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MODEL OF DISTRIBUTION OF THE BUDGET OF THE PORTFOLIO OF IT PROJECTS TAKING IN-TO ACCOUNT THEIR PRIORITY

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Abstract

Article is devoted to a problem of effective distribution of the general budget of a portfolio between the IT projects which are its part taking into ac-count their priority. The designated problem is actual in view of low results of activity of the consulting companies in the sphere of information technologies. For determination of priority of IT projects the method of analytical networks developed by T. Saati is used. For the purpose of application of this method the system of criteria (indicators) reflecting influence of IT projects of a portfolio on the most significant purposes of implementation of IT projects of a portfolio is developed. As system of criteria the key indicators of efficiency defined when developing the Balanced system of indicators which meet above-mentioned requirements are used. The essence of a method of analytical net-works consists in paired comparison of key indicators of efficiency concerning the purpose of realization of a portfolio and IT projects which are a part of a portfolio. Result of use of a method of analytical networks are coefficients of priority of each IT project of a portfolio. The received coefficients of priority of IT projects are used in the offered model of distribution of the budget of a portfolio between IT projects. Thus, the budget of a portfolio of IT projects is distributed between them taking into account not only the income from implementation of each IT project, but also other criteria, important for the IT company, for example: the degree of com-pliance of the IT project to strategic objectives of the IT company defining ex-pediency of implementation of the IT project; the term of implementation of the IT project determined by the customer. The developed model of distribu-tion of the budget of a portfolio between IT projects is approved on the exam-ple of distribution of the budget between IT projects of the portfolio consisting of three IT projects. Taking into account the received coefficients of priority of IT projects of a portfolio and the offered model of distribution of the budget of a portfolio the admissible volume of costs of each IT project was redistributed. It allowed to distribute more correctly the budget allocated for realization of a portfolio, therefore, allowed to avoid unreasonable expenses at implementation of the IT project of a portfolio.

Keywords: *portfolio of IT projects, method of analytical networks, priority coefficient.*

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The analysis of activity of the consulting companies in the sphere of in-formation technologies (IT companies) shows that the share of successfully executed IT projects makes small part among all set of the realized IT projects. This is confirmed by a number of the researches conducted by the international companies Standish Group Inc serves., Info-Tech Research Group [14, 15]. Ac-cording to the received results from 15% to 30% of IT projects are admitted as "successful" (i.e. terms, the budget and a framework of the IT project are observed). One of the reasons of unsuccessful implementation of IT projects is irrational financing. In this regard in process of management of realization of a portfolio of IT projects it is necessary to use a technique of determination of priority of IT projects and the scheme of distribution of total amount of financ-ing between IT projects of a portfolio according to the chosen technique.

Today there is a large number of techniques of determination of priority of IT projects of a portfolio. The analysis of domestic and foreign literature on this subject showed [7] that a distinctive feature of techniques is use of esti-mated values of criteria, various on character (for example, quantitative, mark, qualitative, paired comparison, indistinct estimates) and methods of formation of complex criterion (for example, weighing, hierarchical structure of criteria, a rating method) [3]. We will submit the formalized description of a problem of determination of coefficient of priority of implementation of IT projects of a portfolio (complex criterion). There is a set of IT projects of a portfolio:

$$P = \{P_1, P_2, ..., P_n\} \quad (1)$$

and set of criteria of an assessment of IT projects:

$$G = \{G_1, G_2, ..., P_k\} \quad (2)$$

The problem of determination of priority of implementation of IT projects of a portfolio consists in streamlining of elements of a set of P by criteria of G.

It is noted that there are some various methods of creation of complex criterion of G. In work Van der Merv as André [4] gave an example of use of a rating method at an assessment of priority of substations of the power system ESKOM. A lack of a method is subjectivity of expert judgments. The method of creation of complex criterion of G on the basis of a method of weighing is universal [3]. The complex criterion of G can be calculated as G_i – criteria ($i = \overline{1,k}$) with some scales of k_i [3]:

