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APPLICATION OF INFORMATION-ANALYTICAL SYSTEMS IN MANAGEMENT

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ABSTRACT

The article describes the application of information-analytical systems in the enterprise management. Examples of application of information-analytical systems are given. In the first example, an information-analytical system allows making an optimal choice concerning the enterprise restructuring. In the second example, an information-analytical system solves the problem of optimal estimation of the cost of manufacturing a launcher rocket. In the paper, a methodology of building such systems is presented. The content of the basic blocks of the system is described. The mathematical apparatus for calculating the complexity is presented. The system can be used by the specialists of economic-planning and engineering-technological services and the services involved in the organization and management of labor.

Keywords: *Information, Intelligent Analysis, Big Data, Geodata, Artificial Intelligence, Methods Of Enterprise Management, Analytical Information System, Automated Control System.*

1. INTRODUCTION

Currently, many technologies and systems extract information and data from the information field [17] and create large collections of information. For this reason, management and economy have to deal with large amounts of data [15]. In these cases, an option of obtaining useful information is the application of information-analytical systems (IAS) [12]. In the IAS, heterogeneous data having a large volume are processed. The results of this processing must be interpretable and clear [19], whereas the technologies for the processing of raw data have to be easy to use. The reason for the growing popularity of IAS is the objectivity of analysis and the possibility of applying. The human analyst, in contrast to the machine, always has the inherent subjectivity; he/she is, to some extent, a hostage to the already existing ideas. From an economic standpoint, IAS is less expensive in the processing of large data. It is more profitable to invest money in IAS than to permanently support a whole army of highly trained and well-paid professional statisticians. IAS does not completely exclude the participation of the human being, but greatly simplifies the process of searching for knowledge with the help of efficient algorithms such as the oppositional algorithm [18] or dichotomous analysis [24]. IAS performs the system and dichotomous analysis, IAS makes the analysis result accessible for a wide range of analysts who are not specialists in the system or dichotomous analysis. Application of IAS is topical for all business sectors: banking and insurance (identifying abuse with credit cards, credit risk evaluation, assessment of mortgages, identifying the user profiles, evaluation of effectiveness of the regional branches, the probability of application for the insurance payment, etc.), financial markets (forecasting, analysis of portfolios, simulation of indexes), production (forecasting of demand, quality control, evaluation of the product design), trade and so on. This makes topical the analysis of the IAS application for solving practical problems in business and management.

2. METHODS AND MATERIALS

As the materials, we use the existing descriptions of the IAS application and the practical experience of the authors. As the methods, we use system analysis, dichotomous analysis, cost analysis, qualitative analysis and impact analysis.

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3. RESULTS

The aim of the conducted study is to identify the general regularities of the creation and use of the information-analytical systems.

The main functions of the information-analytical system are:

- Retrieving data from various sources, their transformation, and loading into a repository;
- Data storage;
- Data analysis, including online analytical processing and data mining;
- Preparation of the results of online analytical processing and data mining for their effective perception by users.

The results of applying the IAS are analytical reports focused on the needs of users of different categories and the tools of interactive analysis of information allowing the users- nonprogrammers to quickly prepare reports using familiar concepts of a subject field.

Information-analytical systems are add-ons for the already functioning in the enterprise informational applications and do not require replacing them; these systems accumulate data on all kinds of the company activity: from the conditions at the warehouses to the financial and accounting reports.

Information-analytical systems of the upper level are used to make strategic decisions. They allow a manager to solve the following problems:

preparing consolidated financial statements and presenting a summary of the activities of the enterprise (financial, production-related and other indicators, the dynamics of their changes and the trends);

analysis of the activity of subsidiaries, branches and divisions of the company (analysis of profitability, costs, implementation of the plan);

analysis of financial activity (key financial indicators, trends, mutual payments), optimization of financial flows, realistic assessment of the cost of production;

conducting a comprehensive assessment of the enterprise, based on the constant monitoring of the four most important aspects of it (finances, relations with the outside world, the internal state of the company, innovations);

analysis of the sales processes (preparation of plan, control for the execution of orders, payment for the products shipped, forecast of the flow of funds, forecast of demand).

3.1. Analysis of the problems, solved with the help of IAS. Management of enterprises.

The methods of intelligent data analysis are used especially widely in business applications by analysts and company executives. For these types of users, high-level software tools are being developed, allowing solving rather difficult practical problems without any special mathematical training. The paper [1] analyzes the application of information-analytical models in management. Some specific examples of the use of specialized information models in the management of banks are shown. The basic tendencies of development of information models in the commercial activities are revealed. The features of the use of structural modeling in banking are described. Information-analytical models not only significantly accelerate the execution of banking operations; they are also a tool of improved information security of banking. A number of works are devoted to the use of IAS for the management of the enterprise value [7], [11].

