Paddy Arotder	08
Processor/Rice mill owner	12
Wholesaler/Rice Arotder	08
Retailers	06
Rice mill equipment manufacturer	05
Demand side of BDS	04
BDS provider	02
Sub-total	51
Key informant	01
Total	52

Data collection method: Data were collected through personal interview.

Estimation of Economic Parameters:

Cost determination and analysis: In this study economic profitability of rice processing in rice mills was determined based on economic analysis considering the fixed and variable costs involved in rice milling.

Fixed costs in rice milling:

The fixed costs in rice milling include:

- a) Annual depreciation cost of machinery
- b) Yearly interest on investment for machinery
- c) Tax on machinery
- d) Yearly insurance cost of machinery
- e) Yearly fixed cost for land use
- f) Annual depreciation cost of buildings/infrastructure
- g) Yearly interest on investment for buildings/infrastructure

Annual depreciation costs in (a) and (f) were calculated as

Annual depreciation cost, $D = (P-S)/L$

Where, P = purchase price, Tk,

S = salvage value, Tk

L = Useful life, yr

Interest on investments in (b) (g) were calculated as

Interest on investment, $I = [(P+S)/2] \times i$

Where, i=Interest rate

Tax on machinery, as in (c), was assumed to be 1.4% and insurance cost of machinery, as in (d) was taken as 0.25% of purchase price

Therefore, Total fixed cost in rice milling, $FC = (a) + (b) + (c) + (d) + (e) + (f) + (g)$

Variable costs in rice milling:

Variable costs per year in rice milling include:

- h) Labour cost
- i) Repair and maintenance cost
- j) Cost of electricity
- k) Management cost (Staff salary)
- l) Tax

Total variable cost in rice milling is, therefore, $VC = (h) + (i) + (j) + (k) + (l)$

The cost of fuel for parboiling is not included as because the millers produce rice husks in their rice mills, which are adequate for fueling the boilers and they do not spend extra money for fuel.

Annual operating cost, AOC (Tk/yr), was calculated as

$AOC = FC + VC$

Hourly operating cost of rice mill, HOC, was calculated as

Hourly operating cost, $HOC = \text{Annual operating cost (Tk./yr)} \div \text{hours of use of the rice mill per year (hr/yr)}$

Milling cost per tonne of paddy was calculated as

Milling cost per tonne of paddy (Tk/t) = Annual operating cost (Tk/yr) ÷ Tonne of paddy processed per year (t/yr).

RESULTS AND DISCUSSION

Present status of rice milling in Bangladesh: The rice mills under the Department of Food are generally classified as Husking rice mills, Major rice mills (semi-automatic) and Automatic rice mills, and the numbers is shown in Table 2 with a fortnight capacity of 6,25,600 million tons (DOF, 2007). In addition there are about 1, 00,000 traditional Engelburg type rice huller in the country. There are about 42 automatic, 30 semi-automatic and 1582 registered husking mills are operating in Dinajpur district (DOF, 2007). Among rice milling installations about 95 percent are using Engelburg type steel huller, which incurred a significant loss of rice and rice byproducts. The existing market sizes of husking, semi-automatic and automatic rice mills are estimated as Taka 19795, 27420 and 11360 million, respectively. Automatic and semi-automatic rice mills produce aromatic rice, which are now exported to a limited quantity.

Table 2. Present number of rice mills and their capacities

Rice Mills	No. of Mills	Volume of business, M Tk	Capacity utilization (%)
Husking (registered)	14239	19,795	18
Husking (non-registered)	1,00,000	1170	33
Semi-automatic	457	27420	30
Automatic	142	11360	60

Milling of rice is a labour intensive task. The number of labourer employed in traditional, husking, semi-automatic and automatic rice mills are shown in **Table 3**

Table 3. Types of rice mills and employment

Type of rice mill	No. of rice mill	Employment/unit	Total employment
Husking (registered)	14139	10	1,41,390
Husking (non-registered)	1,00,000	1	1,00,000
Semi-automatic	457	30	13,710
Automatic	142	44	6,248
Total employment			2,61,348

