

## Project-oriented approach to metallurgical enterprises sustainable development management

**Valentina Molokanova**

*D.Sc. in engineering, professor  
Department of management and project management  
Dnipropetrovsk Regional Institute of Public Administration of the National Academy of Public  
Administration under the President of Ukraine  
Dnipro, Ukraine  
E-mail: molokany@gmail.com  
ORCID: <http://orcid.org/0000-0002-4553-4948>*

**Vitaliy Petrenko**

*D.Sc. in engineering, professor,  
Honored scientist and technician of Ukraine  
The Department of intellectual property  
National Metallurgical Academy of Ukraine  
Dnipro, Ukraine  
E-mail: petrenko\_v@email.ua;  
ORCID: <http://orcid.org/0000-0001-5017-1674>*

### Abstract

The management of sustainable development of metallurgical enterprises through a portfolio of projects is examined. There are presented a conceptual framework for managing projects portfolios in organization and formalization of methodological bases of creation of value-oriented development portfolio for metallurgical enterprises.

Keywords: SUSTAINABLE DEVELOPMENT OF METALLURGICAL ENTERPRISES, FORMATION OF A PROJECTS PORTFOLIO, MANAGEMENT BY VALUES

### Introduction

In June 1992 at the UN Conference on environment and development representatives of 178 countries signed a Declaration on sustainable human deve-

lopment, as a biosocial system in conditions of growth speed of environmental changes [1]. This event is directly related to the approach, which was introduced into science under the name of “sustainable develop-

ment”, which allowed doing in the professional literature a large number of generalizations regarding the proposed concept [2-4]. Since metallurgy is one of the main branches of economy of Ukraine, therefore the effective modernization of this sector has a key importance in the context of sustainable development. Proposed for consideration in Johannesburg summit plan of action for the sustainable development strategy consisted of ten items, among which the particular importance for Ukraine have, in our opinion, the following three: to guide the process of globalization towards promoting sustainable development; to modify the national model of production from raw material processing to innovative service [4]; to strengthen international governance of sustainable development. Ukraine is planning a gradual transition to sustainable development strategies too. In 2003, there was created the national Commission of sustainable development of Ukraine and approved the “Integrated program of national implementation of decisions taken at the world summit on sustainable development, for 2003-2015”. However, there is a lack of financial resources for the system concrete actions [5, 6]. At the moment in Ukraine there are very few companies that would not implement innovative projects, but not all of them use the same corporate methodology of project portfolio management that is detrimental to efficiency and results.

A common mistake is that there is no clear correspondence between the strategy of sustainable enterprise development and implementation of portfolio management. The mastery of Ukrainian managers of portfolio management methodology would allow enterprises to better realize their strategic priorities and commitments. The mastery of Ukrainian managers of project management basic methodology would allow the country’s leadership to implement their strategic priorities and commitments.

### **The analysis of literature and problem statement**

During the last years the numerous scientific discussions about the search for a conceptual model of sustainable development that are relevant to many global challenges were conducted. The most reputable scientists recognized that the systemic imperative of life and activity of society is the concept of sustainable development, which declared equal and harmonious combination of three elements of social system – economic, social and environmental aspects [7].

International UN forum on sustainable development held in June 2012, confirmed the conformity of the named concept, and most of the forum participants

mentioned among the priority ideas, that will have the greatest impact on humanity in the period up to 2050, the idea of sustainable business [8].

However, theoretical development and implementation of competitive strategies for sustainable development directly depends on the decision of problems of methodology and formation of “modern paradigm of development” [9], which can be a powerful stimulus to socio-economic transformation.

Taking into account the availability of developed tools to support processes of sustainable development in the theory of organizational development [10, 11], it should be noted that the project management methodology of sustainable development with some exceptions [12, 13] does not exist. However, today project management has become a universally recognized tool of the evolutionary development of organizations through the integration of elements of strategic and tactical management. The following study is one of the first attempts of application of the sustainable development general provisions to the modernization of metallurgic enterprises through portfolios of projects.

### **Purpose and objectives of the study**

The conducted research was aimed to determine the features of project management for sustainable development of metallurgical industry of Ukraine. In the world there are a large number of technological and structural solutions for reduction of energy consumption and emissions of the steel industry [14]. The aim of this work is an overview of the methodology and tools for portfolio management of development organizations in the context of achieving sustainable development of native steel industry.