$$G = \sum_{i=1}^{k} k_i G_i \quad (3)$$

The weight of criterion is defined according to a criterion significance value at an assessment of IT projects of a portfolio. For calculation of a significance value of criteria most effectively to use a method of formation of a com-plex assessment on the basis of a method of the analysis of hierarchies (in case of hierarchical structure of criteria) or a method of the analytical networks (in case of the mutually influencing criteria) developed by Saati T. [9]. We will note that a lack of this method is the high labor input when developing pair estimates increasing with amount of the criteria used at an assessment [1]. However amount of the used criteria at an assessment of IT projects it is necessary to limit to amount of 8–12 criteria, irrespective of the chosen method of formation of complex criterion since at bigger amount of criteria the attention of the expert dissipates that as a result can lead to inexact results [9]. Thus, when determining complex criterion (priority of the IT project of a portfolio) most effectively is to use a method of analytical networks of T. Saati. The system of criteria [11] serves as the indicator of influence of the IT project of a portfolio on the most significant purposes of implementation of IT projects of a portfolio. In this case it is expedient to use the key indicators of efficiency (KPE, English Key Performance Indicator, KPI) defined when developing the Balanced system of indicators (the PROGRAM STATUS WORD, English Balanced ScoreCard, BSC), meeting abovementioned requirements [6].

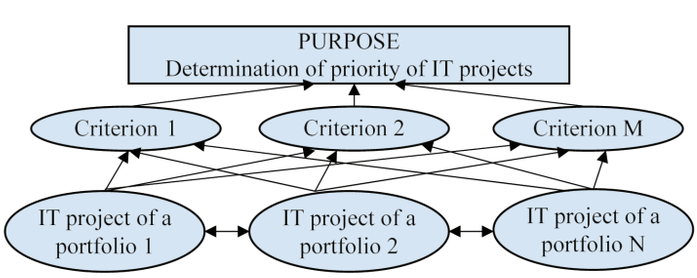

Figure 1. Structure of a problem of determination of priority of IT projects

At calculation of coefficients of priority of IT projects of a portfolio taking into account all indicators, in this article the method of the T.L analytical networks is used. Saati. The method of analytical networks defines extent of influence of several alternatives (IT projects) on the purpose of realization of a portfolio of IT projects, considering mutual influence between indicators, and also between IT projects.

We will describe structure of a problem of determination of priority of IT projects of a portfolio on the basis of the method of analytical networks (MAN) (Figure 1).

With use of a scale of the relations priorities of criteria concerning the purpose are established (c_m), $m = \overline{1,M}$, $\sum_{m=1}^{M} c_m = 1$ (Table 1).

With use of a scale of the relations priorities of alternatives in a section of criteria (IT projects of a portfolio) are established. Establishment of priorities consists in paired comparison of alternatives in a section of each criterion (Table 2).

It is necessary to establish mutual influence of criteria (Table 3).

The results received according to Table 1–3 register in a supermatrix (Table 4).

The received supermatrix (Table 4) needs to be given to a stochastic look. Resultant priorities of elements supermatrix turn out by construction of a stochastic matrix in limit degrees. The supermatrix, with the filled values in the following cells is as a result formed (crossing of the lines "IT Project 1", "IT Project 2", ..., "the IT project N with a column "Purpose"). The received values are coefficients of priority of IT projects ($koeff\_prior_i, i = \overline{1,N}$).

Model of distribution of the budget of a portfolio of IT projects

The analysis of results of the solution of a problem of effective distribu-tion of the budget of a portfolio of the IT projects received by the Russian and foreign scientists [1, 2, 7, 8, 12] is carried out. The solution of the designated task is under construction on the basis of optimization of the set criterion (for example, maximizing profit, minimization of the missed benefit) [2, 8, 12]. It is important to emphasize that application of the considered models in activity of the consulting IT companies, the characterized various works of each IT project of a portfolio on the specialization which is rigidly set by sequence of realization, is analytically difficult solved task [1, 2]. Therefore approximate or

Table 1

Priority of criteria concerning the purpose

PURPOSE	Criterion 1	Criterion 2	Criterion M	Eigenvector
Criterion 1	C_{11}	C_{12}	C_{1M}	C_1
Criterion 2	C_{21}	C_{22}	C_{2M}	C_2
Criterion M	C_{M1}	C_{M2}	C_{MM}	C_M

Table 2

Priority of Alternatives concerning criteria

PURPOSE	Criterion 1	Criterion 2	Criterion M	Eigenvector
Criterion 1	α^1_{11}	α^1_{12}	α^1_{1N}	$\frac{\sum_{i=1}^{N} a^1_{1i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^1_{ij}}$
Criterion 2	α^1_{21}	α^1_{22}	α^1_{2N}	$\frac{\sum_{i=1}^{N} a^1_{2i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^1_{ij}}$
Criterion M	α^1_{N1}	α^1_{N2}	α^1_{NN}	$\frac{\sum_{i=1}^{N} a^1_{Ni}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^1_{ij}}$

