The Use of Modern Software Tools for Monitoring the Competitiveness of Construction Company

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ABSTRACT

The article discusses possibilities of modern project management software monitoring management capacity of building organizations. In also discusses capabilities of various programs in detail that allow businesses to implement effective project management. The usage of modern software tools for project management does not fully meet the requirements of construction companies. According to the authors for continuous controlling of the management potential of performance indicators, adaptation of the existing software to the needs of the management of construction companies is necessary.

Keywords

Software, management capacity, construction, management, project management

1. INTRODUCTION

The hallmark of the modern economic development of Russia is the need to use the whole arsenal of tools to effectively manage the company. Modern construction company cannot do without the relevant software to enable it to quickly and effectively receive and transmit solutions to a managed subsystem.

2. THE IMPACT OF MODERN IT TECHNOLOGIES ON THE COMPETITIVENESS OF CONSTRUCTION COMPANY

Essential to the implementation of project management in a construction company is using the latest software, which has a significant impact on the growth of its competitiveness. Table 1 shows the main objects of automation depending on the life cycle of a construction organization.

In today's dynamic world, it is impossible to process and analyze information for research competitiveness without appropriate software. The study of competitiveness is the prerogative of marketing, of particular interest are analytical programs that support decision-making of a wide range of marketing tasks. The organization can give more attention to the development of its own software for solving problems of competitiveness changes or use the existing ones. The employees of the organization must:
- know about the capabilities of existing software and its development prospects,
- be able to select and apply the necessary software given tasks.

In relation to the above developed methodology of management of projects is aimed to increase competitiveness of these means of selection or development of appropriate software.

Tab. 1. The automation of control processes on the stages of the organizational life cycle

Potential	Stage of the life cycle of the organization			
	Initiate	Growth	Maturity	Decline
Financial	accounting	accounting	budgeting, accounting business planning,	business planning, budgeting accounting
Production	subcontractors	planning, logistics	service design, planning, logistics	service design, planning, logistics
Marketing	customers, suppliers	customers	service logistics, customers	service logistics customers
Management	accounting	wages, accounting, document flow	wages, accounting, testing, PDM, document flow	testing W/p, accounting PDM, document flow BPR, PDM,

PDM (Product Data Management)
BPR (Business Process Reengineering)
PM (Project Management)

Currently there are many software products designed to automate the process of research competitiveness. It is conditionally possible to divide all software used in marketing studies into three groups. The first group includes software products, which when created focused on solving a wide range of tasks, often marketing purposes, but later found their application in it. To search for information in the Internet, a browser is needed such as Internet Explorer 6.0. To process large volumes of information obtained in the marketing research process, you can use Microsoft Excel, Lotus 1-2-3, etc. For the creation and design of research report, a word processor Microsoft Word is applicable.

The second group relates to software for statistical data processing. Among software of this type you can select the following packages - Statistica, SPSS, STADIA, STATGRAPHICS, which have a large set of statistical functions: factorial analysis, regression analysis, cluster analysis, multivariate analysis, criteria of consent, etc. These software products typically include means for visual interpretation of the results: the various graphs, diagrams, data representation on a geographical map.

In the course of research the specialists have to perform calculations with a wide range of indicators, transmit and transform data for analysis and present the results in a visual form. Therefore, when choosing a statistical package, it is first necessary to pay attention to such characteristics as [1]:
• convenience of data management (data export/import, restructuring);
• statistical diversity (number of statistical modules);

• graphics capabilities (a built-in graphics editor, the ability to display the individual elements of the graph, possibility of export of graphs).

The third group includes products that specifically target marketing, and in particular, marketing research competitiveness. The most famous of them are: "BEST Marketing", "the Whale-Marketing" and "Marketing Expert".

In particular, the system of "BEST-Marketing" is a tool that allows you to assess the market position of organizations in a competitive environment. The system can be used in organizations of production, trade and services. Enter quality data, the system converts quantitatively, allowing the appropriate calculations. Among the methods, which is based on "BEST-Marketing", are SWOT analysis, 4P, Ansoff matrix, etc. System capabilities of "BEST - Marketing" are: the definition of promising market niches, analysis of the competitiveness of the goods, the advertising analysis, assessment of the presence of competitors in the market comparative analysis by a product, a comparative analysis of advertising campaigns etc. The software system of "BEST-Marketing" organization will be able to analyze its strengths and weaknesses in the advertising and marketing policies and develop a set of measures to strengthen positions in the market.

A known package of software implementing the concept of life-cycle management of the organization is a stake in the company Telelogic. The Swedish company Telelogic known as a leading provider of integrated software solutions to manage the life cycle of the organization (Enterprise Lifecycle Management, ELM). The ELM refers to the range of tasks associated with defining business goals and bringing business processes in line with these objectives. The company has identified here three main directions: optimization of business processes (Business Process Optimization, BPO), management of the application lifecycle (Application Lifecycle Management, ALM) and development based on models (Model-Driven Development, MDD).