### **Methodical materials of the study**

Today the metallurgical industry of Ukraine meets very serious challenges. The paradigm of sustainable development requires from the steel industry reduction of energy consumption and environmental pollution while maintaining production volumes and this in turn requires considerable investment. In 2009, Boston consulting group [15] identified three main challenges facing the metallurgical enterprises, which can be defined as follows:

- despite continuous growth of energy costs it should remain competitive;
- it is necessary to improve production performance while reducing environmental pollution;
- it is necessary to use new resources in time that arise with the development of technology.

Below is the analysis of possibilities of solutions to these three problems for Ukrainian metallurgical enterprises by the implementation of a portfolio of

sustainable development projects.

### The results of the study

Ukrainian metallurgical companies are moving to the concept of value-oriented business management (Value Based Management). But in order value-oriented business management to become possible, it is necessary to have effective methods of assessing and increasing the value of the business. The value of business has been and remains a figure that has several meanings, depending on the purpose and stakeholders. There is only a certain reference value towards which the rating tends. When analyzing the values of one company, you should first focus on the values of sustainable business as a going concern, bringing revenue. There is only a certain reference value sought by the estimates. When analyzing the values of one enterprise should first focus on the value of sustainable business as an operating enterprise bringing revenue.

The category of “sustainable enterprise development” should be considered as a system combination of two components – resistance of achieved state and stability of motion, determined by system development. The first value is scalar and is characterized by the sustainability of number of indicators, such as profits and costs. With a long-term perspective, the stability of the system state implies keeping it within a certain time period. The second component of sustainability is directly linked to the trend of movement to a specific purpose, and therefore determines the stability of the direction of development and its speed.

In mature systems, project management at the highest level is used as a projects portfolios management. Current research of portfolio management is enhanced by intensive growth of the number of problems the solution of which requires changes in the scientific approach. The implementation of portfolio development can be considered primarily as an approximation to the ideal condition, “portrait” of which at a certain development stage “drew” organizationally-technical system. As is known, the system may not be successful in its development, if it successfully implements the “wrong” projects. Thus, all components of the development portfolio should correspond with the main vector of development of organizational-technical system.

The introduction of professional project management in the enterprise management should be started with individual projects. It is believed that in order to efficiently manage the projects portfolio, companies must first master the management of individual projects and programs. Portfolio represents a set of port-

folios, programs, projects and individual works, which are united in a point in time [15]. Management of the portfolio requires from managers holistic thinking embracing the complexity of problems and the sources of their occurrence, to properly understand the relationships and interaction between phenomena and processes which are related to different levels of project management [16].

The first step in the process of value-oriented system development based on the standard P2M [17] is a description of mission that defines the vision of the dominant organizational values, on the base of which corresponding strategy is developed. Next, the strategy must be translated into the main objective of the program/portfolio, which is broken down into sub-goals corresponding to the priority directions of development of the organization. In the practice of value management there considered the following three functions: identify value, create value, assess the value [17]. To identify the value of the project product or its results often means just copy the values. Imitation and copying of the product value is the path that passed many well-known companies. According to the evolutionary theory of the development of human values of K. Graves [18] the company makes development strategy, relying on the dominant system of values, because values govern the behavior of managers. When building a strategic development focus of the campaign the predominant level of values of the campaign should be considered, as that is the only way to realize the unique properties of the organization to create competitive advantages.

The main features of the transformation in project management are organizational, technical and social systems at any level. The basic Foundation of project oriented management system development is the concept of 5P (Portfolio – Program – Project – Process – Product), which is focused on the continued reproduction of the products of the projects portfolio [15].

Today, the concept of project oriented management in world standards and models is treated from different points of view, that effect on the requirements for procedures and means of projects, programs and portfolios management. In practice, many Ukrainian companies already using the terms and definitions given in the system of knowledge PMI [16] and P2M [17]. A comparative review of various aspects of project, program and portfolio management is considered in table 1, which summarizes the major provisions of the organizational platform of project management [16].

