DOI: https://doi.org/10.30837/MMP.2024.129

INTEGRATING DECISION SUPPORT TECHNIQUES INTO AGILE PROJECT MANAGEMENT

Molokanova V., Kozyr S.

The processes of decision-making in projects on the basis of the value-oriented paradigm are considered. It is determined that in projects decision-making processes should be considered from the position of dominant value memes in the organization. Value-oriented approach makes it possible to more correctly determinate the value of the project product. An analysis of decision-making methods in projects has been proposed, taking into account the influence of the value level of the decision-maker. It is determined that such analysis should contribute to the integration of soft and hard approaches in making project decisions. The findings focus on how decisions in projects align with the dominant values of decision-makers. The issue of the impact of AI-based decision-making automation on the creation of knowledge in project management is considered.

Introduction

Decision-making in project management is used throughout the project life cycle, and is usually carried out under conditions of incomplete input data. Examples are decision-making tasks in the development of investment projects, selection of suppliers or contractors, optimization of project product implementation options, project implementation monitoring, etc. As the complexity and scale of projects increases, the cost of decision-making increases, the consequences of mistakes become more serious, and appealing to the intuition of managers is not always justified.

The successful transition of the system from the current state to the planned one in the best way demonstrates the correct management decision and describes the discipline of project management, which consists of a set of management decisions made. However, the use of mathematical methods of decision-making in project management does not always make it possible to correctly solve the problem, since the choice of decision occurs under limited time conditions and by the totality of heterogeneous contradictory indicators, which, even in the presence of different methods of decision support, is a rather complex problem [1–3].

Analysis of recent researches and publications

Over the past few decades, methods of decision support based on the use of optimization problems have been developed [4, 5]. When using optimization methods, traditional project design models are classified according to what input data

they take into account, and how. In this regard, deterministic and stochastic models with elements of uncertainty are distinguished [6]. Deterministic models, in turn, are divided into linear, nonlinear, dynamic and graphic. It is necessary to supplement this classification with models that take into account different types of uncertainty based on the theory of fuzzy sets [7]. This classification should also take into account single-criteria and multi-criteria task statements. When considering multi-criteria tasks for the formation of projects, it is most often proposed to take into account profit, the need for investment, risks, as well as the dynamics of these indicators as criteria [8, 9].

With the current rapid changes in the environment, modern enterprises face an acute problem of improving their own management system [10]. For a long time, functional and process approaches were used to analyse the development of systems [11, 12]. However, over time, experts have come to the conclusion that enterprises that pay less attention to financial performance and concentrate more on creating organizational value get better results [13, 14]. In recent years, the category of "value" has been increasingly used as a criterion for the effectiveness of the enterprise’s development through projects, while the very concept of "value" is changing with the development of human civilization.

Within the framework of management science, it is customary to distinguish between hard and soft paradigms [15, 16]. The terms "hard" and "soft" reflect two different approaches that have had a strong impact on the development of both academic and practical disciplines. Each of these terms refers to two different paradigms, including specific values, ways of seeing the world, and approaches to practice. Hard methods emphasize the search for objective knowledge, while soft approaches derive from the subjective interpretation of knowledge [18]. The differences between hard and soft include general concepts of the essence of the project, the degree of its success and the satisfaction of the project stakeholders [13, 15, 18]. The value of the project product is the personal perception by stakeholders of the project product ability to create benefits for them due to its unique properties in social, economic, political, or spiritual aspects [19]. Yeoh [20] observed that the acceptance of the product goes beyond technical quality by extending to soft criteria. The value of soft ideas in project models is highlighted by Williams [21] in his study.

The aim of the article is to study the manifestations of the hard to soft paradigm in the science of project management, the integration of hard and soft methods of decision support, the consequences of value influence on decision-making processes in projects.

