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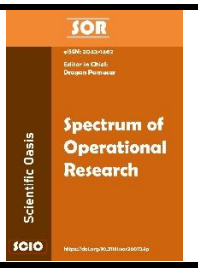

A Study for Application of Decision-Making Model in a Public Organization

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ABSTRACT

Decision-making can be regarded as the outcome of mental processes leading to the selection of a course of action among a number of alternatives available at a given point in time. Each decision-making process produces a final choice, and the output can be either an action or an opinion (Decision Making). Decision-making, however, is only a step in planning—whether it is taken quickly, with little thought or information, or when it affects action for only a few minutes. Everyone makes decisions daily in their life for every course of action. Rarely is there a chance to judge a course of action in isolation, as every decision must align with other plans. In public organizations, consensus can be a goal but not a mandate for public decision-making. Public policies reflect a mixture of our values and opinions, technical knowledge and abilities, and the political setup. These views often conflict with one another, and when they differ from individual views, they can lead to disregard for the opinions and perspectives of others.

1. Introduction and Literature Review

Decision making under public organization is one of the key challenge. There are number of approaches which are required special attention for making an appropriate decision. The various approaches which plays an important role in the Decision Making are: (i) *Foundational Approach:* Defined as the efficiency of bureaucrat and is measured by the ability to use resources optimally. Woodrow Wilson's [1], explained the theory of 'politico-administrative dichotomy' for administration. Historically, policy making has been considered as prerogative political machinery and its implementation vested with the permanent executive. Frank [2] also emphasized that 'Politics are related with policies or expressions of the State will, while administration with the execution of the policies. (ii) *Structural Approach:* This approach has been initiated by scientific management school to analyze bureaucracy and emphasizes on the methods and principles of management. The basic concept is that for any particular job there will exist a best way to do which has been searched systematic research. Structural approach emphasized on the scientific methods to select workers, to determine worker's jobs and to create understandings between management and workers which

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will help in improving organization efficiency. The legacy of this approach was carried forward by many other key exponents' e.g. Urwick [3], developed principles concerning functions of management and considered the structuring of organization as basic principles for all human organizations. Luther Gullick listed these principles and coined the famous acronym "POSDCORB" abbreviated for, planning, organizing, staffing, directing, coordinating, reporting, and budgeting. In addition to these Urwick [3], laid stress on line and staff principle, span of control, principle of departmentalization and others. (iii) *Behavioral Approach*: The sensitive issues related to the individual and group behavior in an organization are addressed by human relations or behavioral approach. Elton Mayo and a group of researchers during their investigation called Hawthorne experiment worked on human element of work and working conditions at Hawthorne plant of Western Electric Company. They observed that human willingness to work depends upon the social informal relationship between the employees. Important features of this approach are explained by Chester Bernard, Herbert Simon, Maslow, Herxberg and others. Behavioral theorists thought on this intellectual stream of thinking and generated awareness on the decisiveness of human behavior for the decision making process in public administration. Inadequacies of this approach were recognition, various problems related to inefficient administration encountered by developing nations during years 1950s and 1960s, had forced the scholars to think in new directions and to develop /recommend plausible theories for better/improved results.(iv) *Contingency Approach:* This approach came into existence as an offshoot of behavioral theory and emphasized on leadership behavior and the organizational context. Its main focus is that there cannot be fixed prescription for the best way of management. The efficiency of an organization depends upon various parameters namely work environment, resources, leadership and strategies, decision making and timely decisions, technologies, employees and employer relationship, task structure and others. Organizational context is the central idea of this theory which differs from one organization to other organization and therefore, changing organizational environments needs changing style of leadership and decision-making. Here the organization's efficiency will be a function of the changing style of the leadership in accordance with the changing task structure and the relationships of their members. Some of the important theorists of this approach are Fiedler, Hersey & Blanchard, and Vroom & Yetton. For example the Fiedler's model which is the result of interaction between styles of the leader, task structure and leader-member relations. The comparison of the four theories which are highly important for decision making in public organization is shown in Table 1.