Accounting

In the article [3,4], IAS is used for accounting. Accounting is a complex information system, a model of real business. The need is quite topical to enrich the business accounting and management accounting by the modern approaches of information processing with respect to large groups of indicators − costs, products and results − to meet the interests of all parties. A properly functioning system of management accounting does not just help solving the industrial, financial and other problems in the most rational way, but also creates new potential, opening up the opportunities for future achievements in the changing conditions of the modern world and legislation.

Real estate valuation

In the article [8], an extension and refinement of the traditional concept of real estate appraisal are proposed using the systems based on intelligent means of information processing. This extension includes the following steps.

1. Primary acquisition.
2. Formation of a base of the scaled data.
3. Creation of a mathematical model of the real estate valuation.

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4. Estimation of the model parameters on the basis of non-parametric statistical methods.

5. Formulation of the problem in a neural network basis.

6. Analysis of the parameters of the mathematical model of real estate valuation, based on the results of neural network training.

7. The choice of architecture and training of the Kohonen maps.

8. Compilation of an information atlas on the basis of synthesis of the Kohonen maps and the GIS maps of the city.

9. Creation of a knowledge base in the form of linguistic control rules based on the analysis of Kohonen maps and the mathematical models of real estate valuation.

The proposed approach to the appraisal of real estate allows widening the range of the solved valuation problems. In this case, the mathematical model takes into account the subjectivity and thus increases the accuracy of calculations and reduces the costs of their adjustment over time.

Marketing analysis

In the article [13], the marketing data mining (MDM) is considered: this is a process of discovery in the raw data the previously unknown, non-trivial, practically useful and accessible interpretation of knowledge necessary for decision-making in the field of marketing. In the general case, the process of MDM operation consists of three stages: identification of patterns (free search);

the use of the revealed patterns to predict unknown values (predictive modeling);

analysis of exceptions, designed to identify and interpret anomalies in the discovered patterns.

The conceptual architecture of MDM should include three components:

- a layer of the data access;

- a layer of interaction with the user;

- business logic.

MDM is used for monitoring the tourist flows.

Analysis of the educational process quality

The article [5] deals with the issues of integrated assessment of the quality of education. An information-analytical system makes it possible to carry out a multivariate evaluation of the quality of education on the basis of current data, trends and forecasting the processes designed to improve the level of training. As a way to improve the quality of education, the use of a modular technology and a rating evaluation of knowledge are considered. To solve the problem of planning the educational services quality, the authors propose to use the MarketingExpert computer program, developed using the analysis techniques adopted worldwide. To eliminate the gaps, ranked series of components and the Ishikawa diagram are constructed. The stages of managing the quality of education are considered. In the article [14], the methods of extraction of knowledge from the Internet are described. An algorithm for partitioning the Internet into blocks for effective information retrieval is presented.

Analysis of e-commerce

There are many services for the research of website traffic [2]. The advantages of IAS in the electronic commerce remove the external restrictions on the size of the analyzed database and the composition of the reports. One can explore the data accumulated over any period of time. New arbitrary reports are created quickly and without programming. The use of this approach allows the users, without consulting the service developers, continuously expand the field and logic of the analysis. The users of the reports − marketing experts, analysts, executives − get into their hands all the benefits of the OLAP technology.

Analysis of logistic flows

In the articles [3,4] and [9], an information-analytical system organizes the accounting, control, planning, procurement, supply, and distribution of material-technical resources. The main goal of the information logistic system is to plan the need for resources and monitor their stock. This system should control the availability of resources and notify about the exceeding the control norms. The information logistic system should also inform the decision maker about the potential resource providers and find the best solution for the supply and sales. The topicality of the use of data mining in business is connected with the tough competition that has arisen as a result of transition from "the market of producers" to "the market of consumers". In these conditions, the quality and validity of the made decisions are particularly important, which requires a rigorous quantitative analysis of available data. When working with large amounts of stored information, it is necessary to constantly and efficiently monitor the market dynamics, and it is

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virtually impossible without automation of the analytical activity.

Analysis of geodata

In the article [10], a review study of the scientific field of intellectual analysis of geodata is carried out [20]. The basic prerequisites for the formation of this direction and its relation to geoinformatics, systems analysis and data mining are revealed. The basic tasks, functions and stages of its carrying out are identified, the circle of the promising directions of development and its relationship to support decision-making in the regional administration are determined. With the use of geodata and the methods of hotspot clustering, a study has been conducted concerning the excess over the maximum allowable uranium concentrations in the groundwater on the territory of Ukraine.

