



Enhancing Cost Accounting Decisions with the MOORA Method: A Multi-Objective Optimization Approach

Kavitha B V

Christ Deemed to be University, Bengaluru, Karnataka, India

Corresponding Author Email: kavitha.bv@christuniversity.in

Abstract: Cost accounting is a field of accounting dedicated to identifying, analyzing, and reporting costs related to business operations a company's operations. It aims to provide detailed insights into the costs of products, services, and processes, helping businesses make informed financial decisions. Cost accounting involves the collection and allocation of costs to specific cost centers or departments, tracking expenditures, and evaluating the efficiency of production processes. It uses various methods such as to calculate the cost of manufacturing items or rendering services, use Job costing, process costing, and activity-based costing are methods used to estimate costs. By examining cost data, companies can identify areas for cost control, budgeting, and financial planning. Cost accounting supports strategic decision-making, cost reduction, and performance improvement, ultimately contributing to enhanced profitability and operational efficiency. The significance of cost accounting research lies in its ability to enhance financial management and operational efficiency within organizations. By investigating various cost accounting methods and practices, research provides insights into how costs are incurred, allocated, and controlled. Businesses can use this information to make well-informed decisions around pricing, budgeting, and cost reduction strategies. Cost accounting research helps identify cost-saving opportunities, improve cost control mechanisms, and optimize resource allocation. It also supports strategic planning by providing accurate cost data that can influence business strategies and assessment of performance. Furthermore, cost accounting study aids in the creation of fresh methods and resources for more efficient cost control. All things considered, cost accounting research is essential for businesses looking to increase profitability, optimize operations, and obtain a competitive edge their respective industries. MOORA (Multi-Objective Optimization by Ratio Analysis) is an approach used to evaluate multiple criteria in decision-making processes for evaluating alternatives based on multiple, often conflicting criteria. It helps in decision-making processes by allowing for the comparison of different performance ratios against reference alternatives. MOORA involves assigning weights to various criteria, measuring their significance, and sorting the alternatives accordingly. This technique aids in balancing multiple factors in complex decision-making scenarios. By systematically measuring trade-offs and considering multiple objectives simultaneously, MOORA provides a structured framework for achieving well-known and effective results. Alternative taken as Activity-based costing (ABC), fixed costing, and job order costing are various techniques used to allocate and manage manufacturing costs, Process Costing, Marginal Costing, Direct Costing, Throughput Accounting, Life Cycle Costing. Evaluation Parameter taken as Accuracy, Cost Control, Decision Support, Complexity, Cost of Implementation, Adaptability. The results indicate that performance accounting received the highest ranking and direct costing received the lowest ranking.

Keywords: Cost Accounting, Activity-Based Costing (ABC), Throughput Accounting, MOORA.

1. INTRODUCTION

Cost accounting involves monitoring, analyzing, and summarizing both fixed and variable costs associated with producing a product, acquiring goods for sale, or delivering a service. This includes expenses related to materials, labor, and operational costs linked to a product or service. Traditional management accounting history has often focused on pinpointing the origins, identifying who made significant contributions first, and determining specific timelines. This focus on invention has resulted in rich narratives but has overlooked the crucial connections between

the stages of the development of accounting and their socioeconomic contexts. Addressing this gap, the recent integration of accounting history with the principles of liberal economics represents a significant theoretical advancement. This new perspective is based on the idea that changes in the pursuit of efficiency in competitive situations drives company organization and control systems, and accounting development is a crucial component of this evolutionary process. The Johnson and Kaplan "Relevance Lost" (1987) exemplifies this new tradition comprehensively. Given its substantial impact on academics, consultants, and practitioners, it is essential to closely scrutinize its historical and theoretical adequacy, especially because these aspects significantly influence the prescriptive conclusions Johnson and Kaplan make use of historical accounting interpretations. [1]

While accounting historians generally agree that Although The rise of cost accounting was driven by the Industrial Revolution. specific economic factors that prompted manufacturing companies to adopt cost accounting methods in the 19th century have not been fully explained. This paper offers an additional explanation, complementing the traditional view that the need to manage the costs of long-term assets, due to The main reason for including cost accounts into the double-entry system was the rise in the utilization of fixed capital. The research findings indicate that the development of cost accounting was spurred by modifications in the timing of expenses as well as modifications in the structure of economic activities, which created a need for financial information for managerial purposes. [2]

In addition to the introduction of ISO 14051, a new international standard for environmental management accounting, One useful management tool that has been proposed is material flow cost accounting (MFCA) tool businesses to consider. This paper reviews existing literature on MFCA, aiming to create a research agenda that will support the future development of this tool. It highlights several concerns: MFCA lacks theoretical underpinnings, its practical application and awareness are limited, To enhance case studies, statistical research techniques, surveys, and interviews are required there isn't enough systematic evidence to encourage the tool's use across various company sizes and outside of production, and it needs to be investigated whether it can be used in conjunction with other accounting tools for performance improvement. The agenda presented in the article looks at potential research directions, examines the tool's applicability in businesses, and recommends expanding the scope of the study. [3]

As businesses face increasing pressure to boost productivity while minimizing environmental impacts, they require instruments that enable them to precisely monitor all of the inputs and outputs of their activities. According to Kokubu and Tachikawa (2013), p. 351, this tracking encourages eco-friendly choices that enhance environmental and economic performance. One such tool that has been proposed is material flow cost accounting (MFCA). The ISO 14051 standard was released by the International Organization for Standardization (ISO) for MFCA in September 2011, it served as even more evidence of its importance. [4]

we limit our examination of business strategy and environmental cost accounting to corporate environmental performance, with a focus on managerial decision-making within the company rather than outward reporting to stakeholders and shareholders. Between five and twenty percent of the total costs of business operations can be attributed to environmental expenditures as noted by Ditz et al. (1995: 15). Given the likelihood of these costs increasing with rising environmental protection demands, this chapter aims to argue that directly integrating environmental costs into business plans and accounting procedures can strengthen a company's competitive advantage. [5]

Cost accounting, in its original sense, involves gathering and assigning historical costs to products and departments, primarily for valuing stock and measuring profit. In its contemporary sense, it merges with management accounting, which focuses on internal reporting to managers, highlighting control and decision-making rather than just accounting stewardship. For the purposes of this essay, the modern definition of cost accounting is more relevant. Thus, cost accounting is defined here as the gathering of pertinent expenses that managers utilize for management, planning, and decision-making. [6]