Methodical materials of the study

Decision-making theory and project management are closely related, as they are used in the transformational process of the system's transition from one state to another. This process can be considered in two aspects: rational and human. In the rational approach, decision-making in a variety of economic situations is usually associated with profit maximization. This is considered rational behaviour in economic decision-making. Rational process and analysis must be logical and algorithmic. If these minimum requirements are not met, that is, if a person has been even slightly, influenced by personal emotions, feelings, or moral norms, then the analysis is considered an irrational criterion. But as modern research shows, no human being ever satisfies these criteria. Therefore, it can be assumed that a person very often acts irrationally, guided not only by the desire to make money, but also by emotions, feelings, and moral norms [23, 24]. As the winner of the Nobel Prize in Economics in 2017, Richard Thaler, said, the theory of rational choice (when a person always chooses the highest profit) is too simple a model, that turns our world into a miserable platform for battles for profit, rejecting other aspects of human life [25]. Taking into account the dominant organizational values allow us to identify the deep motives of the activities of subjects at different levels that make project decisions.

To solve intellectual problems, knowledge from a specific subject area is increasingly used, presented in a certain standard form, and algorithms for their processing are compiled. This is how intelligent decision support systems are formed in various spheres of human activity. Now artificial intelligence algorithms can be considered as another representative of preparation and decision-making, which fully meets the requirements of rational behaviour, but gives rise to a significant number of ethical and legislative questions.

In recent years, project management has been abandoning rigid hierarchical management structures and moving to agile project-oriented systems, which is enshrined in new project management standards [26]. Starting from the 3rd edition, PMBoK has adapted the description of processes to the possibility of using an agile approach to project management [1]. The principles of the agile project management approach described by the Agile Manifesto have gained worldwide recognition and influenced the development of an agile project management methodology. One of the 4 agile main principles is "individuals and interactions over processes and tools" [27]. A continuation of the agile project culture is the study of the mental space of projects, as well as the development of a formalized description of such a space, which allows influencing the success of projects and programs [28]. The main differences between classical and agile project management are presented in Table 1.

The essence of decision-making is the development of an action plan to solve a problem. A problem is always characterized by certain conditions, which are called situations. Identification and description of a problem situation provides initial information for setting a decision-making problem.

Table 1

Classical and agile values of project management

Classical values	Agile values
Hierarchical structures	Horizontal structures
Emphasis on financial and material resources	Emphasis on human resources
Centralization and dependency	Flexibility and autonomy
Management on rules and directives	Management through organizational values
Emphasis on processes	Emphasis on communication
Orientation to internal processes	Taking into account external factors and customer orientation
Compliance with Contact rrequirements	Customer collaboration over contract negotiation
Adaptation fee	Performance reward

The result of the problem is a solution or the choice of the optimal alternative from a set of admissible solutions, focused on the conscious goals achievement. A decision is said to be optimal if it provides an extremum (maximum or minimum) of the selection criterion for the individual decision-maker or satisfies the principle of agreement for a group of persons. A generalized characteristic of a solution is its effectiveness as the ratio of the degree of goals achievement to the costs of achieving them. The greater the degree of goals achievement and the lower the costs of their implementation are, the more effective is the solution [29, 30]. For individual decision-making, the task looks like this:

$$\langle S_0,\ T,\ R \mid S,\ A, L,\ Y,\ f,\ k,\ Y^* \rangle\ , \qquad (2.1)$$

where to the left of the vertical line are the known parameters:

S_0 – briefly describes the content of the problem to be solved;

T is the time allotted for decision-making;

R are the resources required to make a decision.

To the right of the vertical line are unknown parameters: $S = (S_1,\ \ldots,\ S_n)$ is a set of alternative (mutually exclusive) situations that complement the definition of the problem situation and reduce the initial uncertainty of the task.

$A = (A_1, \ldots, A_k)$ are the goals that are solved in a problem situation. The description of goals is carried out qualitatively (content) and quantitatively (a set of indicators), among which the most important are: criteria for achieving goals; indicators of the degree of goals achievement; priorities.

$L = (L_1, \ldots, L_p)$ are many restrictions (financial, material, legal, etc.).

$Y = (Y_1, \ldots, Y_m)$ is a variety of alternative solutions, from which a single optimal or acceptable solution is chosen Y^*. Decisions are described in a meaningful and formal way as a set of characteristics, which necessarily include the resource characteristics for the implementation of decisions.