3.2. Information-analytical system of the enterprise value management (IASEVM)

The task that can be solved by IASEVM is the assessment of the enterprise value based on comparative, income and market approaches. The initial data for IASEVM is a balance sheet, income and loss statement, some other indicators, which are prepared in Excel and converted into the system. The software performs financial and economic calculations and determines the following characteristics: the most liquid assets, quick assets, slowly realizable assets, long-term, short-term and permanent liabilities. According to the results of calculations, analytical conclusions are made about the enterprise's balance sheet liquidity, the dynamics of the liquidity of the balance sheet of the enterprise. During calculations, the enterprise solvency and financial stability are determined, as well as its profits and profitability. The indicators of the enterprise value and the dynamics of their changes are computed. The analysis results are presented in the form of graphs.

The value of the investigated enterprise is determined by different methods. These include the determination of the market value of JSCo by the method of discounted cash flow.

In assessing the value of the enterprise within the framework of the income approach, it is assumed that a potential buyer is willing to pay a price that is comparable with future revenue streams derived from an optimal use of the particular business in certain market conditions, taking into account macroeconomic, sectoral and specific (specific to the given enterprise) risks.

A technology of valuation of 100% of shares by the income approach and the method of discounted cash flow is presented in Figure 1 and includes the following steps:

selection of the cash flow model and determination of the calculation horizon;
analysis and forecast of the gross proceeds;
analysis and forecast of the production costs;
analysis and forecast of the investment costs;
calculation of the value of cash flow for each year of the forecast period;
calculation of the discount rate;
calculation of the current value of cash flow;
calculation of the present reversion value;
calculation of the value of 100% block of shares in the authorized capital of the enterprise according to the income approach as the total value of the current cash flow value and the present value of the reversion taking into account the adjustments on nonperforming assets and the excess (deficit) of current assets.

On the basis of the obtained result of calculation of the value of 100% of shares, the total value is determined of the value of the estimated block of shares by the income approach, taking into account premiums (discounts) on the degree of control and liquidity of the evaluated enterprise, if needed.

In the framework of evaluation by the income approach, the financial, economic and industrial parameters of the activities of JSCo "AMIGO" are analyzed. There have been used the financial statements of the issuer, breakdowns of the balance accounts and the profit-loss statements, financial and marketing plans, projected economic indicators, reference and analytic materials, as well as the generally accessible analytical and program materials on the development prospects of the industry.

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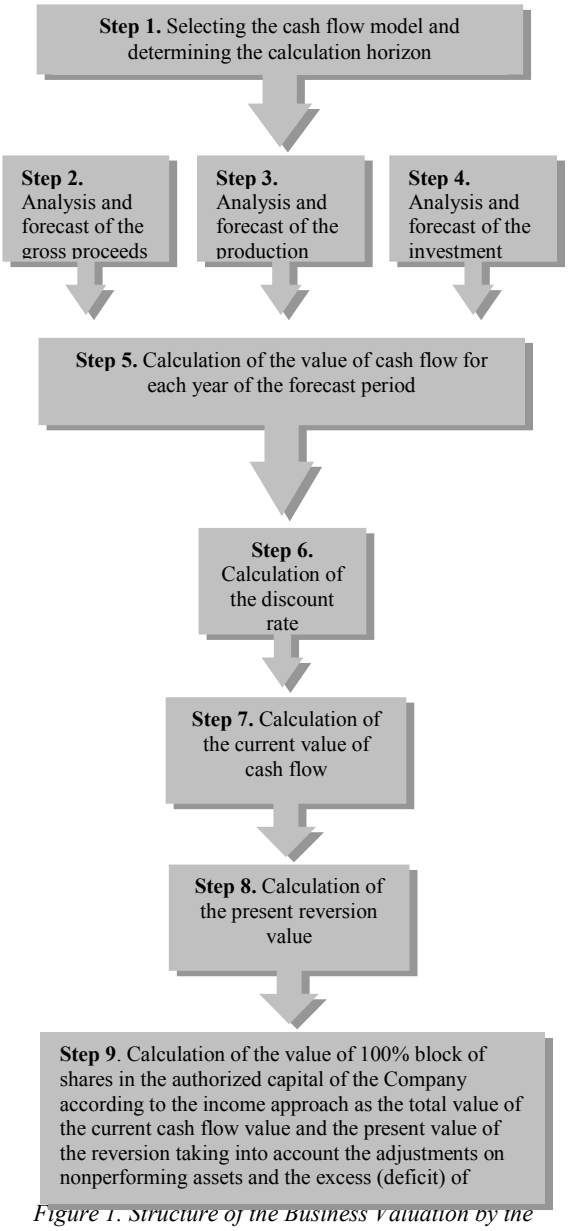

Figure 1. Structure of the Business Valuation by the Income Approach

Cash flow model and the calculation horizon. In the business valuation, one of two models of discounted cash flow is applied:

a model of discounted cash flow for equity capital;

a model of discounted cash flow for the total invested capital.