The results of applying four distinct cost accounting methods—throughput accounting, activity-based costing, direct costing, and standard cost accounting—in a production environment with resource constraints. The aim was to evaluate how these systems aid managers in making two common types of decisions utilizing data from cost accounting. The study involved surveying manufacturing managers to identify the decisions reliant on cost accounting

and using a simulation model to evaluate how these choices will turn out. Additionally, a linear programming solution was compared to the outcomes of the four cost accounting models. The results showed that the throughput accounting model matched the linear programming model every time, but the other three methods usually produced less-than-ideal choices. The study found that production restrictions must be taken into account and assigned expenses must not be used in a cost accounting system in order to give information for the best possible decision-making. [7]

The common belief is that the Industrial Revolution's emergence of the factory system marked the beginning of cost accounting. While this period indeed significantly advanced the field, many modern practices and theories of cost accounting actually date till the fourteenth century. Industrial companies were established during this period as a result of the expansion of commerce in areas like Italy, England, Flanders, and Germany by individuals and partnerships, producing goods like woolen cloth, books, and coins. Historians have noted that improved accounting practices typically followed the emergence of capitalism. Cost accounting, which focuses on recording and analyzing factory expenditures, was no exception to this trend. [8]

This activity-based costing customer profitability report, which was presented as a table or graph, examined how pricing and resource allocation decisions are impacted by various presentation forms and how these decisions affect the profitability of the company. The results show a strong correlation between the user's cost accounting expertise and the presentation style. Notably, persons with minimal knowledge in cost accounting can make more money by using a graphical method instead of a tabular one. Surprisingly, for those with advanced cost accounting knowledge, graphs negatively impact profits compared to tables. These insights suggest that companies should tailor the method of presenting accounting data according to the user's degree of accounting knowledge, benefiting managers, external investors, and other stakeholders. [9]

One often neglected indicator of economic progress is the development and quality of cost accounting practices during a particular era. Essentially, cost accounting provides essential data to ascertain the true costs of goods, which is essential for determining pricing. It is also essential for determining how effective decision-making and production processes are. Cost information is crucial for many planning processes, including the purchase of assets, vertical integration, subcontracting, make-or-buy choices, technology developments, and product mix. [10]

Historical reviews of accounting, some nearly fifty years old, trace the emergence of meaningful cost accounting back to the mid-1880s. However, most of these reviews rely on published works by professional accountants rather than business archives. While British theorists like Garcke, Fells, and Norton are sometimes acknowledged, the practical application of cost accounting for decision-making is often attributed to the Frederick Taylor-led scientific management movement in the United States. Traditional views suggest that significant advances in cost accounting only began with this 'costing renaissance.' An observer even criticized British responses to early cost accounting innovations in other countries as mere superficial gestures rather than practical tools for advancing production. Richard Brown, an Edinburgh chartered accountant, attempted to compile a general history of the profession in 1905 but did not include any discussion of industrial accounting.[11]

The utilization of comprehensive cost accounting in the automotive industry, a field where its implementation is currently uncharted. The study reviews 4381 papers and identifies ten distinct full cost accounting methods, varying in their development and consistency. Among these, the Sustainability Assessment Model, created by Aberdeen University and British Petroleum, is highlighted as a promising tool for the automotive sector. [12]

This approach is unique in that it can translate a variety of sustainability data into a financial score, which makes it easier to communicate the trade-offs and results of difficult sustainability decisions. It evaluates a broad variety of internal and external economic, environmental, resource, and social consequences. are not adequately addressed by current automotive systems. The model's strengths include its provision measurements of financial and material sustainability, its adaptability, and its capacity to integrate multiple sustainability dimensions. The paper also offers insights for future research in complete cost accounting with the integration of numerous sources from different domains.[13]

The ways in which businesses might integrate environmental effects into their cost management and product pricing procedures are examined in this article. It goes over how to figure out and monitor the environmental costs of industry,

both historical and present. The book also discusses the necessity of doing a thorough analysis of potential future environmental effects, taking into account both costs and benefits. It suggests that These elements are taken into consideration by a complete life-cycle costing or the environmental cost accounting paradigm. Examined are the viability of complete environmental cost accounting as well as the associated accounting difficulties. The importance of thorough environmental cost analysis for enhancing long-term profitability, lowering environmental impacts, and improving business environmental performance is finally highlighted. [14]

In order A questionnaire was distributed beforehand in order to notify participants of the purpose of the interview and gather basic descriptive data. Each company provided pertinent information bundles and reports. Interview requests were sent to the cost accounting and general manager personnel. Every organization had one interview, covering a variety of duties and responsibilities, with either a group of two to six managers or a single person, usually the general manager. During factory tours, researchers examined operations at six different companies. The duration of company visits and interviews ranged from one hour to six hours, with the latter being the most typical. Every interview was done in Japanese, with the non-Japanese speaking researcher receiving sporadic summaries in English. During the interview, a transcript of the interviews was prepared in Japanese. [15]

2. MATERIAL AND METHODS

Alternative: Activity-based costing (ABC), job order costing, standard costing, direct costing, throughput accounting, and life cycle costing are all examples of costing.

Activity-Based Costing (ABC): Under ABC, or activity-based costing, allocates overhead costs to products in accordance with the activities that result in them. By identifying the primary functions of an organization, this technique allocates charges to goods and services according to how these functions are used. Cost control, profitability analysis, and pricing can all be improved with the aid of ABC, which aids in comprehending the actual cost of production. Given that it draws attention to cost drivers and offers insights into cost behavior, it is especially helpful in complex contexts with a wide range of products and indirect expenses.

Standard Costing: Assigning expected (standard) costs to goods or services as opposed to actual costs is known as standard costing. These standards are derived from past performance, industry standards, and expectations for the future. Standard costing is primarily used to set a baseline for cost control and performance measurement. Analysis is done on differences between standard and actual expenses to find areas that might be improved. Standard costing makes bookkeeping easier and allows management to concentrate on variances—that is, performance that deviates significantly from expectations.

