

Dulange, S.R.; Pundir, A.K.; Ganapathy, L.

Article

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Journal of Industrial Engineering International

Provided in Cooperation with:

Islamic Azad University (IAU), Tehran

Suggested Citation: Dulange, S.R.; Pundir, A.K.; Ganapathy, L. (2014) : Prioritization of factors impacting on performance of power looms using AHP, Journal of Industrial Engineering International, ISSN 2251-712X, Springer, Heidelberg, Vol. 10, pp. 217-227, <https://doi.org/10.1007/s40092-014-0080-8>

This Version is available at:

<https://hdl.handle.net/10419/157418>

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Prioritization of factors impacting on performance of power looms using AHP

S. R. Dulange · A. K. Pundir · L. Ganapathy

Received: 3 February 2014 / Accepted: 8 July 2014 / Published online: 6 August 2014
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Abstract The purpose of this paper is to identify the critical success factors influencing the performance of power loom textiles, to evaluate their impact on the organizational performance and to find out the effect of these factors on the organizational performance of small and medium-sized enterprises (SMEs) in the Solapur (Maharashtra) industrial sector using AHP. In the methodology adopted, factors are identified through the literature survey and finalization of these factors is done by taking the opinion of experts in the Indian context. By cognitive map, the relation between these factors (direct and indirect effect) is determined and cause and effect diagram is prepared. Then these factors are arranged hierarchically and tree diagram is prepared. A questionnaire was designed and distributed among the experts; data is collected. Using expert choice software data is filled to quantify by pairwise comparison of these factors and are prioritized. The weights demonstrate several key findings: local and global priority reveals that there is a substantial effect of the human resource, product style, and volume on the organizational performance. The skills and technology upgradation impact on organizational performance. Maintenance plays an important role in improving the organizational performances of the SMEs. Overall, the results showed the central role of the operational factors are important. The research is subject to the normal limitations of AHP. The study is using perceptual data provided by Experts which may not provide clear measures of impact factors. However, this can be overcome using more experts to collect data in future studies. Interestingly, the findings here may be generalisable outside Solapur like Ichalkarnji,

Malegaon, and Bhiwadi (Maharashtra). Solapur power loom SMEs should consider AHP as an innovative tool for quantification of factors impacting on performance and improving operational and organizational performance in today's dynamic manufacturing environment. The finding suggests the notion that these critical success factors (CSFs) are to be studied carefully and improvement strategy should be developed. Moreover, the study emphasizes the need to link priority of factors to organizational performance and improvement. The study integrates the CSFs of performance and its quantification using AHP and its effect on performance of power loom textiles. The indirect impacts of underlying and fundamental factors are considered. Very few studies have been performed to investigate and understand this issue. Therefore, the research can make a useful contribution.

Keywords AHP · Factors and subfactors · Prioritization · Power looms · Experts from the field

Introduction

Among many developing countries that actively participate in textiles and apparel trade, the Indian textile industry is exhibiting significant growth potential in the global market with its advantage as low production costs, abundant resources of raw material and cheap labor forces. The textiles and apparel industry is India's second largest industry which consists of spinning, apparel, garment, and man-made fabrics manufacturing. The country is the largest exporter of terry towels and man-made textile products. However, with an increased level of competition from low-cost manufacturers (especially China) around the world, the industry is under tremendous pressure to increase

S. R. Dulange (✉) · A. K. Pundir · L. Ganapathy
NITIE, Mumbai, India
e-mail: srdulange@yahoo.co.in

productivity, to improve performance, to improve production quality and to advance the management systems. Furthermore, competition is much more intense in the textiles and apparel exports business after the quota cancellation as stated by Clark (2005). Therefore, it became crucial for textile product manufacturers to respond to the new challenges with new strategies and solutions.

The power loom textile 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 of total cloth production in the country. Sixty percent 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 as mentioned in the Annual Report (2013), Textile Ministry, India.

In the economic survey conducted by Government of India (2012–2013) states that, these power looms have flourished prominently at various centers in Maharashtra, such as Bhiwandi, Ichalkaranji, Solapur, and Malegaon. These power loom centers work in decentralized sector and play an important role in the growth of power loom industry. India's textile and clothing industry contributes 4 % to gross domestic product, 14 % in industrial production, 18 % of total industrial employment, and 27 % of export earnings.

A number of scholars have studied the factors which impact on performance of manufacturing but very little work is carried out in textiles. The paper proposes a systematic work on identification of factors and its effect, quantification of these factors using AHP in the textile domain.

Literature review

As stated in the report of World Bank study (2003), Indian labor costs are among the lowest in the world. India has ready and cheaper access to basic raw material. The technological standards in the Indian spinning industry are fairly modern, almost comparable to China, Bangladesh, and Sri Lanka do not have either spinning or weaving industries and hence have to import the fabric.