In the system of knowledge of PMI [15] portfolio management is represented by two process groups:

aligning process group and monitoring and control process group. Aligning Process Group determines how components of portfolio will be categorized, evaluated and selected for inclusion, and managed in the portfolio. Monitoring and control process group based on key performance indicators, which are periodically reviewed for alignment with strategic objectives.

Models of portfolio formation can be divided into two broad classes: one-criteria and multi-criteria [10]. Formation of portfolio of sustainable development is definitely applied to multicriteria problems. To solve this problem, you need to submit the value of the proposed alternative projects in the numeric criteria. The system of criteria in the general case may include both a quantitative and qualitative criteria. And the values of characteristics of alternative projects can be

specified both by continuous and discrete values.

Most often in practice there applied methods for the formation of the portfolio, which are focused on the evaluation of the project from the point of view of its financial indicators (ROI, NPV, DPP, PI) [10, 11]. However, the portfolio of sustainable development companies should include only the projects that bring the greatest value to sustainable development, and meet resource and time limitations. In this regard, there is a problem of estimating the value of the project, how closely it matches the sustainable development strategy of an enterprise at the given conditions. So the list of projects candidates into the portfolio in addition to financial performance should contain quantitative indicators of certain aspects of sustainable development of the enterprise.

**Table 1.** Comparative overview of Project, Program, and Portfolio Management

Aspect	Projects	Programs	Portfolio
Scope	Projects have defined objectives. Scope is progressively elaborated throughout the project life cycle.	Programs have a larger scope and provide more significant benefits	Portfolios have an organizational scope that changes with the strategic objectives of the organization.
Changes	Project managers expect changes and implement processes to keep change managed and controlled	Program managers expect changes from both inside and outside the program and are prepared to manage it.	Portfolio managers continuously monitor changes in the broader internal and external environment.
Planning	Project managers progressively elaborate high-level information into detailed plans throughout the project life cycle.	Program managers develop the overall program plan and create high-level plans to guide detailed planning at the component level.	Portfolio managers create and maintain necessary processes and communication relative to the aggregate portfolio.
Management	Project managers manage project team to meet the project objectives.	Program managers manage the program staff and the project managers; they provide vision and overall leadership.	Portfolio managers may manage or coordinate portfolio management staff, or program staff and the project management staff that may have reporting responsibilities into the aggregate portfolio.
Success	Success is measured by product and project quality, timeliness, budget compliance, and degree of customer satisfaction.	Success is measured by the degree to which the program satisfies the needs and benefits for which it was undertaken.	Success is measured in terms of the aggregate investment performance and benefit realization of the portfolio.

Monitoring	Project managers monitor and control the work of producing the products, services, or results that the project was undertaken to produce	Program managers monitor the progress of program components to ensure the overall goals, schedules, budget and benefits of the program will be met	Portfolio managers monitor the strategic changes and aggregate resource allocation, performance results, and risk of the portfolio.
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In general, during portfolio formation one should select projects with fairly large set of parameters that solve the problem of multi decision and deal with many alternatives, with a set of criteria and with plural scales of criteria evaluation. To simplify this task there used methods of rolling of values by weighted criteria method, which was proposed by T. Saaty in the last century. [19]

The main principles of the method are based on the fact that for practical purposes the system is often seen in the form of hierarchical structure that reflects the relationship of its components and their importance for the functioning of the whole system. If we consider the elements in each group independent, the assessment of options for making decision by analysis of the hierarchy is as follows:

1. The system is represented as hierarchical tree showing the relationships of related items.
2. For calculations there used matrix comparisons priority elements of the lower level of the hierarchy in terms of top-level elements, determined by experts.
3. The vector, which is calculated on these matrices relative priorities, is own normal judgments matrix vector.

But the main difficulty in applying this method of writing arises in a particular subject area, in this case the required information on the properties, relationships, constraints, axioms and assertions for a particular steel plant. The source of information for such modeling are the experts and documents from various divisions, which reflects the financial, technological, human and other aspects of the company.

Currently, there is no any common design methodologies and verification model for these purposes. Among the general issues concerning modeling, there distinguished some fundamental rules and generally offered one of the possible ways to develop the domain [20]. Suggested in [20] iterative approach begins with the first superficial description of the subject area, which then is reviewed and refined at the next steps. But such information is not enough for determination of portfolio of sustainable enterprise development. It is necessary to consider the current quarter relative to the dynamic environment, the complexity

is constantly increasing. The continuous growth of algorithmic complexity of the environment makes the need for development of tools based on the creative transformation capabilities and resources to build the projected future.

