ATTRIBUTES ENHANCING INDUSTRIAL PRODUCTIVITY AN EMPIRICAL ANALYSIS

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Abstract

This paper explores the productivity attributes and their impacts in enhancing industrial productivity. The statistical analyses give us insights of the industrial scenario of the estate under consideration. Reliability and validity tests confirm the validity of the scale used. Correlation analysis identifies the relation and closeness among the variables and their intensity in improving the productivity. Chi-square is another test to hypotheses that gives the ideas about the relation and their influences in contributing productivity. Demographic gives the picture of the constitutes of the sample considered. Descriptive statistics high lights the respondents' perceptions about the industrial productivity. The SPSS software is used to analyse various phases of the study. The three points Likert scale is used to extract the impacts of the various attributes considered in this case. This paper indicates the improvement potentials to increase industrial productivity to compete highly competitiveness in the global arena.

Key Words: *Attribute, chi-square, descriptive, enhancing, industrial, productivity*

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1. INTRODUCTION

In the present changing world scenario attributed to globalization, an organization cannot be run merely on investment and returns, but more on the quality of their products, services, human resource, productivity, timeliness, cost-reduction and its commitment to organization's goals. The quality and productivity with commitment can be achieved only when there is a real change in the mindset of people at work in the way they look at the global business, the technology and the organizations. This change can be made only by proper implementation and utilization of technology and human resource development practices. Therefore, the *industrial productivity* became the centre of attention as far as the research is concerned. In the present changing world scenario, any organization has to maintain a good standard to stand in the highly competitive world of globalization and even for small continuous improvement in its quality [2].

2. RELEVANCE OF THE STUDY

It becomes highly necessary for an organisation to be dynamic in the globalisation era of highly competitiveness. In the rapidly changing environment 'human being' is the most important and valuable resource to play vital role in every organisation has in the form of its employees**.** A large number of studies have been carried out from time to time to examine, the changes in the productivity and its impact on economy, at the national level. Studies have also been carried out to analyse productivity trends in major manufacturing industries. Most of these studies are generic in nature and not necessarily area specific. This study is about productivity enhance route programmes in the present context to the changed trends of globalization [2].

Talent is often cited as a key differentiator for competitive success. As more and more organisations realised that managing talent effectively is the key to business success; it is a topic of interest to both industry and academia. For many of the services organisations, it is more often than not an indication of the value of its human assets and other intangible assets. Talent is important to organisational performance; it is not just a human (capital) complementary issue. Human capital organisations not only have good talent, but are designed and managed from the board room to the front line in ways that optimise talent attraction, retention, and performance and is to source great talent to collective organisational capability. With the growth of the services in many countries including India, it would be of interest to work out how value creation happens within a human capital centric approach to talent management [10].

3. OBJECTIVES OF THE STUDY

The primary objective of this research is to take the stock of existing situations and to assess the industrial productivity in the context of the changing industrial scenario of the industrial units of Vitthal Udyognagar, an estate in Anand district of Gujarat, India.

4. RESEARCH DESIGN

The present study is conducted in an industrial estate of Anand district, Gujarat. The estate was established in 1965. At present 1000 odd units working employing around 25000 persons. The units are selected from the members' directory published by Vitthal Udyognagar Industries Association (VUIA). The basic methodology that followed is the questionnaire method. Structured questionnaire is designed and distributed. Each instrument is designed to gain the maximum relevant information from the cross sections of the representative organisations of the industrial estate under consideration. Questionnaires are distributed among the randomly selected organizations to carry out statistical analyses to extract the insights in the detail. For this research study both the primary and secondary sources of data are used. It is observed that there are very few large-medium scale industries and majority of them small scale and ancillary industries [10].

The questionnaires are checked for incomplete, inconsistent, and ambiguous responses and discarded due to unsatisfactory responses. This has resulted in the final sample size as shown in Table 1[6].

Table-1: Total usable questionnaires (Sample size)

Questionnaire distributed	Questionnaire Usable	Response rate
250	156	62.40 %

The response rate 62.40% is considered as acceptable for the statistical analyses

5. STATISTICAL ANALYSIS

The statistical analyses were carried out with the help of SPSS17.0 software and discussed and drawn conclusion as under:

5.1 An index of reliability: Alpha (α)

It is an effective tool for measuring the reliability, which is a numerical coefficient of reliability and validity. Alpha coefficient ranges from 0 to 1 and may be used to describe the reliability of the factors extracted. The higher the score, the more reliable is the generated scale and alpha value 0.7 is to be considered as an acceptable reliability. The Table 2 shows reliability measures [7].