Chaturvedi (2003) identifies key reasons leading to fall in productivity level. They are India's eroding cost competitiveness across products, extremely fragmented nature of the industry, technological obsolescence. He also asserts that since textiles, especially garments is a labor intensive activity there is a crying need to reform labor laws for achieving high productivity and to improve tight delivery schedules.

Kottawata (2007) 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 organizational commitment which in turn affect productivity.

Muruges (2010) have discussed the ignorance toward productivity during last two decades and how the recent developments in managerial philosophies, total quality management (TQM) and 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.

Shanmugasundaram and Panchanatham (2011) have stated that, the main factors affected labor productivity levels are absenteeism of the employees, working conditions of the units and change from high volume to low volume orders. Bheda (2002) mentions the top management of an apparel factory, if so desired can make or break productivity performance. It is often seen that productivity performance of factories producing the same garments is substantially different.

A research by CRISIL on Indian textile and Garment Industry is done which highlight the demand-side issues faced by the industry as,

1. Understanding the change in buyer preferences markets, especially USA and EU keeping up with fashion trends,
2. Competing on non-price factors, and
3. Upgrading technology to improve quality and productivity.

On the supply side, the concerns include:

1. The availability of quality raw material.
2. Low labor productivity.
3. Infrastructural bottleneck.

Each firm's performance and survival is dictated by a combination of external and internal factors. But a firm cannot compete externally if its internal operations are not geared to deliver. The firm level initiatives suggested to improve competitiveness are core competencies, market responsiveness, and organizational restructuring.

Aluko (2003) stated there is a significant relationship between culture, on the one hand and organizational performance on the other. In addition, if all things remain equal, organizations that are performing to the satisfaction of the owners, employees, and customers will be found in culture suitable for their operations. However, the results of this study showed clearly that all things do not remain equal. It was found that variables such as organizational context, organizational culture, nature of the economy and polity, the availability of the needed equipments, and the adequacy of public utilities most especially electricity all

have significant impact on organizational performance. The findings also showed that exogenous variables, such as the nature of the economy and polity and the inadequacy of electricity have more impact on organizational performance than endogenous variables, such as size, organizational culture, organizational structure, and technology. Thus, it is clear from the empirical evidence generated in this study that organizational performance is a multifaceted and multidimensional criterion.

Dulange et al. (2013) have stated that the role of management is very significant and socio-economic factors influence the performance. The survey analysis is carried out to finalize the factors which influence the performance and also, the management intervention is carried out for five firms and suggested lean philosophy which results increase in profit of power looms.

Performance measurement system

Slack et al. (2007) states that, performance measurement is the process of quantifying action, where measurement means the process of quantification and the performance of the operation is assumed to derive from actions taken by its management. Performance here is defined as the degree to which an operation fulfills the five performance objectives as cost, quality, flexibility, dependability, and speed at any point in time, to satisfy its customers. A performance measurement system must be designed in accordance to numerous case-specific factors. Every company must deal with its own unique environment and the most important key factors that affect companies’ productivity vary to a great extent. These factors are in turn interrelated to each other and change over time, which makes analysis and measurement a complex and confusing task. However, it is very important that key factors within a company are identified so that the most suitable performance measures for the company can be selected as mentioned by Tangen (2003).

This paper deals with the prioritization of the factors impacting on performance of power loom textiles. The objective of the paper is to quantify the effect of these factors by making a hierarchy using AHP. It includes three steps.

1. Identification of factors affecting performance and their relationship.
2. Structuring the factors hierarchically.
3. Quantifying the effect of these factors on performance.

Identification of factors affecting performance and their relationship

The factors impacting on performance are different for different department; changes with respect to time and the

Table 1 Types of factor which influence performance

Controllable factors	
1. Absenteeism of the employees	11. Firm organization, management practices, and work arrangements
2. Working condition of the units	12. Resource allocation
3. Training facilities for the employee	13. Motivation level of work force and management
4. Operator to helper ratio in the shop floor	14. High rate of non-first quality production
5. Poor quality of raw material and accessories	15. Maintenance
6. Frequent change of styles	16. Rejection level
7. Technological changes in the field	17. Repair level (in line)
8. Change from high volume to low volume orders	18. Repair level (final inspection)
9. Deviation from standard time in manufacturing	19. Rewarding creative suggestions
10. Accumulation of physical capital and R&D	20. Payment system
Uncontrollable factors	
1. Production location	2. Export destination
3. Type of organization	4. Major product category
5. Market orientation	6. Age of factory
7. Education level of workers	

perception of individuals are also different. These factors are broadly classified as strategic, tactical, and operational. Strategic is a high level plan to achieve one or more goals under condition of uncertainty. A tactic is conceptual action implemented as one or more specific tasks; this term is common in business. An operational is a result of the process of operationalization and is used to define something in terms of a process needed to determine its existence, duration, and quality as stated by Grünberg Thomas (2007).

