N. Alashbayeva*, master, senior lecturer[1]
K. Baigabulova, c.e.s., professor [2]
D. Sugir, master, senior lecturer[1]
Zh. Amanzholov, master[3]
Esil University, Astana, Kazakhstan[1]
L.N. Gumilyov Eurasian National University,
Astana, Kazakhstan[2]
«NS «Aktau sea commercial port» JSC,
Aktau, Kazakhstan[3]
* – main author (author for correspondence)
e-mail: nukanai09@bk.ru

IMPLEMENTATION OF AGILE USING THE GERT METHOD
FOR THE EFFICIENCY OF MANAGING THE COMPANY'S INVESTMENT PROJECTS

The article is devoted to the topical issues of implementing Agile flexible methodology using the GERT method in the management of investment projects of Kazakhstani companies. The results of this study show that the introduction of flexible agile methodology to the company's activities can be implemented in different ways, so the results of the preliminary evaluation of the effectiveness of the project implementation remain ambiguous. In this case, the method of creating a variable model using the GERT method is possible. This method makes it possible to explain the course of the project to the algorithm of specific actions using predefined signs in the form of nodes. The authors present a synthesized method using stochastic networks. It is obvious that the developed network algorithm is a variable probabilistic method of GERT network planning. Thus, some of the operations may not be performed, although on the other hand, other operations can be partially performed, and others can even be performed several times.

The purpose of the research is to develop and present a network synthesized model, where the completeness of the repeating cycle in its continuous actions of completed operations is visually visible and reflected, taking into account the implementation of Agile for the success of the project. Also, it can be noted that it is allowed not to perform any of the works. According to the results of the study, the GERT method was used as the basis for the proposed model, since it allows you to reflect the variability of actions and with its help you can best show the need to return to the «maturity level assessment» step. We can note that in this case, it is allowed to fail to perform any of the works. The study also describes the main properties and disadvantages of alternative networks.

Keywords: Agile, GERT method, project management, network planning, alternative networks, variable model, maturity level assessment, systems limitation theories.

Кілт сөздер: Agile, GERT әдісі, жобаларды басқару, желіні жоспарлау, балама желілер, ауыспалы модель, жетілу деңгейін бағалау, жүйе шектеулерінің теориялары.

Ключевые слова: Agile, метод GERT, проектное управление, сетевое планирование, альтернативные сети, вариативная модель, оценка уровня зрелости, теории ограничения систем.

JEL classifications: G24, L11, L92

Introduction. The article is devoted to topical issues of the implementation of the Agile methodology using the PERT method in the management of investment projects of Kazakhstani companies. The implementation of a flexible agile methodology in the company's activities can be implemented in different ways, therefore, the results of a preliminary assessment of the effectiveness of the project implementation remain ambiguous. To this end, the authors of the article have developed an algorithm using the GERT method, which allows you to explain the progress of the project by an algorithm of specific actions using predefined signs in the form of nodes.

To achieve this goal, a literature review was conducted and studied «The five guiding steps of the theory of system constraints on system redesign», specifically presented by the theory of system constraints by E. Goldratt. The results of the study confirm that the presented approach to creating a variable model using the GERT method in Agile can be significant and significant in the success of investment projects of companies in Kazakhstan.

The article describes a comparative analysis of the application of classical and flexible methods in JSC NC KTZ. An assessment of the effectiveness of the project implementation using Agile technology is presented. According to the data that will be presented in this article, it will be seen how flexible the

approach gives a good result. Therefore, the article is devoted to the importance of optimal Agile implementation for companies that seek to reach a new level and increase their sources of income.

Materials and methods of research. The research methodology included the use of the empirical method, comparative and statistical analysis, graphical assessment method and GERT analysis. The uniqueness and importance of the study lies in the developed logical model with the ability to reflect the multivariability of actions in the presented work of a full-scale project, taking into account the tolerance of partial non-fulfillment of some operations. So, the logical belief is the need to return to the step of «assessing the level of maturity».

Literature review. The relevance of the research topic is emphasized by the fact that for companies, the issues of selecting the most effective management tools are dictated by the specific features of their activities, the need to coordinate and ensure the coherence of multiple teams.