Table 3

Mutual influence of criteria

PURPOSE	Criterion 1	Criterion 2	Criterion M
Criterion 1	kr_{11}	kr_{12}	kr_{1M}
Criterion 2	kr_{21}	kr_{22}	kr_{2M}
Criterion M	kr_{M1}	kr_{M2}	kr_{MM}

heuristic algorithms which allow to receive near – optimum (admissible) decisions are applied to its decision. Besides, the designated models don't allow (shortcomings of models): to consider in a complex specified task, namely: to define a point of balance of each IT project of a portfolio on the basis of criteria of their profitability, compliance to strategic objectives, riskinesses, etc. which can be contradictory; to limit the admissible level of costs of implementation of each IT project of a portfolio. It can lead to a situation when the unjustified sum of financial means is spent for the low-profitable IT project. According to the shortcoming connected with complex consideration of a task, IT projects need to be considered not only in a cut of financial aspect. For example, the considered IT project can not have high value of an indicator of profitability, but have a great influence on increase of competitiveness of the IT company. Therefore at distribution of the general budget between IT projects

Table 4

Supermatrix for determination of priority of IT projects

	Purpose	Criterion 1	Criterion 2	Criterion M	IT pr. 1	IT pr.2	IT pr. N
Purpose	0	0	0	0	0	0	0
Criterion 1	C_1	kr_{11}	kr_{12}	kr_{1M}	0	0	0
Criterion 2	C	kr_{21}	kr_{22}	kr_{2M}	0	0	0
Criterion M	C_M	kr_{M1}	kr_{M2}	kr_{MM}	0	0	0
IT project 1	0	$\frac{\sum_{i=1}^{N} a^1_{1i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^1_{ij}}$	$\frac{\sum_{i=1}^{N} a^2_{1i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^2_{ij}}$	$\frac{\sum_{i=1}^{N} a^N_{1i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^N_{ij}}$	1	0	0
IT project 2	0	$\frac{\sum_{i=1}^{N} a^1_{2i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^1_{ij}}$	$\frac{\sum_{i=1}^{N} a^2_{2i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^2_{ij}}$	$\frac{\sum_{i=1}^{N} a^N_{2i}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^N_{ij}}$	0	1	0
IT project N	0	$\frac{\sum_{i=1}^{N} a^1_{Ni}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^1_{ij}}$	$\frac{\sum_{i=1}^{N} a^2_{Ni}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^2_{ij}}$	$\frac{\sum_{i=1}^{N} a^N_{Ni}}{\sum_{i=1}^{N}\sum_{j=1}^{N} a^N_{ij}}$	0	0	1

of a portfolio it is necessary to consider priority of IT projects of a portfolio, the implementation of IT projects reflecting the comprehensive detailed analysis of conditions. For the purpose of an exception of the above shortcomings the following model to distribution of financial means to i-y the IT project of a portfolio is offered (F_i):

$$F_i \le \frac{(1 + koeff\_prior_i) * D_i}{\sum_{i=1}^{n}(1 + koeff\_prior_i)D_i} * Z_{\text{общ}} \quad (4)$$

where D_i – income from realization of i-y of the IT project of a portfolio; i – number of the IT project, $i = 1,n$; n – number of IT projects of a portfolio;

$koeff\_prior_i$ – coefficient of priority of i-y of the IT project of a portfolio; $Z_{общ}$ – the general expenses allocated for realization of a portfolio of IT projects.

Example of application of a technique of priority of IT projects

As an example the portfolio of IT projects consisting of three IT projects is considered. For convenience of data presentation criteria are numbered the order defined in Table 5:

Table 5

Numbering of criteria

Name of criterion	Number of criterion
Income from implementation of the IT project	1
Size of costs of implementation of the IT project	2
Risk of refusal of implementation of the IT project from the customer	3
Extent of influence of the IT project on increase of competitiveness of the IT company	4
Term of implementation of the IT project	5
Time of implementation of the IT project = IT project Amount of works / Maximum quantity of a manpower	6
Experience of introduction typical in relation to the considered IT project	7
Risk of failure to complete of the IT project in view of competence of experts from the performer	8
Degree of compliance of the IT project to strategic objectives of the IT company	9
Satisfaction of a manpower	10

Priorities of criteria concerning the purpose of realization of a portfolio of IT projects, priority of IT projects in a section of each criterion, mutual influence of criteria and IT projects are established (according to Table 3). The received results are reflected in a supermatrix which is given to a stochastic look and is built in limit degree (Table 6).

