

## UPGRADING STATUS OF LIGHT ENGINEERING CLUSTERS IN BANGLADESH: AN ANALYSIS

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***Abstract:** Light Engineering (LE) is an important industry in Bangladesh which has been acting as a supplier of the necessary machinery, spare parts, and repairing services to other industries of the country. Although the industry has high potential to stand out as a leading industry of Bangladesh, the current upgrading condition of the industry is not optimal. The purpose of this study is to discover the upgrading state of the light engineering clusters of the industry. Taking qualitative approach, the study developed six cases based on collected data through an unstructured questionnaire from three light engineering clusters of the country. The study concludes that the light engineering firms are struggling to survive, and government should take initiatives to facilitate the upgrading of firms.*

***Keywords:** Cluster, Light Engineering, Upgrading.*

### INTRODUCTION

Light engineering is frequently referred to as a mother industry that supports all other industries by providing machinery, equipment's, spare parts, accessories, and import substitute items (Quadir and Mahamud, 2009). All progressive countries have been intensifying their efforts to develop the Light Engineering (LE) sector that acts as a prime mover for the development of a country's industrial base (Uddin, 2010). Bangladesh is a developing country of the South Asia where the light engineering sector has been playing a very significant role in the socio-economic development. The sector has a mentionable contribution to economic growth and poverty reduction of the country (Ahmed and Bakht, 2010). It also has a high potency to contribute to the economic development along with a vast scope of employment generation. By realizing the situation, Bangladesh government has considered this sector as one of the booster sectors.

While the international light engineering clusters are using hi-tech machinery, most of the Bangladeshi light engineering clusters have been using outdated conventional technologies and indigenous machinery through unskilled and semi-skilled workers. Most of the light engineering enterprises have lack of modern technologies like modern heat treatment, material testing, magnetic crack tester, etc. and the common use of machineries in each enterprises of the industry is: lathe machine, grinding machine, shaper, planner, milling, etc. (Uddin, 2010). In consequence, enterprises capability and the products quality have not yet been

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able to meet the competitive challenges that come from the global market (ADSL, 2007). Even the light engineering enterprises are micro and small in size and have limited capacity to upgrade their condition (Ahmed and Bakht, 2010). Thus, the industry is very much locally focused and the current capabilities are not sufficient to meet the local demand. So, light engineering enterprises have to upgrade significantly to meet local demand and to catch up the global market. In this situation, current study is an attempt to explore the existing upgrading situation of the light engineering clusters in Bangladesh. Therefore, the specific research question of the study- what is the current upgrading status of the light engineering clusters in Bangladesh?

The paper has been structured in eight sections. The first section states the study background and introduction, second section represents the relevant recent studies on cluster and upgrading; section three is the objective of the study, methodology of the study has been described in section four, section five is about the light engineering industry of Bangladesh, section six is a description about clusters and case firms, section seven is a brief about overall upgrading condition of clusters, and the next section is conclusion with some recommendations.

## **LITERATURE REVIEW**

Different terms are used by policy makers and academics to denote clusters such as 'industrial districts', 'system of production', 'networking', or for the broader environment, a 'regional innovation system' (OECD, 2007). In the policy brief (OECD-2007), the term 'cluster' defined as "a cluster includes firms and other knowledge-producing agents in a geographically concentrated area with inter-linkages among them". According to Schmitz (1995), a cluster is constituted by a group of producers when they produce the same or similar things in close vicinity to each other. Porter (1998) defines clusters as geographical concentrations of interconnected companies, institutions and some others related industries like specialized input suppliers, specialized infrastructure providers, manufacturer of complementary products, governmental institutions, associated institutions (like universities, standards-setting agencies, vocational training providers, research and technical support providers, trade associations) in a particular fields which are important for both cooperation and competition. Ketels and Memedovic (2008) define cluster as "a natural manifestation of the specialised knowledge, skills, infrastructure and supporting industries in enhancing productivity as the key determinant of sustaining high levels of prosperity in a location and driven by externalities of various types, supplier relationships, the use of a common factor inputs like specialized labour markets, or knowledge spillovers". Laven (2005) differentiated three levels in the cluster: (a) the producers as first level, (b) relations with other local actors (institutional support and services) as second level, and (c) research and development institutions as third level.