Based on Telelogic, this is the task of project management creating innovative products based on specific requirements (Requirement-Driven Development, RDD). This approach, allowing us to achieve our business objectives, ensures the stability and completeness of system requirements in all phases of the development process - from planning to implementation, or to market. A set of tools RDD forms the development platform that optimizes the performance of the whole team and ensures compliance of innovative product and process regulations, internal regulations of the organization and auditing requirements. For complex integrated corporations, the use of this package is justified because the use of the concept ELM implies that companies must articulate and define their business objectives, identify and rank the needs of their clients to align and optimize business processes and development processes to enter the market with a product that will satisfy, the customer needs with a minimum cost for its implementation within the planned budget and deadlines. Controlled life-cycle management of the organization will help to create innovative products to increase the income, but to create them correctly, a minimizing costs and increasing quality.

But not only corporations should follow the change of level of competitiveness, for small and medium businesses, this problem is less relevant in the light of limited financial, human, and other resources.

The authors have investigated the sector of software market, one way or another capable to fully or partially implement the proposed methodology. Most part of these software cannot implement fully the approaches described above and does not have sufficient means of internal settings. Programs with great potential and strong internal resources, such as ARIS Toolset (IDS Prof. Scheer, GmbH) and Workflow Analyser (Meta Software, Corp.), have a very high value (20 000 and 30 000 USD for a single license, respectively), and software development tools and modeling subject areas of any kind, such as SPARKS (Coopers & Lybrand) and G2 (Gensym) – and even more (up to 60 000 USD). In this regard, the author proposes as a compromise, to use as a base available on the Russian market a software product Visio 2007 company Visio Corporation.

Visio 2007 contains all the proposed approaches to the modeling and analysis of construction companies, as well as great opportunities for integration with other, more specialized software products. Built-in programming languages Visual Basic and C++ allow you to create an integrated environment for arranging organizational changes in analysis, modeling and project management of building organizations, and provide sustainable integration with other software products, such as: Access, Excel, Word, MS Project, AutoCAD, MathCAD.

Organization of interaction of various software tools in the framework of the implementation methodology of project management on the growth of competitiveness is shown in Fig.1.
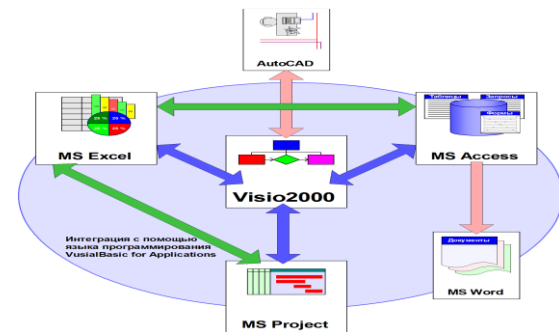
Fig.1. Organization of interaction of various software tools in the framework of the implementation methodology of project management

Tab. 2. The composition and structure of the modules of the software implementation of project management methodology organizational changes of building organizations

Software product	Function
Visio 2007	Visual modeling and analysis of organizations The organization of information links with other modules
MS Access	Storage of all information The organization of the repository and the collective work of several analysts
Excel	Analysis of quantitative data, preparation of graphs and other output presentations
Word	Preparation of working, reporting and other documentation
MS Project	Project management, construction schedule, network models, resource management, time
AutoCAD	Civil engineering project and drawing
MathCAD 14	The construction of complex mathematical models of business and organizational development of construction organization

Thus, each program performs its function in the overall integration of the data from the Visio 2007 (see Table.2.). This modular system seems appropriate in view of the fact that it can be easily adapted to the tasks of each specific project, adding or not using certain features.

3. THE USE ON MATHEMATICAL METHODS IN THE MONITORING OF POTENTIAL OF COMPETITIVENESS OF A CONSTRUCTION COMPANY

Modern automation methods that are used today by Russian companies, are a collection of programs, computers, procedures and rules, along with all related documentation of these components, allowing the use of computing (W) for the solution of specific management problems, in our case, the task of monitoring the level of competitiveness.

The monitoring algorithm also works in the program Microsoft Excel because it is widely known and is in widespread and relatively cheap package of Office programs of Microsoft Office, so training costs handle inputs with different types of analysis: statistical correlation, variance, and analysis of time series.

Using a correlation analysis examines the correlation between the features. In our case, there are a number of factors and performance indicators. To calculate the expected values of the effective feature, the multiple regression equation is used. The correlation coefficients describe the correlation between characteristics. We study the correlation between the factors and effective features.

For correlation analysis, the results are:
the coefficients of pair correlation and multiple regression;
- correlation matrix.

Using the proposed algorithm, the analysis of variance, it is possible to find the total variance as the sum of the residual variance, the variance of interaction of factors, factors I and II, As well as the factors of 1,2,3 and the variance of repetitions. For two-factor variance analysis, the results are documented in the form of a table. The first column contains the name of the variance depending on the source of variation, the second – the variance value, and the third is the number of degrees of freedom.

