Analytic Hierarchical Process Based Prioritization of Performance Measures used by Power Loom Textiles

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***Abstract*— The power loom textiles play a very significant role in Indian economy. This sector produces very important segment of clothing and garment in the form of dhoti, chadder, saari, towel, napkin, bed sheet etc. The power loom textiles which produce these products are lagging behind the apparel and clothing sector in terms of technology and industrial engineering. The Balanced scorecard is well known performance measurement tool used in the other businesses in India. In the previous paper, the author has used survey based research to find out the performance measures by taking the dimensions of balanced scorecard and found out the commonly used performance measures for power loom textiles. This paper is an attempt to make a priority of the performance measures by taking the opinion of experts and using Analytic Hierarchical Process. AHP is a multi criteria decision making tool used for pair wise comparison. This paper describes briefly the meaning of performance along with productivity, profitability, efficiency and effectiveness. This paper gives more emphasis on the term performance and performance measures of power loom textiles in the Indian context.**

Keywords— Performance Measures, Power Loom Textiles, AHP.

I. INTRODUCTION

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. 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 [1].These power looms have flourished prominently at various centres in Maharashtra such as Bhiwandi, Ichalkaranji, Sholapur and Malegaon, these power loom centres work in decentralized sector and play an important role in the growth of power loom industry. India's textile and clothing industry contributes 4% per cent to Gross Domestic Product, 14 percent in industrial production, 18% of total industrial employment and 27% of export earnings [6].

The traditional business owners believe only profit as a measure. Owners of power loom businesses are aware of non financial measures but instead of measuring it they try to control. In enterprise management, Moullin (2003) defines an organization's performance as "how well the organization is managed" and "the value the organization delivers for customers and other stakeholders."The sector is facing a tremendous competitive pressure in the global market. The towels manufactured by the Solapur power loom are having a preference in the world market especially beach towels. Now a day's China is competing by making the printed towels but it has remained number two as the world market prefer the multi-coloured pile lifted terry towels. Solapur is having monopoly in manufacturing these towels. For other type of towels the domestic market is very good. The paper deals with prioritizing the performance measures used by the power looms using AHP for Solapur District (Maharashtra). Expert opinion was taken for pair wise comparison of performance measures. Four experts opinion was taken for filling the questionnaire, two belongings to power loom textiles and two consultants in the field of textiles.

II. LITERATURE REVIEW

The terms productivity and performance are commonly used within academic and commercial circles; they are however rarely adequately defined or explained. Indeed they are often confused and considered to be interchangeable, along with terms such as efficiency, effectiveness and profitability [20] and [23].The productivity is a relative term and is the ratio of output to input. Productivity in manufacturing units is defined as follows: quality and quantity enhancement of product to the ratio of spent cost. The productivity view point is the relationship between the outputs of a production system with the data used for production of output (ILO).The term profitability is defined as the ratio between revenue and cost or profit to assets. It is also defined as the ability of the firm to realize financial gains from its operations. Efficiency is used to measure consumption of an input when used in achieving a certain output. The effectiveness is used to validate the goals of an organization or how much utilities are attained because of the outputs [17].Efficiency means "doing things right" and effectiveness means "doing the right things" [20]. A performance measure is defined as a metric used to quantify the efficiency and/or effectiveness of an action Performance measurement is defined as the process of quantifying the efficiency and effectiveness of action.

A. Performance measure

Performance measure history could be divided in two periods; first one was applied from 1880 to 1980, which

emphasis on financial factors in measuring performance such as profit, productivity, and return of investment (ROI). In the early 1980s, because of global competition, customer requirements changed. Therefore, organizations focused on new methods, philosophies and technological implementation in the management and production [7].

Now, the performance measure is based on financial as well as non financial measures. The performance measure for most of industries is concentrated on financial measure. Power loom textiles performance is also financial based and this can be improved by applying the lean philosophy. So, by applying the lean philosophy [5] the profit can be increased by reducing the cost of manufacturing.

B. Performance objectives

The performance objectives and these are Speed, Quality, Dependability, Flexibility and Cost. [21]

Speed-Fast operations reduce the level of in-process inventory between micro operations, as well as reducing administrative overhead. Products can also be delivered earlier to the customer. Quality-High quality operations do not waste time or effort having to re-do things, nor are there internal customers inconvenienced by flawed service. Dependability-Dependable operations can be relied on to deliver exactly as planned.

