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An Assessment model for Benchmarking in Manufacturing Industries

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Abstract

Benchmarking is the decisive instrument for enhancement which proficient over assessment from former organizations predictable as the best within reason. Benchmarking provides an external focus which forces the organization to seem what the competitors are adopting. The manufacturing industries are focused in this study such as service, professionalism, replace ability, credibility and many more while bringing other processes up to stain and highlights different types of Benchmarking process used for different industries. Thus, the attempt has been made by authors to present an evaluation model for Benchmarking by using ANP approach. Here, ANP approach is used on the basis of software where, group of experts were consulted to establish interrelations and to provide weight age for pair wise comparison. Mutually spirit of experts will provide the identical results for the study and reasonably cooperative for managers to give assurance for internationally manufacturing industries.

Keywords: *Analytical Network Process (ANP), Manufacturing Industries, Benchmarking, Weight age, Customer satisfaction*

1. Introduction

Benchmarking is predictable as an important tool for continuous improvement of quality and an important business practice priority (Dattakumar and Jagadeesh 2003). It is a well defined tool for improving the weakness during improvement processes in which a company measures its performance against market leaders and found how market leaders have achieved their performance levels with uses of knowledge to improve its own performance (Saunders, Mann & Smith, 2007). Benchmarking has been defined as the search for industry best practices that lead to superior performance but it can also be regarded as the constant search for reference points due to the rapid state of change on all fronts (Camp, 1989). The Benchmarking process consists of investigating practices and establishing metrics where practices are interpreted as the processes that are employed and metrics are the quantified result of instituting practices. The purpose of Benchmarking is to systematically identify the processes and performance outcomes of an outstanding organization with those of its competitor's processes and outcomes within the organization itself in the constantly changing business environment. This paper highlights seven different types of Benchmarking techniques, which gives effective use of factors for their implementation. To authenticate the ranking of Benchmarking technique ANP approach has been applied through Super decision software 2.0.8. Experts were asked to give rating of the pair wise comparison of the factors on 1-9 scale. On this basis, Super decision software generated unweighted, Weighted Super matrix and Limit matrix are found. Priorities of the factors can be directly taken from the Limit matrix. As result, this research converts the subjective decision into objective process. Outcome of

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the study is weighted comparison of the critical success factors which can be rank easily accordingly to their weightage. Extensive literature available on Benchmarking reveals the various facets of Benchmarking techniques by many researchers across the global.

1.1 Types of Benchmarking

(a) Performance Benchmarking: It is the comparison of performance measures for the purpose of determining how good our company is as compared to others. Performance benchmarking refers to the comparison of the organizational key processes, products and services. These type of product and service comparisons allow the assessment of competitive positions. According to Bogan & English (1994), performance benchmarking usually focuses on elements of price, technical quality, product or service features, speed, reliability and other performance characteristics. Direct product or service comparisons and analysis of operating statistics are primary techniques applied during performance benchmarking. These performance measures may determine how good one's organization is compared to others.

(b) Internal Benchmarking: A comparison among similar operations within one's own organization. Internal benchmarking refers to comparisons made within the same organization, *e.g.*, between teams, departments, units and divisions. Internal benchmarking assumes that there are differences in the work processes of an organization as a result of differences in geography, personnel, financial situation, etc. Internal benchmarking is mainly used within large organizations where different units may be assessed and compared to each other. If one unit performs better than others, practices can be transferred internally for improvement. The objective of internal benchmarking activity is to identify the internal performance standards of an organization. According to Spendolini (1992), often significant amount of information sharing accompanies internal benchmarking. Many organizations are able to realize immediate gains by identifying their best internal practices and then transferring that information to other parts of the organization.Benchmarking against internal operations or standards, usually in a multi-division or multinational enterprise.

(c) Strategic Benchmarking: The study is undertaken when an attempt is being made to change the strategic direction of company and the comparison with one's competition in terms of strategy is made. In general terms strategic benchmarking examines how organizations compete. It seeks to identify the winning strategies that have enabled high-performing companies to be successful. Benchmarking process may be used to analyze strategic goals in search for alternative activities as part of the strategic planning process. Strategic benchmarking is comparison of strategic choices and dispositions made by other companies/organizations, for the purpose of collecting information to improve one's own strategic planning and positioning (Andersen & Pettersen 1996). The setting of short term and long term goals may belong to strategic planning. Therefore, short term goals may be adapted from one benchmarking partner and long term goals from another.