Table 1
Comparison of four theories (Anita, 2007)

Theories	Foundational theories	Structural theories	Behavioral theories	Contingency theories
Focus	Total administration	Structural aspect of administration	Human resource administration	Environment of administration
Approach	Analyzes the relationship between politics and administration	Analyzes the principle and process of administration	Analyzes the psychological aspects of individual and group behavior	Analyzes the organization behavior as contingent of organization situation/ context

(v) *Managerial Approach:* This approach is the combination of human behavior and its management who are involved in the progress of an organization. Considering the importance of good governance and use of information technology, administration was of the view to recommend managerial perspective in a substantiate manner. Thus in 1980s the New Public Management approach was introduced to achieve major objectives and to improve the efficiency in administration. Attempt has also been made to refine the existing techniques of management and decision making

for better understanding of all those factors which contributes in the efficiency of an organization. Thus decision making is an important part and affects the performance of an organization.

In the past, large number of studies have been carried on the decisions making problems. Wang et *al.,* [4] developed fuzzy Analytical Hierarchy Process based decision making approach for the selection of optimum maintenance strategy in an Industrial system. Panchal et *al.,* [5] applied fuzzy AHP- Technique for Order of Preferences by Similarity to Ideal Solution (TOPSIS) approaches based framework for the selection of best maintenance strategy in thermal power plant. Alsattar *et al.,* [6] implemented a novel Multi-Criteria Decision Making (MCDM) approach for handling the sustainable transportation related decision problem. Ali and Pamucar [7] developed a Tomada de Decisão Interativa Multicritério (TODIM) method based model for the selection of optimal solid waste model. Panchal and Kushwaha [8] expounded the application of decision making approaches for optimal maintenance selection in Sugarcane Industry. Yazdani *et al.,* [9] applied decision model for measuring the resiliency in food supply chain of Spain Company. Yazdani *et al.,* [10] developed a decision making model for studying the agricultural supply chain in the context of circular economy. Yazdani *et al.,* [11] found the best location for logistics centers in the Spanish autonomous communities with the implementation of integrated decision model. Biswas *et al.,* [12] developed a novel Preference Ranking-based on Similarity to Ideal Average Solutions (PRASIAS) method for comparing the organizational performance under disruption. Lian and Wang [13] applied MCDM approach for the personnel suitability selection. Liu *et al.,* [14] implemented decision-making trial and evaluation laboratory (DEMATEL) approach based integrated model for the decision making in tourism industry. Panchal *et al.,* [15] developed a MCDM approach based framework for identifying the best maintenance strategy in a Urea Industry. Panchal *et al.,* [16] developed a decision support system for studying the reliability and risk issues of an industrial system.

From the reviewed literature it has been reported that study of decision making problem has not been yet reported by any other researcher considering the public organization domain. Considering this as a base the study has been carried.

2. Methodology

The methodology used for decision making in the public organization is as follows:

2.1 Grid Analysis

Grid Analysis [17] is also known as Decision Matrix Analysis, Pugh Matrix Analysis or MAUT (Multi-Attribute Utility Theory), is a useful technique for making a decision. It is a powerful technique generally used for the situations where numbers of good alternatives are available to choose from, and numbers of factors are to be taken into account.

Steps of Grid Analysis:

The table consists of options in rows and factors in columns. To find the result score each option/factor combination, weight this score, and add these scores up to give an overall score for the option. Steps are given below:

i. List all the options, label them as row on the table and list all the needed/considered factors, label them as column headings.
ii. Work out the relative importance of each factor in decision by observing on 0-5 scale (0 means not important, while 5 means most important in the final decision (factors with the same importance are acceptable). In the decision making process they are used to weight individual preferences by the importance of the factor. These values are known or available or well oblivious but if not then to estimate some good technique like Paired Comparison Analysis is used.

iii. Weigh down each columns of the table; score each option for each of the factors in decision on 0 (poor) to 5 (very good) scales. If for some particular factor(s) same score has to give means none of them is important for a particular considered factor in the decision, and all options will be scored 0.
iv. In the last multiply each score from step 3 by the values for relative importance (calculated in step 2) and get the weighted scores for each option/factor combination.
v. Add all these weighted scores for each option and select an option which scores highest.

2.2 PMI (Plus/Minus/Interesting)

Grid Analysis based decision making tool is one of the powerful tool known for accurate decision making tool. It is considered as an improvement to 'weigh pros and cons' of techniques used for centuries. The procedural steps of the considered Decision Making tool are [18]: (i) In the column underneath 'Plus', write down all the positive results of taking the action while underneath 'Minus' note down all the negative effects. (ii) The 'Interesting' column will consist of implications and possible outcomes of taking the action, positive (negative, or uncertain). (iii) The implementation of the decision will be known by individual except the points which are noted but not considered (by allotting appropriate positive or negative score) otherwise the assigned score will too subjective. (iv) Take the algebraic some of all the scores and recommend accordingly (strongly positive score means action be taken, while strongly negative score will be used to avoid).