The discount rate of the cash flow to equity is defined as the rate of market return of equity capital. The most widely used are the model of capital asset pricing (CAPM) and the cumulative model.

Since the enterprise's financial statements are prepared in accordance with the accounting standards, the cash flow to equity is not displayed anywhere in the reports, including the cash flow statement. It can be calculated using the algorithm presented in Table 1.

Table 1. A Model Of Cash Flow For Equity

	Net profit after tax
Plus	Amortization charges
Minus	Increase of net working capital
Minus (plus)	Capital investments (sale of assets)
Minus	Reduction of long-term debt
Total	Net cash flow to equity

To perform calculations according to the method of discounted cash flow, the time interval is divided into two: the forecast period and the remaining life time of the enterprise (the post-forecast period).

The forecast period should be long enough, so that, by its end, the further forecasting of the business of the enterprise can be carried with fixed parameters such as a constant growth of revenues, a constant return on invested capital, a constant share of investment in the business and so on. According to the practice, which has been established in the countries with developed market economy, the forecast period for evaluation of the enterprise, depending on the purposes of evaluation and the specific situation, is usually from 5 to 10 years. In determining the duration of the forecast period, the following key factors are taken into account.

A forecast for the JSCo "AMIGO"'s production program is made for the period up to the year 2014. In the Russian practice, as a rule, one tries not to make forecasts for the period more than 4 years. On this basis, the forecast period is fixed to be 4 years. Cash flows are calculated in rubles without taking into account inflation. The production realization plan in the forecast period is made on the basis of the Company's data. The forecast of production volumes in monetary terms is presented in Table 2.

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Table 2. Revenue forecast

Title	2011	2012	2013	2014
Revenue, thous. rubles	428,702	514,443	514,443	514,443

The Company's expenditures in the forecast period are calculated on the basis of JSCo "AMIGO"'s data.

The results of the expenditure forecast are presented in Table 3.

Table 3. Forecast Of Expenditures, Thous. Rub.

Title	2011	2012	2013	2014
Expenditures (prime cost + other spending), thous. rub.	286,355	343,626	343,626	343,626

The Company does not need any significant capital investment. In this regard, in the forecast period, the amount of capital investment is taken to be the amount of depreciation taken equal to the similar indicators of the Company's business plan.

The amount of depreciation in the forecast period is based on the data of the Company's business plan (Table 4).

Table 4. Forecast Of Depreciation, Thous. Rub.

Title	2011	2012	2013	2014
Capital investment	51,444	61,733	61,733	61,733
Depreciation	51,444	61,733	61,733	61,733

When forecasting cash flows, there were taken into account the spending from the profit on the change (increase) of the enterprise's working capital (its own working capital, OWC), required for the production, with an increase in production volumes.

The level of own working capital is determined based on an analysis of the indicators of current assets and liabilities for the last three reporting years. In Table 5, the calculation is presented of the share of the own working capital in the Company's revenue.

Table 5. Share Of The Own Working Capital In The Revenue

Title	2006	2007	2008	2009	2010
OWC, thous. rub.	47,878	56,385	68,302	66,983	93,101
Revenue, thous. rub.	135,114	220,356	232,133	293,853	357,252
The share of OWC in the revenue, %	35.44%	25.59%	29.42%	22.79%	26.06%

The share of OWC is taken to be the average value over the last five years, equal to 27.86%, as the most probable value in the forecast period.

Calculation of the required value of the own working capital is shown in Table 6.

Table 6. Calculation Of The Required Value Of The Own Working Capital, Thous. Rub.

Title	2010	2011	2012	2013	2014
Revenue		428,702	514,443	514,443	514,443
OWC	93,101	119,438	143,326	143,326	143,326
Change of OWC		26,337	23,888	0	0

The discount rate is the rate of return on capital investment, which the investor expects to be achieved when deciding whether to acquire future income, taking into account the risk of receiving them.

Within the framework of these calculations, the discount rate of 15% is taken, which includes the risk-free rate for the Russian Eurobonds and the risks specific to this type of business.