Supply Chain of Rice Mill: There are three channels of supply chain in rice mills. The channels are Imported machinery channel, Rice mill equipment production channel, Rice processing channel. There are two supply channels of machines and equipment for all categories of rice mills. One is imported machinery channel and the other is locally produced machine and equipment channel. Earlier, almost all machines and equipment for rice mills were imported from abroad especially from India and China. However, in recent time 3 manufacturers at Dinajpur and 1 manufacturer (polisher) at Bogra are manufacturing most of the equipments such as dryer, sheller, polisher, grader etc. Boilers for the rice mills are still imported from abroad, as there is no such industry in the country. A common supply chain of rice mills is shown in Figure 1.

Imported machinery channel: This channel consists of Dhaka based importers. The importers usually imports about 30% of machinery and equipment (rice polisher, motor, gear box, belt etc) required by the semi-automatic rice mills and supply it to them on demand. Rest of machines and

equipments are manufactured locally. In case of automatic rice mill, about 30% of machinery and equipment (boiler, dryer, huller, paddy separator, polisher, sheller, heater, motor etc.) is supplied to auto rice mill owners. Rest of the machines and equipments are manufactured locally.

Rice mill equipment production channel: This channel consists of raw materials importers (Dhaka), imports pig iron, hard coke, silicon, ship breaking scrap etc and supply about 25% to the rice mill equipment manufacturers (Boil rice polisher) and they supply about 5% equipment to the rice mill owner. The traders of these raw materials supply about 25% to the manufacturers of paddy separator, dryer, sheller, heater etc. of automatic rice mill. The raw material traders of semi-automatic rice mills supply about 15% of raw materials to the local equipment manufacturer and about 70% is supplied to the local manufacturer of semi-auto rice mill owners.

Rice processing channel: The channel involves farmers, arotdar/commission agents, rice mills, wholesalers and retailers. The farmers generally sell their paddy in the local market and it is bought by the paddy-traders and they in turn sell the paddy to the processors or rice millers. The processors and wholesalers also have their appointed agents to buy paddy on behalf of them. The large processors themselves are usually engaged in the paddy trading thus creating an overall control over rice market from paddy trading to wholesaling. However, the paddy wholesalers are the key players to supply paddy to the processors having high processing capacity. Mostly the larger auto rice millers generally have multiple sources of purchase points to meet their high milling capacity. Relatively smaller capacity husking millers buy paddy from local traders and other sources e.g. farmers/growers,