(d) External Benchmarking: This type of benchmarking is used by companies to seek the help of organizations that succeeded on account of their practices. This kind of benchmarking provides an opportunity to learn from high end performers. Direct service of product competitors are the most obvious to benchmark against. Ultimately, any benchmarking investigation must show what the comparative advantages and disadvantages are between direct competitors. Camp (1989) uses the term competitive benchmarking as a synonym to the commonly used external benchmarking.

(e) Competitive Benchmarking: A comparison with the best of the direct competitors. Benchmarking against other companies in the same industry, whether they are direct competitors or not. Competitors are organizations that may be direct competitors in the same business area; whereas the term external refers to organizations that may not be direct competitors but still they may be a source of valuable information. For example, an

organization operating in the same business geographically far enough not to be a direct competitor may be an excellent benchmarking partner.

(f) Functional Benchmarking: A comparison of methods with those of companies with similar processes in the same function outside one's industry. In functional benchmarking investigations, functional experts from one organization generally focus on their own area of expertise. The key distinction in this type of benchmarking is that it can focus on any organization in any business, the common element being the analysis of excellent functions and practices. There is great potential for identifying functional competitors or leading businesses to benchmark even if in dissimilar functions. It is not too difficult to determine the leading organizations in selected functions.

(g) Generic Benchmarking: A comparison of work processes with others who have innovative, exemplar work processes. Generic benchmarking is related to functional benchmarking. The distinction here is that organizations in totally unrelated areas make comparisons. Therefore, a certain amount of creativity is required. The term generic suggests, without a brand, which is consistent with the idea that this type of benchmarking focuses on excellent work processes rather than on the business practices on a particular organization. This approach may be applicable to all functions of business operation. Camp (1989) argues that generic benchmarking is the purest form of benchmarking because the practices and methods under investigation may be uncovered and not be implemented in the investigator's own area.

2. Literature

Benchmarking was firstly applied in the 1970's for production industry to compare different parameters. Many researchers have done abundant literature survey on benchmarking in various fields like service and manufacturing industries such as Yasin (2002), Dattakumar and Jagadeesh (2003), Singh B., *et al.,* (2012). Dattakumar and Jagadeesh (2003) suggested that it is an important tool which forces the industries to focus on improvements. Benchmarking can also be used in small and medium enterprises, traditional manufacturing industry, large environmental areas and various area of supply chain etc (Hwang & Lockwood, 2006; Singh, *et al.,* 2008; Meybodi, 2009). Providing good Service is the main factor of benchmarking (Koller and Salzberger, 2009; Singh B., *et al.,* 2015a; Wong and Wong, 2008).Choyet et al., 2007 and Dawkins, *et al.,* 2007 apply service tools in benchmarking process for various organizations. The requirement of benchmarking as a tool in any sector is very important **(**Boonitt and Pongpanarat, 2011; Singh B., *et al*., 2015b; Giannakis, 2011).Various tools & techniques are used to find the intensity of benchmarking and maintain business in globally market. Multitude of researchers appeared in the literature applied various techniques as a trendy benchmarking tool over the past few years. Post and Spronk (1999) give a performance measurement technique that combines data envelopment analysis (DEA) and goal programming (GP) to select performance benchmarks. Talluri & Sarkis (2001) gives performance evaluation of bus companies by a fuzzy multi criteria analysis approach. Lin, *et al.,* (2008) used AHP & TOPSIS approaches for customer driven product design process and found suitable results. Tan and Platts (2004) developed a software tool based on AHP to analyze the inter-relationship between factors in hierarchical way. Hon (2005) evaluated the different manufacturing systems on the basis of five dimensions: productivity, quality, Jain, *et al.,* (2011) evaluated the manufacturing performance by using DEA. flexibility, cost and time Anand, *et al.,* (2011) demonstrated the development of the analytic network process (ANP) for the selection of material handling systems (MHS) in the design of FMS for a hypothetical case organization. Ordoobadi (2012) applied ANP technique for justification of AMT. ANP is just a tool to provide weights to the factors. It does not give the overall justification index like graph theoretic and matrix approach (GTMA), which may be used to benchmark the