The cash flows of each forecast year are translated into the current value on the valuation date by the discounting formula:

$$V = \sum_{i=1}^{5} \frac{E_i}{(1+r)^{i-0.5}} + \frac{E_{i+1}}{(r-g_1)(1+r)^5},$$

where Ei is the forecast of the cash flow for the i-th year (the beginning of the forecast period is 2011);

g1 is the rate of the profit increase in the post-forecast period;

r is the discounting rate;

V is the value of the Company.

The current value of cash flows in the forecast period is calculated using the present value factor

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determined at the end of each forecasted year to reduce the error associated with discreteness of the year-by-year calculation of cash flows.

Determining the value in the post-forecast period (reversion value) is based on the premise that the business is able to generate income also after the end of the forecast period. It is assumed that after the end of the forecast period, the business income is stabilized, and in the remaining period there will be a stable long-term growth or infinite uniform returns.

Depending on the business prospects, a particular method of calculation is applied in the post-forecast period:

the method of calculation on the basis of liquidation value. It is used in the case, when in the post-forecast period the company is expected to go bankrupt with the subsequent sale of the existing assets;

the method of calculation according to the net asset value. This method can be used for a stable business, the main characteristic of which is significant tangible assets;

the method of supposed sale, consisting in the translation of cash flow into the indicators of value by means of special coefficients derived from the analysis of retrospective data of the sales of comparable companies;

Gordon's model. The annual revenue of the post-forecast period is capitalized in the cost indicator by means of the capitalization coefficient, calculated as the difference between the discount rate and the long-term growth rates. In the absence of growth rates, the capitalization coefficient will be equal to the discount rate. Gordon's model is based on the expectation of obtaining a stable income in the residual period, and it is presumed that the sizes of depreciation and capital investments are equal.

In this case, Gordon's model is applied. The calculation of the final cost in accordance with Gordon's model is performed by the following formula:

$$V(term) = CF(t+1) / (R - g),$$

where: V(term) is the value in the post-forecast period;

CF(t+1) is the income cash flow for the first year of the post-forecast (residual) period;

R– discount rate of the cash flows;

g – long-term growth rate of cash flows.

The final value V(term) is determined in the Gordon's formula at the end moment of the forecast period.

The calculated value of the capital invested in the company by the method of discounted cash flows consists of the following components:

the current value of cash flows during the forecast period;

the continuing value in the post-forecast period (the reversion value), reduced to the current value at the date of the enterprise evaluation.

Thus, the value of 100% parcel of shares in the authorized capital of the JSCo "AMIGO" on the valuation date, under the DCF method, is equal to 499,713 thousand rubles.

Let us define the market value of the Company using the EVA index (Table 7).

The calculation of the value of business in the framework of this method is similar to the DCF method. The basic formula for calculating is:

The value of enterprise (FirmValue) = The previously invested capital (Capital Invested in Assets in Place) + Current added value from capital investments (PV of EVA from Assets in Place) + The sum of the current added values from new projects (Sum of PV of EVA from new projects)

Thus, the value of 100% parcel of shares in the authorized capital of the JSCo "AMIGO", determined by the EVA model, is equal to 481,787 thousand rubles.

Analytical system of automated calculation of the labor intensity of manufacturing launcher rockets.

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Table 7. The Value Of 100% Parcel Of Shares In The Authorized Capital Of The Jsco "AMIGO", Determined By The EVA Model

	2011	2012	2013	2014	Post-forecast
Revenues from sales	428,702	514,443	514,443	514,443	514,443
EBIT (20% of revenues)	85,740	102,889	102,889	102,889	102,889
IC (Invested capital) (80% of the net profit)	24,007	28,809	28,809	28,809	28,809
NOPAT (tax on profits is 24%)	65,163	78,195	78,195	78,195	78,195
WACC (15%)	3,601	4,321	4,321	4,321	3,601
EVA	61,562	73,874	73,874	73,874	61,562
PVEVA	53,532	55,859	48,573	42,238	53,532
EVApost	281,585				

The current situation in the aerospace industry, connected to determining the labor costs for manufacturing launcher rockets and boosters, is characterized by destruction of a unified system and approaches to the assessment of labor costs for the production of launch vehicles [8]. The technological complexity of manufacturing launcher rockets and boosters at the parent enterprises-manufacturers has increased. An analysis of the labor intensity structure shows that a significant component of growth of labor intensity depends on several factors:

- depreciation of production equipment (moral and physical ones: 75% of the equipment is in operation for more than 20 years);

- the loss of skilled personnel, both the main and auxiliary production workers and engineers;

- the lack of development and introduction of new production equipment and technologies, and so on.