Table -2: Reliability Measures

Sr .No.	Cronbath's Alpha(α)	Internal Reliability
1	≥ 0.90	Excellent
2	**≥ 0.80**	**Good**
3	≥ 0.70	Acceptable
4	≥ 0.60	Questionable
5	≥ 0.50	Poor
6	< 0.50	Unacceptable

Table -3: Reliability of questionnaire used

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0.876	**0.883**	12

Here, an index of reliability (Cronbatch'sAlpha), α = 0.883 is considered as with good internal reliability of the scale and the questionnaire can be used for the statistical analyses [4].

5.2 An index of Correlation (r)

The degree of correlation is measured by the coefficients of correlation**.** It is an index, which speaks the magnitude of relationship between two variables. It states how closely two variables are associated and the effects of attributes on industrial productivity. The index varies between -1 and +1 keeping 0 in the centre. The Table 4 shows the classifications and interpretation of an index of correction [15].

Table- 4: Pearson Correlation Coefficients

Sr. No.	Positive Correlation	Correlation	Negative Correlation
1	+ 1.00	Perfect	-1.00
2	+ 0.75 to + 1.00	Very High	- 0.75 to -1.00
3	+ 0.50 to + 0.75	High	- 0.50 to - 0.75
4	+ 0.25 to + 0.05	Low	- 0.25 to - 0.05
5	+ 0 to + 0.25	Very Low	-0 to -0.25
6	0	Absent	0

Table 5: It is seen that there is high correlation(r = 0.650) between V3: (6σ Philosophy) and V2: (5S Philosophy), both are highly contributing attributes in enhancing productivity. Similarly, there is very low correlation (0.123) between V9 :(Wage Incentive Plans) and V8 :(IE Tools) and so on.

Table- 5: Pearson Correlation Coefficients

Variable	V1	V2	V3	V4	V5	V6	V7	V8	V9	V10	V11	V12
V1. KAIZEN	1											
V2. 5-S	**0.503****	1										
V3. Six Sigma	**0.618****	**0.650****	1									
V4. Taguchi	0.434**	**0.709****	**0.603****	1								
V5. T.Q.M.	0.553**	0.374**	**0.584****	0.360**	1							
V6. OR Models	0.354**	0.583**	0.469**	**0.548****	0.266**	1						
V7. Q-Tools	0.310**	0.545**	0.429**	0.407**	**0.388****	**0.667****	1					
V8. IE-Tools	0.333**	0.554**	0.420**	0.408**	0.256**	0.762**	**0.676****	1				
V9. Incentives	0.203*	0.098	0.171*	0.065	0.152	0.096	0.085	**0.123**	1			
V10. Q.P. Awards	0.372**	0.428**	0.389**	0.386**	0.339**	0.517**	0.582**	0.563**	**0.281****	1		
V11. Memento	0.408**	0.491**	0.419**	0.498**	0.297**	0.577**	0.505**	0.594**	0.237**	**0.785****	1	
V12. P-P-Bonus	0.109	02.112	0.146	0.123	0.225**	0.118	0.138	0.085	0.507**	0.247**	**0.198***	1

5.3 The Chi-Square Test (χ^2)

Chi-square statistic is used to test the statistical significance of the observed association in a cross-tabulation. It helps us to understand how one variable relates to another variable, statistics are available for examining the significance and strength of the association [6].

Cramer's (V) is a modified version of the phi correlation coefficient, and is used in tables larger than 2x2, it has no upper limit. A large value of V indicates a high degree of association. It does not indicate how the variables are associated [6].

Critical Value is based on the theoretical distribution of the test statistic under consideration. The following rule would help in reading the critical values from the tables: The test statistic: Whenever a test is conducted we accept the null hypothesis if the *calculated value* of the test statistic is less or equal to the *critical value*; otherwise it is not accepted [6].

