A Study of Factors Affecting Productivity of Power Loom Industries

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Abstract

Productivity increase is an important indicator of economy and market value of firms. The ministry of textile has stated in its Annual report 2012-13 that textile industry contributes to Indian economy in the form of 4% GDP, 14% industrial production and 11% of total manufacturing export. It also employs about 35 million people. Thus, the growth and overall development of textile industry will have a direct impact on the improvement of nation's economy. The aim of this study is to determine the critical success factors affecting productivity of (textile) power loom industry through data collected using a questionnaire by interview technique. This data is later analysed using statistical technique such as ANOVA in order to find out the critical success factors affecting the productivity and suggest suitable measures for improvement of the same.

Keywords: Productivity, Power looms, Critical success factors, ANOVA

1. Introduction:

The Indian textile industry consists of three distinct sectors representing broadly three levels of technology and Organisation, namely, mills, Power looms and handloom. The growth of the power loom industry started with the loosing of the ground by the textiles mills. The power looms were first introduced in India in the starting of the 20th century. During the great depression period (1929 to 1933) the mill sector started to discard the power looms. The labours of the textile mills refurbish the discarded power looms and started the small units as a small and cottage industry. It was the existence of the decentralised sector of power loom industry.

The other reason for the growth of the power loom industry was conversion of handlooms into power looms. In 1954, for the economic development of the handloom weavers, the scheme of conversion of handloom to power looms was introduced by the government. In 1930 there are about 3000 power looms in the country while at the end of 2008-2009 it raised to about 22.05 laky power looms in the country.

The decentralised power loom sector is one of the most important segments of the Textile Industry in terms of fabric production and employment generation. It provides employment to 57.44 Lakh persons and contributes 62 percent to total cloth production in the Country. 60% of the fabrics produced in the power loom sector are of man-made. More than 60% of fabric meant for export is also sourced from power loom sector. The readymade garments and home textile sectors are heavily dependent on the power loom sector to meet their fabric requirement. [19]

2. Literature review:

Brief review of productivity in general:

Productivity is the quantitative relationship between what we produce and the resources we use. It can be defined as the ratio of output to input. There are three types of productivity measures:

a) Partial productivity measure.

Depending on individual input partial productivity measures are expressed as:

$$\text{Partial productivity} = \frac{\text{Total Output}}{\text{Individual Input}}$$

It can be expressed in terms of labour, capital and material and energy by taking the ratio of total output to individual input.

$$\text{1) Labour productivity} = \frac{\text{Total Output}}{\text{Labour Input}}$$

2) Capital productivity = $\frac{\text{Total Output}}{\text{Capital Input}}$

3) Material productivity = $\frac{\text{Total Output}}{\text{Material Input}}$

4) Energy productivity = $\frac{\text{Total Output}}{\text{Energy Input}}$

The disadvantage of Partial productivity measure is that, only one factor is emphasised while the others are ignored hence total results regarding productivity are not obtained.

b) Total productivity measure

It is based on all inputs and can be applied to any manufacturing firm.

Total productivity = $\frac{\text{Total tangible Output}}{\text{Total tangible Input}}$

c) Total factor productivity

It is the ratio of net output to the labour and capital input.

Total factor productivity = $\frac{\text{Net Output}}{\text{Labour + capital inputs}}$

Factors influencing productivity:

There are two types of factors influencing productivity namely external and internal. The external factors also called as uncontrollable factors comprise of social factor, natural resources, government and infrastructural factor.

The internal are the ones which can be controlled comprising of product factor, plant and equipment factor, technological factor, material and energy factor, human factor, work methodology and management style.

Review of literature:

Chaudhuri et al. [3] have stated the role of productivity in explaining variation in investment growth suggests that there is a need to manage productivity improvements from growth point of view and not only for efficiency improvements; firms should also use the right mix of labour and capital and involve industry associations in educating industries on their needs. Firm size and firm-specific interest rate on long-term loans are the other factors significantly affecting investment growth.

Dolage et al. [5] investigates the influence of the adoption of Flexible Manufacturing Technology (FMT) on the Total factor Productivity Growth (TFPG) of Malaysia Manufacturing Industry using the two situations, one, including the industry fixed effects dummy variables and the other without these, are contrasted which account for the greater variation in FMT show positive and moderately significant relationship with TFPG.

Jain et al. [6] say that manufacturing flexibility is a critical component to achieve a competitive advantage in the market place. This paper presents a review of various issues related with manufacturing flexibility specifically concept, need, dimensions, measurement, relationship among various dimensions, implementation aspect in a company and management of manufacturing flexibility and its aim to contribute to the conceptual systemisation of the material.

Kottawata [7] in his research work has studied the apparel industry in Sri lanka. He has listed major attitudinal factors that affect job performance, such as absenteeism, Job satisfaction and organisational commitment which in turn affect productivity.