The critical success factors which influence performance are internal/controllable and as well as external/uncontrollable. The internal factors are within the control of management and external factors are not within the control of management (Waters 1999). Table 1 shows the controllable and uncontrollable factors. These factors can be divided into five categories.

1. Human Resource, (Karuppusami and Gandhinathan 2006; Lewis et al. 2006; Kim-Soon and Jantan 2010).
2. Product, (Salaheldin 2009; Awan et al. 2009; Salaheldin 2009; Ong 1997).
3. Process, (Mallur and Hiregoudar 2010; Kim-Soon and Jantan, 2010; Ong 1997; Gunasekaran 1998; Baines 1997).

Table 2 Indirect factors

Underlying factors	Fundamental influencing factors
1. Competition	1. Policy environment
2. Openness	2. Institutional factor
3. Demand and supply	3. Social capability

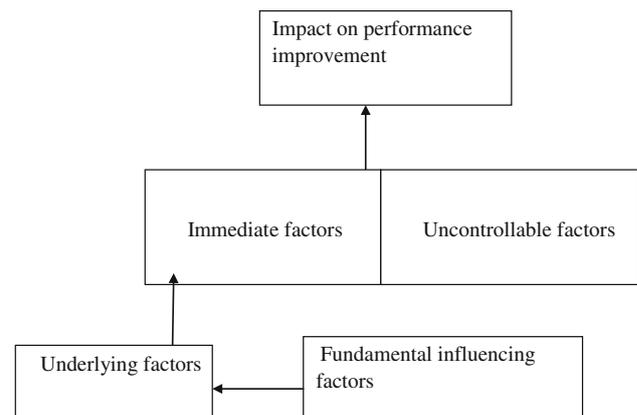
- Control (Mallur and Hiregoudar 2010; Kim-Soon and Jantan 2010) Process, (Kim-Soon and Jantan 2010).
- Uncontrollable, (Bheda 2002; Waters 1999).

This categorization is neither an attempt to sort the factors into the correct categories nor is it an attempt to mention all possible factors. The factors are summarized from the different literatures as though no study has been carried out in the area of performance of power looms. The identified factors belong to manufacturing and then consolidated by taking the opinion of experts from the field of power loom textiles. The research done so far is in the area of apparel and garment industry. The factors are finalized by experts and some performance related factors of supply chain management are taken as stated by Alain et al. (2011). This is an attempt made toward the study on factors influencing on performance of power loom textiles in Maharashtra state of India.

Underlying factors can have an indirect effect on productivity by promoting the immediate causes (controllable factor). They help to determine the extent to which the immediate causes change and bring about an improvement in productivity. There are also fundamental influences which involve more deep-seated policy, social and institutional factors which affect productivity in very general and indirect fashion. They set the general ‘environmental’ conditions which can affect productivity, especially over the long term.

Table 2 (Banks 2009) shows the indirect factors. The general features of the underlying factors are competition, openness of the economy to trade and investment and demand and supply conditions. A change in firm organization, a change in management practice, or the adoption and development of new technologies might not happen without a clear purpose or incentive such as that provided by competition. Access to overseas technologies and management expertise may not be possible without openness to foreign trade and investment. Inaccurate price signals and other distortions to demand and supply outcomes can impede the accumulation of human capital and obscure the merits of different production methods and new technologies. However, more fundamental factors condition productive potential and its long-term realization.

Figure 1 gives the insight on performance drivers. These factors are deep in nature and impact of these factors is

**Fig. 1** Drivers of productivity performance

long term. The policy environment can affect the emphasis given to economic objectives and the development of productivity-enhancing capabilities and the stability of policy settings can affect the risks involved in making long-term investment decisions. Formal and informal institutional ‘rules of the game’ influence the costs of coordinating production activities and conducting business. They influence the incentives facing firms and individuals to raise productivity. Social capability refers broadly to the orientation of people toward change of the kind required to achieve further development.

Research gap

- Most of the previous research on textile SMEs just examines one or several critical success factors that contribute to performance. There is not one unitary framework that comprehensively measures the impact of factors on power loom textile performance.
- Many researchers have argued that a performance measurement system designed for large organizations is not adaptable to power loom SMEs. However, this issue is still very controversial. Some scholars have the opposite view. To date, no empirical studies address the issue.
- While many empirical studies focus on performance measurement in power loom SMEs, none answer the following questions: What are the important factors? Where to concentrate to improve the performance?