2.3 Decision Tree Analysis

Decision Trees are useful tools to help in selecting between several courses of actions. These provide a highly effective structure within which options can be explored, and possible outcomes of choosing those options can be investigated. The technique also help to form a balanced picture of the risks and rewards associated with each possible course of action. These are useful for choosing between different strategies, projects or investment opportunities, particularly when resources are limited to make process clear [19]. Steps of an explicit example are given below.

i. Start a Decision Tree with a decision that we need to make. This can be represented by a drawing a small square on the left hand side of a large piece of paper, and moving half way down on the page.
vi. For each possible solution draw lines from the box towards the right, with a short description of the solution along the line. To expand the thoughts lines are kept apart as far as possible.
vii. At the end of each line the results are considered. If the results are uncertain, draw a small circle and if the result indicates a change in decision then to make it, draw another square (squares represent decisions, and circles represent uncertain outcomes). To understand write decision or factor above the square or circle. Continue this process till the solution is completed and at the end of the line leave it blank.
viii. On the diagram start from the new decision squares and draw out lines representing the options that we could select. Lines drawn from these circles represent possible outcomes. To know the meaning a brief note on the line has been given. Continue this process till all possible outcomes is drawn and decisions one can imagine from the original decisions. To explain an example has been taken from the above site.

3. Analysis based results

To evaluate the decision tree one should analyze which option will have greatest worth to us. To start with assign cash value or score to each possible outcome, make best assessment of how much

one can think and would be worth if that would be an outcome come. Then target each circle (representing an uncertainty point) and estimate the probability of each outcome. At each circle the total must be 100% or 1 when represented in percentages or fractions respectively. If the data are based on past events then make rigorous estimates of the probabilities to assign values otherwise write down best guess. The decision Tree for taking decision for development of new product and consolidated one is shown in Figure 1.

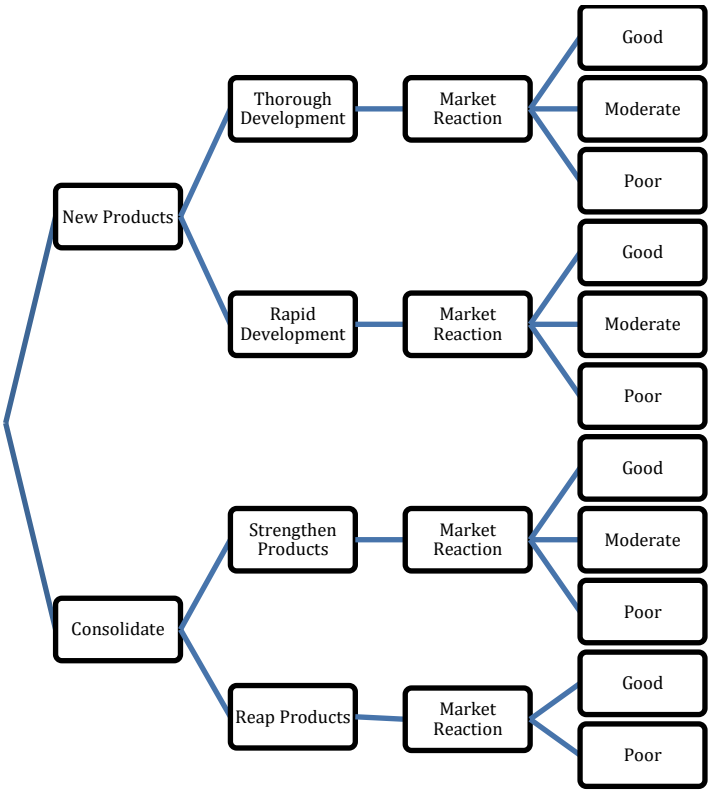

Fig. 1. Example Decision Tree: Should we develop a new product or consolidate? [19]

3.1 Calculating Tree Values

Once the value of the outcomes has been worked out and the probability of the outcomes uncertainty has been assessed then start calculating the values which will help to make individual decision. Start with the right hand side of the decision tree, and move back towards the left. When a set of calculations on a node is completed (decision square or uncertainty circle) record the result. All other calculations leading to that result are then ignored. Value of Uncertain Outcome Nodes can be calculated (circles on the diagram) by multiplying the value of the outcomes by their probability. For a node of the tree the final value will be the total of these values. The considered example is shown below and the table below gives the value (Decision Making, [19]) for 'new product, thorough development as shown in Table 2.