performance of AMT in different organizations, and moreover linguistic variables have not been converted into crisp score, which may appear as unexplained variance in the overall justification performance. The main problem in these models is that they are based on accurate measurement and crisp evaluation. Jharkharia and Shankar (2007) have selected the logistics service provider using ANP. Agarwal and Shankar (2005) have done the modelling the matrices of lean, agile and leagile supply chain. Bayazit (2006) discuss the vendor selection problem using ANP. Saaty (2009) has demonstrated the real application of ANP in entertainment business. Anand, *et al.*, (2009 & 2011) have analyzed the selection of material handling systems in the design of flexible manufacturing system. Chand, *et al.*, (2013) have analyzed the risks in traditional, agile and lean supply chain. Singh, *et al.*, (2015) have derived Fuzzy TOPSIS method for identification of ranking of internal department for improvement in industry.

3. Identification of Factors for Benchmarking

The critical factors of Benchmarking implementation have been taken from literature are listed in Table 1 below:

Table 1. Factors for Benchmarking Implementation (Modified from Singh, *et al.,* 2015)

Types of Benchmarking	Factors	Literature
Performance Benchmarking	Functionality	Gizem Çifçi(2012),Michele Germani (2012),Barbuceanu(2006)
	Technical	Chang, (2007); Grigoroudis et al.,(2008); Hadwich et al.(2010)
	Time behavior	Dominic et al. (2011),Behkamal et al. (2009) &Olsina et al. (2009)
	Replace ability	Calero et al. (2005), Behkamal et al. (2009),Saha R and Grover S (2011)
	Cooperation	Bauer,(2010),Mien Segers& Filip Dochy (1996),Amparo Cervera, (2004)
Internal Benchmarking		
	Teamwork	Michele Germani (2012),Mohamed Zairi, John Whymark, (2000)
	Responsiveness	Henry C.W. Lau, Peter K.H. Lau, Richard Y.K. Fung, Felix T.S. Chan, Ralph, (2005)
	Work attitudes	Pinar Guven-Uslu, (2005),Ravi Shankar,M. Asif Hasan (2007)
	Friendliness	Panchapakesan Padma, Chandrasekharan Rajendran, L. Prakash Sai, (2009),
	Compensation	Parasuraman, Zeithaml, and Malhotra (2005),Adrien Chia, Mark Goh, (2009)
	Reliability	Hakyeon Leea, Chulhyun Kimb (2012),Manuel Cuadrado, Amparo Cervera, (2004)
Generic Benchmarking		
	Standardization	Ahn et al.,(2007) Grigoroudis et al., (2008); Li et al., (2002)
	Tangibles	Grigoroudis et al., (2008); Hadwich et al.,(2010); Ladhari, (2010); Ma et al., (2005)
	Information	Yang et al., (2005); Yoo & Donthu, (2001), Aladwani and Palvia (2002)
	consistency	Ahn et al., (2007); Grigoroudis et al., (2008); Hadwich et al. (2010)
	effectiveness	Li et al., 2002; Patsioura et al., 2009)
	Credibility	Karen Anderson, Rodney McAdam, (2004),Paul D. Hooper, Andrew Greenall, (2005)
Functional Benchmarking		
	Performance	Ahn et al., (2007); Grigoroudis et al., (2008); Li et al., (2002)
	Interactivity	Iwaarden et al. (2004) and Cristobal et al. (2007)
	adequacy	Yoo and Donthu (2001), Aladwani and Palvia (2002), Yang et al. (2005)
	Order management	waarden et al. (2004) and Cristobal et al. (2007)

	Internal quality	Chang, (2007); Hadwich et al. (2010); Ladhari, (2010); Ma et al., (2005)
Strategic Benchmarking		
	marketing	Sungmook Lim & Hyerim Bae (2011),mcmullem (1998),M. Ruhul Amin (2003)
	reward	Mohamed Zairi &John Whymark, (2000),Rajendar K. Garg, Jun Ma, (2005),
	quality planning	Albuquerque and Belchior (2002), Yang et al. (2005)
	recognition	Denrell (2003), Denrell (2005), and Henderson
	Zero defects mentality	Prakash J. Singh, Alan Smith, (2006),Roger John Hilton, Amrik Sohal, (2012)
External Benchmarking		
	Professionalism	Bishnu Sharma, Pam Dyer, (2009)
	Service level	Ashley Y.L. Huang, (2010),P. Padma, C.Rajendran, Prakash Sai Lokachari, (2010)
	Usability	Yoo and Donthu (2001), Yang et al. (2001), Yang, Cai, Zhou, and Zhou (2005)
	Reputation	Galina Setlak (2011)
	Efficiency	N. Adleretal.Omega(2013),Katarzyna Rostek(2012),Albuquerque and Belchior (2002)
Competitive Benchmarking	Customer Service	Bilsel (2004),Kokaua(2005)
	Availability	Alfred Radauer (2010) ,Vishal Sharma(2003)
	Accuracy of service	Montanari(2002),Shankar R (2002)
	Policy & Reward	Sahin(2007),Banwet (2003)