Structuring the factors hierarchically

Cognitive map-design research has the goal of understanding human cognition to improve the design and use of maps. Suwignjo et al. (2000) has stated the cognitive map (mind map) is an effective tool in helping to identify the factors affecting performance and their relationships.



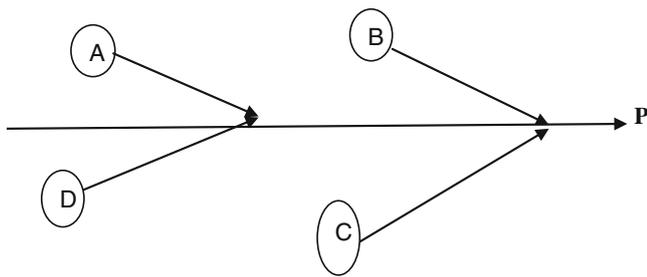


Fig. 2 Cause and effect diagram

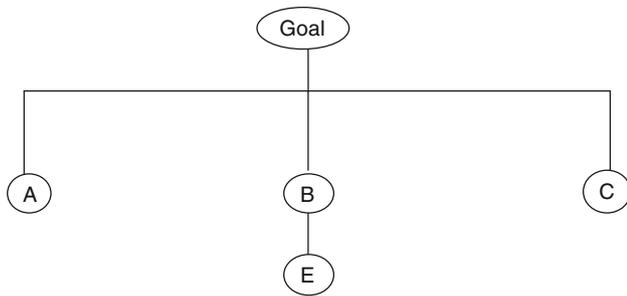


Fig. 3 Tree diagram

Cognition includes perception, learning, memory, thinking, reasoning, and problem-solving, and communication. Eden et al. (1983) define cognitive mapping as a modeling technique which intends to portray ideas, beliefs, values, and attitudes and their relationships one to another in a form which is amenable to study and analysis. The effect of factor on performance may be direct (vertical) or indirect. Direct effect of a factor on performance is an aggregate of all the effects of factors on performance through that factor. Indirect effect is the effect of a factor on performance through other factors. The factors impacting the performance have direct and indirect effect. Cause and effect diagram can be used to identify the hierarchical structure of the factors. The following figure shows the different levels of factor and their impact and relationships and a tree diagram is used to give a clear picture of the same. In the following Fig. 2, *P* is the performance and A, B, C, and D is having an impact on performance. Figure 3 shows the different levels of hierarchy. The factors A, B, and C are on first level and these are having the impact on zero level similarly E is on second level and whose impact is on first level (Indirect effect).

Quantifying the effect of the factor on performance

Many decision-making problems involve a number of factors and subfactors. For difficult decisions, a quantitative approach is recommended. In this paper both qualitative and quantitative approaches are used. All of the

important factors can then be given appropriate weights. AHP process uses pair-wise comparisons and then computes the weighting factors and evaluation. This process was developed by Satty (1980) and published in his book *The Analytic Hierarchy Process*. The decision maker starts by laying out the overall hierarchy of the decision. This hierarchy reveals the factors to be considered as well as the various alternatives in the decision, in this paper only the objectives are considered to prioritize the factors. A number of pair-wise comparisons are done, which result in the determination of factor and subfactor weights and factor evaluations. The AHP is a structured method to elicit preference opinion from decision makers. Its methodological procedure can easily be incorporated into multiple objective programming formulations with interactive solution process. If number of factors are less then, an excel sheet can be used to find out the priority.

The AHP approach involves decomposing a complex and unstructured problem into a set of components organized in a multilevel hierarchic form. A salient feature of the AHP is to quantify decision makers’ subjective judgments by assigning corresponding numerical values based on the relative importance of factors under consideration. A conclusion can be reached by synthesizing the judgments to determine the overall priorities of factors. The AHP approach has been proposed in recent literature as an emerging solution approach to large, dynamic, and complex real world multi criteria decision-making problems. Successful AHP applications have been reported in marketing, finance, education, public policy, economics, medicine, and sports. The AHP approach is thus selected to address the multi criteria decision-making problem to be addressed in this paper to assess and evaluate the impact of factors on performance.

Five experts’ opinion was taken for identification of important factors from the factors which were collected through literature survey. Two experts belong to academia and three are from industries. Five categories are made as human resource, product, process, control, and uncontrollable.

Analytic hierarchy process

AHP approach achieves pair-wise comparisons among factors or criteria to prioritize them at each level of the hierarchy using the Eigen value calculation. In addition to AHP, ANP technique is a general form that allows interdependencies, outer dependencies, and feedbacks among decision elements in the hierarchical or non-hierarchical structures.