The p-value of a test is the probability of obtaining a test value as large as the observed one, when the null hypothesis was really true. This is called the p-value of a test and commonly shown in every computer output associated with a problem of testing. If $p < 0.05$, we say that the test result is significant at 5% level. We then reject the null hypothesis with a high confidence. When the p-value is given along with the test result, there is no need to specify the critical value [6].

Hypotheses Tests:

H_{01}=Quality tools have no impacts on industrial productivity.

H_{02}=Productivity tools have no effects on industrial performance.

H_{03} = Motivational tools have no influences on employees' performance.

Table -6: Quality Tools

Sr.	Variables	(03)	(02	(01)	χ^2 at DF = 8
1	KAIZEN	59	18	79	CV = 87.34
2	5S	20	29	107	TV = 15.507
3	Six Sigma	30	28	98	LSF < 0.0001
4	Taguchi	09	33	114	V = 0.2366
5	TQM	65	14	77	
	Total	183	122	475	

χ^2=Chi-Square, DF = Degree of Freedom, CV = Calculated Value of χ^2, TV = Table Value of χ^2, LSF: Level of significance.

The "quality tools" have positive response. The respondents were divided on the use of 'quality Tools" in the organization where they are serving. Since, $\chi_{cv}{}^2 = 87.34 > \chi_{TV}{}^2 = 15.507$, it has mentioned that the "quality tools" are highly essential to make organization more productive.

Table -7: Productivity Tools

Sr	Variables	(03)	(02	(01)	χ^2 at DF = 4
1	OR Models	59	18	79	CV =7.81
2	Quality Tools	20	29	107	TV =9.488
3	I E Tools	30	28	98	LSF = 0.0988
	Total	109	75	284	V = 0.0913

χ^2=Chi-Square, DF = Degree of Freedom, CV = Calculated Value of χ^2, TV = Table Value of χ^2, LSF: Level of significance.

The "productivity tools" have negative response. The respondents were divided on the use of 'productivity tools" in the organization where they are serving. Since, $\chi_{cv}{}^2 = 7.81 < \chi_{TV}{}^2 = 9.488$, it has mentioned that the "productivity tools" are highly essential to make organization more productive, but here, it is not emphasized.

Table-8: Motivational Tools

Sr.	Variables	(03)	(02)	(01)	χ^2 at DF = 6
1	Incentive Plans	59	18	79	CV = 160.30

2	Q.P. Awards	20	29	107	TV=12.592
3	Mementos	30	28	98	LSF < 0.0001
4	Pay-Perf. Benefits	09	33	114	V = 0.3587
	Total	118	108	398	

χ^2=Chi-Square, DF = Degree of Freedom, CV = Calculated Value of χ^2, TV = Table Value of χ^2, LSF: Level of significance.

The "motivational tools" have positive response. The respondents are divided on the use of "motivational tools" in the organization, where they are serving. Since, χ_{cv}^2 =160.30 > χ_{TV}^2 = 12.592, it has mentioned that the "motivational tools" are highly essential to make organization more productive.

Thus, two null hypotheses are rejected and "quality tools", and motivational tools" which are very much essentials in the interest of the individual employee as well as organization as a whole. Third hypothesis is accepted; therefore it requires changes with respect to the situations leading toward higher individual as well as organizational performance.

5.4 The Demographic details

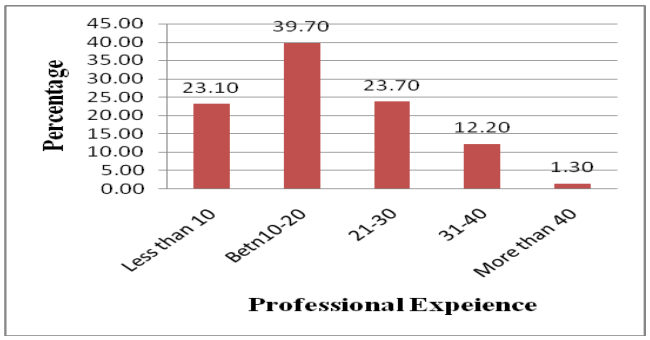

Chart -1: Respondents' professional experience in years

Respondents' professional experience: Highest 39.70% between 10-20 years, 23.70% between 21-30 years, 23.10% less than 10 years, 12.20% of respondents were above 30 years of experience and only 1.30% respondents were of age group more than 40 years work experience have participated in this study.

