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Structuring prospective scenarios for project portfolio selection in a junior consulting company

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Abstract

It is known that the corporate world is highly volatile and susceptible to transformations. Therefore, managers are expected to have increasingly rich and timely information and data to make decisions. However, what happens is that usually, managers consider only the situation or scenario in which the decision is made. In this sense, the present study seeks to structure three future scenarios to help managers of a Junior Enterprise (JE) to compose its portfolio of projects. The Momentum method was used to prospect scenarios in the JE in question so that the results help it in the challenge of effectively dealing with the uncertainties about the coming years. From the data collected, three possible future scenarios were created, which can support the problem of project portfolio selection and help the company's decision-makers to prepare for the worst scenario and maximize the use of the best of the structured scenarios.

Keywords: Scenario Prospecting, Project Portfolio Selection, Junior Enterprise.

1. Introduction

A company's resources (people, time, money, equipment, etc.) are never infinite. Thus, a constant and continuous challenge is to decide which projects should be prioritized in terms of receiving critical resources to ensure the productivity and profitability of the organization [1].

In the financial market environment, it is imperative that investors properly manage their stock portfolio to maximize their return [2, 3]. In the corporate world, the logic is the same for project-driven companies: you need to select and manage your portfolio in the right way to optimize your results.

In this sense, a very latent problem in organizations is how to select the projects to compose a portfolio. Envisioning this context of multiple alternatives and possible criteria, added to complex scenarios, the Multi-

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Criteria Decision Analysis (MCDA) is shown as a favorable methodology to support the decision-making process [4–6].

The problem of project portfolio selection involves choosing, among several possible alternatives, a set of projects that maximize a company's return. However, when it comes to a super volatile environment and susceptible to change, as is the corporate world in the twenty-first century, the task of selecting an optimal project portfolio becomes increasingly complex because of the uncertainties present in the daily life of companies [7, 8].

Thus, the present study takes advantage of the Momentum method for prospecting scenarios of a Junior Enterprise (JE) of engineering consulting and business management in an attempt to support managers in the process of project portfolio selection. [9, 10] observe that decision models based on multicriteria methods usually consider only the situation or scenario in which the decision is made. Thus, it is expected that using the present study, managers and decision-makers of the company compensate for the errors of unpredictability and overprediction in the decision-making of the optimal portfolio, taking into account the specific characteristics of each scenario formulated [11].

2. Theoretical Basis

Tenório [12] defines scenarios as a means of discussing and learning about the main decisions and priorities of an organization, from various segments. Almeida et al., [13] contributed to Brazilian oil and gas companies, and Jardins et al., (2022) [14] to highway concessionaires, both when developing prospective scenario studies.

The Momentum method - a Unified Method of Prospective Strategic Planning - proposed by Costa [15, 16] (2013), is a model that seeks to associate the various techniques of scenario planning, inserting the vision of prospective scenarios in the methods of multicriteria decision aid. According to Almeida et al. [17], the Momentum method proposes a hybrid approach, seeking to unify the concepts presented in various methods of prospecting consecrated scenarios present in the literature.

3. Methodology

This work can be classified as being of an applied nature because it seeks to generate new knowledge through the practical application of the Momentum method. As for the research procedure, the work is characterized by a case study, using multiple data sources and having as a unit of analysis the junior company X, focusing on scenario planning [18, 19].

The case study will consist of the elaboration of three distinct prospective scenarios, one optimistic, one pessimistic, and one trending, from the Momentum method for the junior company in question. The main steps for structuring prospective scenarios are System overview; Mapping of relevant actors; Identification of variables; SWOT analysis; Elucidation of uncertainties; Selection of relevant variables; Definition of key indicators; Definition of scenarios [20, 21].