Liu & Li [10] have studied the growth factors in China's manufacturing industries, industrial productivity, technological progress and efficiency and concluded that China's industrial strength is based mainly in input growth, and the improvement in technical progress.

Murugesh et al. [11] have discussed the ignorance towards productivity during last two decades and how the recent developments in managerial philosophies Total Quality Management (TQM) & Business Process Re-engineering, Flexible manufacturing process (FMS), Computer integrated manufacturing (CIM) etc. and Information and technology (IT) innovations have made the traditional productivity improvement techniques obsolete by presenting a review on productivity consisting of analyses of literature on productivity and a survey of manufacturing enterprises.

San et al. [13] by using the Taiwanese manufacturing industry as an example are able to confirm that labour quality is an important contributing factor in explaining Taiwanese manufacturing sector's changes in productivity.

Seth & Tripathi [14] say that a combined application of Total Quality Management (TQM) and Total Productive Maintenance (TPM) brings out significantly higher improvements than individual drives in the Indian manufacturing industry. The study is based on data collected through a questionnaire as a research instrument and statistical analysis using Microsoft EXCEL 2000.

Sharma & Mishra [16] have examined the interrelation between exporting and productivity performance by using a representative sample of Indian manufacturing firms over the period 1994–2006 and concluded that entering in the export market does not improve productivity performance but exit from the export market does have an adverse effect on the productivity.

Shayan & Sobhanallahi [17] suggest that significant improvements at very low costs are possible at managerial and other work force levels, by introduction of appropriate production management systems. This paper discusses some of the major factual results and discussions of the effects of implementation of a cellular manufacturing environment.

Based on the above literature review and data collected from Annual report of ministry of textiles [19] following factors are listed in the table as shown below

Table 1: List of factors affecting productivity

Sr.No.	Factors	Name of authors
1	Technical Training to labours	Chaudhuri et al. [3], Liu & Li [10], San et al. [13]
2	Capital investment	Chaudhuri et al. [3]
3	Manufacturing flexibility	Dolage et al. [5], Murugesh et al [11], Liu & Li [10], Jain et al. [6]
4	Attitudinal factors	Kottawata [7]
5	Market demand fluctuation	Lee & Johnson [9]
6	Cellular manufacturing	Shayan & Sobhanallahi [17] Salum [12]
7	Right mix of labour	Chaudhuri et al. [3]
8	Computer integrated manufacturing	Murugesh et al. [11]
9	Total productive maintenance	Seth & Tripathi, [14] Brah and Chong [2], Kumar et al. [8]
10	Management philosophy	Murugesh et al. [11], Shayan & Sobhanallahi [17]
11	Re-engineering	Murugesh et al. [11]
12	Export	Sharma & Mishra [16]
13	Technology upgradation	Tanuwidjaja & Thangavelu [18], Murugesh et al. [11]
14	Total quality management	Murugesh et al. [11], Seth & Tripathi [14]
15	Lean Sigma framework	Kumar et al. [8]

(Source: Literature review of research papers)

3. Problem definition:

There are approximately 5.24 Lakh Power loom Units with 23.24 Lakh Power looms as on 30.09.2012. The technology level of this sector varies from obsolete plain loom to high tech shuttle-less looms. There are approximately 1, 05,000 shuttle less looms in this sector. It is estimated that more than 75% of the shuttle looms are obsolete and outdated with a vintage of more than 15 years and have virtually no process or quality control devices / attachments. [19]

The present study aims to understand the functioning and problems of power looms especially of Solapur region in Maharashtra and find out critical success factors that affect the productivity of the firms.

4. Objectives:

The study seeks to examine the firms, considering the facts in a comprehensive manner the state of functioning & problems of Power loom industry in the state of Maharashtra especially of Solapur to the following context:

- To study the nature, administration, status and scope of the Power loom Industry.
- To analyse the problems & issues of Power loom industry.
- To provide suggestions for overall development of Power loom industry and to enhance its productivity.

5. Methodology:

- The study involves secondary data collected through literature review. Through the literature review factors affecting productivity were found out.
- These factors were then used to build a structured questionnaire using a five point likert scale. The primary data was then collected through questionnaire by taking personal interview of the entrepreneurs.
- Then hypothesis testing of this data is carried out using one way ANOVA through which the major factors affecting productivity can be identified.
- Lastly improvement suggestions are given related to the identified factors.

6. Primary data:

Using the above factors as reference a structured questionnaire was built based on a five point likert scale (1-Strongly disagree, 2-Disagree, 3-Neither agree nor disagree, 4-Agree, 5-Strongly agree). This questionnaire consisted of fifty one critical success factors affecting productivity and the responses were collected from about twenty firms.

