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CRITICAL ANALYSIS OF INNOVATION DECISIONS BASED ON ADVANCED TECHNOLOGIES IN BUSINESS ORGANIZATIONS

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Abstract: *The current development context marked by the transition from the VUCA paradigm to the BANI paradigm determines organizational managers to find and implement new development frameworks that ensure the resilience of organizations in the face of multiple and diverse crises as typology. A source of innovation in this regard is the implementation of advanced technologies, an irreversible trend in social dynamics, characterized by multiple challenges. Starting from a general working model applicable to a business organization, such a decision is critically analyzed, using a decision-making method assisted by specific software. These results are discussed in conjunction with practical realities of the development of modern technologies, some of which are of managerial interest, namely the emerging and disruptive ones.*

Keywords*: innovation, business, modern technologies, decision, critical analysis*

1. INTRODUCTION

In contemporary society, more than ever, the survival of an organization in a specific market is correlated with the ability to adapt to the dominant trends of the environment in which it operates. Such a development trend, which is becoming a mandatory direction to adapt and follow in organizational strategies, is given by the proliferation of modern technologies, which fundamentally change the way organizational processes are carried out, regardless of which management functions or organizational functions they are associated with.

Given the exponential growth in the amount of data that organizations face, much of this amount generated and maintained through the technological vector, innovation decisions in business organizations are becoming increasingly complicated to undertake. It follows that the classical methodological-managerial apparatus is no longer sufficient, and multidisciplinary analysis frameworks are needed through which a decision can be documented through multidomain perspectives, also assisted (depending on complexity) by modern technologies (e.g. AI). In this framework, critical thinking becomes an essential tool to use, contributing to increasing the accuracy of the analysis of the identified problem space. Also, as a reality of current managerial practice, it is worth emphasizing that organizational innovation is increasingly correlated with the technical component, even talking about the complementarity between the two concepts [1]. Within this framework of discussion, the observation of author Stelian Brad regarding the balance between challenge and opportunity in the field of technological innovation is auspicious, according to which: „Innovation is never a neutral act. Every technological choice is implicitly a value statement - a declaration of what we consider meaningful, for whom, and at what cost. […] not every idea that can be engineered necessarily deserves to be realized. The guiding principle must shift from feasibility to intentionality" [2, p.404].

When we talk about technology in an updated way, it is necessary to keep in mind the concepts of advanced technologies, with sub-registers such as emerging and disruptive

technologies and the cutting-edge characteristic. As a working concept for advanced technologies, it is explained by "A technology that is still immature but promises to deliver significant value, or that has some technical maturity but still has relatively few users" [3], some examples in this regard being, but not limited to, artificial intelligence, virtual reality and 3D visualization, real-time collaboration, data mining. Innovation is inextricably linked to creativity and given the complexity of the effects (social, economic, etc.) generated by the implementation of new technologies, a flexible and resilient mindset is needed, which critical thinking can ensure.

The managerial implications of implementing emerging technologies in organizations are considerable, and studies have shown that technological innovation reshapes the use of managerial control systems, strengthening risk management and increasing the flexibility of control practices, focusing on organizational performance and sustainability capabilities of firms [4]. Thus, to compete on the global stage, organizations must adopt emerging technologies to develop new business strategies [5]. In fact, the transition to a new management model based on innovation, information and communication technology, has been analyzed by researchers since 2012, becoming a condition for survival for organizations in the current period [6].

In this context, the article aims, by testing AI-assisted software, to model a complex managerial decision, likely to impact substantial managerial, operational, structural, and finally, cultural changes.

From the results obtained, we mention that the application of the decision-making model demonstrated that decision-making processes could become faster, more transparent and more consistent, generating a substantial increase in resilience and competitiveness at the organizational level.

2. RESEARCH METHODOLOGY

The article is a critical analysis of decision-making methods based on new technologies. The premise from which it starts is that organizational innovation and the adaptation of management models to new contemporary realities are not possible without the adoption and integration of technology into the organizational flow.

The research method is the multi-criteria decision-making method, and for the development of the decision-making model, the PAPRIKA method (Potentially All Pairwise Rankings of all possible Alternatives) was used, implemented by the 1000minds software.

The PAPRIKA method, using simple reasoning, offers a high degree of structuring of the decision-making situation and at the same time, more accurately reflects the preferences of decision-makers [7].

PAPRIKA is used to calculate the weights of the criteria by comparing them. The method is less mentally demanding for decision-makers because it generates weights following comparisons between several option packages. The software identifies all possible combinations of alternatives, and the decision maker must choose from a random sequence of paired options.