4. Case Study

4.1 System Overview

Junior Enterprise Movement (JEM) originated in France in 60’s and the Company X, founded in 90’s, is the biggest Junior Enterprise of Engineering and Business Management of the Fluminense Federal University (UFF), and top 3 of Rio de Janeiro. It was founded by a group of students to put into practice the theory learned in the classroom. Its main objectives are the learning of its members, the approximation of these with the labor market, and the promotion of the development of companies and society. The organizational structure of company X is composed of five cells, which are like departments of the company, they are Administrative-Financial, People Management, Marketing, Presidency, and Projects [22–24].

4.2 Mapping of Relevant Actors

According to Rocha, Moreira and Santos [25, 26], relevant actors can be defined as organizations or entities that can significantly influence a given system or field of action. Table 1 summarizes the relevant actors identified in the study and their roles in the system.

Table 1. Relevant actors and their roles in the system

Relevant Actors	System Function
Customers	They are the ones who actually make the company exist, hiring the consultants offered in the project letter
Members	They are those who actually work for the company, executing and managing the consulting projects
Former members	People, graduates or not, who have been part of the company's membership at some point in their academic life
Family of former members	They encourage entrepreneurship, publicize the company to society and provide support in strategic events
Improvers	Students enrolled in UFF undergraduate courses that execute projects when members are overallocated
Brazil Junior	Represent and empower the Brazilian JEM, training entrepreneurs capable of transforming the country
Rio Junior	Represent and develop the JEM of Rio de Janeiro, forming leaders capable of leading changes in the state of Rio de Janeiro
Guidance counselors	Professors and professionals in the area of operation of the company who give all the technical support for the consultancies performed
Trainees	Students enrolled in UFF undergraduate courses who have been approved in the Meta selection process and are about to become members
UFF	It provides the physical structure, gives all the support to the company and its members through its faculty and servers
Partners	Promote training, lectures, events, technical visits and any other form of knowledge transmission

4.3 System SWOT Analysis

Through the use of a SWOT matrix, it was possible to further explore the internal and external aspects of the studied company, raising its strengths and weaknesses, as well as the existing opportunities and threats [27]. The SWOT analysis is described in Table 2.

Table 2. SWOT analysis of the system

Forces	Weaknesses
Qualified and diverse membership (five different engineering)	Lack of a decision-making support tool for managers
Provides state-of-the-art equipment for its members to work with	Some solutions contribute little to the learning and development of members
Opportunities	**Threats**
Symposia and Congresses of an academic nature for the dissemination of the company and networking for the members	More technologically structured competing junior enterprises
Leverage the growth trends of the big data and analytics industry	Disinterest of students in the JEM, opting for internships earlier and earlier in the academic journey

4.4 Selection of relevant variables

The number of variables raised from the uncertainties was relatively high, therefore, to proceed with the construction of the scenarios, it is necessary to find the most relevant variables. To measure the relationship between the variables and their respective degree of impact, a scale with a gradation of values was established. The comparison was performed pairwise and the scale presented in Table 3 was used.

Table 3. Degrees of impact between variables

Classification	Degree
Very negative impact	-7
Negative impact	-5
Average negative impact	-3
Little negative impact	-1
No impact	0
Little positive impact	1
Average positive impact	3
Positive impact	5
Very positive impact	7

Next, the variables were analyzed in the light of their respective degrees of impact and dependence through the Cross-Impact Matrix tool. The score of the Cross-Impact Matrix counted on the contribution of the consensus of three members of the junior company, who due to the maintenance of secrecy, will not have their names revealed in the present study.

After the analysis of crossed impacts, the map of dispersion of variables (figure 1) was configured, aiming at the understanding and identification of the most relevant variables for the theme according to their respective quadrants (delimited by the blue line with the mean values of impact and dependence). The axis of the abscissas corresponds to the impact and of the ordered ones corresponds to the dependence.

