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Performance Measurement of an Industry Using Simple Additive Weightage

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ABSTRACT

Intense globalization and competitiveness are the forces, which pressurizes the manufacturing industries to adopt various quality tools and techniques to remain their stake in the market. Simple additive weightage (SAW) is one of the quality technique, applied in measuring quality of manufacturing industries. Critical success factors affecting the quality of manufacturing industries are identified through intense literature survey.

***Key words*:** *SAW, Critical success factors, Quality.*

INTRODUCTION

In the early days of manufacturing, an operator's work was inspected and the decision was made whether to accept or reject. Later, due to globalization and rapid advancements in technology the manufacturing environment became extremely competitive. So, manufacturers needed to be stay focused on finding ways to design, produce and deliver products, and Quality is the only strategic tool for any manufacturing organization to create a win – win situation in this competitive battle.

Simple Additive Weightage Technique is one of the most used MADM techniques. It is simple and is the basis of most MADM techniques such as AHP and PROMETHEE that benefits from additive property for calculating final score of alternatives. A score in the saw method is obtained by adding contributions from each attribute. Since two items with different measurement units cannot be added, a common numerical scaling system such as normalization is required to permit addition among attribute values. The total score for each alternative then can be computed by multiplying the comparable rating for each attribute by the importance weight assigned to the attribute by the importance weight assigned to the attribute and then summing these products over all the attributes.

LITERATURE SURVEY

Simple additive weighting which is also known as weighted linear combination or scoring methods is a simple and most often used mulltiattribute decision technique (Malczewski, 1997; Janssen, 1992; Eastman, 1993). The method is based on the weighted average. The simple additive weighting method, obtains an index by adding contributions from each attribute. (Churchman and Ackoff, 1954) first utilized the SAW method to cope with a portfolio selection problem.

APPLICATION OF SIMPLE ADDITIVE WELDING

Simple Additive Weighting (SAW) which is also known as weighted linear combination or scoring methods is a simple and most often used multi attribute decision technique. The method is based on the weighted average. An evaluation score is calculated for each alternative by multiplying the scaled value given to the alternative of that attribute with the weights of relative importance directly assigned by decision maker followed by summing of the products for all criteria. The advantage of this method is that it is a proportional linear transformation of the raw data which means that the relative order of magnitude of the standardized scores remains equal.

STEPS INVOLVED IN SIMPLE ADDITIVE WEIGHTAGE

1. Compare each critical success factor with other factor through pairwise comparison and
   construct a comparison matrix.

2. Then assign a score to each factor to show its importance.

3. Determine the optimum value from each column and divide the whole column with the respective value and the normalized matrix is constructed.

4. Now create a weighted sum matrix by multiplying the each element of each column with the respective weight of the factor.

5. Now add the rows to determine the rank.

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IDENTIFICATION OF CRITICAL SUCCESS FACTORS

There are four critical success factors are selected for implementation of SAW technique as follows:

• Human Resource

• Material, Machine and Methodology;

• Planning;

• Organizational Culture

Table 1: Factors and Co-factors affecting quality of manufacturing Industry

Factors	Human Resource	Material, Machine and Methodology	Planning	Organizational Culture
Co-factors	ManPower Planning	Effective Manufacturing Methodology	Financial Planning and Analysis	Environmental Conditions
	Employee Attitude	Uninterrupted flow of material	Plant Location and Layout	Unhealthy relationships with outside partners
	Employee Motivation	Tools used	Competition in the market	Harmonious relationships within the Industry
	Adequate Supervision	Adequate Process Capability	Facilities provided to employees	Comprehension of management towards quality
	Education and Training	Safety requirements		
		Transportation and Storage		

METHODOLOGY

Simple additive weightage method is applied to assess quality of manufacturing organization. To compare the organizations a matrix is formed as shown in Table 2. On the basis of literature survey, weightage of each critical success factor and rank of each factor for all the organizations is determined through pair wise comparison.

Table 2: Matrix consisting of four organizations and four factors

Factors / Organization	1 (0.4) ↑	2 (0.1) ↑	3 (0.2) ↑	4 (0.3) ↑
A	8	4	5	9
B	12	3	6	3
C	4	7	8	7
D	7	5	2	4

Now, construct a normalized matrix as shown in Table 3 by dividing the each element of all columns with highest valued element of the column.

Table 3: Normalized matrix

Factors / Organization	1 (0.4)	2 (0.1)	3 (0.2)	4 (0.3)
A	0.67	0.57	0.625	1
B	1	0.43	0.75	0.33
C	0.33	1	1	0.78
D	0.58	0.71	0.25	0.44

Then construct a weighted matrix by multiplying the all element of each column with the respective weight of the factor as shown in Table 4.