4. Analytical Network Process (ANP)

ANP is the method which provides a framework for dealing with decision making or evaluation problems and presents strengths when working in scenarios with scarce information, also the general form of the AHP as is the case of competitiveness measurement contexts, It does not require severely hierarchical structure but allows the decision levels for more complex inter-relationships. ANP simplify the modeling process by a network of criteria and alternatives all grouped into clusters which provide an accurate modeling. According to Katayama and Bennett (1999), Christopher (2000), Saaty (2005), Aggarwal & Shankar (2005), Dagdeviren & Yuksel (2007), Lee, *et al.*, (2010) and Chand, *et al.,* (2013) various steps are involved in ANP and modeling consists of the following steps:

(i) To Identify the components and elements of the network with their relationships.

(ii) To conduct pairwise comparisons of the elements.

(iii) Place the resulting eigen vectors in pairwise comparison matrices within unweighted matrix.

(iv) Pairwise comparisons on clusters.

(v) To Weight the blocks of the unweighted matrix by priorities of the clusters, so that weighted matrix can be formed as stochastic column.

(vi) To develop limiting matrix where the weights remain stable until raising the weighted matrix in limiting powers.

(vii) Obtain the element priorities as per columns of the limiting matrix. The priority of each alternative is a dimensionless value that will be considered the benchmarking Competitiveness index.

(viii) A sensitivity analysis carrying out if some alternatives obtained very similar results in order to express the sturdiness of the ranking.

For authentication of ANP procedure, Super decision software 2.0.8 is used which give exact value of dimensions. Experts were asked to give rating on 1-9 likert scale for pair wise comparison of the factors which generates weighted super matrix, unweighted

matrix and limiting matrix that gives priorities of the factors.The modeling process with the key clusters which are devoted to types of benchmarking such as, the strategic and competitive types are used. The elements inside each cluster are also identified during clusters definitions and relationship model is constructed to create the links between nodes in the same cluster. After that, the relationships between the elements are defined in a dichotomized manner and the influence between elements of network is also identified. The decision model was built with the help data collection and consists of several clusters where relationships between the model components are shown in figure no. 1. The model included construction of a network which identifies 7 objectives and 36 factors with main goal, are grouped into clusters. On the basis of literature on benchmarking and discussion with experts interdependences between different levels is developed.

ANP is a general form of AHP. AHP was first proposed by Saaty (1980a & 1980b). The AHP is a widely used MADM based on the representation of a decision making problem by a hierarchical structure where elements are independent and unidirectional linked. By considering both qualitative and quantitative aspects of a decision and through a pair wise comparison, it allows to set priorities among the elements and make the best decision. Decision problems are not always structured in a hierarchal way i.e. they may have interrelations among the elements at the same level. To overcome this difficulty, ANP was introduced by Saaty in 1996. ANP simultaneously takes into account both feedback and dependence. ANP generalizes the AHP by allowing networks with or without hierarchal structure. ANP makes the best decision by allowing feedback within elements of a cluster (inner dependence) or between clusters (outer dependence). ANP methodology is explained in Saaty's book (Saaty, 2005). A brief description is given here because of space limitation. The ANP comprises of the following major steps:

Step 1: Model Construction through Networks

Decision problem should be structured into networks by using appropriate methods or through brainstorming. The main thought is to find appropriate Benchmarking technique for industries on the basis of factors identified. So ANP model is developed to structure the decision problem which helps for find out the goal, clusters, elements and alternatives. As per ANP, the clusters & elements computed in Figure 1, where the relationships of all critical success factors with alternatives are shown in a model

Step 2: Pairwise Comparison and Priority Vectors

For importance a comparison is carried out between elements and clusters levels. A likert scale having a range of 1 to 9 can be used for comparing, where 1 indicates identical significance and 9 indicates awesome domination of one element over the other (Meade & Sarkis , 1999). Decision makers are asked to compare clusters through a series of questions for inner and outer dependence to achieve the goal. A reciprocal value is assigned to the inverse comparison, *i.e.*, $b_{ij}=1/b_{ji}$. Local priority vectors are derived similar to AHP. This step is done to derive the eigenvectors and to form a super matrix.