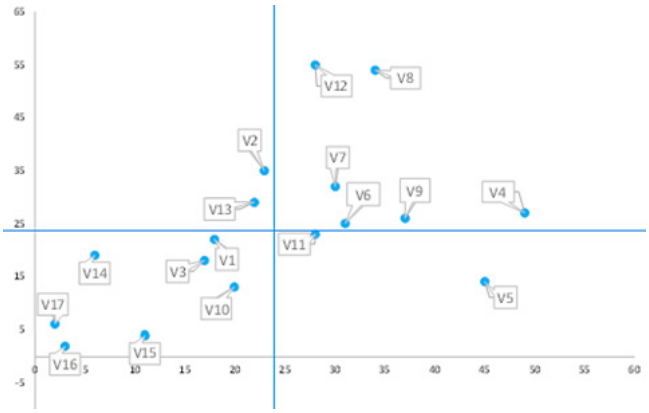

Fig. 1. Dispersion map of the variables.

It is noteworthy that variables 4, 6, 7, 8, 9, and 12 were in the upper right quadrant of the dispersion map and represent those that significantly impact the environment in which the junior company in question is inserted. Therefore, they were prominent variables for the elaboration of the scenarios. On the other hand, variables 1, 3, 10, 14, 15, 16, and 17 were excluded and will not be considered for Morphological Analysis, since they are in the lower left quadrant, which does not impact or is impacted and, therefore, will not be considered.

4.5 Definition of Key Indicators

In an analysis of the characteristics of the quantitative variables suitable for the correlation study, the quantitative variables with the availability of historical data were selected, for the relevant quantitative variables of the study, such as IPCA, SELIC Rate, and Unemployment Rate, data from the Brazilian Central Bank and the Continuous National Household Sample Survey conducted by the Brazilian Institute of Geography and Statistics were consulted.

Table 4. Historical data of the selected quantitative variables

Year	SELIC (%)	IPCA (%)	GDP (trillion R$)	JE Billing (R$)	Executed projects	Unemployment rate (%)	Average household income (R$)	Active members	Budget of the Brazilian Ministry of Economy (MEC) (billion R$)
2017	6.90	2.95	1.3	90000	27	11.9	1445.00	67	126.22
2018	6.40	3.75	1.8	135000	30	11.7	1498.00	75	120.22
2019	4.40	4.31	1.2	185000	34	11.1	1520.00	82	119.77
2020	1.90	4.52	-3.9	300000	46	14.2	1454.00	100	114.25
2021	9.15	10.06	4.6	385000	55	11.1	1353.00	120	90.29

To further expand the degree of understanding of the relationships maintained between the variables and thus increase the robustness of the analysis, Pearson's Correlation was used. Through the input of the data presented in Table 4 and the application of Pearson's Correlation through the MS Excel software, the correlation matrix was performed, as shown in Table 5. Each value in the table represents the correlation between the row variable and the column variable.

Table 5. Pearson correlation matrix between quantitative variables

	SELIC	IPCA	GDP	JE billing	Executed projects	Unemployment rate	Average household income	Active members	MEC budget
SELIC	-	0.5431	0.9429	0.0719	0.1130	-0.7580	-0.5880	0.1636	-0.4653
IPCA	0.5431	-	0.5414	0.8691	0.8812	-0.3043	-0.8144	0.9102	-0.9914
PIB	0.9429	0.5414	-	0.0590	0.0796	-0.9196	-0.4020	0.1473	-0.4466
JE billing	0.0719	0.8691	0.0590	-	0.9974	0.1568	-0.6892	0.9957	-0.9137
Executed projects	0.1130	0.8812	0.0796	0.9974	-	0.1560	-0.7378	0.9965	-0.9245
Unemployment rate	-0.7580	-0.3043	-0.9196	0.1568	0.1560	-	0.0582	0.0826	0.1898
Average household income	-0.5880	-0.8144	-0.4020	-0.6892	-0.7378	0.0582	-	-0.7322	0.8157
Active members	0.1636	0.9102	0.1473	0.9957	0.9965	0.0826	-0.7322	-	-0.9474
MEC budget	-0.4653	-0.9914	-0.4466	-0.9137	-0.9245	0.1898	0.8157	-0.9474	-

The correlation analysis between the variables was based on the reasoning that for significant and positive correlations, the higher the value, the greater its stimulus of increase. Given the results having presented high degrees of significance, all quantitative variables were considered and maintained in the construction of the prospective scenarios, with emphasis on the greater positive correlation for the relationship maintained between the number of projects executed and the billing of the JE with 0.9974 and for the greater negative correlation in the relationship maintained between the MEC Budget and the Number of projects executed by the JE.