Cluster offers opportunities for powerful externalities and may facilitate the development of joint actions among local actors (Pietrobelli and Rabelloti, 2006). According to Porter (1998), clustering is a new way of thinking about the location, and it affects the competitiveness of companies within countries as well as across national borders. It makes the market more transparent, induces local rivalry, and facilitates collective action to tackle common problems (Schmitz, 1995). The literature on industrial clusters analysis emphasize the importance of local linkages for increasing performance and competitiveness (Humphrey and Schmitz, 2002). Companies in a cluster with strong cooperation can better exploit the complementary skills and capabilities of local suppliers and service providers (Ketels and Memedovic, 2008).

Upgrading mainly refers to lower costs, increasing efficiency, and increasing the value adding activities (Humphrey and Schmitz, 2000; Kaplinsky and Readman, 2000 in Laven, 2005). Upgrading is the only way to sustain a competitive advantage i.e. to move to more sophisticated types (Porter, 1990). Upgrading is usually defined as the ability to produce a better product more efficiently, or to move into skilled activities (Pietrobelli and Rabelloti, 2006). Upgrading in any industry is necessary to make better products and services, to make them more efficiently or move into more skilled activities (Porter, 1990; Kaplinsky, 2000 in Humphrey and Schmitz, 2002). Humphrey and Schmitz (2000) identified four types of upgrading: (a) process upgrading: process upgrading means 'transforming inputs into outputs more efficiently by reorganizing the production system or introducing superior technology' Example- footwear producers in the Sinos Valley of Brazil. It involves acquiring new machinery, implementing a quality control program, shortening delivery times, reducing waste, and in general providing a more efficient transformation of inputs into outputs (Navas-Alema'n, 2011); (b) product upgrading: product upgrading means 'moving into more sophisticated product lines in terms of increased unit values'. Example- the apparel commodity chain in Asia. It involves introducing new products, changing designs, improving quality, and producing a more sophisticated final output (Navas-Alema'n, 2011); (c) functional upgrading: functional upgrading means 'acquiring new, superior functions in the chain, such as design or marketing, or abandoning existing lower-value-added functions, to focus on higher-value-added activities'. Example- Torreón's blue jeans industry upgrading from maquila to "full-package" manufacturing. It involves moving from higher margin and difficult-to-replicate activities such as original design, branding, and marketing (Navas-Alema'n, 2011); (d) intersectoral upgrading: intersectoral upgrading means 'applying the competence acquired in a particular function to move into a new sector'. Example - the use of competence in producing televisions in Taiwan to make monitors and then to upgrade into the computer sector; (e) upgrading of marketing linkages: marketing linkages

upgrading which means “a shift to higher value-added chains and lead firms” (Gerrefi, 1999 in Smakman, 2003 in Laven, 2005).

Clustering create the opportunity to attain efficiency gains which are rare possible by individual firms and it is a matter in developing countries where clustering help small firms to overcome well-known growth constraints (Schmitz, 1999). Giuliani, et al. (2005) also has mentioned that ‘clustering helps local firms in industrial districts overcome growth constraints and compete in distant markets in advanced and less developed countries’. According to Laven (2005), clusters in developing countries favor incremental innovation, often require intervention, and most of the clusters do not emerge spontaneously. Laven (2005) also stated as ‘studies on upgrading have been mainly concentrating on small-scale industries in developing countries’. The cluster offers the interesting opportunities for upgrading and modernization of local firms (Pietrobelli and Rabelloti, 2006). The cluster literature emphasize the importance of local level governance and incremental (learning by doing) upgrading through close interactions between local firms and institutions (Humphrey and Schmitz, 2002).