Step 3: Super Matrix Formation

For the resolution of interdependcies, Super matrix is formed that exists between elements and found the virtual stabilized weights for each element. There are different forms that will be in this stage. The outcome of step 2 is un weighted super matrix. Super matrix is actually a partitioned matrix. Its columns represent priorities derived from the pairwise comparison of the elements. As unweighted super matrix may not be column

stochastic, so as to obtain one, multiply each block with cluster priority obtained in the step 2. This stochastic matrix is known as weighted super matrix. To obtain a convergence on the importance of weights, the super matrix is raised to large powers and the resulted matrix is known as limit matrix. Priorities can be directly obtained from the limit matrix.

5. Intensity of Critical Success Factors

To find the intensity of critical factors ANP approach has been applied through Super decision software 2.0.8. As shown in Table 1, there are seven clusters having several factors. A questionnaire has been prepared to rate each factor of cluster with respect to the other factors. Experts were asked to give rating of the pairwise comparison of the factors on 1-9 scale. On this basis, Superdecision software generated Un weighted matrix, Weighted Supermatrix and Limit matrix. Priorities of the factors can be directly taken from the Limit matrix. The priorities of the factors are shown in Table 2. The top factors are availability, zero defects mentality, customer service, function ability, policy, adequacy and service level *etc.*, Level 1 reveals the overall goal, level 2 consists of the main objectives, and level 3 contains the associated attributes.

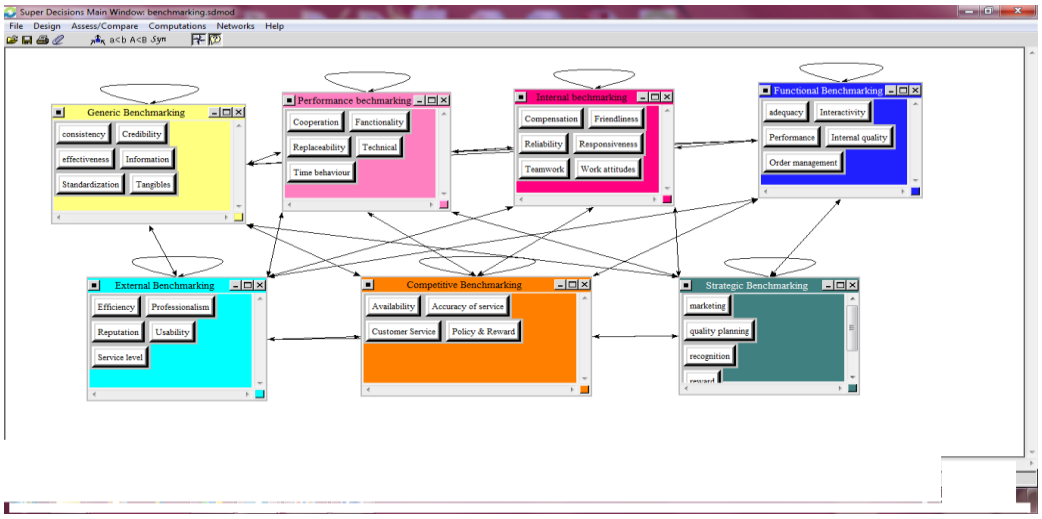

Figure 1. Network Representation of the ANP Model

The entire problem of modeling the elements into network entering the pairwise comparison values and synthesizing the results were carried out using a test version of software package called super decisions. Utilizing the software may prevent a user from understanding the step by step approach of ANP. Saaty (1999) presented a generalized algorithm for ANP to incorporate interdepencies and feedback in decision making. Agarwal, *et al.*, (2006) utilized the algorithm proposed by Saaty (1999) and presented the same in a detailed step by step manner for their problem of selecting a suitable supply strategy. In this section step by step approach of ANP has been adapted for the problem on hand. It involves four stages in various steps.