Key prospects for using Agile: managing uncertainties associated with unforeseen large risks; maximizing the company's development opportunities and prospects; making long-term management decisions, etc. [1].

The Scrum methodology also promotes continuous improvement and improves the quality of the product as the team works on small iterations, each of which must be ready for use. Another benefit of the Scrum methodology is its ability to improve transparency in the development process. This is achieved through a product backlog, which allows the entire team to see what tasks need to be completed and what progress has been made. The disadvantage of the Scrum method is that this methodology is not suitable for all projects. Scrum is not a universal project management method and is not suitable for all types of projects. Some projects may be too complex or have too few repetitive tasks to use Scrum [2].

Having studied the advantages and disadvantages of Scram and Kanban, you may not always achieve the desired result when implementing a company's investment project [3].

Main part. The flexible method includes such complex iterations presented in the form of constant ending cycles, in action it is visualized by planning and development, which is regarded as results in intermediate plans. So certain adjustments are made there to change the presented initial plan from the beginning of the iteration to the end of the cycle. [4].

Such technologies reveal ideas for urgent modification of the presented product, in which their main goals and requirements for completing the action plan by the time the project was completed were not entirely clear. In today's fast-paced environment, an agile approach offers unique solutions and project outcomes. As for Scrum, when using it, such inaccuracies in its application are revealed, that is, disadvantages can create certain difficulties, namely, when concluding an upcoming contract with a potential customer and the wrong team that does not know how to work cohesively and does not have explicit communications established in advance for their competence and implementation in time in the company's budgeted budgets.

The report of the traditional model of investment project management efficiency of JSC NC «KTZ»: P = 164859,9 – (67200 + 29866) = 67793,9 million tenge. P = 67793,9 – 9527,4 = 58266,4 million tenge. Income tax = 58266,4x 0,20 = 11653,1 million tenge. The outflow of cash from investment activities is equal to capital expenditures. K= 448 000 million tenge. Let's calculate the payback period of the investment project using the graphical and analytical method (figure 1).
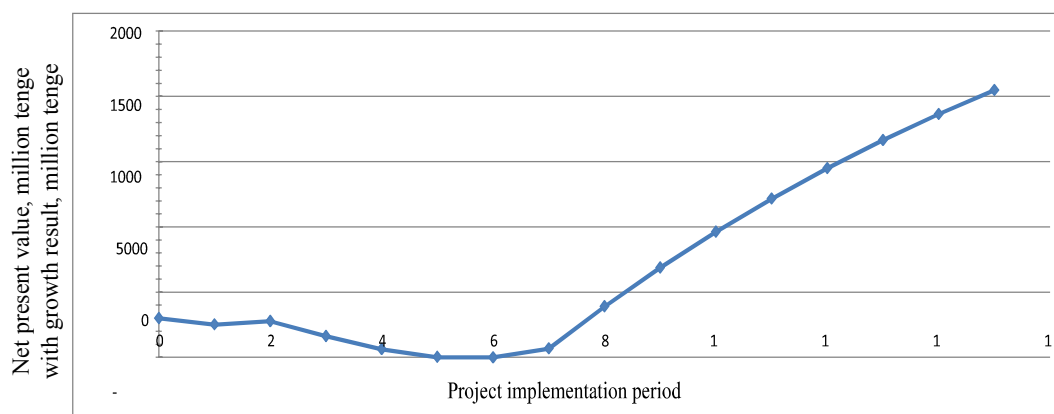

Figure 1. **Determination of the payback period according to the traditional model of the investment project of JSC NC «KTZ» by a graphical and analytical method***

* Compiled by the authors based on the source [5]

In the second and subsequent years of the reporting period, all calculations are given the results of the above calculations and indicators of the effectiveness of the project are determined.

The calculation was carried out on the basis of the traditional methodology, the results of which are presented. The estimated payback period of the project is 7.81 years. At the same time, net income for 15 years is 2,494,927 million tenge, and net discounted income – 976,098.8 million tenge. But as practice shows, this project cannot be implemented without the participation of the state.