This eliminates wasteful disruption and allows the other micro operations to operate efficiently. Flexibility-Flexible operations adapt to changing circumstances quickly and without disrupting the rest of the operation. Flexible micro operations can also change over between tasks quickly and without wasting time and capacity. Cost-Low cost operations allow the company to sell their products at a competitive price, and increase profitability.

C. Partial measures of performance

The five generic performance objectives are –

Speed

Quality

Dependability

Flexibility

Cost

They can be broken down into more detailed measures, which represent the operational performance shown in Table I.

TABLE I: Some typical partial measures of performance. [21]

Performance objective	Some typical measures
Quality	Number of defects per unit
	Level of customer complaints
	Scrap level
	Warranty claims
	Mean time between failures
	Customer satisfaction score
Speed	Customer query time
	Order lead time
	Frequency of delivery
	Actual *versus* theoretical throughput time
	Cycle time
Dependability	Percentage of orders delivered
	Average lateness of orders
	Proportion of products in stock
	Schedule adherence
	Mean deviation from promised arrival
Flexibility	Time needed to develop new products/services
	Range of products/services
	Machine change-over time
	Average batch size
	Time to increase activity rate
	Average capacity/maximum capacity
	Time to change schedules
Cost	Minimum delivery time/average delivery time
	Variance against budget
	Utilization of resources
	Labour productivity
	Added value
	Efficiency
	Cost per operation hour

III. RESEARCH QUESTIONS

The research presented in this paper is specifically concerned with the investigation of how do power loom textiles measure performance today? Are they inclined to use financial measures or non-financial ones? What type of performance measurement approaches are used by power loom textiles?

A. The approach for performance measurement used in the paper

By considering the performance dimensions as quality, flexibility, cost, dependability and speed which are commonly mentioned as the main operational performance measures [21] The AHP questionnaire is framed to make a pair wise comparison of performance measures considering the financial and non financial measures [14] The questionnaire is prepared by considering the some dimensions of performance measures which are suitable for the textiles [16] The seventeen performance measures are finalised through questionnaire survey by the author in his earlier publication.

B. Performance measures used in the study

These measures are grouped in three categories like Financial Measures, Non Financial Measures and Process Performance Measures. This is not an attempt to make it in a clear group rather these are general groups. These measures are used in the AHP questionnaire to find out the priority towards the performance measures used by the power loom textiles.

Table II shows the factors as Financial, Non financial and Process with its sub factors.

TABLE II Factors and Sub factors

Financial Measures	1. Gross profit margin(C11) 2. Cost of product sold(C12) 3. Total sales revenue(C13) 4. Low manufacturing cost(C14)
Non Financial Measures	1. Quality of the yarn(C21) 2. Less scrap and defects(C22) 3. Number of customer orders received(C23) 4. Satisfaction of customers(C24) 5. In time delivery(C25) 6. Employee satisfaction(C26) 7. No injury to operator ,no in plant accidents(C27) 8. Technical expertise of employee(C28) 9.Flexibility in manufacturing(C29)
Process Performance Measures	1. Number of units produced(C31) 2. Amount of material inventory(C32) 3. Low lead time, maintenance & breakdown(C33) 4. Capacity of the unit(C34)

IV. RESEARCH METHODOLOGY

The objective of the paper is to find the out the performance measure used by power loom textiles. Based on the above literature review and survey result of previous paper the performance measures are considered in order to prepare the questionnaire.

The research methodology consists of the following steps:

1. Development of an AHP questionnaire to collect information about the measures used by power loom textiles.

2. Filling the data obtained through questionnaire survey to prioritize the performance measures.

V. ANALYTIC HIERARCHY PROCESS

AHP process uses pair wise comparisons and then computes the weighting factors and evaluation. This process was developed by Thomas L. Saaty and published in his 1980 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 sub factor 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. The AHP approach involves decomposing a complex and unstructured problem into a set of components organized in a multilevel hierarchic form (Saaty). 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 variables. 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.

The AHP consists of following steps.