In Bangladesh, the study on light engineering clusters in the international context is very limited. Even there is no consensus among scholars to define the light engineering firms. Therefore, no widely accepted universal definition can be referred (Uddin, 2010). It varies from country to country as the definition of mini; micro, small, medium, and large industries vary from country to country. According to Uddin (2010), Light Engineering (LE) industry consists of firms which production process is involved in engineering or technology, require small capital investment, and the product category includes metal products, electrical, electronics, and electromechanical products. Rabbani (2005) defined LE as “Light Engineering should have a local engineering aspect in the design of a product or its making, i.e., where indigenous engineering intellect or skill has a contribution. In Bangladesh, Light Engineering firms are micro or small in sizes that produce spare parts and supporting materials for other industries. In fact, a very few number of studies conducted on light engineering industry of Bangladesh. Recently some studies have taken place on the characteristics, existing problems, future prospects, government role, private-public collaboration, technology use, innovation progress, and policy issues related to the light engineering sector (Uddin, 2010; Ahmed and Bakht, 2010; Quadir and Mahmud, 2009, Rabbani, 2005). These studies cover limited issues, and still different significant issues related to light engineering industry are unexplored. Specifically, no study has been taken yet to see the situation of light engineering enterprises from cluster up-gradation perspective. This study gap creates a scope to explore the upgrading condition of the light engineering cluster.

## **OBJECTIVES**

The primary objective of the study is to explore the existing upgrading situation of the light engineering clusters in Bangladesh. For attaining the primary objective of the study, the specific objectives are as follows:

1. To know the upgrading condition of light engineering firms in respective of different upgrading typologies
2. To explore the actors that work behind the up-gradation and de-gradation of enterprises
3. To understand the overall upgrading position of the industry from global market perspective
4. To know the role of government in upgrading the light engineering firms

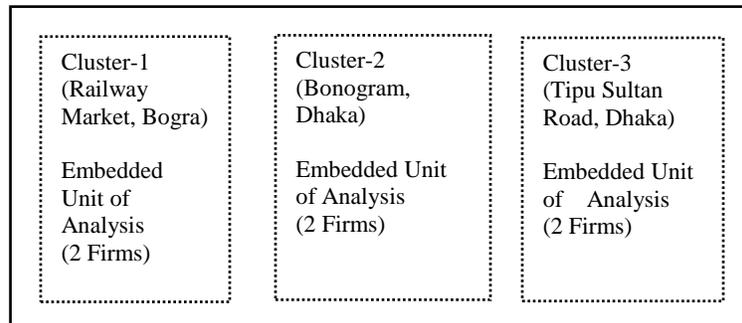
## **METHODOLOGY**

This is an exploratory study, and case study method is used as a research strategy. According to Yin (2002), in general, 'what' questions favor the exploratory study, 'who' and 'where' questions favor the descriptive, and 'how' and 'why' questions favor the explanatory study. In this study, the research question is 'what' question, so the case study method is used as an appropriate research strategy. After selecting the case study as a research strategy, the next step was to design the case study. There are different light engineering clusters in the Light Engineering (LE) industry of Bangladesh. Before selecting the cases from the industry, various sources were used to collect information about the current condition of the different clusters of the industry. After getting insights of the whole industry through some secondary sources like articles, newspapers, and websites of relevant institutions, three clusters from Light Engineering (LE) industry of Bangladesh are selected for the study. Two cases were selected from the capital city (Dhaka) and another one from the northern part (Bogra) of the country. Tipu Sultan Road, and Bonogram from Dhaka were selected because of their growth, reputation, and long history, and Railway Market from Bogra was chosen because of the cluster's reputation, vast customer base, and reliable source of agricultural tools and machineries. A general understanding of the upgrading situation of light engineering industry is developed from the understanding of three selected clusters. Multiple case design was used to select case firms from each cluster. Three Light Engineering (LE) clusters are considered as multiple-case design and information collected from different units of each cluster as embedded unit of analysis.

The following figure shows the case study design:

**Figure 1: Case Study Design for Current Study**

CONTEXT (Light Engineering Industry of Bangladesh)



Both primary and secondary data were collected for the study. Primary data collected from 15 case firms of Railway Market, Bogra; 10 case firms of Tipu Sultan Road, Dhaka; and 10 case firms of Bonogram, Dhaka. Both secondary and primary data collected from Bangladesh Engineering Industry Owners' Association (BEIOA), Light Engineering Product Business Promotion Council (LEPBPC), Small and Medium Enterprise Foundation (SMEF), and Bangladesh Agricultural Merchant Machineries Association (BAMMA).