Produced by the alignment algorithm (approximation) of time series using the method of least squares allows to find the equation of the curve which most accurately reflects the main trend in the changes of levels depending on time. The algorithm makes a linear approximation (straight $y = a + b \cdot t$) and quadratic (parabola $y = a + b \cdot t + c \cdot t^2$).

The results of time series analysis are:
- a schedule in which the actual values are built, as well as linear and quadratic approximation functions (straight and parabola);
- the ratios of both approximation functions.

In the table, enter the values of the resultant variable Z and the factors X_1, X_2, X_3 , X_4 and X_5, hidden columns calculate the quadratic values X_1^2, X_2^2 …, Z^2, the multiplication X_1Z, X_2Z, … the calculated value of the effective feature Z_1, the deviation $(Z-Z_{средн})$, the squared deviation $(Z-Z_{средн})^2$, the difference $(Z_1-Z_{1,средн})$, as well as its square. There are simple averages of the effective feature actual $(Z_{средн})$ and estimated $(Z_1 \text{ и } Z_{1,средн})$. To find the Z_1, you need to substitute the values of factors and the resultant variable in a multiple regression equation $Z_1 = a_0 + a_1 X_1 + a_2 X_2$. The coefficients a_0,

a_1, a_2 can be found by the Gauss method from the system of equations:

$$\begin{cases} \sum Z = a_0 n + a_1 \sum X_1 + a_2 \sum X_2 \\ \sum X_1 Z = a_0 \sum X_1 + a_1 \sum X_1^2 + a_2 \sum X_1 X_2 \\ \sum X_2 Z = a_0 \sum X_2 + a_1 \sum X_1 X_2 + a_2 \sum X_2^2 \end{cases}$$

where n - is the number of rows in the table.

The coefficient of multiple regression $R_{мн}$ is calculated by the formula: $R_m = \sqrt{\dfrac{D_{Z_1}}{D_Z}}$,

where $D_{Z_1} = \dfrac{\sum (Z_1 - Z_{1,avg})^2}{n}$,

and $D_z = \dfrac{\sum (Z - Z_{avg})^2}{n}$

The coefficient of regression of the pair: $R_{X_1 X_2} = \dfrac{n \sum X_1 X_2 - \sum X_1 \sum X_2}{\sqrt{\left(n \sum X_1^2 - \left(\sum X_1\right)^2\right) \cdot \left(n \sum X_2^2 - \left(\sum X_2\right)^2\right)}}$

Is calculated similarly as $R_{X_1 Z}$ and $R_{X_2 Z}$.

Using the analysis of variance, we find the average rows and columns of the completed table, the average over the whole table and the average I II ... and 1,2,3 ... factors [2]. The variance in repetition is found as follows: the average difference in repetitions and the total mean are calculated. Find the square of the resulting number. We find the sum of the squares and multiply it by the product of the number of gradations of factor A by the number of gradations of factor B. Similarly, the dispersion by factor I II and the factor 1,2,3 are found. The total dispersion is found by the formula:

$$D = \dfrac{\sum (Y - Y_{средн})^2}{n} .$$

When analyzing the dynamics series, the values of the calendar time t and the actual value of the analyzed indicator X are entered into the table. In the hidden columns, the product X. In the hidden columns, the product $X \cdot t$ is calculated, then $t2$, $t3$, $t4$ and $X \cdot t2$ are calculated. Find the sums of these columns.
The equation of the straight line is as follows: $X = a + bt$. The coefficients a and b by the Gauss method can be found from the system:

$$\begin{cases} \sum X = an + b \sum t \\ \sum Xt = a \sum t + b \sum t^2 \end{cases}$$

The parabola equation
X = a + bt + ct2.

The coefficients a, b, c, as in the previous case, are found from the system:

$$\begin{cases} \sum X = an + b \sum t + c \sum t^2 \\ \sum Xt = a \sum t + b \sum t^2 + c \sum t^3 \\ \sum Xt^2 = a \sum t^2 + b \sum t^3 + c \sum t^4 \end{cases}$$

The program is controlled through the menu system, which is a standard interface offered by Excel tools. This is a set of pseudoknots and dialogs used for obtaining background or baseline information from the user [2].

The greatest significance of managerial capacity, is at almost every stage of the life cycle of a construction organization. Continually monitoring key indicators on capacities, an organization can avoid the loss of competitiveness. Modern software allows you to monitor in real-time, online, to promptly identify problem areas (indicators) that affect the loss of competitiveness. Among these indicators of potential are:

1. Advancing coefficient of labor productivity above the average wage growth

2. The ratio of the actual level of education for each position of administrative staff

3. The coefficient of conformity of qualification of workers of complexity of work performed

4. The turnover rate

5. The experience of managers and specialists

6. The intensity of managerial work.

Thus, using the standard program, it is possible to diagnose and monitor the core capabilities of the company, identifying priority areas for improvement/

REFERENCES

[1] M. Guseva Innovative projects are the basis for growth of competitiveness of the company M. //Economics of entrepreneurship №6 2012

[2] M. Guseva. Managing competitiveness of business structures in construction. Monograph, Moscow: Architecture-S. – 2011. 392c