$f(A, S, Y)$ – Decision-Maker preference function.

k – Criterion for choosing the best solution.

Y^* – the optimal solution.

So, the decision-making task of an individual decision-maker is formulated as follows. Under the conditions of the problem situation S_o, the available time T and resources R, it is necessary to define S_o by the set of alternative situations S, to formulate the set of goals A, constraints L, alternative solutions Y, to assess the advantages of solutions and to find the optimal solution Y^* from the set Y using the formulated selection criteria k.

For a group of decision-makers, the decision-making task looks like this:

$$\langle S_o, T, R \mid S, A, L, Y, F(f), G, Y^* \rangle , \qquad (2.2)$$

where S_o, T, R, S, A, L, Y, Y^* are the same designations as for the individual decision-maker's task. $F(f)$ is a function of group preference, which depends on the vector of individual preferences of group members $f = (f_1, f_2, ..., f_d)$, d is the number of experts in the group. G is the rule (principle) of harmonization of individual preferences for the formation of group advantage (for example, the principle of votes majority, etc.).

So, the task of group decision-making is formulated as follows. Under the conditions of the problem situation S_o, the available time T and the resources R, it is necessary to determine S_o by the set of alternative situations S, to formulate the set of goals A, constraints L, alternative solutions Y, to make an individual assessment of the advantages of decisions, to build a group function of preferences $F(f)$ and on the basis of the chosen principle of agreement G to find the optimal solution Y^*, that satisfies the group's preference. Generalized stages of the decision-making process in projects are shown in Fig. 1.

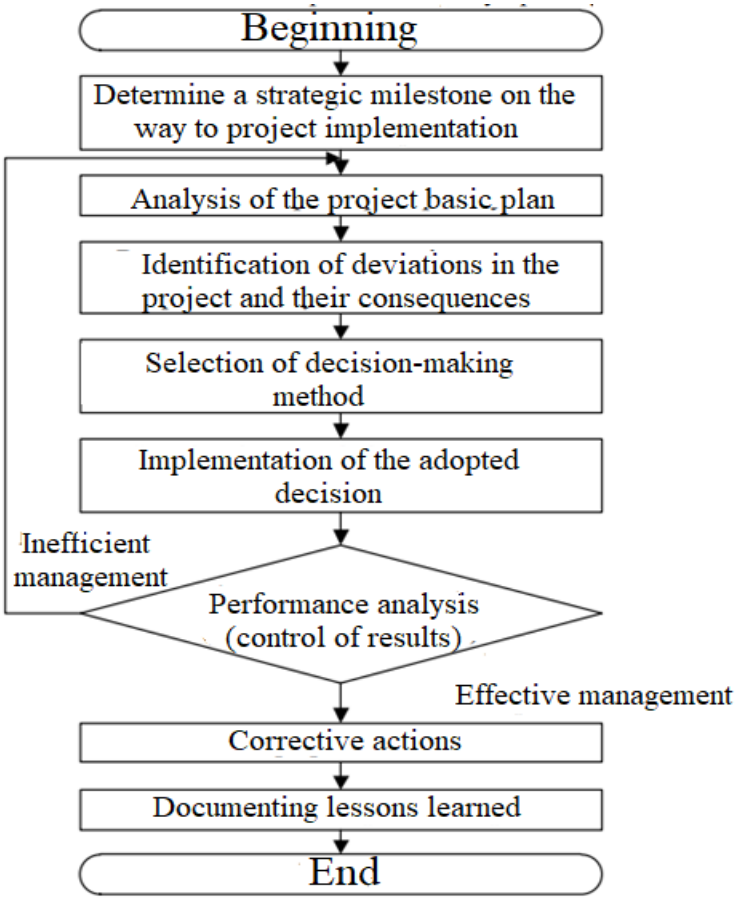

Fig. 1. Stages of the decision-making process in project

Results of the study

In the process of preparing and choosing a decision, it is necessary to take into account two sides: the formalized one, due to the mathematical rules of the decision-making process, and the subjective side, due to the peculiarities of the behaviour of the person making the managerial decision. Taking into account the influence of the "human factor" is provided by descriptive models, in which the behavioural characteristics of the decision-maker are decisive. They reveal the motives and factors (values) influencing the strategy and tactics of decision-making. Taking into account the individuality of perception of the world and life experience, it can be argued that each person has his own unique "model of the world" depending on what he considers valuable in this world [6].