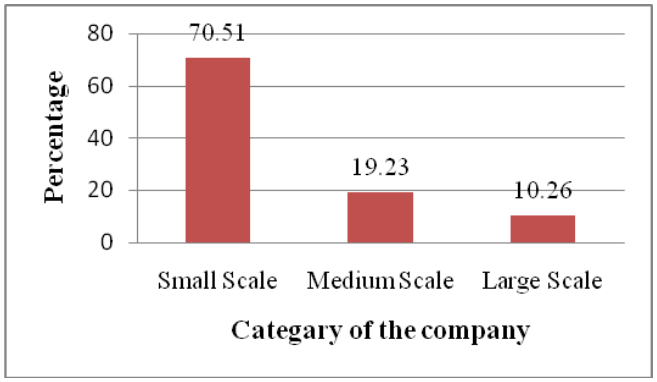

Chart -2: Category of the company

Category of the company: As mentioned earlier majority units are in small scale. The same thing is reflected over here. In this survey 70.51% (110), Small scale, 19.23% (30), Medium scale and only 10.26 % (16) large scale units have participated and provided relevant data for this study.

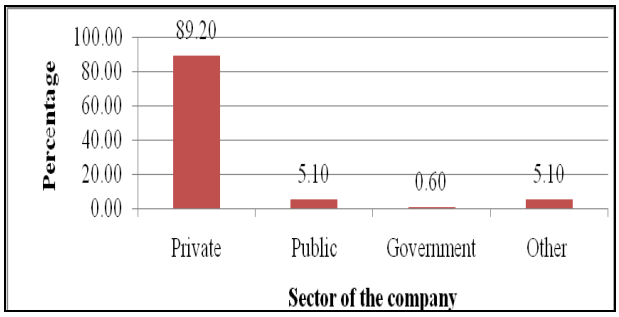

Chart -3: **Sector of the Industry**

Sector of the company: Out of 100% respondents (156 units sample size), 89.20% of units in private sector, 5.10% of public sector, only 0.60% government units, while 5.10% were others have participated and supplied data for this research study.

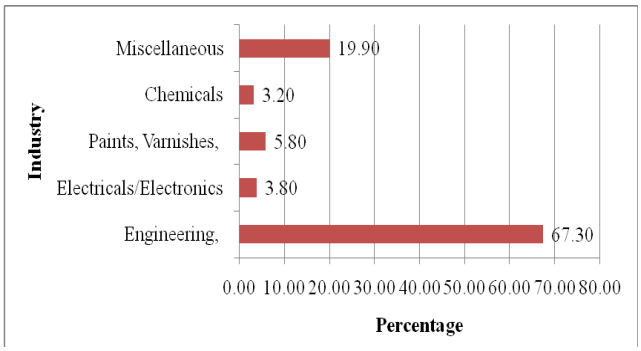

Chart -4: Classification of the Industry

Classification of the industry: Estate under study was dominated by 67.30 %(105) engineering units, the other classified units were very few in the dedicated sample: 3.80% Electrical/Electronics, 5.80% Paints, Varnishes and 3.20% Chemicals industries. Remaining miscellaneous units amount 19.90% of the total, have participated in this research study and supplied the relevant data for the research study.

5.5 Descriptive Statistics

Table-9: Quality Introspect: In the context of improving productivity of the organization

Sr.	Statement	Yes	Not Sure	No	Total
	Agreement Level	3	2	1	
I	**Does your company follow quality concept for productivity improvements?**				
1	KAIZEN Philosophy	59	18	79	156
2	5S-Phylosophy	20	29	107	156
3	Six -Sigma Philosophy	30	28	98	156
4	Taguchi's Philosophy	9	33	114	156
5	TQM Philosophy	65	14	77	156
	Total Frequency	**183**	**122**	**475**	**780**
	Percentage	**23.46**	**15.64**	**60.90**	**100**
Only 23.46% of respondents in agreement to follow various quality concept tools to improve industrial productivity.					
II	**Does standard model follow for productivity improvements?**				
6	Operation Research :Models / Tools	17	26	113	156
7	Quality Improvements :Models / Tools	35	20	101	156
8	Industrial Engineering :Models / Tools	25	24	107	156
	Total Frequency	**77**	**70**	**321**	**468**
	Percentage	**16.45**	**14.96**	**68.59**	**100**
Only 16.45% of respondents in agreement to follow various standard models to improve industrial productivity.					
III	**Does an incentive scheme follow for motivating workers for better performance?**				
10	Wage incentive Plans	95	21	40	156
11	Quality Performance Awards	36	29	91	156
12	Mementos, Certificates	22	36	98	156
13	Pay-Performance link benefits/Bonus	114	15	27	156
	Total Frequency	**267**	**101**	**256**	**624**
	Percentage	**42.79**	**16.19**	**41.02**	**100**
Only 42.79% of respondents in agreement to follow various wage incentive Scheme for betterment of the organization to improve industrial productivity**.**					