4.6 Prospective Scenarios Project

The configuration of the three possible scenarios for JE took place through the existing concepts in the morphological analysis [28], thus formulating the trajectories to be analyzed, as established in the configuration of the key indicators.

Based on the analyses, three possible scenarios (pessimistic, optimistic, and trendy) were elaborated through the understanding of the system and the configurations of the data presented in Table 4. For the construction of the pessimistic and optimistic scenarios, the maximum and minimum values of the quantitative variables in Table 4 were analyzed, and the trend scenario used the projections for the variables of the Brazilian economy prepared by the Economic Analysis Report of Banco Santander [29].

The "Bonanza" trend scenario was composed with the help of projections and analyses for the main variables of the Brazilian economy contained in the Santander Brasil Economic Analysis [30]. The trend is that by 2024, GDP will grow by 0.7%, due to the consolidation of the reopening of the service sector, thanks to advances in the health field, via vaccination of the majority of the population, by expanding the real wage bill, by reducing the unemployment rate with the recovery of employment. However, despite GDP growth, an extremely high annual SELIC rate is expected (forecast of 10.5% by the end of 2023) and also high inflation, with the IPCA index at 5.3% per year in 2023. In general, in the trend scenario, a positive performance of some key indicators is expected, but on the other hand, the balance is balanced with the poor performance of other indicators. This fact leads to a slow and gradual recovery of the economy, where the ecosystem for the entrepreneur and the JEM is gradually warming up and maintaining for the next few years the results of billing and the number of members of the JE since the demand for projects will take longer to grow.

For the optimistic scenario, "Project Storm" the internal and external environment of the system presents extremely favorable conditions for the growth of JE. In this scenario, the economic variables are opportune for an increase in market demand for consulting projects, thus increasing JE's revenue. In "Project Storm", the economy is heated, new ventures are emerging, and existing ones are expanding, a fact that combined with the low cost of access to credit (provided by a lower SELIC rate) drives entrepreneurs to seek intelligent solutions for their business. In this scenario, micro, small, and medium businesses will start to look less at cutting expenses and saving costs and will value a specialized external view, which is the case of consulting. With the growing demand for projects, the number of members will also grow, as will the resources available to invest in innovative solutions. With the economy doing well, young students will not need to work to help with household bills, which will increase interest and increasingly anticipated demand for the Junior Enterprise Movement.

For the pessimistic scenario "Project Shortage", the political and economic scenario of the country is unfavorable and insufficient to promote actions necessary for the resumption of economic growth, thus sinking into the uncertainties of an economic crisis, which is derogatory for the entrepreneurial ecosystem, especially for micro, small and medium enterprises that correspond to the majority of JE's clients. In this scenario, the high IPCA will reflect a high cost of living and a low purchasing power of the population. With the population buying less and less, companies sell less and less, leading them to opt for more restrictive policies, opting for cost reduction. One of the reflections of cost reduction in companies is the increase in the unemployment rate, where many people have become unemployed. The government needs to intervene, directing resources to treat the economic health of the country and the tendency is that the budget directed to education decreases because the Constitutional Amendment 95 prevents public spending from growing more than inflation [31]. All this context will reduce the demand for JE projects, reducing the billing and consequently the training of its members, who given the socioeconomic context, will often have to look for a job to help with household bills.