6.1 Factors influencing productivity

The study comprised of both the internal as well as external factors affecting the productivity of power loom industry. There were total 51 factors under consideration which were divided into eight groups namely (1) Product factor (PF) discussing about the variety, cost and quality of the product.

(2) Material factor (MF) discussing about the count variations, strength variations and inventory level of the firm.

(3) Preparatory function factor (PFF) discussing about the functions such as dying, drying, loading time of the beam etc.

(4) Plant and equipment factor (PEF) discussing about the machine utilization, layout, maintenance, ergonomic conditions and housekeeping.

(5) Market factor (MF) discussing about the purchase, sales, export etc.

(6) Technological factor (TF) discussing about the use of IT software, R&D efforts and use of automated material handling.

(7) Government and infrastructure factor (GIF) discussing about the cost of electricity and water, regulation of market, cost of yarn, subsidy and various schemes.

(8) Human factor (HF) discussing about the skill, training, professional culture, dedication, attitude of the workers. At the same time motivation schemes, satisfaction of employees. Also the communication strategy and management style of the entrepreneur and supervisor.

6.2 Discussion on the survey of power looms

a. Administration:

Mostly all the firms had supervisors serving as a link between the workers and entrepreneur. Direct communication of the entrepreneurs regarding strategic decisions of the firm with the workers was hardly seen. There was a jobber to perform the maintenance work. The entrepreneurs lagged in management style due to lower level of education.

b. Problems and issues:

The various problems faced by power loom industry are fluctuation in cost of yarn, improper management style, lack of housekeeping, reduction in production due to use of conventional shuttle looms, lack of automation in material handling systems and preparatory functions, absenteeism and lateness in workers, unprofessional culture of the workers and other attitudinal factors of the workers.

c. Productivity enhancement:

Some of the above problems can be solved such as entrepreneurs should learn newer and better management techniques in order to run their firms better. Housekeeping should be implemented to save time. Looms with updated technology should be adopted to increase production rate with financial support of government schemes such as TUFS (Technology up gradation fund scheme).

Automation in material handling will reduce the unproductive time of workers and also the fatigue caused due to loading of heavy beams on the loom. Automation in preparatory functions will reduce the lead time of the product. The workers should be motivated by giving bonus, insurance and increments. A proper professional culture should be inculcated among the workers by inducting seminars. Performance rating of the workers helps to develop a competitive atmosphere. The workers should be satisfied so that they can deliver their best.

If the above problems are solved then there will be an increase in production and also better functioning of the firm which will ultimately lead to enhanced productivity.

7. Hypothesis testing:

A hypothesis is made through the review of literature and considering the objective of the study. Only one hypothesis is made for the study.

ANOVA test (One way).

One way hypothesis was carried out based on the data collected from 20 firms and 51 factors.

Null hypothesis (H_o): There is no significant difference between the responses of different firms.

Alternative hypothesis (H_1): There is significant difference between the responses of different firms.

Level of significance: 5%

Critical value of 'f': 1.5967

Degrees of freedom: 1039

Table 2: One way ANOVA

ANOVA						
Source	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between	25.549	19	1.34	0.8951	0.5894	1.5967
Within	1532.33	1020	1.5			
Total	1557.88	1039				

Result: As f_{cal} (0.8951) < f_{crit} (1.5967) null hypothesis is accepted.ie There is no significant difference between the responses of different firms.

Hence by doing the analysis of primary data we can find out the factors which mostly affect the productivity of power looms.

8. Primary data analysis:

The primary data was collected through questionnaire consisting of fifty one factors, from about twenty firms. The mix of the firm consisted of small scale industries with a turnover of about 80 lacks to 10 crores. The number of looms ranged from about 12 looms to 96 looms. The range of the workers varying between small scale industries to medium scale industry is from 12 to 220.

During the analysis it was found that the responses of various firms were not significantly different. This has been proved by hypothesis testing. It is clear that the entrepreneurs are lagging in management skills. The reason for this is the medium level of education of the entrepreneurs.

The variation in the cost of yarn affects productivity. But it is an external factor hence government must take appropriate measures to regulate the price of yarn and reduce the peak fluctuations.

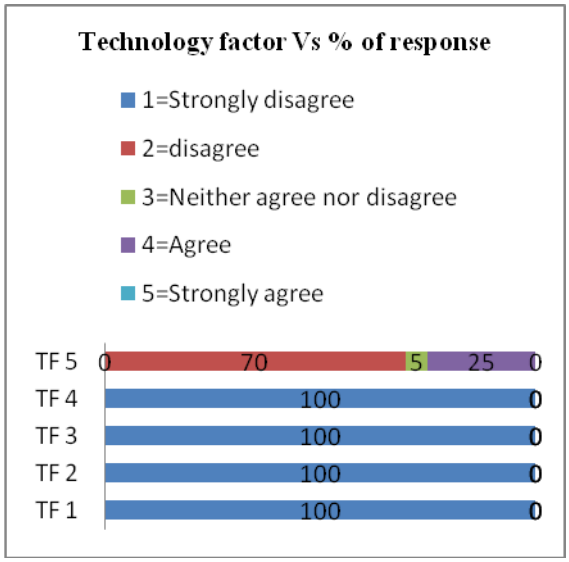

Fig 1: Technology factor Vs % of frequency of the response.