1. Identify all relevant and important performance measure factors.

2. Identify all relevant and important performance measure sub factors.

3. Construct all factors and sub factors into hierarchy structure

4. Collect experts opinion through questionnaire

5. Pair wise Comparison between main factors and sub factors by Experts.

6. Compute priority weights and rating of factors and sub factors.

7. Analyze and evaluate the priority of all factors.

A. Satty Scale

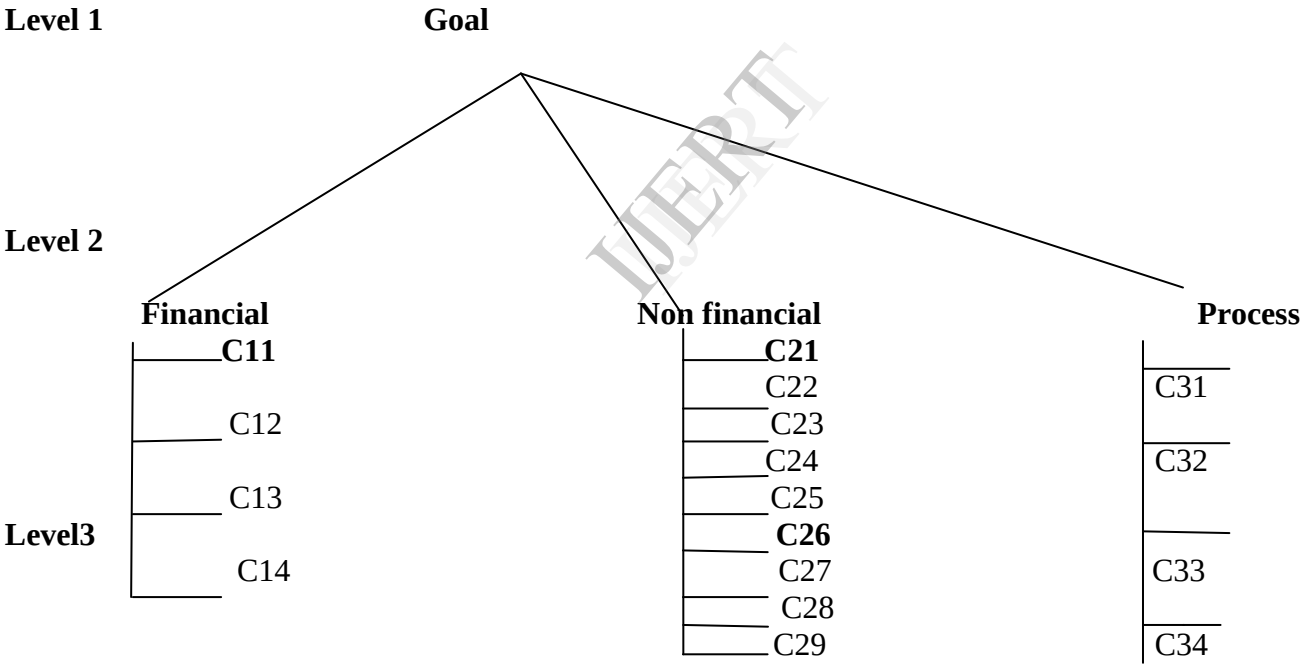
The decision-maker expresses the opinion regarding the relative importance of each factor and preferences among the

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 III). 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).

Table III Numerical rating and preferences [19]

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

B. HIERARCHICAL DIAGRAM



AHP template is used for evaluation purpose. The AHP template works under Windows OS and Excel version MS Excel 2010 (xlsx extension). The workbook consists of 20 input worksheets for pair-wise comparisons, a sheet for the consolidation of all judgments, a summary sheet to display the result, a sheet with reference tables (random index, limits for geometric consistency index GCI, judgment scales) and a sheet for solving the Eigen value problem when using the eigenvector method (EVM).

VI. RESULT OF PAIR WISE COMPARISON

The result table will show all criteria with calculated weights and rank, using the EVM:

	Criterion	Comment	Weights	Rk
1	Criterion 1	First Criterion	27,9%	2
2	Criterion 2	Second Criterion	7,2%	3
3	Criterion 3	Third Criterion	64,9%	1
4				
5				
6				
7				
8				
9		for 9&10 unprotect the input sheets and expand the		
10		question section		

Principal Eigen value lambda and consistency ratios GCI (geometric consistency index) and CR (consistency ratio)

Eigenvalue			lambda:	3,000	
Consistency Ratio	0,37	GCI:	0,00	CR:	0,0%

In the section below the comparison matrix along with the normalised vectors is displayed:

Matrix		Criterion 1	Criterion 2	Criterion 3	0	0	0	0	0	0	0	normalized principal Eigenvector
		1	2	3	4	5	6	7	8	9	10	
Criterion 1	1	1	5	1/3	-	-	-	-	-	-	-	27,9%
Criterion 2	2	1/5	1	1/7	-	-	-	-	-	-	-	7,2%
Criterion 3	3	3	7	1	-	-	-	-	-	-	-	64,9%
0	4	-	-	-	1	-	-	-	-	-	-	0,0%
0	5	-	-	-	-	1	-	-	-	-	-	0,0%
0	6	-	-	-	-	-	1	-	-	-	-	0,0%
0	7	-	-	-	-	-	-	1	-	-	-	0,0%
0	8	-	-	-	-	-	-	-	1	-	-	0,0%
0	9	-	-	-	-	-	-	-	-	1	-	0,0%
0	10	-	-	-	-	-	-	-	-	-	1	0,0%

A. *Consistency*

Consistency ratios are calculated in all *input sheets* and in the *summary sheet*. With λmax the calculated principal eigne value - either based on the priority eigenvector derived from RGMM in the input sheet or derived from EVM in the summary sheet – the consistency index *CI* is given as

$$CI = \frac{(\lambda_{max} - N)}{N - 1}$$

The consistency *ratio CR* is calculated using

$$CR = \frac{CI}{RI}$$

The value of RI is taken from the table of random consistency index table as shown below for n number of experts.

n	1	2	3	4	5	6	7	8	9
RCI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

B. Goal-Level 1

AHP Analytic Hierarchy Process (EVM multiple inputs)

K. D. Goepel Version 12.08.2013 http://bpmsg.com

Only input data in the light green fields and worksheets!

n= 3 Number of criteria (3 to 10) Scale: 1 Linear

N= 4 Number of Participants (1 to 20) α: 0.1 Consensus: 97.3%

p= 0 selected Participant (0=consol.) 2 7 Consolidated

Objective: To find out which factor mostly influences the performance of power loom industry.

Author:

Date:

EVM check: 1.28406E-05

Table	Criterion	Comment	Weights	Rk
1	Financial measures		51.6%	1
2	Process performance		22.3%	3
3	Non-financial performance		26.1%	2

Result: Eigenvalue lambda: 3.000

Consistency Ratio 0.37 GCI: 0.00 CR: 0.0%

Matrix

	Financial measures (1)	Process performance (2)	Non-financial performance (3)
Financial measures (1)	-	2 2/7	2
Process performance (2)	4/9	-	5/6
Non-financial performance (3)	1/2	1 1/5	-

normalized principal Eigenvector

51.56%
22.30%
26.15%

C. Financial Measures-Level 2 and 3

AHP Analytic Hierarchy Process (EVM multiple inputs)

K. D. Goepel Version 12.08.2013 http://bpmsg.com

Only input data in the light green fields and worksheets!

n= 4 Number of criteria (3 to 10) Scale: 1 Linear

N= 4 Number of Participants (1 to 20) α: 0.15 Consensus: 100.0%

p= 0 selected Participant (0=consol.) 2 7 Consolidated

Objective: To find out which sub factor from financial measure mostly influences the performance of power loom industry.

Author:

Date:

EVM check: 1.17626E-07

Table	Criterion	Comment	Weights	Rk
1	Gross profit margin		42.3%	1
2	Cost of product sold		13.7%	4
3	Total sales revenue		17.4%	3
4	Low manufacturing co		26.6%	2

Result: Eigenvalue lambda: 4.143

Consistency Ratio 0.37 GCI: 0.19 CR: 5.2%

Matrix	1 Gross profit margin	2 Cost of product sold	3 Total sales revenue	4 Low manufacturing cost	normalized principal Eigenvector
1 Gross profit margin	-	2	3	2	42.28%
2 Cost of product sold	1/2	-	1/2	1/2	13.72%
3 Total sales revenue	1/3	2	-	1/2	17.44%
4 Low manufacturin	1/2	2	2	-	26.56%

D. Non Financial Measures-Level 2 and 3

AHP Analytic Hierarchy Process (EVM multiple inputs)

K. D. Goepel Version 12.08.2013 http://bpmsg.com

Only input data in the light green fields and worksheets!

n=	9	Number of criteria (3 to 10)	Scale:	1	Linear
N=	4	Number of Participants (1 to 20)	α:	0.15	Consensus: 99.7%
p=	0	selected Participant (0=consol.)	2	7	Consolidated

Objective: To find out which subfactor in product that mostly affects productivity.