The AHP consists of following steps (Satty 1980).

1. Identify all relevant and important performance impacting factors.

Table 3 Numerical rating and preferences (Saaty 2000)

Numerical rating	Verbal judgments of preferences
9	Extremely preferred
8	Very strongly to extremely
7	Very strongly preferred
6	Strongly to very strongly
5	Strongly preferred
4	Moderately to strongly
3	Moderately preferred
2	Equally to moderately
1	Equally preferred

2. Identify all relevant and important performance impacting subfactors.
3. Construct all factors and subfactors into hierarchy structure.
4. Collect experts' opinion through questionnaire.
5. Pair-wise comparison between main factors and subfactors by Expert choice.
6. Compute priority weights and rating of factors and subfactors.
7. Analyze and evaluate the impact of all factors.

Satty scale

The decision maker expresses the opinion regarding the relative importance of each factor and preferences among the factor by making pair-wise comparisons using a nine-point (Numerical scale) system ranging from 1 (the two choice options are equally preferred) to 9 (one choice option is extremely preferred over the other) (Table 3). The AHP scoring system is a ratio scale where the ratios between values indicate the degree of preference. The nine-point scale has been the standard rating system used for the AHP (Saaty 2000).

Factors and subfactors impacting on performance

The main factors are human resource, product, process, control, and uncontrollable. Table 4 shows the main and subfactors. The following factors and subfactors are finalized by the experts in the Indian power loom context.

Group decision making

The AHP allows group decision making, where group members can use their experience, values, and knowledge to break down a problem into a hierarchy and solve it by the AHP steps. Brainstorming and sharing ideas and

insights (inherent in the use of expert choice in a group setting) often leads to a more complete representation and understanding of the issues. The following suggestions and recommendations are suggested in the expert choice software manual (Trial version, Non-commercial use) (Expert Choice Inc, Expert Choice software and manual. 4922 Elsworth Ave., Pittsburgh, PA 15213, USA).

1. Group decisions involving participants with common interests are typical of many organizational decisions. Even if we assume a group with common interests, individual group members will each have their own motivations and, hence, will be in conflict on certain issues. Nevertheless, since the group members are 'supposed' to be striving for the same goal and have more in common than in conflict, it is usually best to work as a group and attempt to achieve consensus. This mode maximizes communication as well as each group member's stake in the decision.
2. An interesting aspect of using Expert Choice is that it minimizes the difficult problem of 'group-think' or dominance by a strong member of the group. This occurs because attention is focused on a specific aspect of the problem as judgments are being made, eliminating drift from topic to topic as so often happens in group discussions. As a result, a person who may be shy and hesitant to speak up when a group's discussion drifts from topic to topic will feel more comfortable in speaking up when the discussion is organized and attention turns to his area of expertise. Since Expert Choice reduces the influences of group-think and dominance, other decision processes such as the well known. Ishizaka and Labib (2009) has stated the advantages of expert choice.
3. When Expert Choice is used in a group session, the group can be shown a hierarchy that has been prepared in advance. They can modify it to suit their understanding of the problem. The group defines the issues to be examined and alters the prepared hierarchy or constructs a new hierarchy to cover all the important issues. A group with widely varying perspectives can feel comfortable with a complex issue, when the issue is broken down into different levels. Each member can present his own concerns and definitions. Then, the group can cooperate in identifying the overall structure of the issue. In this way, agreement can be reached on the higher-order and lower-order objectives of the problem by including all the concerns that members have expressed. The group would then provide the judgments. If the group has achieved consensus on some judgment, input only that judgment. If during the process it is impossible to arrive at a consensus on a judgment, the group may use some voting technique,