5. Conclusion

From this study, it was possible to bring greater knowledge to company X about which variables that can most impact the problem of project portfolio selection, because the approach by the Momentum method allowed the structuring and analysis of the variables and uncertainties observed in the construction of the prospective scenarios.

The study based on the data collected allowed the creation of three possible future scenarios, which may support the creation of portfolios adapted to these scenarios, helping JE decision-makers to prepare for the worst-case scenario and maximize the use of the best-case scenario. In addition, the methodology applied here can be a proposal for strategic-prospective planning for JE.

References

1. Jafarzadeh, H., Akbari, P., Abedin, B.: A methodology for project portfolio selection under criteria prioritisation, uncertainty and projects interdependency–combination of fuzzy QFD and DEA. Expert Syst Appl. 110, 237–249 (2018)
2. de Araújo Costa, I.P., Moreira, M.Â.L., de Araújo Costa, A.P., de Souza de Barros Teixeira, L.F.H., Gomes, C.F.S., Santos, M. Dos: Strategic Study for Managing the Portfolio of IT Courses Offered by a Corporate Training Company: An Approach in the Light of the ELECTRE-MOr Multicriteria Hybrid Method. Int J Inf Technol Decis Mak. 21, 351–379 (2022). https://doi.org/10.1142/S0219622021500565
3. Barbosa de Paula, N.O., de Araújo Costa, I.P., Drumond, P., Lellis Moreira, M.Â., Simões Gomes, C.F., dos Santos, M., do Nascimento Maêda, S.M.: Strategic support for the distribution of vaccines against Covid-19 to Brazilian remote areas: A multicriteria approach in the light of the ELECTRE-MOr method. Procedia Comput Sci. 199, 40–47 (2022). https://doi.org/10.1016/j.procs.2022.01.006
4. Costa, I.P. de A., Costa, A.P. de A., Sanseverino, A.M., Gomes, C.F.S., Santos, M. dos: BIBLIOMETRIC STUDIES ON MULTI-CRITERIA DECISION ANALYSIS (MCDA) METHODS APPLIED IN MILITARY PROBLEMS. Pesquisa Operacional. 42, (2022). https://doi.org/10.1590/0101-7438.2022.042.00249414
5. Maêda, S.M. do N., Costa, I.P. de A., Castro Junior, M.A.P. de, Fávero, L.P., Costa, A.P. de A., Corriça, J.V. de P., Gomes, C.F.S., Santos, M. dos: Multi-criteria analysis applied to aircraft selection by Brazilian Navy. Production. 31, (2021). https://doi.org/10.1590/0103-6513.20210011
6. do Nascimento Maêda, S.M., de Arajo Costa, I.P., Simões Gomes, C.F., dos Santos, M., da Mota, I.S., de Barros Teixeira, L.F.H. de S.: Economic and edaphoclimatic evaluation of Brazilian regions for African mahogany planting - an approach using the SAPEVO-M-NC ordinal method. Procedia Comput Sci. 199, 323–330 (2022). https://doi.org/10.1016/j.procs.2022.01.196