As a result of construction of a supermatrix in limit extents (Table 6) coefficients of priority of IT projects (crossing of the lines "IT Project ...", and a column "Purpose" are calculated) ($koeff\_prior_i\ i = \overline{1,n}$).

Taking into account the found coefficients of priority of IT projects of a portfolio the budget of a portfolio between IT projects is distributed ($Z_{общ}$ =520 000 rubles), considering the income (D_i), received from their realization (Table 7).

Table 7

Income from implementation of IT projects of a portfolio

	IT project 1	IT project 2	IT project 3
Income (rub.)	370 000	720 000	190 000

At distribution of the budget the distribution formula is used (4). The fol-lowing results (Table 8).

Table 8

Income from implementation of IT projects of a portfolio

	IT project 1	IT project 2	IT project 3
Expenses (rub) without priority coefficients	150 312,50	292 500,00	77 187,50
Expenses (rub) taking into account priority coefficients	133 684,50	320 351,40	65964,19

Thus, the budget of a portfolio of IT projects is distributed between them taking into account not only the income from implementation of the IT project, but also other criteria, important for the IT company.

Conclusion

The analysis of results of the solution of a problem of effective distribu-tion of the budget of a portfolio of the IT projects received by the Russian and foreign scientists showed that, as a rule, at distribution of financial resources in a portfolio the model of optimization of the set criterion is used (for example, profit maximization, minimization of duration of realization of a portfolio). The specified models are analytically difficult solved. Besides, they don't allow: to consider in a complex specified task, namely: to define a point of balance of each IT project of a portfolio on the basis of criteria of their profitability, com-pliance to strategic objectives, riskinesses, etc. which can be contradictory; to limit the admissible level of costs of implementation of each IT project of a portfolio. It can lead to a situation when the unjustified sum of financial means is spent for the low-income IT project. In this regard, in this article it is offered at the solution of a problem of effective distribution of financial means to use the developed model of distribution of the budget of a portfolio of IT projects taking into account their priority. Application of the developed mathematical model of distribution of the cumulative financial means allocated for realization of a portfolio of IT projects between IT projects taking into account their prof-itability and priority, allows to carry out IT projects within admissible expens-es adjusted for their priority, therefore, not to allow unjustified costs of im-plementation of separate IT projects of a portfolio.

References

1. Anshin V. M. Models of management of a portfolio of projects in the conditions of uncertainty / V.M.

Table 6

The Resultant supermatrix for determination of priority of IT projects

	Purpose	Cr 1	Cr 2	Cr 3	Cr 4	Cr 5	Cr 6	Cr 7	Cr 8	Cr 9	Cr 10	IT pr. 1	IT pr.2	IT pr.3
Purpose	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criterion 1	0	0,01	0,01	0	0	0	0	0	0	0	0	0	0	0
Criterion 2	0	0,01	0,01	0	0	0	0	0	0	0	0	0	0	0
Criterion 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criterion 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criterion 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criterion 6	0	0	0	0	0	0	0,01	0	0	0	0,01	0	0	0
Criterion 7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criterion 8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criterion 9	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Criterion 10	0	0	0	0	0	0	0,01	0	0	0	0,01	0	0	0
IT project 1	0,253	0,18	0,17	0,19	0,25	0,36	0,26	0,14	0,17	0,37	0,26	1	0	0
IT project 2	0,543	0,69	0,67	0,48	0,50	0,50	0,46	0,57	0,50	0,47	0,48	0	1	0
IT project 3	0,204	0,12	0,14	0,32	0,25	0,14	0,26	0,29	0,33	0,16	0,26	0	0	1

Anshin, I.V. Demkin, I.M. Nikonov, I.N. Tsarkov. M.: MATI publishing center, 2007. 117 p.