Table 4 Factors and subfactors affecting performance

Factors	Meaning	Subfactors
Human resource (C1)	Power looms are labor intensive. The skill upgradation through training improves the performance. Motivated work force can give a better performance. Absenteeism is attitudinal problem and this can be reduced by the rewards. The good wages improves the performance and gives job satisfaction. The work force varies depending on the nature of job as dyer, weaver, sticher, supervisor, and helper, for a determined output the ratio of work force should be maintained.	Absenteeism of the employees (C11) Training facilities for the employee (C12) Operator to helper ratio in the shop floor (C13) Motivation level of work force and management (C14) Rewarding creative suggestions (C15) Payment system (C16)
Process (C2)	Technology used by the power loom textiles is old and upgradation is necessary, government has initiated the schemes (TUFS), R&D activities improve the variety and quality and which require physical capital. Better management practices reduce waste, rework, and high rate of non-first quality products. Good working condition gives job satisfaction, improves quality performance. Maintenance reduces rejection and standard time can be achieved.	Working condition of the units (C21) Technological changes in the field (C22) Accumulation of physical capital and (R&D) (C23) Firm organization, management practices and work arrangements (C24) Resource allocation (C25) High rate of non-first quality production (C26) Maintenance (C27)
Product (C3)	Incoming quality of yarn and dyes are very important to achieve better quality products. Flexibility in product is essential as the production is in batch type. Industrial engineering is an important field in power loom textiles.	Poor quality of raw material and Accessories (C31) Frequent change of styles (C32) Change from high volume to low volume orders (C33) Deviation from standard time in manufacturing (C34)
Control (C4)	In-process repair is a common task in power loom textiles. During final inspection, the wastage is more but rejection of a lot can be reduced.	Rejection level (C41) Repair level (inline) (C42) Repair level (final inspection) (C43)
Uncontrollable factors (C5)	Local and export market demands are different, product category varies, and location of unit and experience (Age of factory) are the important factors to blossom the business. Education of work force cannot be controlled but training enhances the satisfaction level and performance.	Production location (C51) Type of organization (C52) Market orientation (C53) Export destination (C54) Major product category (C55) Age of factory (C56) Education level of worker (C57)

or may choose to take the ‘average’ of the judgments. The group may decide to give all group members equal weight, or the group members could give them different weights that reflect their position in the project. All calculations are done automatically on the computer screen.

- The Group Meeting: While Expert Choice is an ideal tool for generating group decisions through a cohesive, rigorous process; the software does not replace the components necessary for good group facilitation. There are a number of different approaches to group decision making, some better than others. Above all, it is important to have a meeting in which everyone is engaged, and there is buy-in and consensus with the result.

The above four points which are mentioned in the Expert Choice manual is useful while conducting a meeting online or off-line. In this paper while collecting the data first of all the entire main and subfactors are finalized by

the Experts which are taken from the review of literature. The next step is direct and indirect impact of factors on performance is finalized. Then the main factors, subfactors are arranged hierarchically. The questionnaire is prepared for pair-wise comparison. A numerical scale is provided for pair-wise comparison. The filled questionnaires are collected from the experts and then the data is entered in the software. The example of the questionnaire is shown in Appendix A.

Applying the AHP method

A questionnaire is prepared which consists of the immediate (controllable), external, underlying, and fundamental influencing factors. The underlying and fundamental factors are having the indirect effect through factor (training facility for the employee, management and organization, management practices, work arrangements) on the



performance. The questionnaire is distributed among the academia and industry personnel. As till today, no work has been contributed in the area of power loom textiles; the researcher has invited the owners who are having bachelor's degree in textiles. One consultant has shown interest in the study and two Industrial Engineering professors are invited for the same. The sample size of expert is five. The reliability of the questionnaire is already checked by the author in his survey-based research [8]. The experts have given the pair-wise comparison between these factors. By following the AHP procedure which is described in the Sect. 4, the hierarchy of the problem can be developed. The decision makers have to indicate preferences or priority for each factor in comparison to other factor.

Breaking down the problem

The first step is to develop the hierarchy of the problem. This classifies the goal, factors, and subfactors into three major levels. The level four is having certain factors which make an indirect effect on goal. The highest level of the hierarchy is a goal which is to find out the factors which makes highest impact on performance. The level 2 represents the main factors which include human resource, product, process, control, and uncontrollable factor. The level 3 represents subfactors which are shown in Table 4. The underlying factors and fundamental influencing factors have direct impact on training and organization, management practices, work methods. These factors have indirect effect on human resource and process; these factors are shown in Table 2. Breaking down the problem in hierarchy, this is shown in the Fig. 4.

Figure 4 represents the hierarchy of factors. The level 1 is goal, determination of potential factors which impact on performance. Level 2 is the category made for the factors which impacts on performance like human resource, process, product, control, and uncontrollable factors which constitute 28 subfactors. The hierarchy for C12 and C24 (level 4) is shown for underlying and fundamental factors which indirectly impact on the performance, which is explained in Fig. 1.

Comparative judgments to establish priority

The filled questionnaire is used for pair-wise comparison by taking either a numerical scale, verbal scale, or graphical scale. In this paper a numerical scale (1 to 9) is used. The pair-wise.

comparison is done for main factors and subfactors. For example the human resource is most important factor than process and moderately important than product it means that the control and uncontrollable factors are least important criteria. After inputting the factor with its

importance into Expert Choice, the priorities from each set of judgments were found and which is recorded in Table 5. The table shows the local and global priority. A consistency check must be applied. Satty (1980) has proposed a consistency index (CI) which is related to the Eigen value method. The consistency ratio, the ratio of CI and RI is given by: $CR = CI/RI$, where RI is random index. The consistency ratio should be less than 0.10, in this hierarchy the consistency ratio is 0.06.