Author:

Date:

EVM check: 5.25718E-14

Table	Criterion	Comment	Weights	Rk
1	Quality of the yarn		23.5%	1
2	Less scrap and det		5.9%	9
3	Number of custom		12.0%	4
4	Satisfaction of cust		13.2%	3
5	In time delivery		16.3%	2
6	Employee satisfact		7.0%	6
7	No injury to operat		9.3%	5
8	Technical expertise		6.7%	7
9	Flexibility in manuf	for 9&10 unprotect the input sheets and expand the	6.1%	8

Result				
Eigenvalue			lambda:	10.086
Consistency Ratio	0.37	GCI: 0.33	CR:	9.4%

Matrix	1 Quality of the yarn	2 Less scrap and defects	3 Number of customer orders received	4 Satisfaction of customers	5 In time delivery	6 Employee satisfaction	7 No injury to operator, No in plant	8 Technical expertise of employees	9 Flexibility in manufacturing	normalized principal Eigenvector
1 Quality of the yarn	-	3	2	2	5	2	2	2	3	23.54%
2 Less scrap and defects	1/3	-	1/3	1/2	1	1/2	1/3	1/2	1 2/5	5.87%
3 Number of customer	1/2	3	-	2/5	1/2	2 1/5	2	3	2	12.02%
4 Satisfaction of customers	1/2	2	2 4/9	-	1	2	1 1/5	2	2	13.19%
5 In time delivery	1/5	1	2	1	-	4 3/4	3	5	1	16.31%
6 Employee satisfaction	1/2	2	4/9	1/2	1/5	-	1	1 1/3	1	6.96%
7 No injury to operator, No	1/2	3	1/2	5/6	1/3	1	-	2	2	9.30%
8 Technical expertise of	1/2	2	1/3	1/2	1/5	3/4	1/2	-	2 1/5	6.70%
9 Flexibility in manufacturin	1/3	5/7	1/2	1/2	1	1	1/2	4/9	-	6.11%

E. Process Performance Measures-Level 2 and 3

AHP Analytic Hierarchy Process (EVM multiple inputs)

K. D. Goepel Version 12.08.2013 http://bpmsg.com

Only input data in the light green fields and worksheets!

n=	4	Number of criteria (3 to 10)	Scale:	1	Linear
N=	4	Number of Participants (1 to 20)	α:	0.1	Consensus: 99.9%
p=	0	selected Participant (0=consol.)	2	7	Consolidated

Objective To find out which sub factor from process mostly influences the performance of power loom industry.

Author

Date

EVM check: 8.13916E-08

Table

	Criterion	Comment	Weights	Rk
1	Number of units produced		38.0%	1
2	Amount of material invent		15.2%	3
3	Low lead time, maintenan		37.6%	2
4	Capacity		9.2%	4

Result

Eigenvalue lambda: 4.200

Consistency Ratio 0.37 GCI: 0.26 CR: 7.3%

Matrix

	Number of units produced 1	Amount of material inventory 2	Low lead time, maintenance & breakdown 3	Capacity 4	normalized principal Eigenvector
Number of units 1	-	3 5/7	1	3	38.03%
Amount of material 2	1/4	-	2/7	3	15.20%
Low lead time, 3	1	3 1/2	-	3 2/9	37.59%
Capacity 4	1/3	1/3	1/3	-	9.19%

VII. CONCLUSION

The AHP study gives the insight of performance measures used by the power loom textiles. In the era of competition and to remain competitive in the business the organizations has to decide and implement the correct performance measures. The performance measure gives the feedback for the business. This paper gives the priority of factors and sub factors. The power loom textiles are more inclined towards financialmeasures51.6%.It's good for the businesses as 26.1% are inclined towards the non financial measures, for them the customer satisfaction is also important. The gross profit margin is the main priority for the industries and is 42.3 %. In non financial measures the industries give priority to the incoming yarn quality (23.54%) as the quality of the product is mostly dependent on raw material. In process performance measures the priority is for number of units produced which shows the birds eye on volume of production, the weight age is 38%. The orientation of most of the power loom textiles is towards the financial measures. This paper gives the feed back towards measurement and the area of improvement to flourish the business.