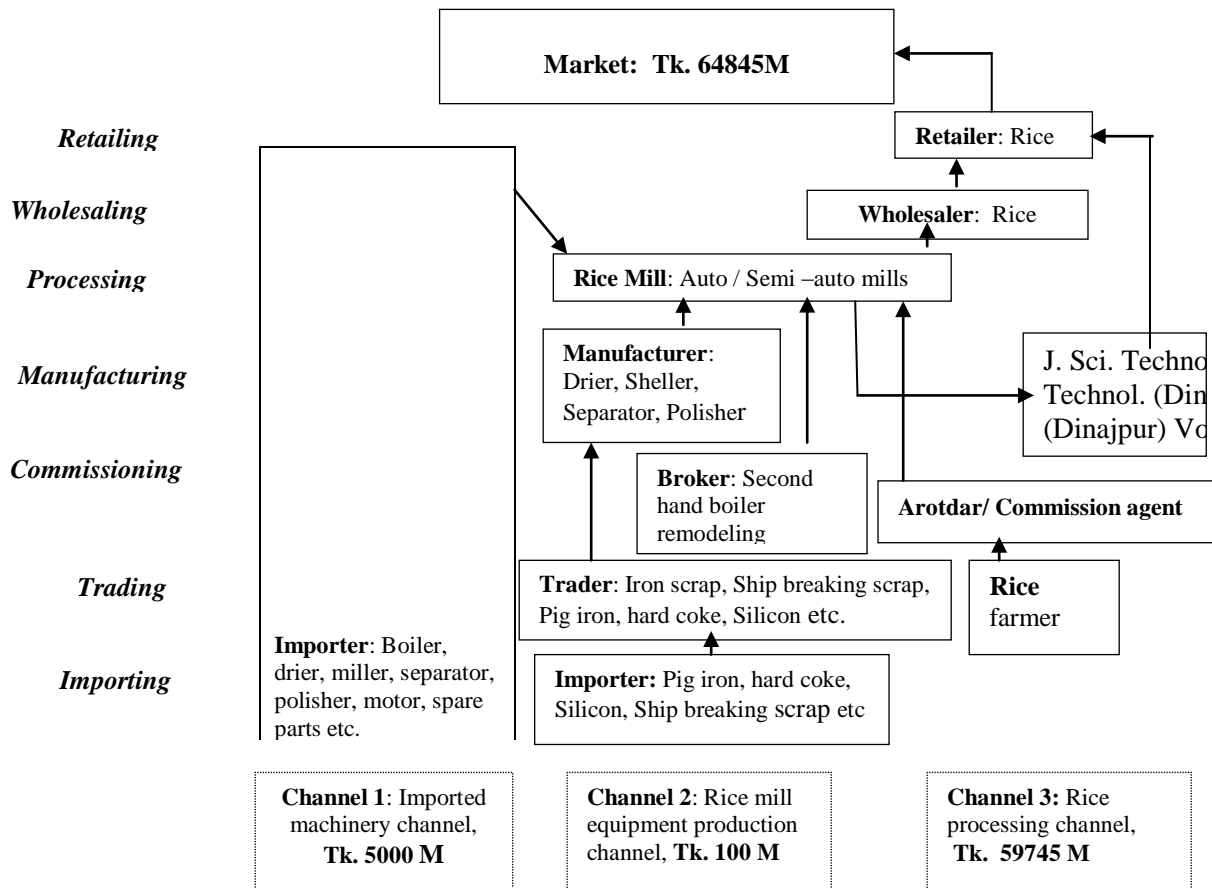


Figure 1. Supply Chain of Rice mill (Auto/Semi-auto mills)