Respondent response on factors

Respondent one who is owner of power loom textile puts forward the same weightings product, process, control, and human resources (rating 3). Absenteeism (rating 3) plays a significant role in power loom textiles. The performance of power loom is highly dependent on the work force. If wages are paid based on the performance then output will be high. The market potential is high in this type of industry. By providing the incentives the morale of the workforce will be high and they will get motivated (rating 4). Regular training (rating 4) should be provided which enhances the quality and performance.

In process, the technological adoption (rating 4) is essential as compared to the existing technology. The working procedure should be adopted in such a way that the second quality production (rating 4) should get reduced. The working condition (rating 5) may be improved by providing the air conditioning to the shop floor. Maintenance (rating 4) is huge as machines are having number of rotary and reciprocating parts. So, care should be taken in maintenance and TPM should be implemented.

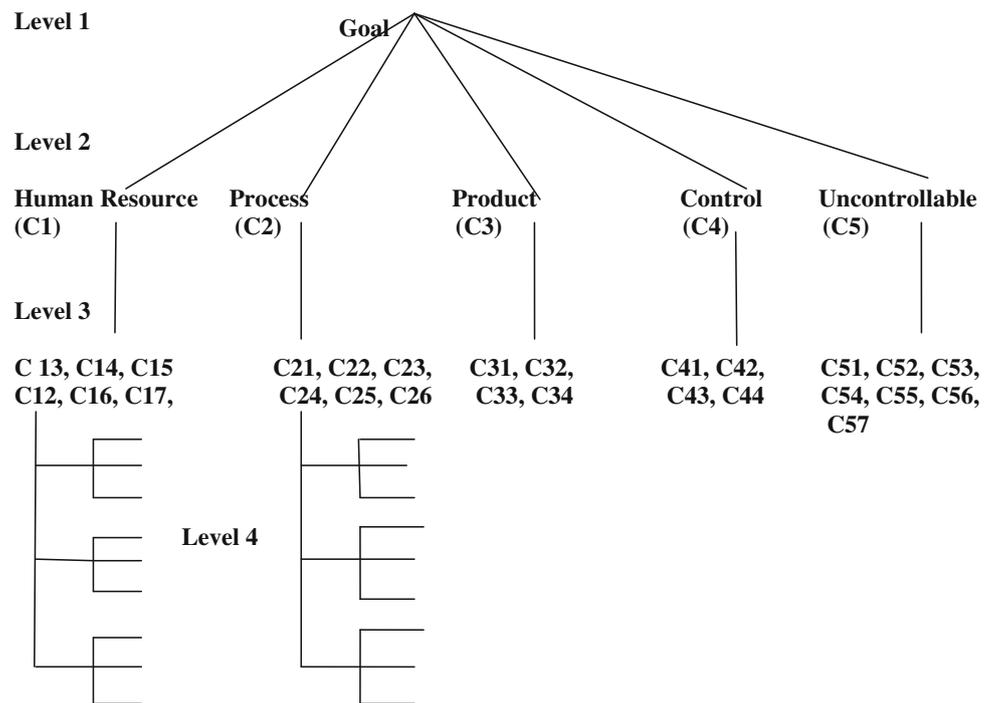
In product factor, poor quality of raw material (rating 3) is affecting the quality and performance of power looms. The change in design and lot size (ratings 4) affects the performance of power looms.

In control, the yarn breaks very frequently so, the in-line quality check (rating 4) is essential. The scrap or rejection level is less in power looms but the more is the second quality production.

Results and discussion

AHP aims at evaluating a set of criteria elements and subcriteria elements use pair-wise comparisons. Despite its popularity, there are some criticisms imposed upon AHP for practical decision making, such as ambiguity in ratio scales (Dyer 1990), pair-wise comparisons, criteria weight and problems in the rank reversal (Belton and Gear 1983). However, AHP overcomes other decision-making methods in many ways. It is a method with large penetration both in

Fig. 4 Hierarchy of objectives (Factors)



academic and professional environment and is implemented by business tools widely tested and validated. Arkan et al. (2011) has mentioned the use of AHP in supplier selection and how AHP overcomes compared to other tools.

The paper gives an idea of factors which influences on performance of power loom textiles which gives guidelines to the owners/managers about the potential area of improvement. The opinion of academician, consultants, and experts from core textiles counts the result in a positive manner.