Thus, the cost of manufacturing the products has increased significantly, which has led to the need to change the method of the labor intensity calculation.

On the other hand, during 25 years, there have substantially developed the automation tools of economic calculation, the use of which allows improving the labor productivity and reducing the cost of manufactured products.

Implementation of an analytical system for automated calculating the labor intensity of manufacturing launcher rockets (ASACLIMLR) will allow not only reducing the time and costs of performing economic calculations, but also increasing the efficiency of manufacturing by optimizing the structure of production.

ASACLIMLR is a complex integrated system which organizes the accounting, control, planning and production of articles of manufacture. It includes in its composition various blocks, each of which performs a specific function. The block of "Labor content of the rocket-and-space engineering products" is intended for storaging in a database and making available in a convenient way the information on launcher rockets and boosters. It ensures storaging in a database, providing and automatic calculating the intermediate parameters and the labor content of products. This block system can store, process and provide information on the following products of rocket-and-space engineering: launcher rockets, stages of launcher rockets, rocket launcher blocks, dry compartments of rocket blocks, side fairings, tanks, nose cone, and upper stages.

ASACLIMLR is based on a mathematical model of the labor content of the launch vehicle production, allowing storing all the necessary data for the calculation, as well as the design-technological characteristics of launch rockets, stages and the rocket blocks.

The development of ASACLIMLR allows conducting assessment of technological feasibility of the manufacturing programs for existing products and perspective programs of creating new launch vehicles, solving the problem of concentration and restructuring of production, optimization of the use of the production capacities of enterprises, the manufacturers of launch vehicles.

A mathematical model of ASACLIMLR is based on the calculation of the labor intensity standards in manufacturing the products of rocket-space engineering (RSE) and the evaluation of reasonableness of the labor intensity of the production programs of the parent enterprises of the rocket-space industry (RSI).

In the manufacturing technically demanding, labor-intensive and expensive RSE products, the significance of the labor content indicator is particularly high. First, the labor intensity of manufacturing a product is the basis for the price of defense products. Second, the labor intensity of the production program is the basis for calculation of the level of use and justification of the need for the workers of the main production. Third, the increase

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in the technical level of production, the introduction of new technologies and new equipment leads to reducing the labor intensity and improving the labor productivity. Thus, while forming the measures for reconstruction, technical re-equipment, etc., included in the program of innovative development, the data should be used determining the need for priority reducing the labor content; on the other hand, the results of fulfilling these measures should be evaluated according to the achieved level of decrease in labor input.

The proposals on the procedure of calculation and examination of the labor input standards in manufacturing the products of rocket-and-space engineering and the labor intensity of the production programs of the organizations (enterprises) of the rocket-space industry include three main sections: the procedure for the design and calculation of the labor input standards in manufacturing the products in the RSI organizations; the procedure for calculating the labor intensity of the production programs of the RSI organizations; organization of works on the development and expertise of the labor input standards and the labor intensity of the production program of the enterprise and making management decisions based on the results.

Labor intensity is the work time (labor) expenditures for production (manufacturing). Depending on the composition of labor expenditures to be included in it, one distinguishes the technological labor intensity, the labor intensity of the production maintenance, the labor intensity of production and the labor intensity of production management.

The labor intensity of production (Lpr) is the labor inputs of workers (primary and secondary) and is calculated by the formula:

$$Lpr = Ltechn + Lmaint, \quad (1)$$

where Ltechn is the technological labor intensity, which includes all the labor costs of the primary production workers (PPW), both the piece workers and time-workers;

Lmaint is the labor intensity of the production maintenance, defined by the labor inputs of the workers of support units.

The total labor intensity (Ltot) is the labor costs of all categories of industrial personnel, and is given by the formula:

$$Ltot = Ltechn + Lmaint + Lmanag, \quad (2)$$

where Lmanag is the labor intensity of production management, including labor costs of engineering and technical workers, clerks, and junior maintenance staff.

The procedure for manufacturing a product at the enterprise is determined by a technological process consisting of technological impacts: processing stages, groups of operations, operations on the product, its parts, blocks, components, assemblies, subassemblies, parts in the respective departments, sections and workplaces.

The technological labor input is the labor (working time) input of the primary production workers, engaged in the technological impact on the objects of labor that are taken into account in the production of enterprise (suitable change in the form, condition, physical and chemical properties of the object of labor, as well as the relative position of its parts in the assembled state) or carrying out control operations stipulated by the technological process and/or the time expenditures of the equipment operation.