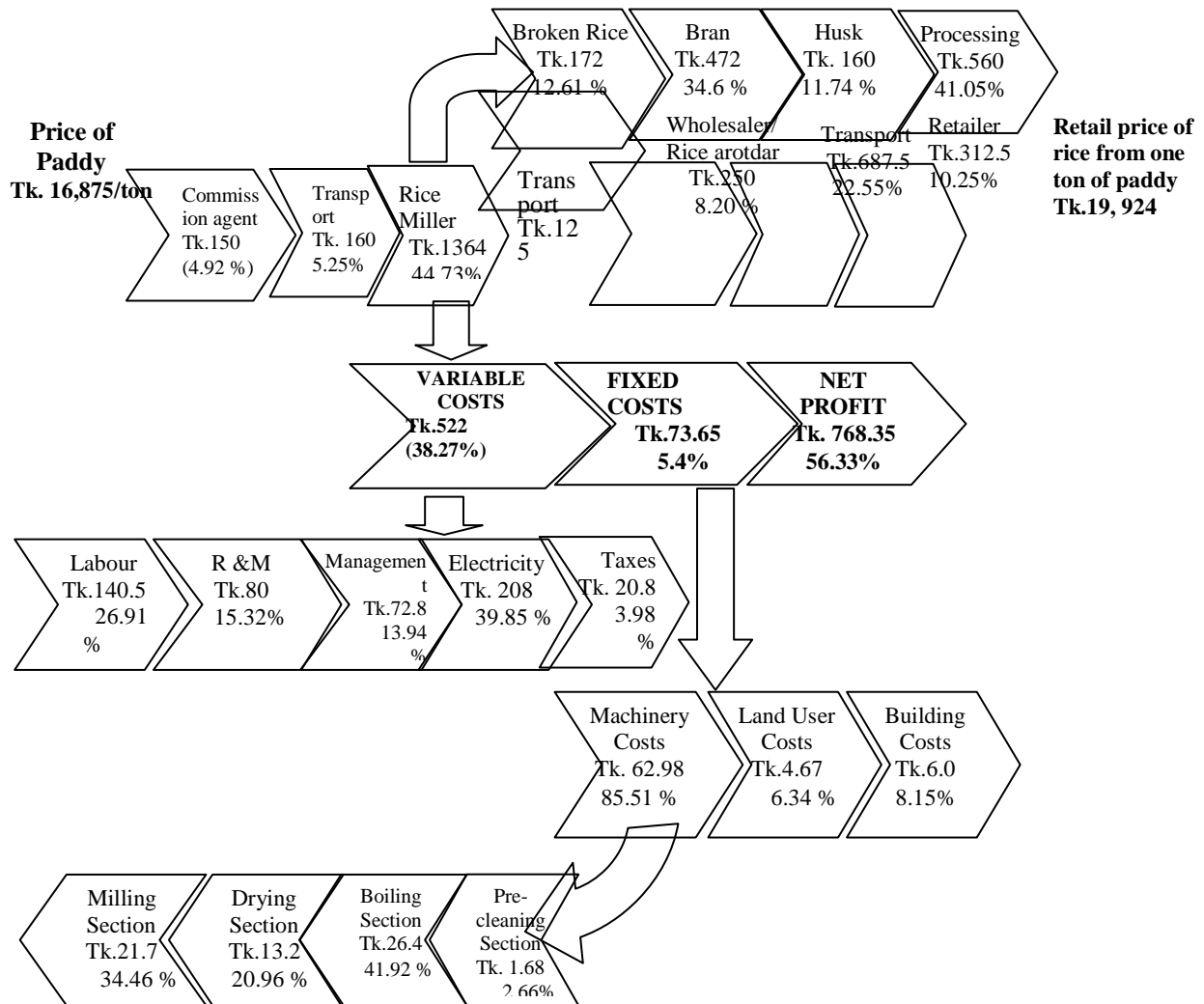


Figure 2. Value chain (value addition) of Automatic rice mill (parboiled rice)

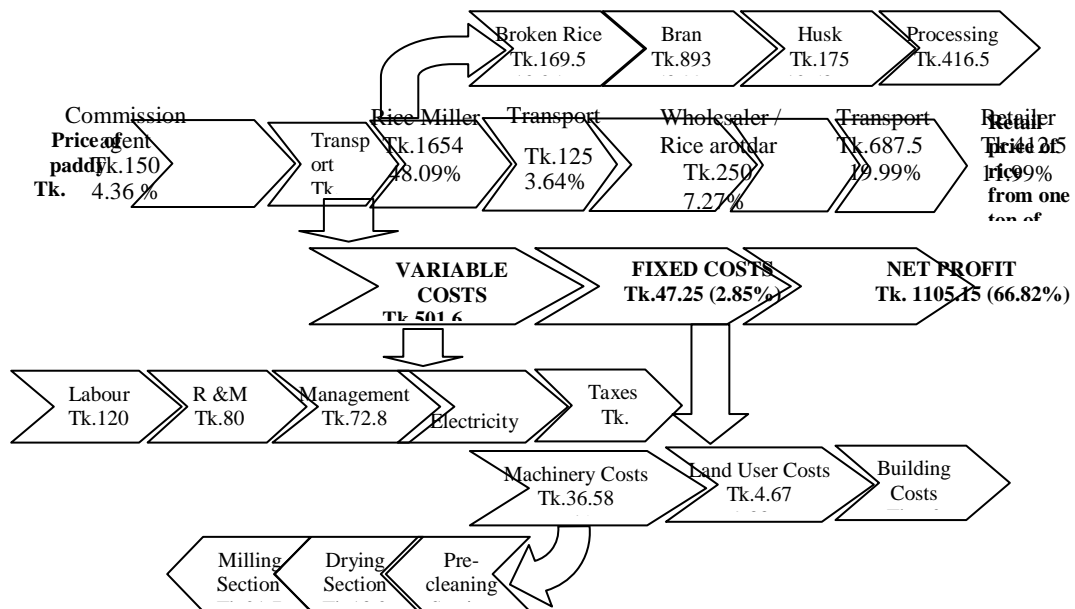


Figure 3. Value Chain (value addition) of Automatic Rice mill (Aromatic rice)