Each time the decision maker classifies a set of two alternatives, all other hypothetical sets of options that can be classified into pairs by transitivity are found and eliminated [8].

To streamline the decision-making process, to improve the accuracy of the resulting solutions while reducing the time allocated and the complexity of the decision-making process, scientific literature recommends the use of artificial intelligence in decision-making [9].

Starting with 2023, 1000minds launched an AI assistant as part of its decision-making software.

Among the advantages of integrating AI are: recommending an impressive number of criteria, involving the (human) decision-maker throughout the process, personalizing the criteria through human judgment (through the generated comparisons), creating a fully auditable and refinable decision model much faster and with less effort [10].

3. CREATING THE DECISION-MAKING MODEL

The developed decision-making model aims to capitalize on an opportunity, simultaneously pursuing two objectives: the digitalization of the organization and, through this, the creation of new managerial models. A decision-making method was applied that can provide technical support to a manager in a complex choice situation. Thus, the PAPRIKA method (Potentially All Pairwise Rankings of all possible Alternatives) was used, a technique used by the 1000minds software for multi-criteria decisions, based on the decision-maker's preferences. The configuration of the decision-making situation is carried out using the AI assistant offered by the software.

The first stage completed was the definition of the proposed project (of the decision-making situation): *Emerging technologies contributing to the creation of new management models.*

Selecting the types of technologies that would be most advantageous for the organization is the next stage. Following documentation and consultation with specialists in the field of modern technologies, decision-making alternatives were developed: *artificial intelligence, internet of Things (IoT), blockchain technology, augmented reality şi cloud computing*. Those technologies considered responsible for the digital transformation of organizations were selected, as an important part of innovation, an essential condition for organizational survival in the competitive environment in which they operate. [11].

In the next stage, the criteria and their levels are defined, based on which the software generates hypothetical alternatives. The criteria suggested by the AI assistant are refined, resulting in five criteria, each structured on three levels. The resulting alternatives are constituted in packages of different options from which the decision maker must choose, depending on the needs or constraints existing in the organization where the decision is implemented. In the developed model, the number of comparisons and choices made by the decision maker was 72, so that the accuracy of the process is the highest. The software automatically minimizes the number of questions that the decision maker must answer by eliminating those that are logically implied by previous answers.

Following the decision maker's answers, the method applies logical rules to automatically deduce other preferences, finally the software generating the relative importance of each criterion (weights in %) and the value of each level of the criteria.

Table 1 presents the resulting values based on the decision maker's preference in a concise point system. The total score for the highest-ranking technology, hypothetically speaking – that is, the technology with the highest levels on all criteria – could be 100%.

The percentage values for each technology in the table represent a combination of the relative importance (weight) of the criterion and the level's performance relative to the criterion.

Table 1

The weight of criteria and levels within each criterion.

Criteria/levels	Weight (sum =1)	Score (0-100)	Preference value
Transformative impact			
Limited transformative impact	0,479	0,0	**0,0%**
Moderately transformative		58,4	**28,0%**
Highly transformative		100,0	**47,9%**
Sustainability			
Provide short-term assistance	0,341	0,0	**0,0%**
Medium use		82,2	**28,1%**
Long-term viability		100,0	**34,1%**
Innovation potential			
Low innovation potential	0,136	0,0	**0,0%**
Moderate innovation potential		77,7	**10,6%**
High innovation potential		100,0	**13,6%**
Scalability			
Limited scalability	0,024	0,0	**0,0%**
Moderately scalable		87,8	**2,1%**
Highly scalable		100,0	**2,4%**
Integration ease			
Complex integration	0,020	0,0	**0,0%**
Moderate integration		40,0	**0,8%**
Seamless integration		100,0	**2,0%**

The weight of a criterion is represented by the preference value corresponding to its

highest level and is summed for all criteria to a total of 100%, i.e. the preference values for the criteria sum to 1 (see figure no. 1).

The subjectivity of the decision maker results from the way in which the levels are defined for each weight. The specifics of the organization and the assumed objectives dictate the construction of the decision-making model.

The value for each level of a criterion represents the degree of performance of the respective level in relation to the criterion. The lowest level corresponds to the minimum possible value in relation to the criterion, and the highest level corresponds to the maximum possible value.

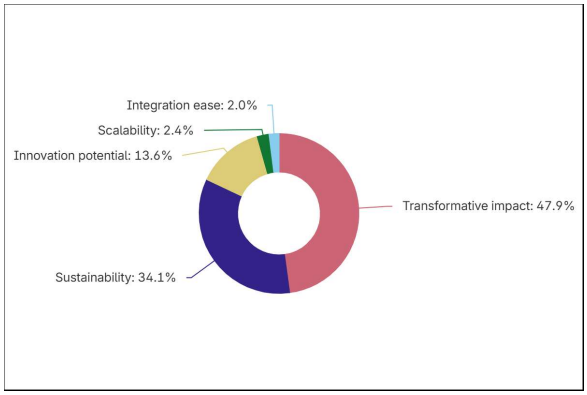


Fig. 1. Chart of criterion weights

The levels located between these two extremes correspond to fractional values of the maximum possible value.