Table 2
Developed values for the new products

0.4 (probability good outcome)	$1,000,000 (value)	$400,000
0.4 (probability moderate outcome)	$50,000 (value)	$20,000
0.2 (probability poor outcome)	$2,000 (value)	$400
		$420,400(+)

The values for the linguistic terms for the decision tree extended under new product and consolidated are shown in Figure 2.

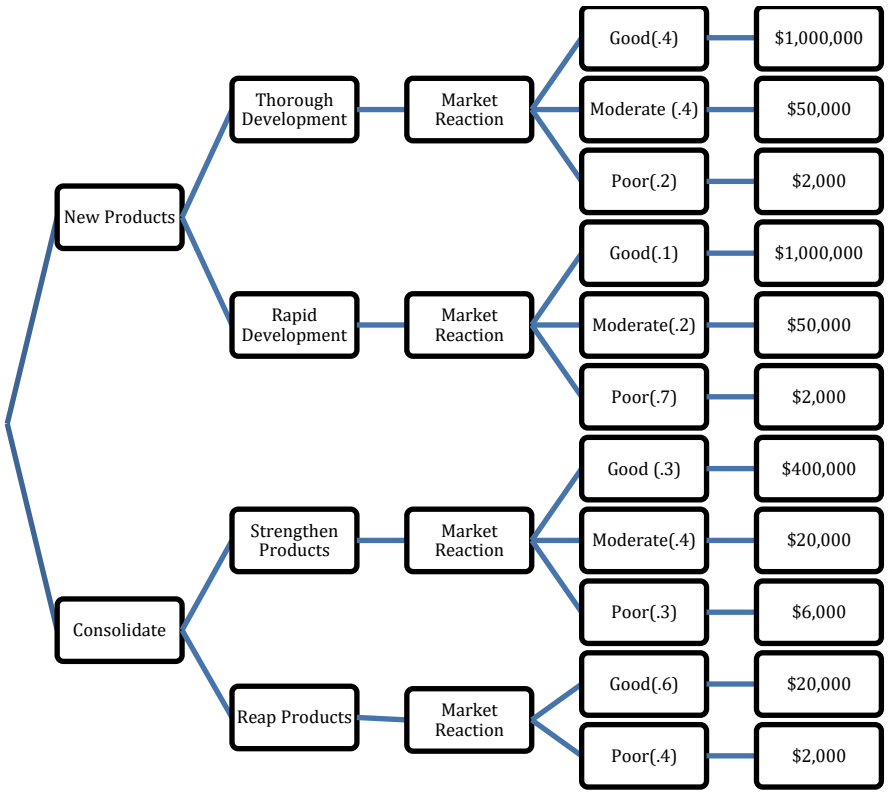

Fig. 2. Example Decision Tree: Should we develop a new product or consolidate? [19]

3.2 Calculating Decision Nodes Values, Decision making

To evaluate a decision node: (i) Write down the cost of each option along each decision line (ii) subtract the cost from the outcome value that has been already calculated. The resulting value will represents the benefit of that decision. Here, the amount already spent has not been counted for this analysis (called sunk costs) despite the emotional cost is not factored into the decision. Once these decision benefits have calculated, choose the option having largest benefit, take that as the decision made and this is the value of that decision node. Figure 3 below shows the calculation of decision nodes of considered example. Here the benefit calculated previously for 'new product, thorough development' is $420,400. The future cost of this approach has been estimated as $150,000 which gives a net benefit of $270,400. The net benefit of 'new product, rapid development' is $31,400 (Decision Making, [19]).