(I) Does quality concept is followed for the improvements?

From Table 9, it is seen that 60.90% of the organizations not using any type of concepts or productivity improvement tools. 15.64% of respondents were not sure about the use of these types of tools / models /concepts for productivity improvement. 23.46% respondents in overall were using these concepts, tools, models for improving productivity. Hence, it is concluded that more efforts are required to adopt latest quality concepts of improving productivity.

(II) Does standard model is followed for productivity improvements?

From Table 9, it is seen that the 68.59% of the organizations are not using standard model for productivity improvement tool. 14.96% of the organizations are not sure about the use of these standard models for improving productivity.16.45% of the organizations confirmed that they are using standard models as productivity improvement tools. Hence, it is concluded that more effort is required for organizations to understand the importance and use of standard operations research models to increase industrial productivity.

(III) Does your company have incentive schemes for motivating workers for better performance?

From Table 9, it is seen that the 41.02% of the organizations do not have any incentive, 16.19% not sure about the incentive scheme to motivate workers for betterment of the organization. 42.79 % of respondents confirmed that they have incentive scheme for motivating employees to work more and productive.

6. CONCLUSION AND DISCUSSION

Most of the organizations of the estate under study operating their traditional ways and yet to adopt productivity improvement tools and techniques by and large. Most of the units need not find use of any sophisticated tools or techniques to increase productivity of the organizations or do not have enough awareness about the these tools and techniques.

From this analysis it has been concluded that for enhancing industrial productivity, quality tools, productivity tools and motivational tools play vital role in improving employees' as well as organizations' productivity. It helps improve the health of the estate and hence the living standard of the people.

Hence, it is concluded that all these concepts / tools / techniques / models / incentive schemes must be tried to enhance industrial productivity of the estate under study. There is a lot of potential for improvements in industrial performance of the industries by using advanced approaches to improve industrial performance in highly competitive world.

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APPENDIX

Questionnaire: A study of industrial productivity scenario and potentiality.

[A] Personal Information (Respondent)

1. **Age range**: ☐ Under 25 ☐ 25-40 ☐ 40-55 ☐ Over 55

2. **Professional experience** :(Years)
☐ Less than 10 ☐ 11-20 ☐ 21-30 ☐ 31-40 ☐ More than 40

[B] Organization's Profile

1. **Category of the company:**

☐ Small Scale ☐ Medium Scale ☐ Large Scale

2. **Sector:**
☐ Private ☐ Public ☐ Government

3. **Classification of industry** :

1.	Engineering, Foundry, Fabrication, Machining	
2.	Electricals / Electronics	
3.	Paints ,Varnishes, Resins	
4.	Chemicals	
5.	Miscellaneous	

[C] Quality Introspect

Please indicate your level of agreement of the following

Sr.	Statement	Yes (03)	Not Sure (02)	No (01)
I	**Does your company follow quality concepts for the improvements?**			
1.	**KAIZEN** Philosophy: Continuous improvement			
2.	The **5S** Philosophy			
3.	**Six Sigma** Philosophy			
4.	**Taguchi's** Philosophy			
5.	**TQM** Philosophy: Total Quality Management			
II	**Does your company follow standard models for Productivity improvement?**			
6.	Operations Research : Models / Tools			
7.	Quality Improvements : Models / Tools			
8.	Industrial Engineering : Models/ Tools			
III	**Does your company have incentive schemes for motivating workers for betterment of the organization?**			
9.	Wage incentive plans			
10.	Quality Performance Awards			
11.	Mementos, Certificates			
12.	Pay- Performance like benefits / bonus			