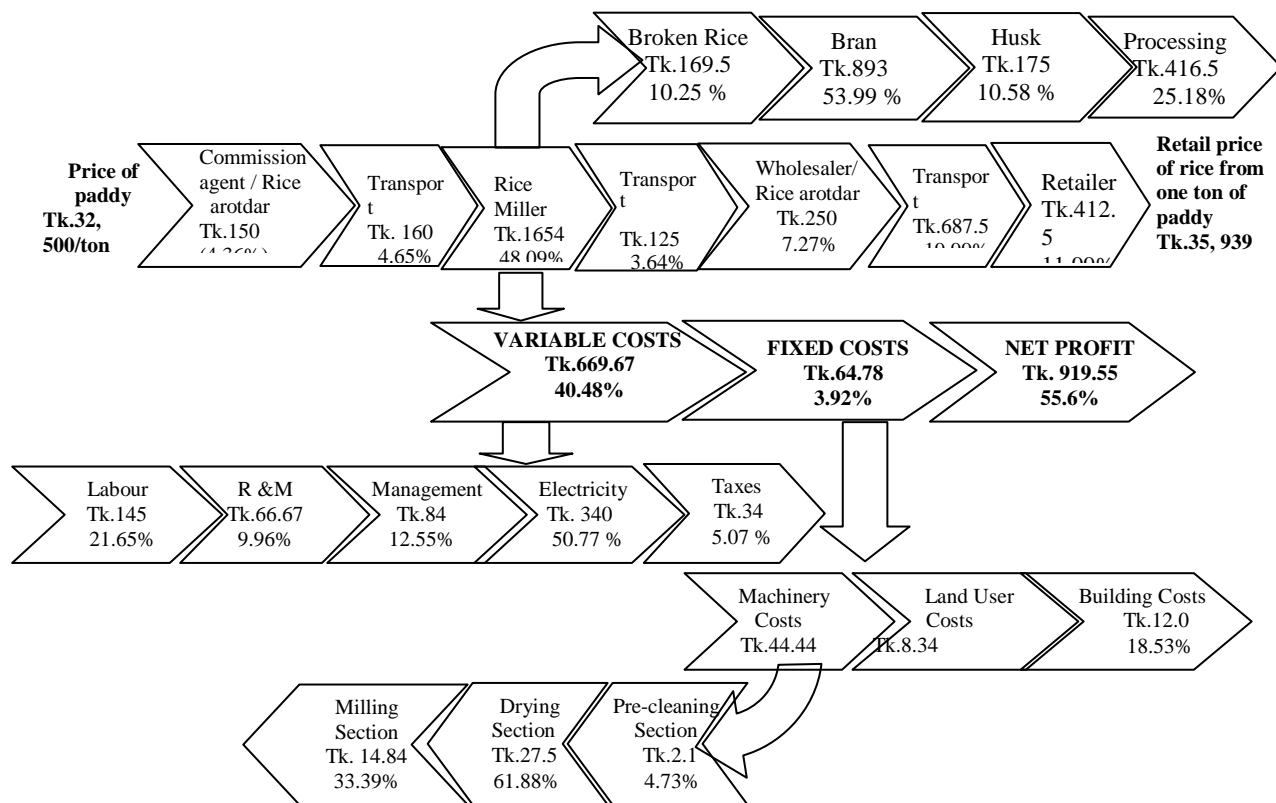


Figure 4. Value Chain (value addition) of Semi-automatic Rice mill (Aromatic rice)

In semi-automatic rice mills, rice milling (48.09%), transport (19.99%), retailing (11.99%) and wholesaling (7.27%) constitute the major value addition (Figure 4) for aromatic rice. The profit margins are Taka 919.55 (55.6% of value addition at this level) for aromatic rice. The lower profit margins registered for semi-automatic rice mills are because of the low capacity utilization, which is about 15% compared to 60% for automatic rice mills.