For collecting primary data, an informal questionnaire was used by which respondents were interviewed from the case firms of the three Light Engineering (LE) clusters. Most of the respondents were the owners of the firms. There was some informal discussion with the workers and customers around the clusters. Data also collected from various relevant institutions of LE industry through formal discussion with the presidents, executives, officers, and secretary of the institutions. All of the interviews were conducted at the beginning of 2012. Interviews with respondents were maximum of 30 minutes and a minimum of 10 minutes.

Observation techniques also applied to get insights of relevant upgrading matters from each cluster like production process, repairing services, customer dealing system, and firms structure, workers condition, infrastructure, as well as the overall environment. Secondary data collected from different kinds of literature, and relevant websites like various written reports, internal records, administrative documents, newspaper clippings, newsletters, brochures, and published articles, statistical and survey data from different institutions and their websites. For data analysis, relying on proposition strategies was followed, and both the pattern matching and explanation building technique were used. For presenting output of

the study, tabular techniques are applied. Output of data analysis is used to present the upgrading situation of light engineering clusters of Bangladesh.

### **BRIEF DESCRIPTION OF THE LIGHT ENGINEERING (LE) INDUSTRY OF BANGLADESH**

Light Engineering (LE) industry is a very significant sub-sector of SMEs in Bangladesh. Quadir and Mahamud (2009) have stated that ‘although there is no historical reference about LE industry in Bangladesh, the common saying is that the industry started by providing maintenance support to the large-scale industrial units commissioned in the 1950s in Bangladesh (then East Pakistan)’. But the industry has been demonstrated a tremendous growth since 1985. It has been playing an important role in the economy of Bangladesh through supplying useful products and services to agriculture, helps imports substitution, besides aiding industrial development (Quadir and Mahamud, 2009). The contribution of this sector has been 2.15% of Bangladesh’s GDP in the last few decades (Quadir and Mahamud, 2009). Recently the industry has received special attention from the Bangladesh government. The industry has considered as a thrust sector for development and incorporated in ‘Industrial Policy, 2009’ and as a priority sector in ‘Export Policy 2009-12 (Ahmed and Bakht, 2010).

Most of the light engineering firms are micro and small in nature that are financed and managed by the owners of the businesses. A recent study on Light Engineering sector by IFC-SEDF estimates that total annual turnover of the sector is US\$ 1600 million of which import substitute products is around US\$ 200 million. Another recent study conducted by International Finance Corporation (IFC) in partnership with UK Department for International Development and Norwegian government shows that the sector generates employment for 600,000 people who are working in 50,000 micro firms and 10,000 Small and Medium Firms.

Light engineering firms are spread all around the country. There are some traditional clusters of Light Engineering firms such as old town of Dhaka city, industrial zone of Khulna and Gazipur, northern parts (Bogra, Nougá, and Pabna) of the country, major land and water transport stations like Narayangong, Chittagong, Jessore (BIET, 2011).

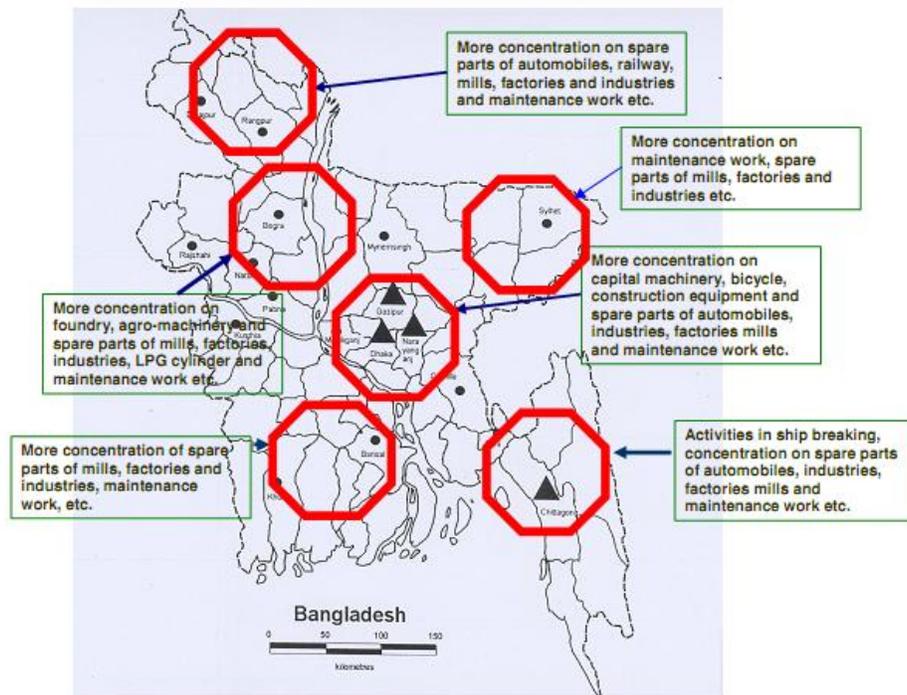
The BIET (2011) brochure identified the members of BEIOA in different districts of the country that is shown in the following table:

**Table 1: BEIOA Members in Different District**

Region	Dhaka	Bogra	Jessore	Tongi-Gazipur	Pabna	Narrayangong	Chittagong	Khulna
Number of Firms	5000	1500	1000	1000	500	1000	2000	1000

Source: BIET, 2011 Brochure: 29

Each of the clusters has some particular characteristics that give it a particular designation. For example- clusters in Bogra concentrate on foundry and agro-machineries, clusters on Rangpur focus on spare parts. The following figure shows the location of different clusters around the country and their concentration.

**Figure 2: Country-wide Product Map of Light Engineering**

Source: SMEF-2008

## **BRIEF DISCUSSION OF THE THREE SELECTED LIGHT ENGINEERING CLUSTERS**

In this section, a brief description of the three selected clusters, and upgrading situations of two firms from each cluster are presented.

### **Cluster 1: Railway Market, Bogra**

Railway Market (Bogra) is a famous cluster for supplying necessary machineries and equipment to the agricultural sector of Bangladesh. This cluster is situated in northern part of the country. There is no particular date of establishment of the cluster. Some firm owners mentioned that the cluster established before liberation of Bangladesh. From its inception, the cluster has been contributing significantly to economic development of the country. It supplies agricultural products and repairing services to all around the country. Quality products, cheap product price, customized service, and semi-skill workers made the cluster as a distinctive cluster. But the cluster has been struggling with different problems like high prices of hard coke and pig iron, lack of working capital, high interest rate for loan, high prices of raw materials, lack of land to expand business, lack of skilled workers, shortage of power supply, lack of government support, lack of training facilities, competition with foreign products, etc.

A brief description of two case firms from this cluster is presented in following. One firm as an example of upgraded and another one as a downgraded firm:

**Case 1-Sumon Engineering Works:** Sumon engineering works is an example of the upgraded firm. It was established in 1985 by Mr. Zillar Rahman who has twenty-seven (27) years of experience in the same business. The founder has only primary level of education. The starting capital of the firm was only BDT 18,000 and it has reached to BDT.20 lac in 2012. Average monthly sales turnover of the firm is BDT 30,000. The firm has a branch in BSCIC, Bogra also. Main products of this firm are deep tube-well materials, shallow engine liner, piston, and other agricultural equipment and machinery.

Sumon Engineering has upgraded a lot within its business passage. Although the firm started the business with only two/three products, now they have more than thirty products. Moreover, the firm has been providing various repairing services. Their products' quality has increased and service delivery time has reduced. Product rejection rate is also very low as they upgraded their production process. Some modern machinery are added from China, India, and Japan to assure smooth operation. The firm also added a good number of designs and models as per requirement of local customers. Currently, they do not have any involvement with other sectors, but they wish to involve to more subsectors of the industry in future.

**Case 2-Khalek Engineering Workshop:** Khalek engineering workshop is an example of the downgraded firm. It was established in 1973 by Md. Abdul Khalek. The founder is at the age of fifty-two (52), and he has forty years of

working experience in the same business. Different engine crack, grinding machine, liner, and other machinery are the primary products of the firm. The initial capital of the firm was BDT 5,000 and after four decades it has reached to BDT.10 lac in 2012. Current monthly sales turnover of the firm is only BDT15,000 on an average.