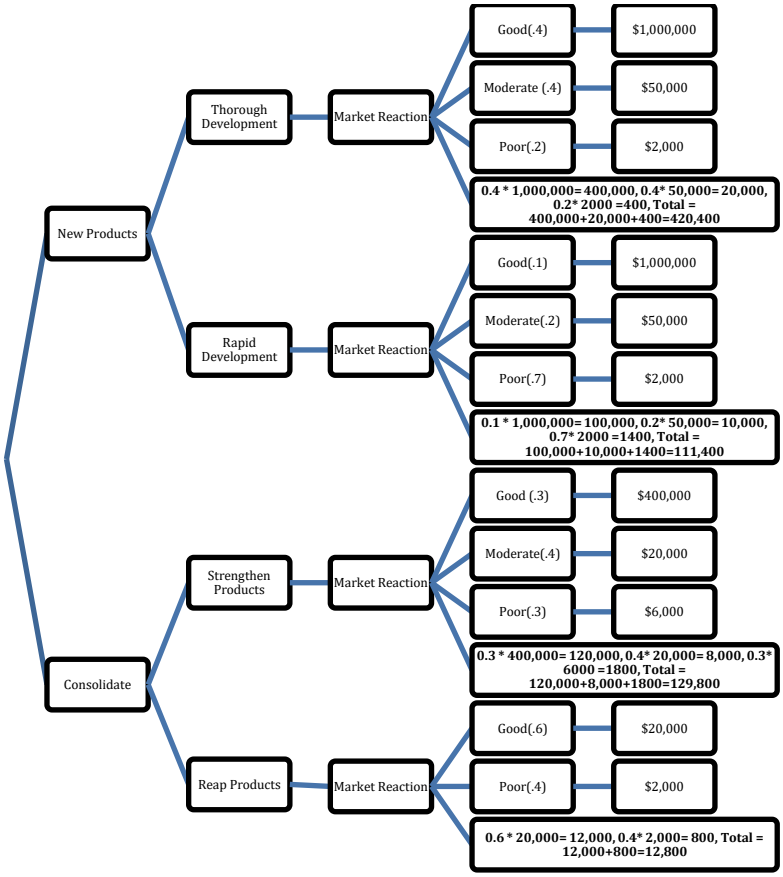

Fig. 3. Example Decision Tree: Should we develop a new product or consolidate? [19]

Through this section choose the most valuable option, 'new product, thorough development', and allocate this value to the decision node as shown in Figure 4.

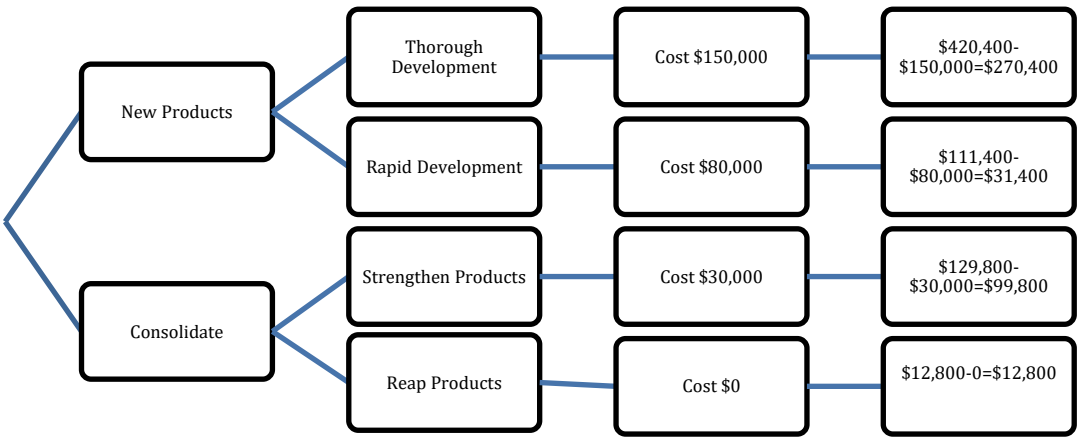

Fig. 4. Example Decision Tree: Should we develop a new product or consolidate? [19]

3.3 Cash Flow forecasting, Decision making

Cash Flow forecasts technique is used to build a model how the cash has to move within a project or an organization [20]. It helps to predict whether the sales or income will cover the costs of operation and to analyze whether a project will be sufficiently profitable to justify the effort put into

it. Personal finances analysis is also done by using this technique particularly when individual has to make difficult financial decisions. Normally structure Cash Flow Forecasts is prepared in a standard way (steps are given below). A system diagram will show the relationships between factors and one can quantify the relationships, and based on them build a model. The structure of the model will depend upon the system being modeled.