At the same time the two important factors being identified were the human factor and the technological factor which are explained using bar charts. The technological factor which consists of automated material handling, shuttle less looms, automation in preparatory process should be adopted. The output of the rapier looms as compared to the conventional shuttle looms is 2.5 times. It was observed that mostly all the firms did not implement IT, upgrade technology and neither worked on R&D due to unawareness of the technological benefits as well as fear of high initial investment.

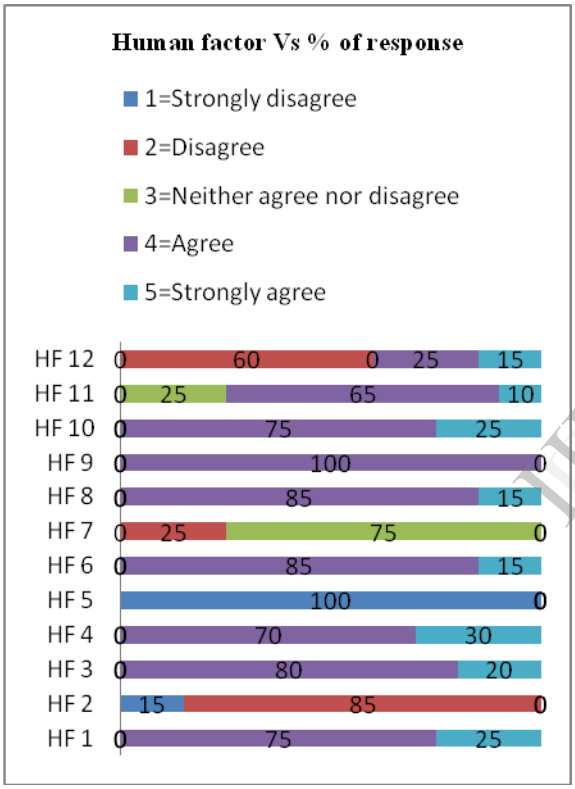

Fig 2: Human factor Vs % of frequency of the response.

Textile industry is labour based industry. It was observed from Fig 2, that 85% of firms did not provide training to the workers, 100% of the firms said that workers do not follow professional culture, absenteeism was observed in workers of about 85% of the firms and there was no direct communication with workers in about 60% of the firms which has led to reduction in the labour productivity. The attitudinal factors affect the job performance. [7]

9. Conclusion and suggestions:

There are approximately 5.24 Lakh Power loom Units with 23.24 Lakh Power looms as on 30.09.2012. The technology level of this sector varies from obsolete plain loom to high tech shuttle-less looms. There are approximately 1, 05,000 shuttle less looms in this sector. It is estimated that more than 75% of the shuttle looms are obsolete and outdated with a vintage of more than 15 years and have virtually no process or quality control devices / attachments. [19]
This study has helped to identify some critical success factors that affect the productivity of power looms. From the analysis it is clear that fluctuation in cost of yarn affects productivity. But this external factor is to be regulated by government.

Other factors such as infrastructure, plant and equipment factor do not have much greater impact on the productivity. On the contrary human factor and technological factor are the two most important factors affecting productivity.

The labour productivity can be increased by implementing motivational schemes for the workers. There should be direct communication between the entrepreneur and workers regarding the strategic plans. The quality of the workers should be enhanced by providing them training. This helps them to build their confidence which is reflected in their performance. The workers should be treated well in order to build a sense of belongingness in them towards the organisation. The attitudinal factors affect the job performance. [7] Hence job satisfaction among the workers should ensured by providing them appropriate wages, bonus and insuring them.

The technology plays very vital role in increasing productivity. But due to high initial investment required, entrepreneurs do not switch to technological up gradation. This problem can however be solved by making the entrepreneurs aware of the government subsidies for technology up gradation through various schemes such as TUFS. The benefits of adopting newer technologies such as increased rate of production, reduced overhead costs, reduced material handling time, lead time must be explained to the entrepreneurs through various programmes, seminars. If these two factors are controlled then there will be an assured growth in productivity.

In future analysis can be carried out by measuring the productivity of each factor to calculate partial productivity as well as comprise all the factors in order to calculate total productivity.

The significant factors can be found using software and productivity improvement tools or techniques can be then applied in order to improve the productivity of the firm by controlling the critical factors.

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