The objective of this paper is to find out the important factors which influence the performance of power loom textiles. Literature suggests the various factors which influence the performance of power loom textiles. AHP tool quantifies the factors which influence the performance. The priority of the objectives (factors) is shown in Table 5. The role of human resource is very important as the industry is labor intensive. The priority for the human resource is 37.66 %. The labor absenteeism is observed as 23.97 %, which highly impact on the performance. The absenteeism of work force means loss of production. Training facility for the employee and management is also important; the effect of this is 20.01 %. To achieve a high performance, a motivated work force is important factor which is 20.02 %. A second important factor is product; it means the design, volume, and quality of product which is having an impact of 22.56 % on performance. Poor quality of raw material and accessories (Equipment parts, dyes, kandi, and shuttle) is having a high impact on performance

because it leads to poor quality of product, low value of the product which is 40.32 %. Frequent change in style and volume makes an impact on performance. Age of the factory and good management practices impact on the performance. Maintenance of power loom is an important factor. Welfare and rewards motivate the work force which in turn leads to high performance. Underlying factor and fundamental influencing factors make an indirect impact on the performance but as these factors are having a long-term base and effect, the experts have given equal importance for all.

In a nut shell, human resource, product style and volume, maintenance, age of factory are having more impact on performance of power looms.

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Appendix: A questionnaire items for experts

Please fill the following questionnaire. The 27 subfactors are categorized into five groups, namely human resource, process, product, control, and uncontrollable. This questionnaire is to have a pair-wise comparison between the above factors. Similarly for subfactors there will be pair-wise comparison. Evaluation is done by a numerical scale by comparing between A and B, weights are given either to A or B based on the preference. For example the human

Table 5 Priority of objectives/factors

Objectives	Local priority	Global priority
Institutional	33.09	0.29
Goal	100	100
Human resource C1	37.66	37.66
Absenteeism C11	23.97	9.03
Training facility for the employee and management C12	20.01	7.54
Competition	30.88	2.33
Policy	33.28	0.77
Institutional	33.87	0.79
Society	32.85	0.76
Openness	30.09	2.27
Policy	34.04	0.77
Institutional	33.64	0.76
Society	32.31	0.73
Demand and supply	39.03	2.94
Policy	35.50	1.04
Institutional	31.43	0.92
Society	33.07	0.97
Operator to helper ratio on the shop floor C13	7.77	2.93
Motivated workforce C14	20.02	7.54
Reward C15	11.39	4.29
Payments C16	16.84	6.34
Process C2	15.30	15.30
Working condition of unit C21	14.17	2.17
Technological changes in the field C22	16.98	2.60
Accumulation of physical capital and R&D C23	6.39	0.98
Organization, management practices, work arrangements C24	17.27	2.64
Competition	32.90	0.87
Policy	37.81	0.33
Institutional	25.66	0.22
Society	36.53	0.32
Openness	33.88	0.90
Policy	38.71	0.35
Institutional	32.14	0.29
Society	29.15	0.26
Demand and supply	33.22	0.88
Policy	39.15	0.34
Institutional	33.09	0.29
Society	27.76	0.24
Resource allocation C25	7.07	1.08
High rate of non-first quality production C26	9.96	1.52
Maintenance C27	28.16	4.31
Product C3	22.56	22.56
Poor quality of raw material & accessories C31	40.32	9.10

Table 5 continued

Objectives	Local priority	Global priority
Frequent change of styles C32	28.59	6.45
Change from high volume to low volume C33	21.55	4.86
Deviation from standard time C34	9.54	2.15
Control C4	13.52	13.52
Rejection level inline C41	22.34	3.02
Repair level inline C42	49.82	6.73
Repair level in inspection C43	27.84	3.76
Uncontrollable C5	10.96	10.96
Production location C51	6.63	0.73
Type of organization C52	10.14	1.11
Market orientation C53	10.82	1.19
Export destination C54	18.72	2.05
Major product category	9.41	1.03
Age of factory C56	22.48	2.46
Education level of worker C57	21.80	2.39

resource is having 6 subfactors so; there will be 15 comparisons and so on.

Compare the relative preference with respect to: main criteria < goal.

Numerical scale 1–9 (Saaty), where (1 = equally important, 2 = equally to moderately, 3 = moderately preferred, 4 = moderately to strongly, 5 = strongly preferred, 6 = strongly to very strongly, 7 = very strongly preferred, 8 = very strongly to extremely, 9 = extremely preferred).

Sr.No	Evaluation criteria A	Numerical scale	Evaluation criteria B
1	Human resource	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Process
2	Human resource	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Product
3	Human resource	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Control
4	Human resource	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Uncontrollable
5	Product	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Process
6	Product	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Control
7	Product	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Uncontrollable
8	Control	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Process
9	Control	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Uncontrollable
10	Uncontrollable	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Process

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