For the implementation of the effectiveness of the introduction of Agile in JSC NC «KTZ», a pilot project for the implementation of the investment project was introduced. The cost of the project is 243,750 thousand tenge, of which 202936 thousand tenge will be spent in 2023, and 40,813 thousand tenge in 2024. These data are presented according to the cost of work report. Storage after the implementation of this system also requires certain costs. According to forecasts, for employees of administrative and management personnel who are most involved in the implementation of the company's projects, the motivational component of higher wages in the amount of 468 thousand tenge (10% of the salary according to the staffing table) will be preserved. The project team consists of 25 people. Also, the support of the project management information system (for example, license renewal, technical support, etc.) requires additional costs.

In Table 1, we calculate the costs of maintaining a corporate development project management system.

Table 1

Calculation of system storage costs*

Expense item	Amount for 1 month	Total per year
Amount of bonuses for administrative and management personnel	468000x25 employees =11700 thousand tenge	140 400 thousand tenge
Information management system support	3000 thousand tenge	36000 thousand tenge
Total:		176400 thousand tenge

* Compiled by the authors based on the source [5]

After the implementation of the project methodology, the company's net profit will increase by 6%. Based on this, table 19 presents the calculation of net profit.

The arithmetic mean of net profit for the last three years was taken as the initial indicator of net profit.

Table 2

Calculation of the effectiveness of the project*

№	Name of the indicator	Value of the indicator by period, tenge					
		2023	2024	2025	2026	2027	2028
1	Material costs for the implementation of the project	-202936500	-40813500				
2	Expenses related to the support of the implemented management system			-47268000	-47268000	-47268000	-47268000
3	Δ Net profit			131870700	143739180	156675480	170776320
4	Total cash flow	-202936500	-40813500	84602700	96471180	109407480	123508320
5	Discount (discount) coefficient 12%	1,000	0,893	0,797	0,712	0,636	0,567
6	Discounted cash flow	-202936500	-36440820	67444650	68666130	69530370	70081830
7	Accumulated cash flow	-202936500	-239377320	-171932280	-103266150	-33735780	36346440

* Compiled by the authors based on the source [5]

Thus, it amounts to 7.68% of interest on risk – free deposits (the arithmetic mean of the rate values for long-term deposits of the 5 largest banks) and 4.32% on risk (the risk value is generally low), inflation is not taken into account.

The low risk rate is due to the independence of the project result from external factors, such as changes in market conditions, supply and demand, and the overall level of prices for raw materials and products. Existing risks refer to socially oriented risks and depend on the internal environment of the company.

NPV= 36346440; IRR=17%; DPBP= 5,5; PI= 1,13. Thus, we can conclude that the project is economically profitable. The net discounted income for the project was more than zero, amounted to 36346050 Tenge, the internal rate of Return was 17% and turned out to be higher than the average cost of capital, the profitability index is more than a unit. All indicators have positive values, which means that the project is effective. Before the introduction of Agile in JSC NC KTZ, according to the traditional method of project management, the project implementation period was 7.81 years, and after the introduction of Agile, the pilot project implementation period was 1.13 years. This suggests that the introduction of flexible technology significantly reduces the project implementation time.

Kazakhtelecom has actively initiated the adoption of Agile practices since 2019. As a pilot project, two teams were formed to focus on creating new products and implementing innovative projects based on Big Data. According to the «11th annual report State of Agile», the utilization of Agile methodology has witnessed a notable increase in various companies. For instance, Air Astana reported a rise from 35 percent to 88 percent in Agile implementation compared to the Waterfall method. Similarly, Samruk Kazyna experienced an increase from 23 percent to 47 percent, while JSC «Accumulative Pension Fund 'GNPF'» observed a growth from 56 percent to 65 percent, all in comparison to the Waterfall method. This data reflects the growing prevalence of Agile practices within corporations [5].
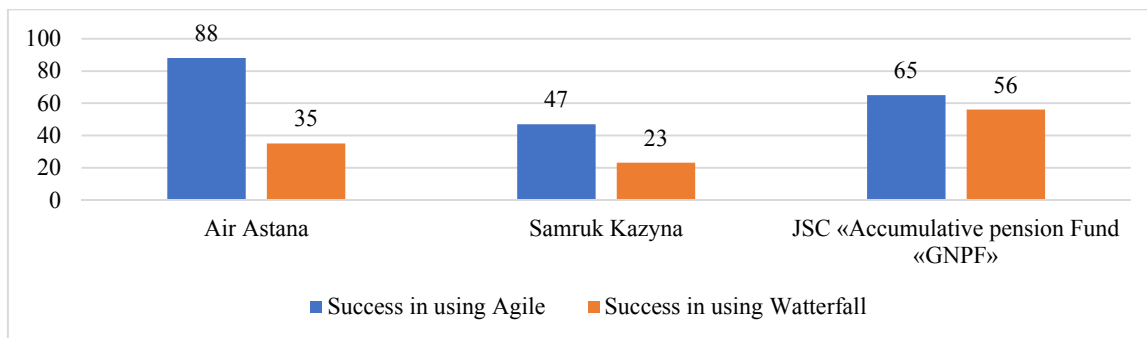