Cash Flow Forecast has been structured through a table. On the table columns are for each period (normally a month) within the forecast and individual cash movements (such as sales of a product, sales costs, and particular expenses) is shown in rows. To forecast this table is created in three stages (Referring to the example):

i. Set up column heading: Decide the period of time over which we want to run your forecast, and the length of the periods within it. Generally, the forecast will run over one/two years, with the periods as months. One column titled as 'Cash Movement' put the periods of the forecast as the next column headings. Thus column headings are generated, for example, Cash Movement, January, February, March, and April etc.

ix. Set up Row Titles: three main groups of rows organization are:

x. (a) Income: Income expected during the period, a separate row for each source of income. For examples Sales of a product, Sales of BCD service, Investment incomes etc, where costs of operation are directly dependent on the amount sold and write a subtotal at the bottom of the group.

xi. (b) Outgoings: These rows show all costs which are itemized by the type of cost. For examples Staff salaries, Payroll taxes, Stationery, Telephones etc. Set up a subtotal at the bottom of this group also.

xii. (c) Totals: The next row shows the total of the income rows minus the total of the out-going rows for the month. This shows profit or loss for the month. Below this, a running total is given which add profit or loss for the period to the previous running total. This will show the financial position at the end of the period.

xiii. Estimate values: now a table marked with column headings and row titles is available. To fill the values of the cells on the table first fill in the column and then adjust values in the other columns appropriately. During entering the projections for the sales in new business, it is considered that sale will not be much until our customers mentioned that he has observed our business several times (often 6 or 7 times). The sales estimates will be much more reliable when they are based either on previous years' revenues, on trial marketing, or on good quality market research. In the situation where large sums are involved (for example transactions in the financial market), project evaluation is a complex and sophisticated art, and need to use more formal techniques.

3.4 Cost/ Benefit Analysis, Decision making

Cost Benefit Analysis (CBA) [21] is a relatively simple and widely used technique for deciding whether to make a change. In this technique add the value of the benefits of a course of action and subtract the costs associated with it. Costs considered may be either one-off, or ongoing. Benefits are those which are most often received over time (time taken for the benefits of a change to repay its costs). This effect of time is taken into analysis by calculating a payback period. It is noted that many companies look for payback on projects over a specified period of time e.g. three years or five years.

In the simple form, it is carried out using only financial costs and financial benefits. Various questions the people have to answer, and have to defend are there. For example what may be the

value of stress-free travel to work in the morning? While for financial market the situation is different and project evaluation is done using other techniques.

3.5 Stepladder Technique, Decision making

Stepladder Technique, Decision making technique [22], developed by Steven Rogelberg, Janet Barnes-Farrell and Charles Lowe in 1992 is used to make decisions within a group that can often be challenging. The technique encourages all members to contribute on an individual level before being influenced by anyone else.

The Stepladder Technique has been explained through five basic steps.

i. Before the formation of a group, present the task/ problem to all members and give each one sufficient time to think, and needs to be done. So that each can build their own opinions on how to best accomplish the task or solve the problem.
ii. Form a core group of two members and give them time to discuss the problem.
iii. Include one member of the third group into the core group. This member will put his ideas to the existing members BEFORE hearing already discussed their ideas. Then all three members will conclude for their solutions and ideas (when discussed their options together).
iv. Repeat this process by adding 4th, 5^{th} and so on members to the group. Give sufficient time for discussion after each member.
v. Reach a final decision only when all members have been included and have put their ideas.

5. Conclusions

Decision making is a process of logical and quantitative analysis of all influencing factors, it assist the decision maker in analyzing problems with several course of action and consequences. A decision having sound solution to the problem, based upon maximum inputs, as unbiased as possible and well addressed by each team member will give best result. In a public organization decision are taken either by authorization or by a group. The application of the Decision Making tool in the public organization results in optimal identification of decision to be made along with the goals to be achieved, get the facts, develop alternatives, rate each alternative, rate the risk of each alternative and making of the decision. It gives in optimal decision regarding the consolidation of the product or development of the new product as per the cash flow in the market. It provides an estimate about the correct amount of cash flow required for the product.