2. Barkalov P.S. Problems of distribution of resources in management of projects / P.S. Barkalov, I.V. Burkova, A.V. Glagolev, V.N. Kolpachev. M.: YIP RAHN, 2002. 65 p.
3. Burkov V.N., Dzhavakhadze G.S. Economic-mathematical models of management of development of branch production. M.: YIP RAHN, 1997. 64 p.
4. Van der Merv of André. Definition of priorities within multi – Projects / Van der Merv of André. *Management of projects and programs*, 2007, no. 3(11), pp. 250–254.
5. Dieng R. Critical factors of success of the project: some aspects of management of IT projects in China. *Management of projects and programs*, 2009, no. 1(17), pp. 6–13.
6. Kaplan Robert S., Norton Deyvid P. Balanced system of indicators. From strategy to action. 2nd prod., испр. and. additional / [the Lane from English M. Pavlova]. M.: JSC Olympe-business, 2008. 320 p.
7. Kendall I., Rollinz To. Modern methods of management of portfolios of projects and office of management of projects: Maximizing ROI: The lane with English. M.: JSC PMSOFT, 2004. 576 p.
8. Matveev A.A. Models and methods of management of portfolios of projects / A.A. Matveev, D.A. Novikov, A.V. Tsvetkov. M.: PMSOFT, 2005. 206 p.
9. Saati T.L. Decision-making at dependences and feedback: Analytical networks. The lane with English / Nauch. edition A.V. Andreychikov, O.N. Andreychikova. Prod. the 4th. M.: LENAND, 2015. 360 p.
10. Savich A.V., Tsipes G. L. How to estimate influence of the separate project on the end results of the program: opinions and facts. *Management of projects and programs*, 2007, no. 3(11), pp. 192–208.
11. Chuyeva L.N., Chuyev I.N. Analysis of financial and economic activity: Textbook. 7th prod., reslave. and additional. M.: Publishing and trade corporation "Dashkov and Ko", 2007. 352 p.
12. Gerchak Y. On the Allocation of Uncertainty-Reduction Effort to Minimize

Total Variability. *IEEE Transactions*, 2000, vol. 32, pp. 403–407.

13. Leu S.-S., Chen A.-T., Yang C.-H. A GA- Based Fuzzy Optimal Model for Construction Time-Cost tradeoff. *International Journal of Project Management*, 2001, vol. 19, pp. 47–58.
14. www.standishgroup.com – the official site of the company, the providing service in research and the analysis of overall performance of IT projects.
15. www.infotech.com – the official site of the company, the providing service in research and the analysis of overall performance of IT projects.

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МОДЕРНИЗАЦИЯ

МОДЕЛЬ РАСПРЕДЕЛЕНИЯ БЮДЖЕТА ПОРТФЕЛЯ ИТ-ПРОЕКТОВ С УЧЕТОМ ИХ ПРИОРИТЕТНОСТИ

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Аннотация

Статья посвящена проблеме эффективного распределения общего бюджета портфеля между ИТ-проектами, входящими в его состав, с учетом их приоритетности. Обозначенная проблема является актуальной ввиду невысоких результатов деятельности консалтинговых компаний в сфере информационных технологий.

Для определения приоритетности ИТ-проектов используется метод аналитических сетей, разработанный Т. Саати. С целью применения данного метода разработана система критериев (показателей), отражающих влияние ИТ-проектов портфеля на наиболее значимые цели реализации ИТ-проектов портфеля. В качестве системы критериев использованы ключевые показатели эффективности, определяемые при разработке Сбалансированной системы показателей, которые удовлетворяют вышеперечисленным требованиям. Суть метода аналитических сетей заключается в попарном сравнении ключевых показателей эффективности относительно цели реализации портфеля и ИТ-проектов, входящих в состав портфеля. Результатом использования метода аналитических сетей являются коэффициенты приоритетности каждого ИТ-проекта портфеля, которые используются в предложенной модели распределения бюджета портфеля между ИТ-проектами. Таким образом, бюджет портфеля ИТ-проектов распределен между ними с учетом не только дохода от реализации каждого ИТ-проекта, но и других важных для ИТ-компании критериев, например: степень соответствия ИТ-проекта стратегическим целям ИТ-компании, определяющая целесообразность реализации ИТ-проекта; срок выполнения ИТ-проекта, определяемый заказчиком. Разработанная модель распределения бюджета портфеля между ИТ-проектами апробирована на примере распределения бюджета между ИТ-проектами портфеля, состоящего из трех ИТ-проектов. С учетом полученных коэффициентов приоритетности ИТ-проектов портфеля и предложенной модели распределения бюджета портфеля был перераспределен допустимый объем затрат на каждый ИТ-проект. Это позволило более корректно распределять выделенный для реализации портфеля бюджет, следовательно, позволило избежать необоснованных затрат при реализации ИТ-проекта портфеля.

Ключевые слова*: портфель ИТ-проектов, метод аналитических сетей, коэффициент приоритетности.*

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