Figure 2. **Agile methodology success in percentages***
* Compiled by the authors based on the source [6]

Having become familiar with the proposed methods of Agile methodology and having studied and assessed their pros and cons, the authors propose a model of a network algorithm for the success of a project with agile management.

In such a process of action, we assume that not all signals presented in the block will be operational; some steps may not be performed at all, while others may be performed partially or more accurately [7].

In Table 1 we demonstrate the conditional values of the GERT method.

The GERT method shows the cyclical pattern of work and the change in activities, using predetermined values, interpreting the complex process of the project into a precise algorithm of actions.

Thus, it is clear that such an introduction of project management into the activities of a particular company can be implemented using different approaches, where the very result of the preliminary assessment and analysis is not entirely unclear.

Table 3

Symbols of the GERT method*

Legend	
1	2
Source node (deterministic) to be committed	
A node is realized if A and B are executed followed by either C or D or E.	

1	2
Intermediate node with probabilistic input and output. A node is realized if A and B are executed followed by either C or D.	
An intermediate node with deterministic input and output. A node is realized if A is performed followed by B and C.	
The final node that is realized if A and B are performed.	
The final node that is implemented if either work A or B is performed.	

* Compiled by the authors based on the source [7]

Figure 1 shows a network model based on systems constraint theory.

The values for the initial estimate for Figure 1 are:

A – assessment of the current state of the organization;

B – analysis for changes in work;

V – refusal of the proposed project, ineffectiveness of work;

G – study of the company's project work;

G1 – the company does not have the ability to make changes;

D – find the exact limitation (weak link);

E – find a way out to ease the restriction;

ZH – remove the restriction;

Z – the system is normalized, there are no new restrictions;

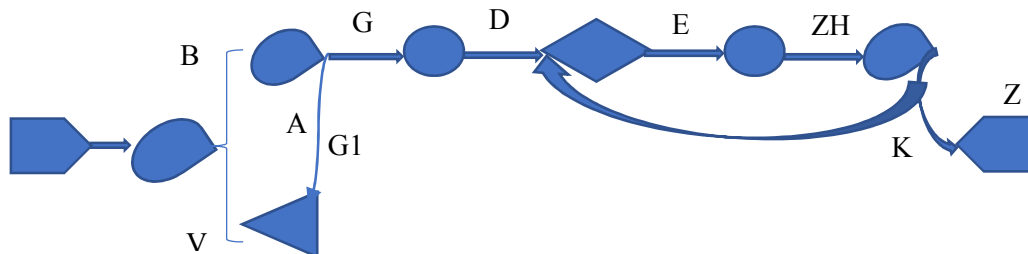K – search for new limits and then return to the new search step 1.

Figure 3. **Network model in accordance with the theory of system constraints by E. Goldratt***
* Compiled by the authors based on the source [7]

In an enterprise management system, a weak link can appear anywhere, both in production activities and in the company's management system.