REFERENCES

[1] Annual Report 2013, Textile Ministry, India.
[2] Akhayan.P. (2013) "Critical Factors of business Intelligence" World Applied Science Journal 22 (9): pp-1344-1351
[3] Ali, Zairi M and Mahat F (2013) "Total Quality Management for Malaysian Food Industry: Conceptual Framework", Journal of Advanced Management Science vol-I, No-4.
[4] Choi and JG Wacker, (2013) "supply chain management in textiles and apparel", Institute of Textiles and Clothing, Hong Kong Polytechnic University, Hong Kong, China.
[5] Dulange S R, Pundir A K and Ganapathy L (2013)"A case study on power loom textiles: 5 S Philosophy", Industrial Engineering Journal Vol-VI and Issue No-12, December 2013.pp-38-41.
[6] Economic Survey, Government of India, (2012-2013), Ministry of Finance.
[7] Ghalayini AM, Noble JS and Crowe TJ (1997) "An integrated dynamic performance measurement system for improving manufacturing competitiveness", International Journal of Production Economics, Vol. 48, pp. 207-225.
[8] Georgise and Thoben K D (2013) "Assessing the Existing Performance Measures & Measurement Systems in Developing Countries: An Ethiopian Study," Global journal of Researches in Engineering, Industrial Engineering Volume 13 Issue 2 Version 1.0.
[9] Hedman J and Kalling T (2013) "Object-oriented modelling of manufacturing resources using work study inputs" Forty Sixth CIRP Conference on Manufacturing Systems.pp-443-448
[10] Jiaqin Yang and Ping Shi (2002), Applying Analytic Hierarchy Process in Firm's Overall Performance Evaluation: A Case Study in China, International Journal of Business, 7(1).

[11] Kim Song-Kyoo (2013), Analytic Hierarchy Process Expansion for Innovation Performance Measurement Framework, Hindawi Publishing Corporation Journal of Engineering, Volume 2013, 6 pages.
[12] Kamal M. Al-Subhi Al-Harbi (2001), Application of the AHP in project management, International Journal of Project Management 19, pp-19-27
[13] Kaplan R.S and Norton D.P (1996a) "The balanced scorecard: Translating strategy" into action. Boston, MA: Hard Business School Press.
[14] Kaplan R.S and Norton D.P (1992) "The balanced scorecard - measures that drive performance" Harvard Business Review, pp. 71-79.
[15] Kaise (2013) "Analytical Hierarchy Process for Designing Multi-Criteria Performance Measurement Framework", "Global Journal of Researches in Engineering, Industrial Engineering, Vol 13, Issue 1, Version 1.0.
[16] Montava R, Garcia R and Bonat A (2013) "Textile industry indicators for management," Total Quality Management and Business Excellence.
[17] Mohanty R. P (1992) "Consensus and conflicts in understanding productivity", International journal of production economics, pp. 95-106.
[18] Narayanan and Dardis R. (2013) "Improvement of Ergonomic Factors That Affects Employees in a Textile Industry," International Journal of Engineering Science and Innovative
[19] Saaty T. L (2000), "How to Make a Decision: The Analytic Hierarchy Process," European Journal of Operational Research, Vol. 48, No. 1, 2000, pp- 9-26.
Technology (IJESIT) Volume 2, Issue 1

[20]Sink, D.S and Tuttle T.C. (1989) Planning and Measurement in your Organization for the Future,ch. 5, Industrial Engineering and Management Press, Norcross, GA, pp. 170-84.
[21] Slack N, Chambers S and Johnston R (2007) Operations Management, Fifth edition, Financial times Ltd., London England.
[22] Srivastava S.K (2013) "Review of various supply chain measurement frameworks: A proposed framework for ITES industry," Global Journal of Management and Business Studies.Vol-3, No-9, pp-999-1006
[23] Sumanth D, (1994) Productivity Engineering and Management, McGraw-Hill Inc., ISBN 0-07-062572-7.
[24] Tangen S (2003) "An overview of frequently used performance measures", Work Study, Vol.52 No. 7, pp. 347-354.
[25] Zala V (2010), "A Study of Productivity and Financial Efficiency of Textile Industry of India", thesis PhD, Saurashtra University.

APPENDIX A QUESTIONNAIRE ITEMS FOR EXPERTS

Please fill the following questionnaire. The 17 sub factors are categorized in three groups namely Financial Performance Measures, Non Financial Measures and Process Performance Measures. This questionnaire is to have a pair wise comparison between the above factors. Similarly for sub factors 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 Financial Measures are 4 sub factors so; there will be 6 comparisons and so on.

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

Numerical Scale 1 to 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	Financial Measure	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Non Financial Measure
2	Non Financial Measure	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Process Measure
3	Process Measure	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Financial Measure