Job Order Costing: Task Order When creating customized goods or services, costing is necessary because every task or batch is different. Because costs are recorded separately for each project, it is appropriate for specialized manufacturing, printing, and building businesses. Each work has overhead, direct labor, and direct materials costs allocated to it, giving a comprehensive picture of the expenses related to individual projects. This approach makes it easier to accurately analyze profitability, set prices, and manage costs for customized goods.

Process Costing: Process costing is employed in sectors like textiles, food processing, and chemicals where output is uniform and continuous. After accruing over time, costs are allocated to the units produced during that time. Because this strategy averages prices across all units, it is effective in production environments with little variability and large volume. It aids in price setting, efficiency monitoring, and the provision of a clear image of production costs.

Marginal Costing: Variable costing, another name for marginal costing, is concerned with the price of creating an extra unit of output. The income statement is charged with fixed expenses, which are treated as period expenses. The only expenses that are variable are direct labor, direct materials, and variable overhead taken into account. Making decisions about pricing, product mix, and production levels can benefit from the application of marginal costing. It offers a clear approach to study cost behavior and aids in comprehending how variations in volume affect profitability.

Direct Costing: Since it simply accounts for direct costs—materials and labor—into the price of goods and services, direct costing and marginal costing are comparable. Overheads and indirect costs are classified as period expenses rather than being assigned to specific items. This approach makes cost accounting easier to understand and gives a

clear view of the production's direct costs. It aids in making quick decisions and directs management's attention to expenses that are within direct control.

Throughput Accounting: Throughput Accounting emphasizes how quickly a company makes money from sales, allowing it to concentrate on how each product contributes to total profitability. It treats all other expenses as constant and only takes into account variable costs, which are usually direct materials. Throughput per unit of constraint is the main metric used in throughput accounting, which aids in the identification of bottlenecks and the optimization of production flow. This method helps to maximize the system's throughput overall and is in line with the Theory of Constraints (TOC).

Life Cycle Costing: Life Cycle Costing (LCC) considers the overall cost of ownership of a product from the point of development to the points of manufacture, use, upkeep, and disposal. This approach gives businesses a thorough understanding of costs, enabling them to make well-informed choices regarding investment, pricing, and product design. LCC is especially important for sectors like infrastructure, defense, and aerospace that have lengthy product life cycles. By emphasizing the long-term financial and environmental effects of products, it promotes sustainable behaviors.

Evaluation Parameter: Accuracy, Cost Control, Decision Support, Complexity, Cost of Implementation, Adaptability.

Accuracy: For the purpose of giving trustworthy financial information that supports decision-making, costing procedures must be accurate. Maintaining competitive pricing and reaching financial goals is made easier with accurate cost data, which guarantees that product pricing, profitability analysis, and financial reporting reflect real costs. There are differences in the accuracy of different costing techniques. For example, Activity-Based Costing (ABC) yields very accurate cost allocation by offering comprehensive insights into the expenses of particular activities and goods. On the other hand, less accurate cost data may result from the use of more straightforward techniques like direct costing, which might not fully capture all costs.

Cost Control: Cost control involves monitoring and regulating spending to ensure that it stays within allotted spending limitations. Organizations that maintain competitive pricing and profitability benefit from effective cost control. distinct costing techniques provide distinct contributions to cost control. By allowing companies to set cost benchmarks and monitor variances, standard costing aids in the identification of inefficient regions. Process costing makes it easier to keep track of costs across high production volumes in continuous production settings. By helping to comprehend how variable expenses affect profitability, marginal costing facilitates the making of better immediate judgments. Every approach provides resources and knowledge that can improve an organization's capacity for efficient cost control.

Decision Support: Because they offer pertinent cost data for strategic decisions, costing methodologies are important in decision support. Pricing tactics, financial planning, and investment choices are all included in decision assistance. For instance, marginal costing, which concentrates on the cost of producing extra units, is useful for making decisions about price and product mix that must be made quickly. Activity-Based Costing, which shows the actual cost of an activity, aids in the development of well-informed decisions about product lines and cost control. By assessing the overall cost of ownership across a product's life, life cycle costing aids in making long-term decisions. Depending on the requirements of the company, various insights from each approach might help direct decision-making.

Complexity: The degree of complexity and intricacy needed to construct and maintain the system is referred to as "complexity" in costing methodologies. Because they are so precise, methods like Life cycle costing and activity-based costing require complex calculations and data. collection procedures. They need a lot of work to track costs across different activities or stages of the product lifecycle and identify cost drivers. On the other hand, more straightforward techniques like standard costing or direct costing are less complicated and simpler to use. A costing method's usability and the resources needed for its implementation and upkeep might be affected by its complexity.

Cost of Implementation: Both money and resources must be spent in order to adopt a costing approach. High accuracy and in-depth analysis methods, like Activity-Based Costing, can have significant upfront setup expenses, which include system modifications, training, and continuing maintenance. The insightful information they offer

justifies this expenditure. Because simpler techniques like standard costing and direct costing are more clear and easy to integrate, they typically have lower implementation costs. To choose the best course of action, organizations must assess the benefits of the strategy against the costs of execution.

Adaptability: The ability of a method to adapt to changes in the business environment, such as modifications to product lines, production processes, or market conditions, is referred to as adaptability. Costing techniques differ in how flexible they are. Activity-Based Costing, for instance, is very flexible since it can be modified to account for shifts in the activities and cost drivers. Because of its flexibility, marginal costing is appropriate for making snap decisions in dynamic contexts. However, in order to stay current, approaches with inflexible frameworks, such as Standard Costing, might need to undergo recurring evaluations and modifications. The costing method's adaptability guarantees that it will always deliver reliable and practical information.