In case of parboiled rice and aromatic rice the profit margins per ton rice mills are found Taka 768 and 1105, respectively. In case of semi-automatic rice mills the average profit margin for aromatic rice is found Taka 920. The variation in profit margins is because of processing cost in various types of rice mills. Moreover, high capacity and capacity utilization of automatic rice mills provide an edge over processing cost of rice in husking and semi-automatic rice mills.

intermediaries, etc. Commission agents have the trading arrangement with the large auto rice mills and buy rice on commission basis for them. In case of automatic rice mills about 50% milled rice is supplied to the rice arotdar/ wholesaler, 10% to the government godown, 20% to the rice retailers for the market. About 50% of the rice husk is supplied to the rice husk briquette producers and rest 50% is supplied to the rice husk retailers. In case of semi-automatic rice mill about 70% rice is supplied to the rice arotdar/ wholesaler, 10% to the government godown, 20% to the rice retailers for the market. The marketing channels indicate that wholesalers/arotdars play the pivotal role in milled rice marketing and control the supply of rice in the retailers market.

Value Chain Analysis: In automatic rice mills, rice milling (44.73%), transport (22.55%), retailing (10.25%) and wholesaling (8.20%) constitute the major value addition (Figure 2) for parboiled rice. For aromatic rice the major value additions are rice milling (48.09%), transport (19.99%), retailing (11.99%) and wholesaling (7.27%) (Figure 3). The profit margins at rice millers' level are estimated as

Taka 768.35 (56.33% of value addition at this level) and Taka 1105.15 (66.82% of value addition at this level) for parboiled and aromatic rice, respectively. Parboiled rice milling requires boilers for parboiling of paddy which incurred about 5% of value addition as fixed cost compared to 3% fixed cost for aromatic rice. This additional cost is incurred because of the boiler, which adds an amount of Tk. 26/ton of milled rice.

Constraints of Rice Mills in Supply and Value Chains: The major constraints of the sub-sectors along with Business Development Service (BDS) provisions and potential service providers are summarized in the Table 4.

Table 4: The major constraints of the sub-sectors

Pri ori ty Ar ea s	Constraints	Business Development Services	Service Providers
	Lack of skill at rice mill and workshop level: Operation, maintenance and repair skill (rice mill); Technical skill (for fabrication of rice mill equipment); Management skill (business management, accounting & marketing).	Provisions for training on operation, maintenance and repair of rice mill to operators and technicians.	Poly Technique Institute (PTI), Technical School & College (TSC), Apprenticeship at rice mills (Embedded), Apprenticeship at workshops (Embedded), Senior mechanics (Embedded)
		Provisions for training on management, accounting and marketing skill to management personnel.	Private training institutes, Private enterprises (Rice mills) can provide training beside its production line.
	Lack of access to export market for aromatic rice.	Provisions for easy access to export market for aromatic rice to rice mills.	Private sector exporters (Embedded)
	Loss of rice due to inappropriate technology at rice mills.	Provisions for access to knowledge and skill to replace engelburg huller by rubber roll huller to husking and traditional rice mill owners	Bangladesh Agricultural University (BAU), Bangladesh Rice Research Institute (BRRI), PRAN (Transacted), Intermediate Technology Development Group (ITDG), Large Machinery Suppliers (Embedded), Rice mill associations
	Lack of knowledge and skill to replace engelburg huller by rubber roll huller.	Provisions for legislation to replace engelburg huller by rubber roll huller of husking and traditional rice mills.	Private enterprise can provide technical service to replace engelburg huller by rubber roll huller.
	Lack of steady supply of electricity.	Provisions of non-interrupted supply of electricity to producers and sellers.	Power Development Board (PDB) Palli Bidyut Samati (PBS)

CONCLUSIONS

Based on the findings the following priority Business Development Services (BDS) are recommended for further intervention: Developing skills at rice mill and workshop level related to Operation, maintenance and repair skill (rice mill), Technical skill (for fabrication of rice mill equipment), Management skill (business management, accounting and marketing); Developing management, accounting and marketing skill to management personnel; Facilitating easy access to export market for aromatic rice to rice millers; Access to information, knowledge and skill to replace engelburg huller by rubber roll huller to rice mill owners; Enacting legislation to replace Engelburg rice huller by rubber roll huller to husking and traditional rice huller owners; Policy options on non-interrupted supply of electricity to producers and sellers.

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