Initial data:

A – identification of the category of the degree of technological maturity;

B – identify the key philosophy and vision of project management;

V – to prepare a program and special documentation for successful management;

G – prepare samples;

D – to prepare team members for the implementation of management, taking into account their preliminary and further training;

E – download the automated control system;

ZH – in the process of action, prepare a project for the creation of a project office;

Z – to prepare samples of projects in an atomized control system;

I – implement the designated operation of the pilot corporate project in the project management system;

K – prepare and thoroughly evaluate and analyze the completed project cycle;

L – based on the key requirements, make changes to the relevant documents and business processes operating in a logical sequence;

M – make repeated changes to existing business processes;

O – integration of all processes into the UP in accordance with the significant areas of the assigned task;

P – implementation of a corporate updated audit of the project management system;

R – using proper benchmarking to improve the entire corporate system.
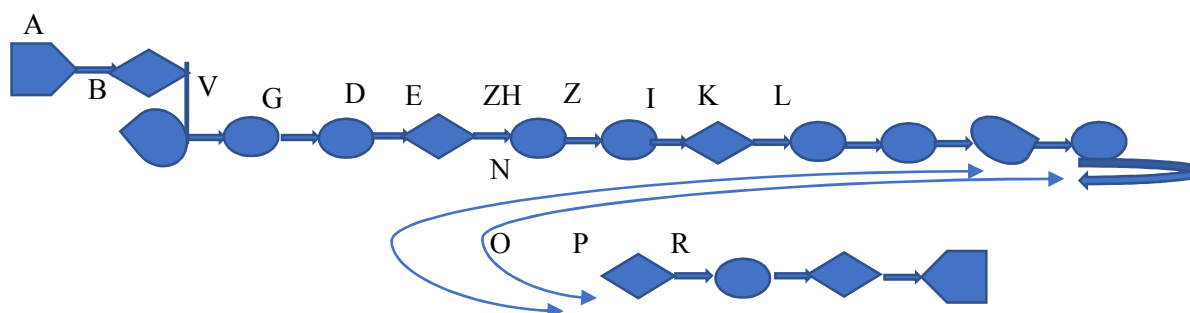

Figure 4. **Universal network model of variability of actions
for performing work during the implementation of an investment project***
* Compiled by the authors

Thus, in accordance with the presented algorithm, the authors propose to implement each point step by step.

There is also a drawback of the GERT method, which manifests itself during the operational management of investment projects, and it is associated with the difficulty of practically accounting for changes in the topology of work [8].

Conclusion. This article discusses the main Agile approaches to investment project management. The introduction of flexible Agile methodology into a company's activities can be carried out using a variety of approaches, so the result of the preliminary analysis and assessment of the effectiveness of project implementation remains ambiguous.

Thus, in the study, the authors recommended the option of creating a network model using the GERT method. This approach makes it possible to create a clear algorithm of work actions and connect predetermined signs using them in the form of nodes.

The choice of the GERT method is predetermined by the fact that it adequately represents and models complex processes where it is clearly difficult to identify the work, namely the sequence of their implementation along one chain to achieve the success of the final goal of the project, when there is a multivariate project.

The purpose of this article was to present the basic concepts and foundations of the GERT network for managing investment projects, to demonstrate the developed universal model in the Agile implementation process. However, it should be remembered that GERT is capable of working with both extremely complex projects and current systems.

Thus, the material presented gives only a superficial idea of what can actually be achieved using the GERT method. In addition, the analysis only considered the most obvious use case for GERT results. According to the authors, in most cases, the results of project network planning can be more intelligently used in the process of managing investment projects than often happens not only in GERT, but also in PERT/CPM.

In further research, it is planned to consider in more detail the management technologies of project teams implementing project activities based on the methodology of flexible project management. The willingness of the team to work on the basis of agile values is characterized by responsibility for a specific result, independence of work, focus on cooperation with the customer, compliance with the principles of methodology.

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Алашбаева Н.М., Байгабулова К.К., Сугир Д.С., Аманжолов Ж.М.