MOORA (Multi-objective Optimization on the basis of Ratio Analysis): This technique is called Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA), and it is used to derive ratios. This method, which uses dimensionless integers, is a first step toward optimization and can be used in different Lithuanian regions. It evaluates the disparities in ten districts' goals in an efficient manner. There is a noticeable contrast with less wealthy districts, even though three districts are rated well because of their prosperity. Furthermore, labor migration between districts is important because it might lead to economic imbalances that may call for remedial measures like automatic redistribution or migration deterrents. As an alternative, districts may think about industrialization and commercialization as ways to promote growth. [16]

When there are conflicting qualities or concurrent constraints in multi-objective optimization settings, the MOORA (Multi-Objective Optimization by Ratio Analysis) approach is useful. It can be used in a wide range of contexts, from manufacturing and process design to green decision-making and trade-offs between conflicting goals. Multiple Criteria Decision-Making (MCDM) approaches play three important roles in supporting the relevance of MOORA. First of all, it improves on conventional MCDM techniques by intricately organizing factors. Second, it tackles computation time issues that are frequently brought up in MCDM literature. Last but not least, MOORA is effective, needing little processing time and system resources. Its usefulness also extends to educational settings, where it can be used in computerized tests or other selection procedures and aids in prioritizing applicants based on a variety of criteria when choosing university or college scholarships.[17]

MOORA is a flexible and effective method for managing complex scenarios involving several qualities, standards, and opposing objectives. It methodically tackles multi-objective optimization problems, which frequently ask for balancing conflicting criteria. Because this approach may adjust to diverse features with varying degrees of significance, it is very helpful for managing complex and contradictory objectives. It is a sensible option for a variety of circumstances due to its clarity and adaptability. It's important to remember, though, that MOORA might not be able to handle some disruptions.[18]

A reliable technique for handling multi-objective optimization issues that takes into account different features and reconciles competing elements is Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA). This method facilitates updates and enhancements in situations when there are competing qualities or various standards. It is excellent at handling the complexity brought on by competing goals and supply chain problems. MOORA is versatile, applicable in a range of areas such as assessments, provider selection, method design, and optimal solution determination. Furthermore, MOORA can be adapted to address identified failures by prioritizing them based on impact and severity. Through its extensions, MOORA integrates different analytical methods and credibility concepts to handle uncertainties associated with failures. The practical nature of MOORA ensures it provides realistic outcomes that support decision-makers. Comparisons with traditional methods underscore MOORA's effectiveness in identifying and resolving failures. [19]

The MOORA method proves to be very effective when examined closely. For the researchers, it is clear that MOORA and the MOOSRA method are essential for selection processes, leveraging current data. From the earlier discussion, it's evident that both MOORA and MOOSRA meet all the criteria for decision-making challenges, making them highly reliable in production environments. When comparing them to the ratio of benefits to costs, the denominator charge of the rate indicates that these models provide a better overall financial performance.[20]

Both the MOORA and MOOSRA methods are complex and distinctive, offering a thorough perspective on performance measurement techniques. They incorporate elements from the Rate Engine and Reference MOORA, blending attitudes with feature factors. We carried out extensive simulations for port planning, effectively setting goals, identifying types of substitutes, and assessing their importance. These methods are relevant to stakeholders, including national and local authorities and participating companies. A distinct emphasis on sovereignty is apparent when addressing consumer-related production challenges.[21]

Officers, along with customers, frequently act as legal representatives, which can introduce some subjectivity and potential inaccuracies. To tackle problems related to the rating of CNC gadget devices, MOORA's decision-making framework is utilized. This framework incorporates complete information, known as a linguistic variable, which helps examiners manage ambiguous data. The article explores how multi-MOORA ranking is applied in different regions to provide a detailed overview, with the results of these rankings being summarized through evaluations. [22]

Step 1: Design of decision matrix and weight matrix

For a MCDM problem consisting of m alternatives and n criteria, let $D = x_{ij}$ be a decision matrix, where $x_{ij} \in \mathbb{R}$

$$\begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}$$

The weight vector may be expressed as.

$$w_j = [w_1 \dots w_n], \text{ where } \sum_{j=1}^n (w_1 \dots w_n) = 1$$

$$n_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}$$

where $i \in [1, m]$ and $j \in [1, n]$

Step 3: Weighted normalized decision matrix

$$W_{nij} = w_j n_{ij}$$

Step 4: Calculation of Performance value

The performance value of each alternative is calculated as

$$y_i = \sum_{j=1}^g N_{ij} - \sum_{j=g+1}^n N_{ij}$$

Where g is the number of benefit criteria and (n - g) is the cost criteria.

The alternatives are ranked from best to worst based on higher to lower y_i values.

3. RESULT AND DISCUSSION

TABLE 1. Cost Accounting

	Accuracy	Cost Control	Decision Support	Complexity	Cost of Implementation	Adaptability
Activity-Based Costing (ABC)	90	85	90	80	70	75
Standard Costing	80	75	80	60	60	80
Job Order Costing	85	70	75	65	65	70
Process Costing	75	80	70	70	55	65
Marginal Costing	70	65	75	50	50	80
Direct Costing	65	60	70	55	55	70
Throughput Accounting	80	85	85	75	60	65
Life Cycle Costing	90	80	85	85	75	70

This table 1 compares various cost accounting methods across six key attributes: Accuracy, Cost Control, Decision Support, Complexity, Cost of Implementation, and Adaptability. Activity-Based Costing (ABC) scores high on accuracy and decision support, making it useful for detailed analysis but comes with higher complexity and

implementation costs. Standard Costing is less complex and more adaptable but may not be as precise. Job Order Costing is suitable for custom products, balancing accuracy with complexity. Process Costing works well for mass production but offers moderate adaptability. Marginal and Direct Costing are less complex but offer lower precision. Throughput and Life Cycle Costing excel in decision support, with Life Cycle Costing also providing high adaptability.