To move from one level of values to another level, the decision-maker is motivated by difficulties in choosing possible alternatives. In some cases, it maybe one's own subjective doubts, and in another, it may be the objective need to solve the problem taking into account changes in the environment. The more complex the object to be managed, the higher the value level of decision-making required [31]. At the same time, each level corresponds to a certain reflexive-mental mechanism

of decision-making, which takes into account the internal ranking of values and their criteria of a decision-maker person. From the point of view of the value-oriented approach, the role of the project manager is a product of his value memes, which are successfully adapted to the activities of the organization. In this context, the project manager plays the role of a photocopier who replicates value project memes into the project plan [31, 32].

Let us consider in more detail the influence of dominant values in decision-making methods (Table 2).

Table 2

Value orientations of decision-making in projects

Level of values	Type of thinking	Value memes	Principles of decision-making	Comments
1	2	3	4	5
Purple	Clans	Belonging to a clan as a guarantee of well-being	Customs and traditions. Council of Elders. Mystical signs. The Clan Always Benefits	Traditional-semantic level of decision-making. Decisions are made based on the opinion that the clan leader always knows best how to act in the best interests of the clan
Red	Self-centred	The desire for profit and power	Tough diktat. Unquestioning submission. The strong appropriate all the benefits to themselves	Conceptual level of decision-making. At this level, subjective desires are departed from and strict concepts are used. As a form of thinking, this level reflects the subordination of the weak to the stronger
Blue	Obedience to law and hierarchy	Commitment to order and law, patriotism	Orders from the authorities. Compliance with regulations. Benefits accrue to the most righteous	Task-problem level of decision-making. Decision-making is carried out according to a pre-known algorithm in accordance with the regulations of the management system

Continuation of the table

1	2	3	4	5
Orange	Materialistic, result-oriented	Striving for Success Through Innovation	Finding the best options. Result-oriented. The most successful one has benefits	Individual semantic level of decision-making. Decision-making is based on logical reasoning, creative thinking and common sense. Involvement of the experts
Green	Focus on preserving the environment, consensus, interpersonal relations	Harmonious social environment, equality of opportunity	Consensus-building. Everyone must cooperate. Every opinion must be taken into account. Public Benefit	Communicative and semantic level of decision-making. Decisions are made on the basis of communicative interaction of all stakeholders through understanding and consensus
Yellow	Systemic and integrative, focus on quality of life	Synergetic Integration Acceptance of Diversity	Knowledge comes first. High ethical standards. Solving paradoxes. The most competent benefit	Universal-ontological level of decision-making. It requires a systematic vision of the world, the integrity of the representation of the object of management in the interaction of all its parts

Because project managers should not be limited to monitoring projects and returning them to a controlled state. They must possess the skills necessary to make non-standard creative decisions with the ability to effectively influence the direction and course of the project. In reference models with fixed decision-making algorithms, it is possible to calculate the amount of input influence at which the system moves along the desired trajectory. This is how neural networks can compute values any functions to predict risks and project outcomes, allowing us to take timely preventive measures.

In practice, neural networks are well suited for classification, optimization, and forecasting problems.

However, there are a number of disadvantages associated with the use of neural networks to solve problems of information identification. The main one is that a neural network requires a large amount of factual information to train (the number of observations is from 50 to 100).