Stage 1: Model Construction and Problem Structuring

To structure the decision problem and develop the ANP model, the goal, clusters, elements and alternatives have to be identified. The main goal or objective is to select a suitable Benchmarking for the industry. According to ANP terminology the main factors and sub factors will be termed as clusters & elements. The above figure shows relationships of goal, clusters, elements and alternatives in form a model. The model can

be structured as a network model as shown in Bayzit (2006) or as a hierarchical network model as in Agarwal et al.(2006) with the main goal at the top and the alternatives at bottom similar to hierarchical structure of AHP.


Super Decisions Main Window: benchmarking.sdmod: Cluster Matrix View

Cluster Node Labels	Competitive Benchmarking	External Benchmarking	Functional Benchmarking	Generic Benchmarking	Internal bechmarking	Performance bechmarking
Competitive Benchmarking	0.142857	0.142857	0.142857	0.200882	0.142857	0.142857
External Benchmarking	0.142857	0.142857	0.142857	0.100318	0.142857	0.142857
Functional Benchmarking	0.142857	0.142857	0.142857	0.209427	0.142857	0.142857
Generic Benchmarking	0.142857	0.142857	0.142857	0.119994	0.142857	0.142857
Internal bechmarking	0.142857	0.142857	0.142857	0.143070	0.142857	0.142857
Performance bechmarking	0.142857	0.142857	0.142857	0.118329	0.142857	0.142857
Strategic Benchmarking	0.142857	0.142857	0.142857	0.107980	0.142857	0.142857

Figure 2. Cluster Matrix View

Stage 2: Pairwise Comparison

Pair wise comparisons are carried out between element and cluster levels. Pairwise comparisons are carried out between the clusters as well the elements to find out the importance of a cluster or element over the other cluster or element. A scale having a range of 1 to 9 similar to the one used in AHP will be used for comparing, where 9 indicates overwhelming dominance and 1 indicates equal importance (Saaty,1999). Pairwise comparison is carried out with respect to goal. A matrix is formed and relatives weights of each cluster are obtained as eigenvector using the formula.This comparison of pairwise at cluster level and at the level of element also. The pairwise comparison matrix is developed to determine the importance of elements within each cluster.The e cluster will be found out. However, the matrices of other pairwise comparison not shown due to space limitations.

Stage 3: Super Matrix Formation and Analysis

Super matrix is used for the resolution of the inter dependcies that exits between the elements. The super matrix will find out the relative stabilized weights of each of the elements. There are different forms that will be in this stage: The unweighted super matrix, where the enteries are taken directly from the e vectors obtained. The rows and columns of the super matrix are abbreviations of elements and the clusters. The e vectors obtained in in the earlier steps through pairwise comparisons are the entries for each column. For this problem, the enteries in the e vector the column of various tables would be entered under respective columns. This will yield a square matrix depending upon the relationships that exist between several elements. Since this matrix can't be represented as a single table nor it can be accommodated in a single page so they are not shown in this paper.

Cluster Node Labels		Accuracy of service	Availability	Customer Service	Policy & Reward	Efficiency	Professional ism	Reputation	Service level
Competitive Benchmarking	Accuracy of service	0.047619	0.000000	0.000000	0.000000	0.071429	0.035714	0.047619	0.035714
	Availability	0.000000	0.047619	0.000000	0.071429	0.071429	0.035714	0.047619	0.035714
	Customer Service	0.047619	0.047619	0.142857	0.071429	0.000000	0.035714	0.000000	0.035714
	Policy & Reward	0.047619	0.047619	0.000000	0.000000	0.000000	0.035714	0.047619	0.035714
External Benchmarking	Efficiency	0.000000	0.000000	0.000000	0.071429	0.035714	0.000000	0.000000	0.047619
	Professional ism	0.000000	0.071429	0.047619	0.071429	0.035714	0.000000	0.071429	0.047619
	Reputation	0.000000	0.000000	0.000000	0.000000	0.035714	0.071429	0.000000	0.000000
	Service level	0.071429	0.071429	0.047619	0.000000	0.035714	0.071429	0.071429	0.047619

Figure 3. Weighted Super Matrix View

The weighted super matrix, where each sub matrix is multiplied by its weight to make the matrix column stochastic, *i.e.*, the sum of values in each columns made equal to 1.It is necessary to check column enteries of the unweighted super matrix. If the unweigthed super matrix is not column stochastic then unweighted super matrix is converted into weighted super matrix by multiplying each sub matrix by its weight to make it column stochastic.