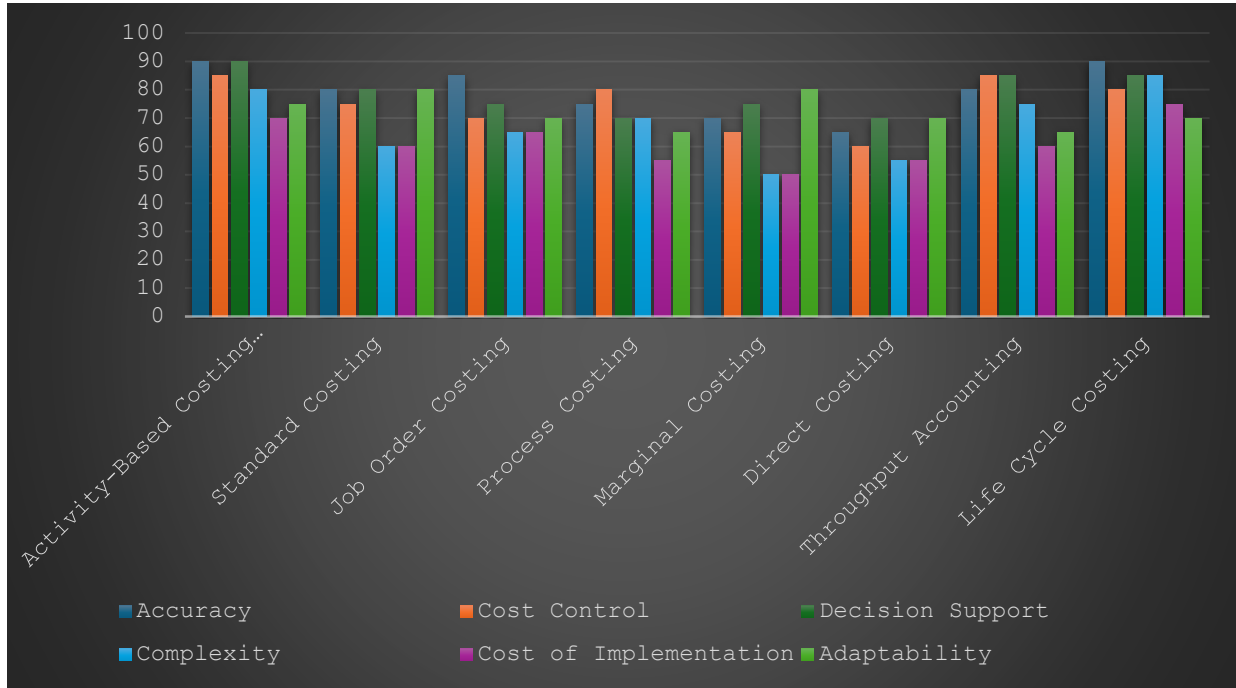


FIGURE 1. Cost Accounting

Table 1. Shows The Cost Accounting Accuracy it is seen that Activity-Based Costing (ABC), Life Cycle Costing is showing the highest value for Direct Costing is showing the lowest value. Cost Control it is seen that Activity-Based Costing (ABC), Throughput Accounting is showing the highest value for Aluminium 5052-0 is showing the lowest value. Decision Support it is seen that Activity-Based Costing (ABC) is showing the highest value for Process Costing, Direct Costing is showing the lowest value. Complexity it is seen that Life Cycle Costing is showing the highest value for Marginal Costing is showing the lowest value. Cost of Implementation it is seen that Life Cycle Costing is showing the highest value for Marginal Costing is showing the lowest value. Adaptability it is seen that Standard Costing, Standard Costing is showing the highest value for Process Costing is showing the lowest value.

TABLE 2. Divide & Sum

Accuracy	Cost Control	Decision Support	Complexity	Cost of Implementation	Adaptability
8100	7225	8100	6400	4900	5625
6400	5625	6400	3600	3600	6400
7225	4900	5625	4225	4225	4900
5625	6400	4900	4900	3025	4225
4900	4225	5625	2500	2500	6400
4225	3600	4900	3025	3025	4900
6400	7225	7225	5625	3600	4225
8100	6400	7225	7225	5625	4900
50975	45600	50000	37500	30500	41575

The table 2 shows the results of a "Divide & Sum" calculation for different cost accounting methods across six criteria: Accuracy, Cost Control, Decision Support, Complexity, Cost of Implementation, and Adaptability. The values represent the squared scores for each attribute, likely used to emphasize the differences between methods. Activity-Based Costing (ABC) and Life Cycle Costing excel in accuracy and decision support but have high complexity and implementation costs. Standard Costing and Throughput Accounting provide balanced scores with moderate complexity and adaptability. Marginal and Direct Costing show lower scores in decision support and accuracy, indicating they may be less effective for precise cost management. The bottom row sums up the total scores for each attribute across all methods, highlighting overall trends.

TABLE 3. Normalized Data

Accuracy	Cost Control	Decision Support	Complexity	Cost of Implementation	Adaptability
0.3986	0.3980	0.4025	0.4131	0.4008	0.3678
0.3543	0.3512	0.3578	0.3098	0.3436	0.3924
0.3765	0.3278	0.3354	0.3357	0.3722	0.3433
0.3322	0.3746	0.3130	0.3615	0.3149	0.3188
0.3100	0.3044	0.3354	0.2582	0.2863	0.3924
0.2879	0.2810	0.3130	0.2840	0.3149	0.3433
0.3543	0.3980	0.3801	0.3873	0.3436	0.3188
0.3986	0.3746	0.3801	0.4389	0.4294	0.3433

The table 3 presents normalized data across six factors: Accuracy, Cost Control, Decision Support, Complexity, Cost of Implementation, and Adaptability. Each row represents a set of measurements, normalized to a common scale for comparative analysis. For instance, the first row shows relatively balanced scores, with Complexity having the highest normalized value at 0.4131. These values allow for an easy comparison of different attributes, making it simpler to identify strengths and weaknesses across various scenarios. The highest values indicate the most significant factors in a given context, such as Adaptability being crucial in some cases, evident from higher scores. Normalization helps in minimizing unit disparities, enabling more insightful decision-making.