For analytical tasks in projects, this cannot always be ensured. In addition, implicit learning leads to the fact that the structure of connections between neurons becomes "incomprehensible". It becomes difficult to answer the question of how the neural network gets the result. This phenomenon can be called the "logical opacity" of neural networks trained according to implicit rules [33]. Even a well-trained neural network is a "black box", i.e., a system in which only input and output quantities are available to an external observer, and its internal processes that take place in it are unknown. The implementation of artificial intelligence in project management is considered useful for providing more accurate estimates, simplifying workflows, automating repetitive tasks. However, AI-based decision-making raises important questions about its ethical use, safety, and responsibility in decision-making. Therefore, the use of AI in agile projects, where the main role is played by people and not processes, should be very careful. Because in this way we can lose such a valuable component of creating innovations as live human communications. In projects, we must constantly remember that the project product is created for people, and not for rationally thinking machines.

Conclusions

The achievement of the value-oriented direction of project management should enrich project managers with an understanding of the laws of transformation of the surrounding world through design. Establishing compliance with the established practices of value-based project management has shown that decision-making processes should be considered from the standpoint of a fundamentally new paradigm – on the basis of dominant value memes in the organization. The application of the above provisions makes it possible to take into account the level of dominant values in projects at certain moments of their implementation and to more correctly calculate the value of the project product. AI tools greatly assist project managers in controlling and monitoring projects. However, AI’s lack of ethical considerations and transparency suggests that project managers should still be careful when interpreting results. The proposed analysis of decision-making methods in projects should contribute to the development of professional competence of project managers.

Future Research

As there are still many uncertain issues in the value-based project management methodology, we propose to continue research on value creation in different types of project organizations. We also propose to investigate how the use of artificial intelligence in project decision-making processes can affect projects that have a social focus. We believe that now there is a need for active cooperation of trade unions, non-governmental organizations and individual researchers on the consequences of using artificial intelligence in decision-making processes and studying possible dangers on this path.

References

1. Project Management Body of Knowledge Guide (PMBOK® Guide). American National Standard ANSI/PMI 99-001-2004 / Ed. by S. D. Bushuev. – 3rd ed. – Project Management Institute USA, 2004. – 388 p.
2. A. Akhavan Tabassi, D. Bryde, E. Mustafa Kamal, and J. Dowson, Challenges For Project Management In The 21st Century. 2019. DOI: 10.15405/epms.2019.12.63
3. R. K. Wysocki, Effective Project Management: Traditional, Agile, Extreme, 5th edition. Indianapolis, Ind: Wiley, 2009.
4. A Guide to the Management of Innovative Projects and Programs: vol.1, version 1.2 / transl. from English under the editorship of S. D. Bushuev. – K. : Nauk. Svit, 2009.– 173 p.
5. Management of Innovative Projects and Programs Based on the P2M Knowledge System: Monograph // Yaroshenko F.A., Bushuev S.D., Tanaka H. – Kyiv: Summit-Kniga, 2012. – 272 p.
6. Molokanova V.M. Value-oriented portfolio management of organization development: abstract. Doc. Tech. Sci., Spec. : 05.13.22 – management of projects and programs / V. M. Molokanova – K. : MES KNUCA, 2015. – 40 p. (in Ukrainian).
7. Coffin, M. A and B.W. Taylor. Multiple Criteria R&D project selection and scheduling using fuzzy logic. Computer&Operations Research, 23, pp. 207–221.
8. Morteza Ghobakhloo. Industry 4.0, digitization, and opportunities for sustainability. Journal of Cleaner Production. Vol. 252. 2020. DOI: https://doi.org/10.1016/j.jclepro.2019.119869
9. A.J. Shenhar and D. Dvir, "Project Management Research – The Challenge and Opportunity", Proj. Manag. J., vol. 38, no. 2, pp. 93–99, Jun. 2007, DOI: 10.1177/875697280703800210
10. Radulescu, C.Z., Radulescu, M., Filip, F.G., et al. Decision analysis for the project selection problem under risk 9th IFAC Symposium on Large Scale Systems: Theory and Applications 2001 (LSS'01).
11. H. Kerzner, Project Management: A Systems Approach to Planning, Scheduling, and Controlling, 11th edition. Hoboken, New Jersey: Wiley, 2013.
12. Delisle C.L. Would the real project management language stand up / C.L. Delisle, D. Olson. Int J Project Manage 22 – 2004 – №4. − pp. 327–337.
13. Garcia A.B. Voting on the agenda: the key to social efficient meetings / A. B. Garcia, J. Kunz, M. Fischer. Int J Project Manage 23 – 2005 – №1. − pp. 17–24.