Table 2. Intensity of Critical Factors

S.No.	Name	Normalized By Cluster	Limiting
1	Accuracy of service	0.19773	0.02899
2	Customer service	0.33778	0.04153
3	Availability	0.28538	0.03389
4	Zero defects	0.30557	0.03221
5	Efficiency	0.26357	0.03412
6	Professionalism	0.22415	0.02981
7	Reputation	0.13345	0.02877
8	Service level	0.34245	0.03607
9	Usability	0.18379	0.03264
10	Adequacy	0.23174	0.03975
11	Interactivity	0.16084	0.03216
12	Internal quality	0.35261	0.04230
13	Order Management	0.13518	0.03156
14	Performance	0.32178	0.02309
15	Consistency	0.25379	0.03143
16	Credibility	0.11654	0.01542
17	Effectiveness	0.14713	0.02069
18	Information	0.14982	0.02068
19	Standardization	0.15648	0.02640

20	Tangibles	0.21576	0.02987
21	Compensation	0.28690	0.03782
22	Friendliness	0.18612	0.02467
23	Reliability	0.14223	0.01998
24	Responsiveness	0.17178	0.01757
25	Teamwork	0.13121	0.01732
26	Work attitudes	0.18720	0.02907
27	Cooperation	0.21983	0.03162
28	Functionality	0.29817	0.05187
29	Replace ability	0.15260	0.01908
30	Technical	0.12432	0.01761
31	Time behavior	0.21343	0.02987
32	Marketing	0.15213	0.02143
33	Quality planning	0.18564	0.02465
34	Recognition	0.17980	0.03021
35	Reward	0.18709	0.03088
36	Policy & Reward	0.32085	0.03713

6. Results and Conclusions

This paper gives the intensity of critical success factors for manufacturing industries affecting Benchmarking implementation by ANP approach. These critical factors assist an industry to assess their competence beside implementation of Benchmarking. Five CSFs have identified for selection of Benchmarking process in development of manufacturing industries. These factors are the internal quality, service level, customer service, function ability, policy as resultant index shown in Figure 4. These factors are somewhat similar to those identified by various researchers all over world. Analysis of the findings shows that these are the most important factors among all these factors and very needful requirement for industries developing country like India.

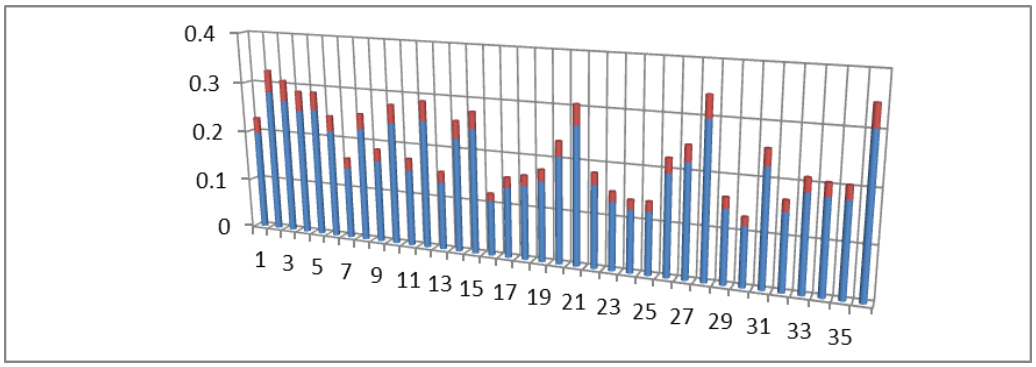

Figure 4. Resultant Index

The proposed approach of ANP, for the evaluation of affecting Benchmarking has the following features:

1. The most imperative assistance of ANP is a holistic approach in which all determinants involved are connected in a network system that accepts various dependencies.
2. The reason for choosing ANP method was that it is suitable for networked decision problems in the benchmarking processes. So, ANP for the present study is seen defensible
3. The ANP is also goal-oriented and it allows the feedback loops in the model which helps for better understanding of problem.
4. A methodology that takes into accounts both quantitative and qualitative factors and the interrelations between them should be utilized.

5. ANP model provides the performance scores and weights of the areas of success for ranking.

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