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Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Wilson, W. (1941). The study of administration. Political Science Quarterly, 56(4), 481–506.
[2] Goodnow, F. J. (2017). Politics and administration: A study in government. Routledge.
[3] Urwick, L. F. (1943). The elements of administration. Harper.
[4] Panchal, D., & Kumar, D. (2017). Maintenance decision-making for power generating unit in thermal power plant using combined fuzzy AHP-TOPSIS approach. International Journal of Operational Research, 29(2), 248–272. https://doi.org/10.1504/IJOR.2017.083958
[5] Wang, L., Chu, J., & Wu, J. (2007). Selection of optimum maintenance strategies based on a fuzzy analytic hierarchy process. International Journal of Production Economics, 107(1), 151–163. https://doi.org/10.1016/j.ijpe.2006.08.005

[6] Alsattar, H. A., Qahtan, S., Mourad, N., Zaidan, A. A., Deveci, M., Pamucar, D., Antucheviene, J., & Ding, W. (2025). A decision modeling approach for the development of sustainable transportation oil companies. Engineering Applications of Artificial Intelligence, 150, 110623. https://doi.org/10.1016/j.engappai.2025.110623
[7] Ali, J., & Pamucar, D. (2025). Normal wiggly probabilistic hesitant fuzzy-based TODIM approach for optimal solid waste disposal method selection. Heliyon, 11(2), e41908. https://doi.org/10.1016/j.heliyon.2025.e41908
[8] Panchal, D., & Kushwaha, D. K. (2025). Intuitionistic fuzzy approaches-based structured framework for optimal maintenance policy decision in sugar mill. Journal of Quality in Maintenance Engineering, 31(1), 196–222. https://doi.org/10.1108/JQME-07-2024-0065
[9] Yazdani, M., Torkayesh, A. E., Chatterjee, P., Fallahpour, A., Montero-Simo, M. J., Araque-Padilla, R. A., & Wong, K. Y. (2022). A fuzzy group decision-making model to measure resiliency in a food supply chain: A case study in Spain. Socio-Economic Planning Sciences, 82, 101257. https://doi.org/10.1016/j.seps.2022.101257
[10] Yazdani, M., Gonzalez, E. D., & Chatterjee, P. (2021). A multi-criteria decision-making framework for agriculture supply chain risk management under a circular economy context. Management Decision, 59(8), 1801–1826. https://doi.org/10.1108/MD-10-2018-1088
[11] Yazdani, M., Chatterjee, P., Pamucar, D., & Chakraborty, S. (2020). Development of an integrated decision making model for location selection of logistics centers in the Spanish autonomous communities. Expert Systems with Applications, 148, 113208. https://doi.org/10.1016/j.eswa.2020.113208
[12] Biswas, S., Chatterjee, P., & Zavadskas, E. K. (2025). PRASIAS: A new preference ranking model for comparing organizational performance under disruption. International Journal of Information Technology & Decision Making. Advance online publication. https://doi.org/10.1142/S0219622025500208
[13] Liang, G. S., & Wang, M. J. J. (1994). Personnel selection using fuzzy MCDM algorithm. European Journal of Operational Research, 78(1), 22–33. https://doi.org/10.1016/0377-2217(94)90119-8
[14] Liu, C. H., Tzeng, G. H., & Lee, M. H. (2012). Improving tourism policy implementation—The use of hybrid MCDM models. Tourism Management, 33(2), 413–426. https://doi.org/10.1016/j.tourman.2011.05.002
[15] Panchal, D., Chatterjee, P., Shukla, R. K., Choudhury, T., & Tamošaitienė, J. (2017). Integrated fuzzy AHP-CODAS framework for maintenance decision in urea fertilizer industry. Economic Computation and Economic Cybernetics Studies and Research, 51(3), 179-196.
[16] Panchal, D., Singh, A. K., Chatterjee, P., Zavadskas, E. K., & Keshavarz-Ghorabaee, M. (2019). A new fuzzy methodology-based structured framework for RAM and risk analysis. Applied Soft Computing, 74, 242–254. https://doi.org/10.1016/j.asoc.2018.10.033
[17] Mind Tools. (n.d.). Grid analysis. Retrieved November 9, 2024, from http://www.mindtools.com/pages/article/newTED_03.htm
[18] Mind Tools. (n.d.). PMI (Plus, Minus, Interesting). Retrieved November 9, 2024, from http://www.mindtools.com/pages/article/newTED_05.htm
[19] Mind Tools. (n.d.). Decision tree analysis. Retrieved November 9, 2024, from http://www.mindtools.com/dectree.html
[20] Mind Tools. (n.d.). Cash flow forecasting. Retrieved November 9, 2024, from http://www.mindtools.com/pages/article/newTMC_06.htm
[21] Mind Tools. (n.d.). Cost benefit analysis. Retrieved November 9, 2024, from http://www.mindtools.com/pages/article/newTED_08.htm
[22] Mind Tools. (n.d.). Stepladder technique. Retrieved November 9, 2024, from http://www.mindtools.com/pages/article/newTED_89.htm