The technological labor intensity is measured in standard hours, i.e. in standardized man-hours and/or machine-hours. The technological process contains the necessary data to establish the technically substantiated allowance time (TSAT). In the case of the lack of the necessary data to calculate TSAT for the operations of the technological process, as well as the design documentation (drawings), the determining of the technological labor intensity by using experimental and statistical standards is allowed.

Depending on the state of development of design and technological documentation, the technological labor input can be found by the methods of consolidated determining the labor input. With regard to new products, it is allowed to determine the technological labor intensity by the method of borrowing it from the technological processes of the analogous products previously manufactured by the enterprise.

In the general case, the normalized labor input comprises all the time expenditures, required by the technological process, taking into account the number of workers simultaneously participating in the execution of an operation (several workers handling heavy machinery or unique multi-machine operations). The normalized labor intensity, expressed in machine-hours (i.e. the machining content) includes only the processing time without taking into account the working hours of workers handling the given machine, a piece of equipment.

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The project labor intensity is the labor intensity of manufacturing articles (products), calculated on the basis of prescriptive technological processes. The project labor intensity is the basis for determining the designed capacity of the enterprise. The planned technological labor intensity is the normalized labor costs, the work of equipment to manufacture the product (goods) or perform a certain amount of work, established in accordance with their reduction in the planned period. It is taken into account when calculating the enterprise loading in the planning period. As a rule, the planned technological labor input must comply with the normalized labor input.

The reporting technological labor input is the actual labor costs, the work of equipment for manufacturing of the product (goods) or performing a certain amount of work recorded in the reporting period. This indicator is used in the evaluation of labor inputs of the primary production workers and analysis of the enterprise implementation of the planned labor intensity.

The result of any production process is a product: any object or a set of objects of production to be manufactured. A product of RSE is considered as a set of components, which include: parts, units, aggregates, components and assembly units (CAU).

The labor intensity of the production of articles at the parent RSI enterprises is the foundation which provides connection between the technological and economic indicators in the planning of production and which ensures solving the problems of estimating the level of use of production capacity and feasibility of the production program in terms of labor resources.

The labor intensity of manufacturing a product unit is determined based on the existing industry standards for equipment performance, the established technically substantiated time standards and the experimental-statistical standards.

In the case of multi-machine operation, the labor intensity includes the normalized time of processing a part on each machine separately.

The labor intensity of manufacturing a product is added from the labor intensity of manufacturing its constituent elements (parts, units, assemblies, parts and assembly units).

The labor intensity of manufacturing a unit of n-th product (t_n) is determined by the formula:

$$t_n = \sum_b \sum_{a^n} k^n * t^b_{a^n}, \quad (3)$$

where b is the workspace index,

a^n is the index of a component element of the n-th product,

k^n is the number of identical component elements, included in the n-th product,

$t^b_{a^n}$ is the labor intensity of manufacturing, processing of the a-th component element at the n-th workplace.

The above formula shows the labor intensity of manufacturing a unit of production as the sum of labor contents of its constituent elements over all workplaces, at which manufacturing (processing) of the constituent elements of the n-th product is carried out.

In addition, if at the b-th workplace no manufacturing (processing) of the constituent elements of the n-th product is performed, then we put $t^b_{a^n} = 0$.

A production sector consists of workplaces, grouped according to the specialization of works. Accordingly, it is possible to calculate the labor intensity (tnm) of carrying out the works corresponding to specialization on the n-th product according to the following formula:

$$t^m_n = \sum_{b^m} \sum_{a^n} k^n * k^m * t^{b^m}_{a^n}, \quad (4)$$

where m is the index of a production sector,

b^m is the index of a workplace of the m-th production sector,

a^n is the index of a component element of the n-th product,

k^m is the number of identical workplaces, included in the m-th production sector,

k^n is the number of identical component elements, included in the n-th product,

$t^{b^m}_{a^n}$ is the labor intensity of manufacturing, processing of the a-th component element on the m-th production sector.

It follows from the formulas 3 and 4 that the labor content of a unit of n-th product can be calculated as the sum of labor intensities of works

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over all the production sectors with respect to the n-th product:

$$t_n = \sum_m t_n^m \qquad (5)$$

In the enterprise, to calculate the labor content of the product unit from the constituent elements and the elements of the production structure according to the above formulas, it is recommended to use a statement of labor content of manufacturing the product unit according to the current standards.

The current system of calculation of technological labor intensity at the enterprise. In a centralized system, the time standards are developed directly by the employees of the department of labor and wages (DLW). In a decentralized system, the time standards are developed by the employees of the office of labor and salaries (BLS) of the work units or the employees of other units. Experience shows that a centralized system is more preferable, because the time standards are identical in terms of their intensity, do not depend on the work unit number and are calculated under the unified control, which minimizes errors in standardization.