Mr. Khalek believes that clustering has some positive impact on upgrading of the industry, but the effect is not very significant. The cluster attracts an enormous number of employees from different regions of North-Bengal. But currently Mr. Khalek is struggling to keep his workers by providing expected wages and benefits. Once the firm exported products in Nepal, but now no foreign customers are showing their interest in firm's products. Mr. Khalek has no plan to expand his current business. Moreover, he is trying to get return as much as possible from the firm and he may quit business at any time. As a result, there is no sign of upgrading in the firm.

#### **Cluster 2: Bonogram, Dhaka**

Bonogram is a very well known cluster in the capital city Dhaka. Firms of this cluster have some familiar characters such as micro or small in nature, illiterate both owners and workers, small amount of capital investment, workers expertise in reverse engineering, production as per customer requirement, financial crisis, lack of government support, price hike of raw materials, deficiency of power supply, etc. The primary products of the cluster are electric items, motor parts, liner, chemical, packaging and printing items, jute mill items, agricultural items, and different types of repairing services. Bangladesh Engineering Industry Owners' Association (BEIOA) is very near from the cluster, but most of the cluster members are not the member of the association. Although the cluster attracts many workers from different regions of the country, most of the workers are semi-skilled or unskilled. The firms are still using outdated technologies, so their production process is not satisfactory. They added machineries and equipment to their production process gradually, but most of them are made by themselves. The cluster is not upgraded significantly in its long journey.

A brief description of two case firms from this cluster is presented in following. One firm as an example of upgraded firm and another one as a downgraded firm.

**Case 1- J. Hoque Engineering Works;** J. Hoque Engineering is an example of upgraded firm. It was established in 2001 by Aynul Huda who has only seventh grade of academic qualification. The founder is forty-five year old, and he has forty years of work experience in the same business. The primary products of the firm are various machinery and repairing services. The starting capital of the firm was BDT.2 lac and it has extended to BDT 10 lac in 2012. Monthly sales turnover of the firm is BDT 50,000.

According to Mr. Huda, "workers of this firm gained skills through long work experience in same business, but they do not get any institutional training". The firm has been trying to satisfy a good number of wholesale and retail customers.

Mr. Huda added some machinery in production process within his limited capacity. By using his personal efforts, Mr. Huda developed some designs and models. The firm also added different new products in the product line to meet the local customer demand. As the skills of the workers increased, the product rejection rate has reduced significantly. The founder believes that their products are very standard and able to meet the local demand successfully. The firm has no plan to involve in other sectors or any subsectors at this moment.

**Case 2-Saddam Engineering:** Saddam engineering is an example of the down graded firm. It was established by Mir Mohammad Ali in 2006. The founder is a thirty-three year old person, and he has only primary level of education. But he has gathered fifteen years of business and work experience. Jute mill machineries and spare parts are the main products of the firm. The firm also provide repairing services in jute mills. The starting capital of the firm was BDT.1 lac and after six years, the investment has reached to BDT.2 lac in 2012.

Now the firm is struggling to survive in business. According to Mr. Ali, “the firm’s products demand has reduced extremely as the current situation of the jute industry is not good”. Two workers are currently working in the firm, but Mr. Ali does not know how many days he will be able to keep the workers. The firm’s product line is not increasing as the product demand has reduced significantly. Their product rejection rate is reduced and product quality is also improved. But the firm couldn’t able to add any new machinery to improve the performance. Instead, the firm has been trying to sell the present machineries to others. The firm has no involvement in upgraded functions except production.

### **Cluster 3-Tipu Sultan Road, Dhaka**

This is one of the oldest and renowned clusters in capital city Dhaka. Many light engineering firms of the country were developed by the former workers of this cluster. Although this is the oldest cluster of the country, it has same problems as like as other two clusters such as lack of capital, semi-skilled and unskilled worker, lack of supports from private and public sources, scarcity of modern machineries, severe competition with foreign products (especially Chinese and Indian products), high raw material price, lack of government support, shortage of power supply, lack of research initiatives and cooperation with any technical universities and institutions, etc. Bangladesh Engineering Industry Owners’ Association (BEIOA) is situated in this cluster, but most of the firms are not satisfied with the initiatives of the association.