The preference values represent the basis for comparison between the criteria, which are ordered from those with the highest values to those with the lowest values.

Table 2

Relative importance of criteria.

	Transformative impact 47,9%	Sustainability34,1%	Innovation potential 13,6%	Scalability 2,4%	Integration ease 2,0%
Transformative impact 47,9%		1,4	3,5	19,9	24,4
Sustainability 34,1%	0,7		2,5	14,2	17,4
Innovation potential 13,6%	0,3	0,4		5,7	6,9
Scalability 2,4%	0,1	0,1	0,2		1,2
Integration ease 2,0%	0,0	0,1	0,1	0,8	

Each number in Table 2 represents the ratio of the relative importance or weight of the criterion on the left to the criterion on the top. These indicators have the same calculation as a marginal rate of substitution. The numbers in Table 2 help us understand the decision maker's reasoning. For example, the criterion transformative impact is 24.4 times more important to the decision maker than integration ease, and innovation potential is 5.7 times more important than scalability. The decision maker's preferences result from the relationships that are created between the criteria.

Table 3

Technology ranking.

Technology Criteria	Rank Score
Artificial intelligence	
Scalability – Highly scalable 2,4%	**1st** 98,8%
Integration ease - Moderate integration 0,8%	
Innovation potential - High innovation potential 13,6%	
Sustainability - Long-term viability 34,1%	
Transformative impact - Highly transformative 47,9%	
Blockchain technology	
Scalability – Moderate scalable 2,1%	**2nd** 98,5%
Integration ease - Moderate integration0,8%	
Innovation potential - High innovation potential 13,6%	
Sustainability - Long-term viability34,1%	
Transformative impact - Highly transformative 47,9%	
Cloud computing	
Scalability – Highly scalable2,4%	**3rd** 77,1%
Integration ease - Seamless integration 2%	
Innovation potential - Moderate innovation 10,6%	
Sustainability - Long-term viability34,1%	
Transformative impact - Moderately transformative 28%	
Internet of Things (IoT)	
Scalability – Highly scalable2,4%	**4th** 69,8%
Integration ease - Moderate integration0,8%	
Innovation potential - Moderate innovation 10,6%	
Sustainability –Medium use 28%	
Transformative impact - Moderately transformative 28%	
Augmented reality	
Scalability – Limited scalability 0%	**5th** 69,6%
Integration ease - Complex integration 0%	
Innovation potential - High innovation potential 13,6%	
Sustainability - Medium use28%	
Transformative impact - Moderately transformative 28%	

Table no. 3 contains the decision options, i.e. technologies, classified according to the total score obtained.

The total score is calculated by summing the resulting values for each technology, depending on how the technology is evaluated based on the decision criteria developed.

Each of the criteria contributed to the final score, which was also highlighted in figure no. 2.

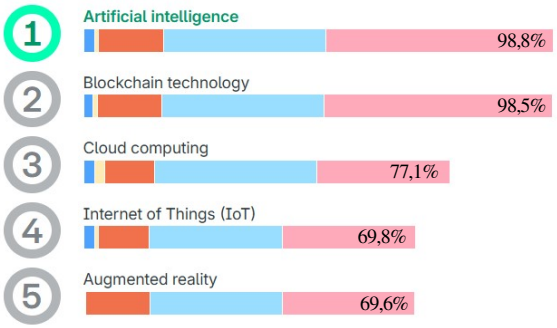


Fig. 2. Classification of technologies according to criteria established by the decision maker

According to the data in table 3 and figure 2, artificial intelligence and blockchain technology are the technologies that meet the needs of the decision maker, according to the decision-making model built.

4. CONCLUSION

The article aimed to critically analyze organizational innovation decisions through digital transformation, based on new technologies. To this end, the method itself applied in the case study represents a test of a technology-assisted decision-making method. An accessible software was selected in terms of complexity for a manager from any field of activity. The convergence of 1000minds, the PAPRIKA method and artificial intelligence represents the perfect solution in the transformation towards a modern and sustainable decision-making culture.