7. Santos, N., Rocha Junior, C. de S., Moreira, M.Â.L., Santos, M., Gomes, C.F.S., Costa, I.P. de A.: Strategy Analysis for project portfolio evaluation in a technology consulting company by the hybrid method THOR. Procedia Comput Sci. 199, 134–141 (2022). https://doi.org/10.1016/j.procs.2022.01.017
8. de Assis, G.S., dos Santos, M., Basilio, M.P.: Use of the WASPAS Method to Select Suitable Helicopters for Aerial Activity Carried Out by the Military Police of the State of Rio de Janeiro. Axioms. 12, 77 (2023). https://doi.org/10.3390/axioms12010077
9. dos Santos, F.B., dos Santos, M.: Choice of armored vehicles on wheels for the Brazilian Marine Corps using PrOPPAGA. Procedia Comput Sci. 199, 301–308 (2022). https://doi.org/10.1016/j.procs.2022.01.037
10. Jardim, R.R.J., Santos, M., Neto, E., da Silva, E., de Barros, F.: Integration of the waterfall model with ISO/IEC/IEEE 29148:2018 for the development of military defense system. IEEE Latin America Transactions. 18, 2096–2103 (2020). https://doi.org/10.1109/TLA.2020.9400437
11. Drumond, P., de Araújo Costa, I.P., Lellis Moreira, M.Â., dos Santos, M., Simões Gomes, C.F., do Nascimento Maêda, S.M.: Strategy study to prioritize marketing criteria: an approach in the light of the DEMATEL method. Procedia Comput Sci. 199, 448–455 (2022). https://doi.org/10.1016/j.procs.2022.01.054
12. Tenório, F.M., dos Santos, M., Gomes, C.F.S., Araujo, J. de C.: Navy Warship Selection and Multicriteria Analysis: The THOR Method Supporting Decision Making. Presented at the (2020)
13. de Almeida, I.D.P., Corriça, J.V. de P., Costa, A.P. de A., Costa, I.P. de A., Maêda, S.M. do N., Gomes, C.F.S., dos Santos, M.: Study of the Location of a Second Fleet for the Brazilian Navy: Structuring and Mathematical Modeling Using SAPEVO-M and VIKOR Methods. Presented at the (2021)
14. Jardim, R., dos Santos, M., Neto, E., Muradas, F.M., Santiago, B., Moreira, M.: Design of a framework of military defense system for governance of geoinformation. Procedia Comput Sci. 199, 174–181 (2022). https://doi.org/10.1016/j.procs.2022.01.022
15. Costa, I.P. de A., Basílio, M.P., Maêda, S.M. do N., Rodrigues, M.V.G., Moreira, M.Â.L., Gomes, C.F.S., dos Santos, M.: Algorithm Selection for Machine Learning Classification: An Application of the MELCHIOR Multicriteria Method. Presented at the October 29 (2021)
16. Oliveira, A.S., Gomes, C.F.S., Clarkson, C.T., Sanseverino, A.M., Barcelos, M.R.S., Costa, I.P.A., Santos, M.: Multiple Criteria Decision Making and Prospective Scenarios Model for Selection of Companies to Be Incubated. Algorithms. 14, 111 (2021). https://doi.org/10.3390/a14040111
17. de Almeida, I.D.P., de Araújo Costa, I.P., de Araújo Costa, A.P., de Pina Corriça, J.V., Lellis Moreira, M.Â., Simões Gomes, C.F.,