A brief description of two case firms from this cluster is presented in following. One firm as an example of upgraded firm and another one as a downgraded firm.

**Case 1- Iqbal Engineering Works:** Iqbal engineering works is a case of upgraded light engineering firm. It was established in 1975 by Md. Iqbal. The founder is sixty (60) year of old and he has only primary level of academic qualifications. But he has forty years of a long business and work experience. The main products of the firm are jute and textile mill equipment and machinery,

lathe machine, drill machine, piston, and liner. Mr. Iqbal started business with an initial capital of only BDT 5,000 and his current total asset value is BDT.10 lac.

Within the long journey, the firm has enriched its capacity. The cluster brings a lot of light engineering experts in the cluster. The firm has to compete with foreign imported items as low priced products enter very easily into the market from China and India. It is hard to compete with foreign competitors as the firm has limited technical capacity. Mr. Iqbal mentioned, “my firm has taken research initiative in small scale and developed some small spare parts of bulk machinery. The firm improved its product and service quality to some extent. The firm’s product rejection rate is very low and the product delivery time is also reduced. The firm has developed various product design and models. At this moment, the firm has no plan of sectoral upgrading, but in future they will extend if get proper support.

**Case 2- Fancy Engineering Works:** Fancy engineering works is an example of the downgraded firm. It was established in 1990 by Fatik Chand. The founder is fifty-two (52) year of old, and he has only primary level of academic qualifications. He also has twenty-five years of work and business experience. Initial capital of the firm was BDT.5 lac and it has reduced to BDT.3 lac in 2012. Currently, three workers are working in the firm. The primary products of the firm are agricultural tools, washing plants, and various machineries.

According to Mr. Chand, “my firm has no collaboration or cooperation with other firms”. It has no technological agreement for building capacity or any joint effort for new product and existing product quality development. The firm has no initiatives to develop new design, or new model. Although the workers’ skill has improved, and product rejection rate is reduced, the product demand and customer orders have reduced significantly. The founder has no motivation to remain in the same business. If any opportunity arises in future, he will switch to other businesses.

## **OVERALL UPGRADING STATUS OF THE LIGHT ENGINEERING CLUSTERS OF THE INDUSTRY**

The Light Engineering (LE) industry of Bangladesh has a long history. Some of the firms in the industry started their operations before the liberation of Bangladesh. But the industry has upgraded to slight scale during its long journey.

As it has mentioned in literature review section, upgrading consists of product, process, functional, inter-sectoral, and marketing linkages upgrading. As per product upgrading is concerned, clusters of the light engineering industry added various sophisticated products to the product lines. Most of the firms in each cluster started business with one or two products and added a good number of products to their product lines. Firms developed some new products as per the demand of local customers, but most of them through reverse engineering. According to the opinion of experts of the industry, reverse engineering is one of

the major strength of the industry workers. Firms are very handy to imitate a product through reverse engineering. According to one of the workers, “if anyone gives a product to make same prototype, we are able to make one as it is”. But the significant issue is product quality as a sign of product upgrading. According to the opinions of the firm owners and workers, their products quality has improved a lot as the product rejection rate is reduced. They also added that local customers are very satisfied with the product quality. Some firms believe that their products have better quality than imported products. But they could not export their products for lack of necessary support from government. In contrast, experts of the industry think that quality of the light engineering products are not in export standard. In reality, owners and workers don't know what is quality standard and how they can assure export quality. In fact, there has no quality control system, and firms do not need to collect any quality certificate. As a result, they fail to recognize the product configuration and demand specification of foreign buyers. As a result, no light engineering cluster has involvement in foreign buyers in international market. Therefore, they do not get any opportunity to increase technological capability.

According to the opinion of the clusters members, now firms can deliver products faster, and the product rejection rate is reduced as the firms and workers have achieved skills through a long work experience. But the workers do not possess necessary knowledge and skills to absorb the technology, and to operate the machine and equipment. So, there has no notable process upgrading in the industry. Actually, the light engineering firms have no required technologies to meet the demand of global buyers. Most of the clusters have been using traditional and outdated machines and tools. By using the current conventional technologies, it is not possible to meet the expectation of foreign buyers. As most of the founders of firms illiterate, they do not have any academic knowledge of organizing skill and management techniques. They manage the whole process by using their non-academic understanding and experience.