Table 4: Weighted matrix

Factors / Organization	1 (0.4)	2 (0.1)	3 (0.2)	4 (0.3)
A	0.268	0.057	0.125	0.3
B	0.4	0.043	0.15	0.099
C	0.132	0.1	0.2	0.234
D	0.232	0.071	0.05	0.132

Now add all the rows to determine the rank of each industry.

Industry A = 0.268 + 0.057 + 0.125 +0.3

Industry B = 0.4 + 0.043 + 0.15 + 0.099

Industry C = 0.132 + 0.1 + 0.2 + 0.234

Industry D = 0.232 + 0.071 + 0.05 + 0.132

Hence,

Industry A = 0.75

Industry B = 0.692

Industry C = 0.666

Industry D = 0.485

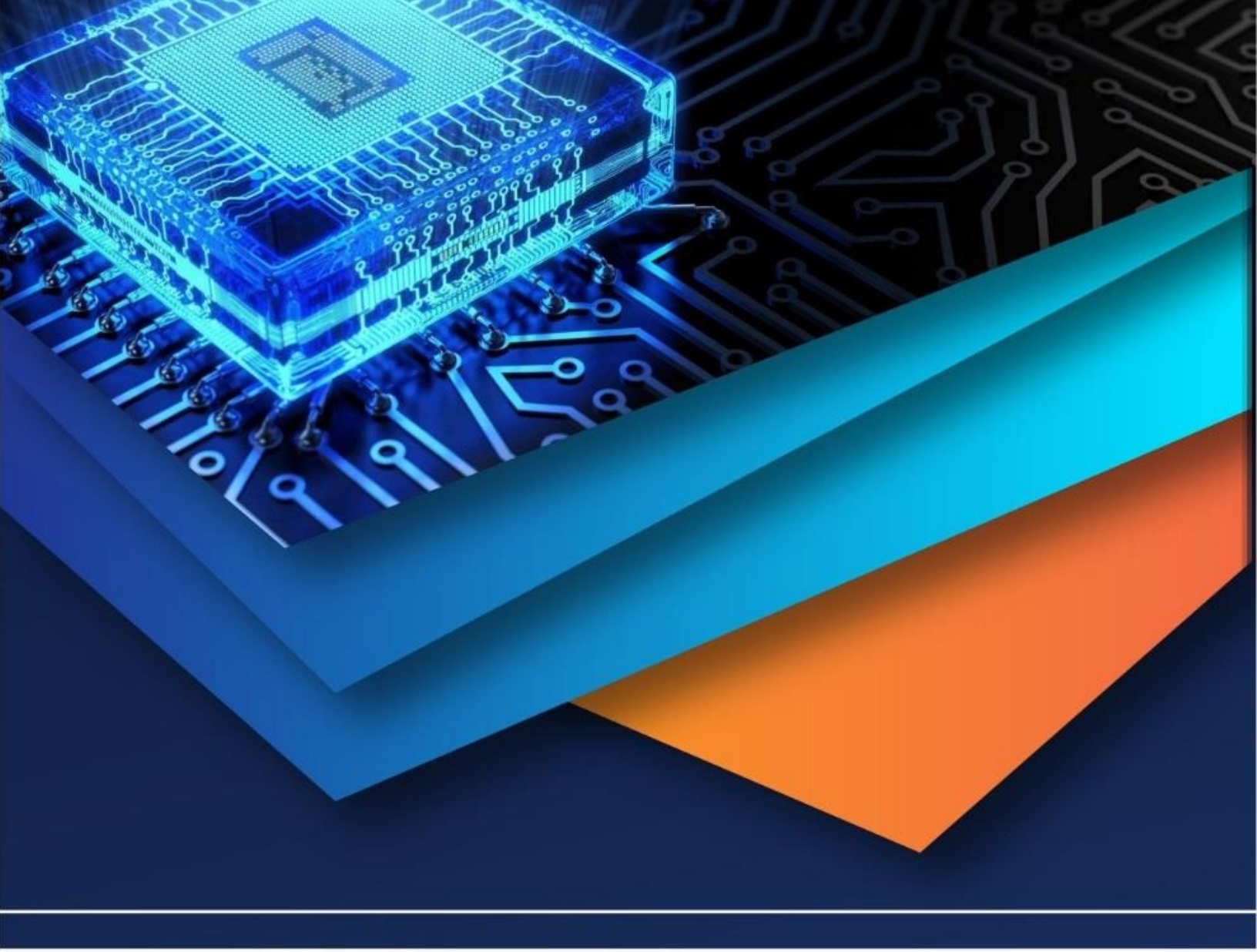
The score of the industries indicates the rank of the industries and Industry A is the best Industry as it scores highest rank whereas Industry B is the worst as it scores the last rank.

CONCLUSION

To predict or compare the performance of a manufacturing process, it is necessary to analyze various factors and their effect. Therefore, a mathematical model is required to correlate the different factors, sub-factors to evaluate and compare the manufacturing processes. The present works undertakes the application of Simple Additive Weightage technique in measuring quality of manufacturing organizations.

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