dos Santos, M.: A multicriteria decision-making approach to classify military bases for the Brazilian Navy. Procedia Comput Sci. 199, 79–86 (2022). https://doi.org/10.1016/j.procs.2022.01.198
18. Maêda, S.M. do N., Basílio, M.P., Costa, I.P. de A., Moreira, M.Â.L., dos Santos, M., Gomes, C.F.S., de Almeida, I.D.P., Costa, A.P. de A.: Investments in Times of Pandemics: An Approach by the SAPEVO-M-NC Method. Presented at the (2021)
19. de Almeida, I.D.P., Hermogenes, L.R. dos S., Costa, I.P. de A., Moreira, M.Â.L., Gomes, C.F.S., dos Santos, M., Costa, D. de O., Gomes, I.J.A.: Assisting in the choice to fill a vacancy to compose the PROANTAR team: Applying VFT and the CRITIC-GRA-3N methodology. Procedia Comput Sci. 214, 478–486 (2022). https://doi.org/10.1016/j.procs.2022.11.202
20. Costa, I.P. de A., Basílio, M.P., Maêda, S.M. do N., Rodrigues, M.V.G., Moreira, M.Â.L., Gomes, C.F.S., dos Santos, M.: Bibliometric Studies on Multi-Criteria Decision Analysis (MCDA) Applied in Personnel Selection. Presented at the (2021)
21. Santos, M. dos, Costa, I.P. de A., Gomes, C.F.S.: MULTICRITERIA DECISION-MAKING IN THE SELECTION OF WARSHIPS: A NEW APPROACH TO THE AHP METHOD. International Journal of the Analytic Hierarchy Process. 13, (2021). https://doi.org/10.13033/ijahp.v13i1.833
22. Lellis Moreira, M.Â., Simões Gomes, C.F., dos Santos, M., Basilio, M.P., de Araújo Costa, I.P., Souza Rocha Junior, C. de, José Jardim, R.R.-A.: Evaluation of drones for public security: a multicriteria approach by the PROMETHEE-SAPEVO-M1 systematic. Procedia Comput Sci. 199, 125–133 (2022). https://doi.org/10.1016/j.procs.2022.01.016
23. Bremm De Carvalho, E., Ângelo Lellis Moreira, M., Vilarinho Terra, A., Francisco Simões Gomes, C., dos Santos, M.: Proposal of Criteria for Selection of Oil Tank Maintenance Companies at Transpetro Through Multimethodological Approaches. Presented at the (2023)
24. Moreira, M.Â.L., Gomes, C.F.S., dos Santos, M., do Carmo Silva, M., Araujo, J.V.G.A.: PROMETHEE-SAPEVO-M1 a Hybrid Modeling Proposal: Multicriteria Evaluation of Drones for Use in Naval Warfare. Presented at the (2020)
25. Rocha Junior, C. de S., Moreira, M.Â.L., Santos, M.: Selection of interns for startups: an approach based on the AHP-TOPSIS-2N method and the 3DM computational platform. Procedia Comput Sci. 199, 984–991 (2022). https://doi.org/10.1016/j.procs.2022.01.124
26. Pereira, R.C.A., da Silva, O.S., de Mello Bandeira, R.A., dos Santos, M., de Souza Rocha, C., Castillo, C. dos S., Gomes, C.F.S., de Moura Pereira, D.A., Muradas, F.M.: Evaluation of Smart Sensors for Subway Electric Motor Escalators through AHP-Gaussian Method. Sensors. 23, 4131 (2023). https://doi.org/10.3390/s23084131
27. Drumond, P., Basílio, M.P., Costa, I.P. de A., Pereira, D.A. de M., Gomes, C.F.S., dos Santos, M.: Multicriteria Analysis in Additive Manufacturing: An ELECTRE-MOr Based Approach. Presented at the October 29 (2021)
28. do Nascimento MAÊDA, S.M., Basílio, M.P., Pinheiro, I., d de Araújo COSTAa, M.Â., MOREIRA, L., dos SANTOS, M., GOMES, C.F.S.: The SAPEVO-M-NC Method. Modern Management Based on Big Data II and Machine Learning and Intelligent Systems III: Proceedings of MMBD 2021 and MLIS 2021. 341, 89 (2021)
29. Nassim Mellem, P.M., de Araújo Costa, I.P., de Araújo Costa, A.P., Lellis Moreira, M.Â., Simões Gomes, C.F., dos Santos, M., de Pina Corriça, J.V.: Prospective scenarios applied in course portfolio management: An approach in light of the Momentum and ELECTRE-MOr methods. Procedia Comput Sci. 199, 48–55 (2022). https://doi.org/10.1016/j.procs.2022.01.007
30. Santos, M., Quintal, R.S., da Paixão, A.C., Gomes, C.F.S.: Simulation of Operation of an Integrated Information for Emergency Pre-Hospital Care in Rio de Janeiro Municipality. Procedia Comput Sci. 55, 931–938 (2015)
31. Tenorio, F.M., Santos, M. Dos, Gomes, C.F.S., Araujo, J.D.C., De Almeida, G.P.: THOR 2 Method: An Efficient Instrument in Situations Where There Is Uncertainty or Lack of Data. IEEE Access. 9, 161794–161805 (2021). https://doi.org/10.1109/ACCESS.2021.3132864