It is necessary to pay attention to the state and usability of technological processes for the calculation of technically substantiated norms of time for the control operations with mandatory indication of controlled parameters, technical requirements for quality, tools and sampling of the control, which are determined by the department of chief technologist in conjunction with the department of technical control and the department of labor and salary of the enterprise. The share of the labor content of control operations can be no more than 8 percent of the total labor content.

The labor intensity of manufacturing products on the NC equipment and machining centers is determined by a technological scheme, selected in accordance with the passport data of equipment and the tool life. A feature of standardization of the operations of mechanic processing of parts on NC machines and machining centers is that the principal time (the machine time) and the time associated with the transition constitute a single value: the time of automatic work of the machine according to the program.

The existing form of payment at the enterprise company (piecework or time-based). The piecework system can be of the following types: direct piecework system when the payment is entirely dependent on the quantity of the produced products; piecework-progressive one when the production output within the norm is paid according to the ordinary rates, whereas over-the- norm output, according to higher rates; and piecework-bonus one, when besides earnings according to direct piecework rates, bonuses are paid for quality and quantity. The time-based remuneration system is divided into the simple time-based one, when the salary is summed from the base wage rate and the actual working time, and the time-rate-plus-bonus payment system, when besides the wage rate, an award is given for high performance in the work.

It is necessary to take into account the proportion of time-workers and piece workers in the enterprise and the standards according to which the time-worker works (technically substantiated or experimental-statistical standards, the type of fulfillment of the standards). It is necessary to take into account the factors of reducing the technological labor intensity of manufacturing the products. Technical measures should provide no less than 70% of the total amount of reduction (the organization of works and the share of participation of technological services and the standardization services).

Depending on the combination of these factors, the seriation of production and the approach to identifying labor input are determined; and this, in turn, will help to determine the degree of accuracy of technical standardization and, as a consequence, the level of implementation of the time standards. The level of existing time standards at the enterprise is contained in the reports for the last month of any production department. It is necessary to analyze selectively several departments (e.g., the mechanical and assembly ones), various categories of workers: to calculate the percentage of compliance with the time standards for pieceworkers and time-workers and, in total, for a department, to determine the type of the time standards of workers (technically substantiated or experimental-statistical) and their impact on earnings.

The materials, submitted by the enterprise to experts, should include: an assessment of the validity of the applied standards of technological labor intensity of manufacturing the products and their changes in the reporting and the current periods, including an assessment of the presence and accuracy of calculation of technically substantiated time standards or the validity of application of experimental-statistical or consolidated standards. There should be presented

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the results of analysis of the reduction or increase of the labor content of products, execution of works taking into account implementation in organizations of various technical and organizational measures, as well as estimates of the coefficients of fulfillment of standards and working time fund provided by organizations.

According to the results of research and expertise, the conclusions and proposals are formulated to adjust the existing standards of technological labor intensity at the given enterprise.

4. DISCUSSION

The paper describes the examples of the use of information-analytical systems in management. Information-analytical systems allow performing qualitative analysis of the indicators of the managed object. They are similar in composition to the expert systems and help the subject of control to make a correct conclusion about the control object and the necessary corrections in the control actions to be taken. Thus, expert systems can be a part of the information-analytical systems.

When creating information-analytical systems, a very important issue is the structure of the data being processed. These data can be quite diverse and weakly structurable. The amount of data can be very large. In the developed system, it is necessary to choose a single form of data presentation, to resolve the issue of the possibility of their aggregation and congression.

5. CONCLUSION

The information-analytical system of the enterprise value management estimates its value on the basis of comparative, income and market approaches. The initial data for the system is the balance sheet, the income-loss statement and some other indicators. The software performs financial and economic calculations and determines: the most liquid assets, quick assets, slowly realizable assets, long-term, short-term and permanent liabilities. In accordance with the results of calculations, analytical conclusions are made about liquidity of the enterprise's balance, the dynamics of liquidity of the balance. During calculations, the enterprise's solvency and financial stability, the enterprise's profit and its profitability are determined. The indicators of the enterprise value and the dynamics of their changes are calculated. The analysis results are presented in the form of graphs.

The analytical system of automated calculation of the labor intensity of manufacturing launcher rockets is designed for professionals of the planning-economic, technological services and the services responsible for organization and management of labor at the enterprises of the rocket-space industry, for the calculation of the labor intensity of manufacturing launch vehicles, in carrying out the design-search work and the development of design documentation on the early stages of development work for new and modernized launch vehicles, launch rockets and boosters.

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