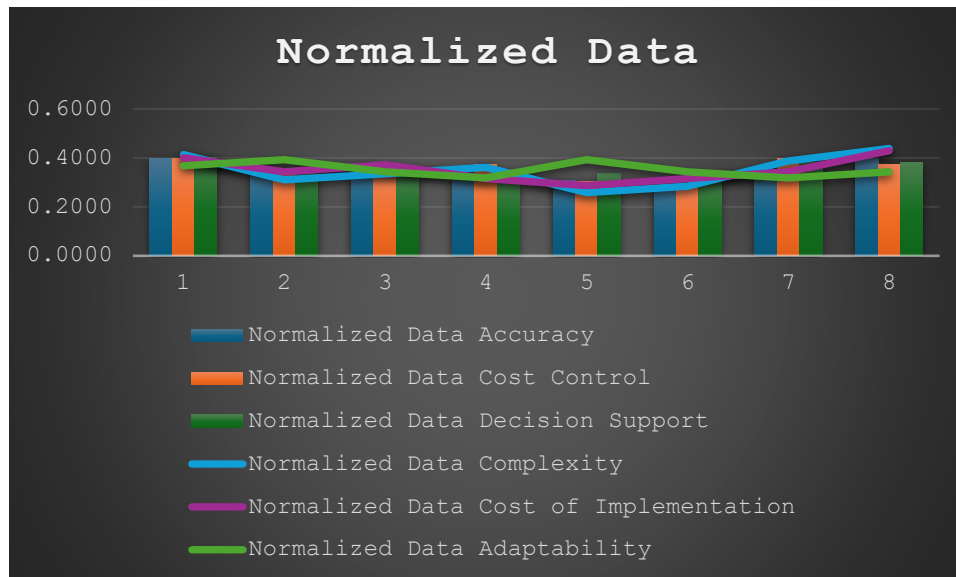


FIGURE 2. Normalized Data

Figure 2 you provided shows a stacked bar chart titled "Normalized Data," which doesn't display any data but instead outlines factors influencing the cost of normalizing data. Data normalization involves transforming data into a consistent format, often to prepare it for analysis. Key reasons for normalizing data include: Facilitating easier comparison, Minimizing data redundancy, Enhancing the efficiency of data storage and retrieval. The chart lists the

following factors affecting the cost of normalization: Complexity, Implementation Cost, Adaptability. The significance of these factors can vary depending on the dataset and normalization methods used. For instance, normalizing relatively clean and simple data may incur lower costs, whereas complex and messy data may lead to higher costs. There is no universal answer to the cost of data normalization. Understanding these influencing factors helps in making more informed decisions on how to approach data normalization for specific needs.

TABLE 4. Weight

Weight					
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25	0.25	0.25

The table 4 represents a uniform distribution of weights, with each entry having a value of 0.25. This suggests that each element in the table has an equal influence or importance. The repeated values across the table could be used in averaging processes, convolution operations, or scenarios where equal contribution is desired from all components, such as a simple moving average filter in signal processing.

TABLE 5. Weighted normalized decision matrix

Accuracy	Cost Control	Decision Support	Complexity	Cost of Implementation	Adaptability
0.0997	0.0995	0.1006	0.1033	0.1002	0.0920
0.0886	0.0878	0.0894	0.0775	0.0859	0.0981
0.0941	0.0820	0.0839	0.0839	0.0930	0.0858
0.0830	0.0937	0.0783	0.0904	0.0787	0.0797
0.0775	0.0761	0.0839	0.0645	0.0716	0.0981
0.0720	0.0702	0.0783	0.0710	0.0787	0.0858
0.0886	0.0995	0.0950	0.0968	0.0859	0.0797
0.0997	0.0937	0.0950	0.1097	0.1074	0.0858

The table 5 weighted normalized decision matrix is a tool used to evaluate and compare multiple options based on various criteria that are each assigned a specific weight, indicating their importance. In the given table, the criteria are Accuracy, Cost Control, Decision Support, Complexity, Cost of Implementation, and Adaptability. Each option is assigned a weighted normalized score for each criterion, representing the relative performance of that option. For instance, a high score in "Accuracy" indicates a strong performance in that area. The scores have been normalized and weighted to allow for a fair comparison across all criteria, helping decision-makers prioritize options based on overall performance.

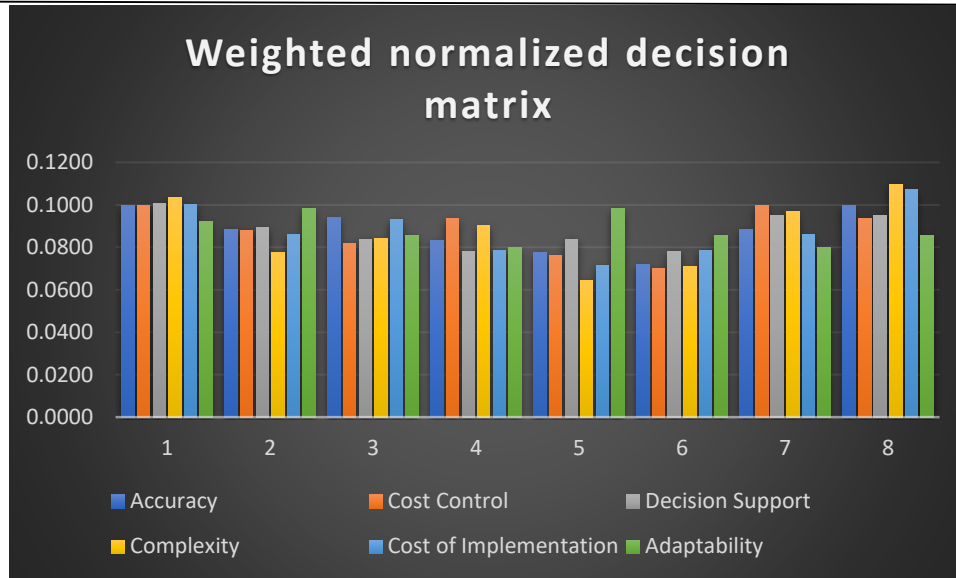


FIGURE 3. Weighted normalized decision matrix

The figure 3 you provided is a weighted normalized decision matrix. This matrix helps in decision-making by evaluating multiple factors (criteria) and their relative importance. In the matrix, eight criteria are listed (Accuracy, Complexity, Cost Control, Decision Support, Cost of Implementation, and Adaptability), each assigned a weight ranging from 0.0000 to 0.1200. The total of these weights equals 1.0000. The matrix is missing the actual values, which are typically the scores for each option (e.g., Option 1, Option 2) against each criterion. Once these values are included, you can compute a weighted score for each option by multiplying each criterion's weight by the corresponding score for that option, then summing these products. The option with the highest weighted score is deemed the most favorable based on the defined criteria and weights. Here's a summary of the process for using a weighted normalized decision matrix: Identify the options to be evaluated. Define the criteria that are crucial for your decision. Assign a weight to each criterion to reflect its importance. Score each option against each criterion. Calculate the weighted score for each option by multiplying the criterion weights by the option scores and summing these results. Select the option with the highest weighted score.