КОМПАНИЯНЫҢ ИНВЕСТИЦИЯЛЫҚ ЖОБАЛАРЫН БАСҚАРУДЫҢ ТИІМДІЛІГІ ҮШІН GERT ӘДІСІ АРҚЫЛЫ AGILE ЕНГІЗУ

Аңдатпа

Мақала Қазақстандық компаниялардың инвестициялық жобаларын басқаруда GERT әдісін Қолдана отырып, Икемді икемді әдіснаманы енгізудің өзекті мәселелеріне арналған. Осы зерттеудің нәтижелері компанияның қызметіне икемді ептілік әдістемесін енгізуді әртүрлі тәсілдермен жүзеге асыруға болатындығын көрсетеді, сондықтан жобаны іске асырудың тиімділігін алдын-ала бағалау нәтижелері екіұшты болып қалады. Бұл жағдайда gert әдісін қолдана отырып айнымалы модель құру әдісі мүмкін. Бұл әдіс жобаның барысын түйіндер түрінде алдын ала анықталған белгілерді қолдана отырып, нақты әрекеттер алгоритміне түсіндіруге мүмкіндік береді. Авторлар стохастикалық желілерді қолдана отырып синтезделген әдісті ұсынады. Әзірленген желілік алгоритм GERT желісін жоспарлаудың ауыспалы ықтималдық әдісі болып табылатыны анық. Осылайша, кейбір операциялар орындалмауы мүмкін, бірақ екінші жағынан, басқа операциялар ішінара орындалуы мүмкін, ал басқалары тіпті бірнеше рет орындалуы мүмкін.

Зерттеудің мақсаты желілік синтезделген модельді әзірлеу және ұсыну болып табылады, мұнда қайталанатын циклдің толықтығы оның аяқталған операцияларының үздіксіз әрекеттерінде жобаның сәттілігі

Үшін Ептілікті жүзеге асыруды ескере отырып, көзбен көрінеді және көрініс табады.. Сондай-ақ, жұмыстардың ешқайсысын орындамауға рұқсат етілгенін атап өтуге болады. Зерттеу нәтижелері бойынша ұсынылған модельдің негізі ретінде GERT әдісі пайдаланылды, өйткені ол әрекеттердің өзгермелілігін көрсетуге мүмкіндік береді және оның көмегімен «жетілу деңгейін бағалауға» қайта оралу қажеттілігін жақсы көрсетуге болады.қадам. Бұл жағдайда жұмыстардың ешқайсысын орындамауға жол берілетінін атап өтуге болады. Зерттеу сонымен қатар балама желілердің негізгі қасиеттері мен кемшіліктерін сипаттайды.

Алашбаева Н.М., Байгабулова К.К., Сугир Д.С., Аманжолов Ж.М.

ВНЕДРЕНИЕ AGILE С ПОМОЩЬЮ МЕТОДА GERT ДЛЯ ЭФФЕКТИВНОСТИ УПРАВЛЕНИЯ ИНВЕСТИЦИОННЫМИ ПРОЕКТАМИ КОМПАНИИ

Аннотация

Статья посвящена актуальным вопросам внедрения гибкой методологии Agile с использованием метода GERT в управлении инвестиционными проектами казахстанских компаний. Результаты данного исследования показывают, что внедрение гибкой agile-методологии в деятельность компании может быть реализовано разными способами, поэтому результаты предварительной оценки эффективности реализации проекта остаются неоднозначными. В этом случае возможен метод создания переменной модели с использованием метода GERT. Этот метод позволяет объяснить ход проекта алгоритмом конкретных действий, используя заранее определенные знаки в виде узлов. Авторы представляют синтезированный метод с использованием стохастических сетей. Очевидно, что разработанный сетевой алгоритм представляет собой вариабельный вероятностный метод планирования сети GERT. Таким образом, некоторые операции могут не выполняться, хотя, с другой стороны, другие операции могут быть выполнены частично, а третьи могут быть выполнены даже несколько раз.

Цель исследования - разработать и представить сетевую синтезированную модель, в которой полнота повторяющегося цикла в его непрерывных действиях завершенных операций визуально видна и отражена с учетом внедрения Agile для успеха проекта. Также можно отметить, что разрешается не выполнять ни одну из работ.

Согласно результатам исследования, за основу предложенной модели был взят метод GERT, поскольку он позволяет отразить вариативность действий и с его помощью можно наилучшим образом показать необходимость возврата к этапу «оценка уровня зрелости». Можно отметить, что в этом случае допускается отказ от выполнения каких-либо работ. В исследовании также описаны основные свойства и недостатки альтернативных сетей.