As almost all clusters sell their products and services in the domestic market and no involvement in export, the industry has almost static state from the starting to the present. Most of the clusters are only involved in the same pattern of production. So, the cluster firms do not have any option to capture more functions at a higher level of the value chain. Firms have no involvement in branding, and marketing initiatives. Even, no firms think that they need marketing effort to promote their products. There has no R&D center in any clusters, or any R&D initiatives by a particular firm in any clusters. The firms have been trying to improve some models and design by their own initiatives without following any scientific method. As they have capability to imitate a product through reverse engineering, they believe that imitating process is a kind of research.

Most of the cluster members are rigid and still in the same sector since the inception of the business. Very few firms are extended their operations to other sectors. Some firms have intention to involve to sub-sectors if they get proper support from government and other sources. Another type of upgrading is identified by Laven (2005) is upgrading of marketing linkages. It refers to capture the position of market leader in the value chain. The firms in the light engineering clusters have no intention to capture the different linkages in the existing value chain.

In the following table, upgrading condition of the industry is summarized in respect of upgrading categories:

**Table 2: Summary of Upgrading in the Light Engineering (LE) Industry of Bangladesh**

Upgrading Categories	Upgrading Status in a Nut Shell
Product Upgrading	The product lines are increased to some extent in some firms. On the other hand, product number has reduced significantly in some firms. Product rejection rate has reduced as existing product quality has improved through long working experience. But, product quality is not as standard as to meet the export quality prerequisite.
Process Upgrading	Products have been manufactured by conventional indigenous technologies. Firms have no ability to import modern machinery and equipment as per requirement. Even, firms have no involvement in global value chain (GVC), so they do not have any option to absorb technological know-how from lead buyers. Although workers are not used to in modern technologies, they are expert in reverse engineering.
Functional Upgrading	Light engineering clusters are static in nature. Almost all of the clusters are involved in traditional production function. They are rarely involved in functions like branding and marketing. They put their effort for reverse engineering and developed different models and design through that process.
Inter-sectoral Upgrading	Very few firms are involved in other sub-sectors of the industry. Most of them are in the same sector for long time. Even they do not have any plan to move other sectors or sub-sectors in near future. They only want to expand their current business in existing sector.
Marketing Linkages Upgrading	GVC has no existence in the light engineering clusters. So, shifting to higher level of the value chain is not possible, and firms have no option to upgrade marketing linkages within the domestic value chain.

## CONCLUSIONS

Light Engineering (LE) industry has a very significant role in the socio-economic development of the country. Last few decades, the industry has been contributing considerably to GDP of Bangladesh, reducing the poverty level through employment generation, producing import substitute products, and supplying necessary items for other sectors. But the upgrading movement of the light engineering clusters of the industry is very insignificant. Most of the light engineering clusters are dependent on backdated indigenous technologies. Furthermore, the workers who are using technologies are unskilled or semi-skilled. Passing a long time in same business, the cluster firms are only capable to meet the partial domestic demand as their product standard is not satisfactory for international market. Moreover, they are involved only in manufacturing of limited light engineering products and small scale repairing services. Therefore, clusters' capacity has not upgraded significantly.

Government should come forward more actively to solve the problems and to create a platform for upgrading of the light engineering clusters. Government also should create an access to the international market to export Light Engineering (LE) products. Joint collaborations with all private and public research institutes, technical universities, and experts in other institutions are also necessary to increase the R&D initiatives of the light engineering clusters. As the workers are unskilled/semi-skilled, sufficient training facilities can make them competent. So, necessary training initiatives should be taken. Government also should assure that firms will get easy access of loan from any financial institutions without any collateral. Trade associations should play more active role in each cluster to identify the problems and to negotiate with government to solve the problems. They also should enlist all light engineering firms to the associations and try to assure continuous interaction with the members. In this way, the overall scenario of the upgrading condition of the light engineering clusters can be improved. Further research initiatives should be taken to explore what actors play role behind upgrading status of the light engineering clusters.

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