TABLE 6. Assessment value & Rank

	Assesment value	Rank
Activity-Based Costing (ABC)	0.0044	4
Standard Costing	0.0044	3
Job Order Costing	-0.0029	6
Process Costing	0.0062	2
Marginal Costing	0.0032	5
Direct Costing	-0.0151	8
Throughput Accounting	0.0207	1
Life Cycle Costing	-0.0146	7

The table 6 ranks various costing methods based on their assessment values. Throughput Accounting ranks first with the highest assessment value of 0.0207, indicating it may offer significant insights for decision-making by focusing on maximizing the throughput of a system. Process Costing follows closely in second place with a value of 0.0062, suggesting it is effective for industries where products are indistinguishable from each other, like chemicals or food production. Standard Costing and Activity-Based Costing (ABC) are tied for third and fourth place, highlighting their utility in managing and controlling costs. Conversely, Direct Costing and Life Cycle Costing have negative values, indicating potential drawbacks in their application or less relevance to certain business contexts.

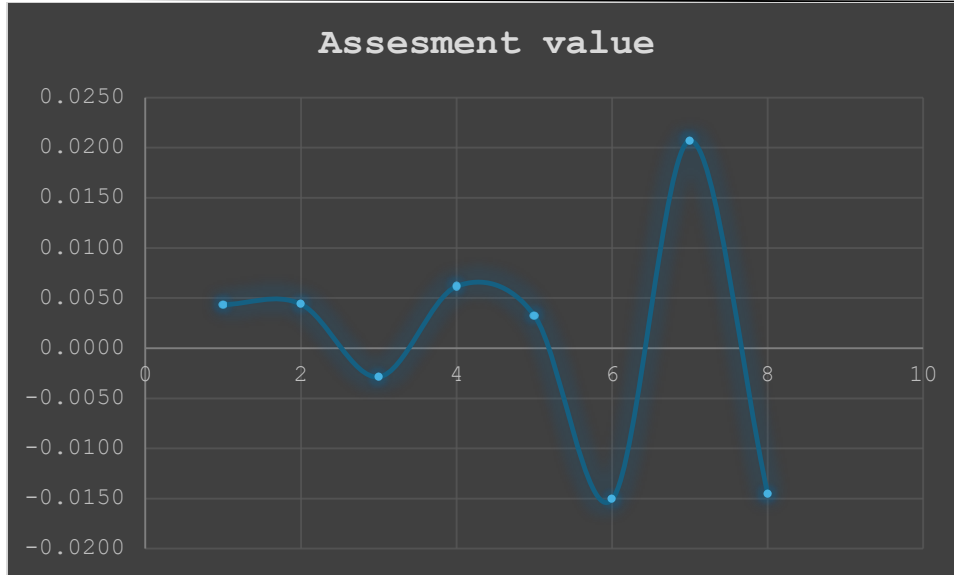


FIGURE 4. Assesment value

The figure 4 you provided is a line graph titled "Assessment Value." The y-axis represents the assessment value, ranging from -0.0200 to 0.0250, while the x-axis denotes time, though the specific time increments (e.g., years, months, weeks) are unclear. Without additional context, it's challenging to determine the exact nature of the graph. The presence of both positive and negative values on the y-axis suggests that the assessment value might be a relative measure, such as the difference from a baseline. Here are a few potential interpretations of the graph: The assessment value may be rising over time, which could indicate inflation or an increase in the assessed item's value (e.g., real estate). The assessment value may be fluctuating, potentially due to market conditions or periodic evaluations. The assessment value may be declining, possibly due to deflation or a decrease in the assessed item's worth.

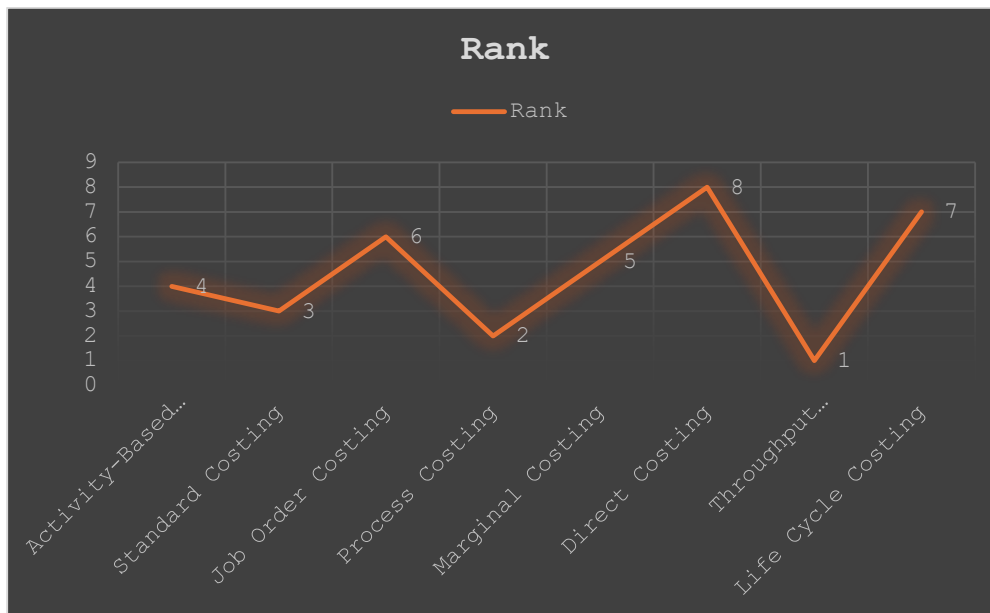


FIGURE 5. Rank

Figure 5. Rank Shows the Activity-Based Costing (ABC) is in 4th rank, The Standard Costing is in 3rdrank, The Job Order Costing is in 6th rank, The Process Costing is in 2nd rank, The Marginal Costing is in 5th rank, The Direct Costing is in 8th rank, The Throughput Accounting is in 1st rank, The Life Cycle Costing is in 7th rank.