The application of the PAPRIKA algorithm was carried out with the assistance of AI, but at the same time under the intervention of the decision-maker throughout the decision-making process. A decision regarding the adaptation of the types of technologies to an organizational field for the development of new managerial models can be adopted in a short time, with a high level of structuring. As advantages for the manager, it should be mentioned that adjustments can be made during the decision-making process, one can go back to correct certain errors (there is no need to restart the algorithm), it is precisely from these freedoms that the subjectivity of the procedure comes.

Based on the final resulting values, the best solution can be adopted, in this case artificial intelligence and blockchain technology obtaining the highest values, according to the decision-maker's preferences. The values of preferences and classified technologies are determined by the compromises made by the decision maker in relation to the specifics of the organization and the resources it has.

The main contribution of the article is to raise awareness among stakeholders about the possibilities of simplifying organizational processes, by testing a model of technology-assisted decision-making innovation, which can create immediate and emergent effects.

One of the results that should be mentioned is the highlighting of the central role of digital technologies in organizational innovation and increasing competitiveness, with significant implications for managers and decision-makers. This justifies the consideration, depending on the size of the organization, the activity profile and the scope of its activities, of the establishment of distinct structures specialized in the field of research-development-innovation.

5. REFERENCES

[1] Vahter, P., Vadi, M., *The relationship of technological and organizational innovation with firm performance: Opening the black box of dynamic complementarities*, Technological Forecasting and Social Change, vol. 206, ISSN 0040-1625, 2024, https://doi.org/10.1016/j.techfore.2024.123516.

[2] Brad, S., *Artificial intelligence assisted design and innovation for industry 5.0,* Acta Technica Napocensis Series: Applied Mathematics,

Mechanics, and Engineering Vol. 68, Issue Special I, May, 2025, pp. 403-420.
[3] https://www.gartner.com/en/information-technology/glossary/advanced-technology.
[4] García-Nieto, M., Ramón-Jerónimo, J.M., Flórez-López, R., Segovia-Villarreal, M. *The Impact of AI Automation, Blockchain and Big Data on Sustainability and Performance: A Management Control Perspective*, Sustainable Development, October 2025, DOI10.1002/sd.70327
[5] Dudczyk, P., Dunston, J.K., Crosby, G.V. *Blockchain Technology for Global Supply Chain Management: A Survey of Applications, Challenges, Opportunities and Implications*, IEEE ACCESS, vol. 12, pp. 70065-70088, May 2024, DOI10.1109/ACCESS.2024.3399759
[6] Rio-Belver, R., Cilleruelo, E., Garechana, G., Gavilanes, J., Zabalza, J. *New Management Models Based in Cloud-Computing*, pp. 921-927, 2012, DOI10.3846/bm.2012.118
[7] Hansen, P., Ombler, F. *A New Method for Scoring Additive Multiattribute Value Models Using Pairwise Rankings of Alternatives*, Journal of Multi-Criteria Decision Analysis, vol. 15, no. 3-4, pp. 87-107, may-august 2008, DOI10.1002/mcda.428
[8] Samah I.A.A., Ahmed A.-M., *A MCDM Methodology to Analysis Strategies and Factors of Lean Production in Sustainability Development,* Journal of Sustainable Development and Green Technology (JSDGT. vol. 02, no. 02, pp. 34-43, 2023, https://doi.org/10.54216/JSDGT.020204
[9] Kovari, A., *AI for Decision Support: Balancing Accuracy, Transparency, and Trust Across Sectors,* Information, vol. 15 no.11, 2024, https://doi.org/10.3390/info15110725
[10]https://www.1000minds.com/articles/1000minds-ai-assistant.
[11] Vărzaru, A. A., Bocean, C. G. *Digital Transformation and Innovation: The Influence of Digital Technologies on Turnover from Innovation Activities and Types of Innovation,* Systems, vol. 12 no.9, 2024, https://doi.org/10.3390/systems12090359

Analiza critică a deciziilor de inovare bazate pe tehnologii avansate în organizațiile de afaceri

Rezumat: Contextul de dezvoltare actual marcat de trecerea de la paradigma VUCA la paradigma BANI determină managerii organizațiilor să găsească și să implementeze noi cadre de dezvoltare care să asigure reziliența organizațiilor în confruntarea cu crize multiple și diverse ca tipologie. O sursă de inovare în acest sens este implementarea de tehnologii avansate, o tendință ireversibilă dealtfel în dinamica socială, caracterizată de provocări multiple. Pornind de la un model de lucru general aplicabil pentru o organizație de afaceri, este analizată critic o astfel de decizie, folosind o metodă decizională asistată de un soft specific. Sunt discutate aceste rezultate coroborat cu realități practice ale dezvoltării tehnologiilor moderne, din care o parte de interes managerial, sunt cele emergente și disruptive.

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