14. Bushuev, S.D., Bushueva, N.S. "Formation of value in the activities of project-oriented organizations." Coll. Sciences. Works. Ed. V. A. Racha. – 2009 – №3 (31). – P. 5–14.
15. P. Oakley, "How the name date (Harvard) reference style in papers shows an underlying interpretivist paradigm whilst numeric references show a functional paradigm?", Systemist, vol. 25, no. 1, pp.25–30, 2003.
16. J. Mingers, "The contribution of critical realism as an underpinning philosophy for OR/MS and systems", Journal of the Operations Research Society, vol. 51, pp. 1256–1270, 2000.
17. J. Pollack, "The changing paradigms of project management", International Journal of Project Management, vol. 25, pp. 266–274, 2007.
18. G. Midgley, Systemic intervention: philosophy, methodology, and practice, 1-st ed. New York, USA: Plenum, 2000.
19. Rach V.A., Hladka O.M. Value-oriented strategic milestone decisions in real estate development projects. – Lugansk: SNU Publishing House. V.Dalia, 2009. – № 3. – P. 161–168.
20. Wateridge, "The role of configuration management in the development and management of Information systems/Technology (IS/IT) projects", International Journal of Project Management, vol. 17, no. 4, pp. 237–241, 1999.
21. K. T. Yeo, "Critical failure factors in information system projects", International Journal of Project Management, vol. 20, no. 3, pp. 241–246, 2002.
22. L. Williams, "The need for new paradigms for complex projects", International Journal of Project Management, vol. 77, no. 5, pp.269–273. 1999.
23. James R. Chapman. Project Management Scalable Methodology Guide. Human Resources Management. Доступно: www.hyperthot.com
24. Gemünden, H. G. (2014). Project management as a behavioural discipline and as driver of productivity and innovations. Project Management Journal, 45(6), 2–6. DOI: http://dx.doi.org/10.1002/pmj.21466
25. Thaler R. Toward a positive theory of consumer choice / J. of Economic Behaviour and Organization. 1990. № 1. P. 39–60.
26. ICB: IPMA Competence Baseline / Retrieved from: http://ipma.ch/resources/media/ipma-publications/ipma-competence-baseline/
27. Manifesto for Agile Software Development. Accessed: Jun. 04, 2023. [Online]. Available: https://agilemanifesto.org/
28. Sliger, M. (2008). Agile project management and the PMBOK® guide. Paper presented at PMI® Global Congress 2008–North America, Denver, CO. Newtown Square, PA: PMI.
29. Zlaugotne, B., Zihare, L., Balode, L., Kalnbalkite, A., Khabdullin, A., Blumberga, D. (2020), «Multi-Criteria Decision Analysis Methods Comparison», Environmental and Climate Technologies, No. 24, Issue 1, P. 454–471. DOI: 10.2478/rtuect-2020-0028
30. Greco, S., Ehrgott, M., Figueira, J. R. (2016), «Multiple criteria decision analysis. State of the Art Surveys», Publ. Springer, New York, 1346 p.
31. S.D. Bushuev, EV Verenich, R.F. Yaroshenko. Formal model of the mental space of a project or program, Radioelectronics, Informatics, Management. 2017. No. 1, P. 153–160.
32. Don E. Beck, & Chris K. Cowan. (2010) Spiral Dynamics: Managing Values, Leadership and Change. Open World, 2010.
33. I. Suleimenov, Y. Vitulyova and A. Bakirov, "Hybrid Number Systems: Application for Calculations in Galois Fields," 2022 3rd Asia Conference on Computers and Communications (ACCC), Shanghai, China, 2022, pp. 126–130, DOI: 10.1109/ACCC58361.2022.00028