4. CONCLUSION

Because it provides essential insights into the financial aspects of production and operational processes, cost accounting is an essential component of modern corporate management. It provides a thorough grasp of how resources are used and expenses are created by concentrating on monitoring, evaluating, and regulating costs related to the production of goods and services. By providing a detailed understanding of cost behavior, cost allocation, and cost management methods, this specialist area of accounting aids businesses in making well-informed decisions. Giving management precise and pertinent cost data to enhance operational efficiency and strategic planning is the main goal of cost accounting. Businesses can calculate the cost of their operations using a variety of cost accounting techniques, including job costing, process costing, and activity-based costing. more accurately offering services or manufacturing things. This detailed cost information is essential for setting prices, budgeting, and financial forecasting. By understanding the cost structure, Businesses are able to pinpoint areas where expenses can be cut or managed, resulting in increased profitability and a competitive edge. Cost accounting is important for controlling and evaluating performance as well. Managers can determine which costs are actual vs budgeted or standard by comparing the two. variances and investigate their causes. This variance analysis helps in assessing the efficiency of production processes and operational performance. Effective cost control mechanisms are vital for maintaining financial stability and achieving strategic goals. Cost accounting research and practices contribute to developing more accurate and reliable cost control techniques, which in turn support better decision-making and resource allocation. Moreover, cost accounting offers insightful information for long-term strategic planning. By analyzing cost data, businesses can assess the profitability of specific products, services, or initiatives, allowing them to concentrate on areas with the highest return on investment. Organizations are better able to manage resources and seek growth possibilities that are in line with their financial objectives when they have this strategic focus. For businesses looking to attain operational excellence and efficiently manage their financial resources, cost accounting is a vital tool. Its focus on thorough cost analysis and control promotes strategic planning, increases profitability, and aids in well-informed decision-making. Businesses can improve their financial results, make the most use of their resources, and maintain a competitive edge in the market by incorporating cost accounting procedures into their management procedures. Continuous research and innovation in cost accounting continue to improve and develop these procedures as markets and industries change, hence promoting the sustainability and success of organizations.

REFERENCES

- [1]. Hopper, Trevor, and Peter Armstrong. "Cost accounting, controlling labour and the rise of conglomerates." *Accounting, organizations and society* 16, no. 5-6 (1991): 405-438.
- [2]. Johnson, H. Thomas. "Toward a new understanding of nineteenth-century cost accounting." *Accounting Review* (1981): 510-518.
- [3]. Epstein, Paul R., Jonathan J. Buonocore, Kevin Eckerle, Michael Hendryx, Benjamin M. Stout Iii, Richard Heinberg, Richard W. Clapp et al. "Full cost accounting for the life cycle of coal." *Annals of the New York academy of sciences* 1219, no. 1 (2011): 73-98.
- [4]. Christ, Katherine L., and Roger L. Burritt. "Material flow cost accounting: a review and agenda for future research." *Journal of Cleaner Production* 108 (2015): 1378-1389.
- [5]. Gale, Robert JP, and Peter K. Stokoe. "Environmental cost accounting and business strategy." In *Handbook of environmentally conscious manufacturing*, pp. 119-136. Boston, MA: Springer US, 2001.
- [6]. Edwards, John Richard. "Industrial cost accounting developments in Britain to 1830: a review article." *Accounting and Business research* 19, no. 76 (1989): 305-317.
- [7]. Boyd, Lynn H., and James F. Cox Iii. "Optimal decision making using cost accounting information." *International Journal of Production Research* 40, no. 8 (2002): 1879-1898.
- [8]. Garner, S. Paul. "Historical development of cost accounting." *The Accounting Review* 22, no. 4 (1947): 385-389.
- [9]. Chan, Yee-Ching Lilian. "Improving hospital cost accounting with activity-based costing." *Health care management review* 18, no. 1 (1993): 71-77.
- [10]. Cardinaels, Eddy. "The interplay between cost accounting knowledge and presentation formats in cost-based decision-making." *Accounting, Organizations and Society* 33, no. 6 (2008): 582-602.
- [11]. Fleischman, Richard K., and Thomas N. Tyson. "Cost accounting during the industrial revolution: The present state of historical knowledge." *Economic History Review* (1993): 503-517.
- [12]. Letmathe, Peter, and Roger K. Doost. "Environmental cost accounting and auditing." In *Green Accounting*, pp. 359-365. Routledge, 2018.

- [13].Jasinski, Dominik, James Meredith, and Kerry Kirwan. "A comprehensive review of full cost accounting methods and their applicability to the automotive industry." *Journal of Cleaner Production* 108 (2015): 1123-1139.
- [14].Hopper, Trevor, Tsutomu Koga, and Jitsuo Goto. "Cost accounting in small and medium sized Japanese companies: an exploratory study." *Accounting and Business Research* 30, no. 1 (1999): 73-86.
- [15].Epstein, Marc J. "Improving environmental management with full environmental cost accounting." *Environmental Quality Management* 6, no. 1 (1996): 11-22.
- [16].Sutarno, S., M. Mesran, S. Supriyanto, Y. Yuliana, and A. Dewi. "Implementation of Multi-Objective Optimazation on the Base of Ratio Analysis (MOORA) in Improving Support for Decision on Sales Location Determination." In *Journal of Physics: Conference Series*, vol. 1424, no. 1, p. 012019. IOP Publishing, 2019.
- [17].Attri, Rajesh, and Sandeep Grover. "Decision making over the production system life cycle: MOORA method." *International Journal of System Assurance Engineering and Management* 5, no. 3 (2014): 320-328.
- [18].Dey, Balaram, BipradasBairagi, Bijan Sarkar, and SubirSanyal. "A MOORA based fuzzy multi-criteria decision-making approach for supply chain strategy selection." *International Journal of Industrial Engineering Computations* 3, no. 4 (2012): 649-662.
- [19].Ghoushchi, SaeidJafarzadeh, Samuel Yousefi, and Mohammad Khazaيلي. "An extended FMEA approach based on the Z-MOORA and fuzzy BWM for prioritization of failures." *Applied Soft Computing* 81 (2019): 105505.
- [20].Sarkar, Asis, S. C. Panja, Dibyendu Das, and Bijon Sarkar. "Developing an efficient decision support system for non-traditional machine selection: an application of MOORA and MOOSRA." *Production & Manufacturing Research* 3, no. 1 (2015): 324-342.
- [21].Braun, H. (2010). Multi-objective decision making: A comparative study of MOORA and AHP methods. *International Journal of Management and Decision Making*, 11(1), 13-27.
- [22]. Kumar, S., & Kumar, N. (2014). MOORA: A powerful method for multi-objective optimization. *Procedia Engineering*, 97, 1538-1546.