Thus, the task of selecting project portfolio to sustainable development comes down to the task of maximizing the integral target criteria  $F(\cdot)$ .

Formally, this problem can be represented as follows:

$$F(s) \rightarrow \max, s \in S \quad (1)$$

where  $S$  – vector of possible strategies.

At the stage of pre-selection of projects it was deliberately eliminated inefficient projects. At this stage, instead of the criterion of maximum objective function, it is more appropriate to use a certain threshold value criterion of efficiency:

$$F(s) \geq D, s \in S_D \quad (2)$$

where  $D$  – some real number;  $S_D$  – subset of set  $S$ .

The next step is an analysis of the most competitive projects. Analysis estimates and searches the optimal solution, which is determined by the type of the problem. For structured problems described by objective models, it uses techniques of additive or multiplicative convolution, selection of main criteria and displaying the others criteria as other restrictions. There are a fairly large number of methods for expert evaluation of the effectiveness of projects based essentially on a single methodological basis, differing mainly by the terms and subject of applicability industry. At the level of programs/portfolios to quantify the effectiveness discounted cash flow method and expert assessments are commonly used. The most adequate to the requirements of [20] is a method of expert review of important parameters and their assessment in points. In this method each expert evaluates the options according to a point system. The different factors weighted by experts provide a transition from the parameter estimates in points to coefficients weight.

Based on this information, you can create a portfolio of projects that will provide maximum value to the organization. Unfortunately in professional litera

ture, there are few works, in which the object of study would be large portfolio of projects as a means of synergetic development of complex systems. By the effect of synergies of portfolio is meant a situation where the utility derived from the portfolio exceeds the sum of each project values separately. Most of literature sources propose to describe the synergistic effects as depending from three variables: increase profits, reduce costs, decrease investment and track the dynamics of these variables. Thus, the overall synergy effect could be expressed by the growth of the cash flow scale or return on investment capital.

In our case, the task of obtaining a synergistic effect is required to determine the structure of the portfolio by joint projects maximizing the synergistic effect. The task is extremely complex and there are no effective methods of its solution. In some cases, the problem is solved sequentially. First, the problem of selecting a certain number of projects united by a common purpose is solved. For example, it has been selected N projects that can be attached to the portfolio. The cost of each project is estimated as:

$$C_i = K_i(1 + S_i) \quad (3)$$

where  $K_i$  – assets of each project after its completion  $S_i$  – return on investment. The cost of the combined portfolio will be considered as:

$$C = K(1 + S) \quad (4)$$

where  $K_i$  – sum of all portfolio assets;  $S$  – return on investment.

The Company Investment Yield from the sale of the portfolio will be presented in the next form:

$$S = \sum_{i=1} \beta_i S_i \quad (5)$$

where  $\beta_i$  – weighted coefficient of each component of the company's portfolio;  $S_i$  – return on investment of each component of company's portfolio.

There is introduced variable  $x$  for each potential component of the portfolio to solve the problem of portfolio formation:  $x_i=1$  if the project went into a plurality of portfolio components, otherwise  $x_i=0$ . Then the problem becomes:  $x_i \in \{0;1\}$   $i = 1, n$ , maximizing

$$S(x) = \beta_0 S_0 + \sum_{i=1}^N \beta_i S_i x_i \quad (6)$$

where  $\beta_0$  – efficiency ratio of investment before the beginning of the portfolio;  $S_0$  – coefficient of return on investment before the implementation of the

portfolio. At the limit:

$$\sum_i C_i x_i \leq R \quad (7)$$

where  $C_i$  – cost of each portfolio components;  $x_i$  – variable for each portfolio components;  $R$  – the total budget of the company for a specified period of the portfolio.

In our case, the effect of portfolio synergies refers to a situation where the utility of implementing project portfolio exceeds the benefits of each implementing project separately in a specified period of time. But as we know the success of final product of any system is dependent on environmental factors. Each external factor has a share in the total process of the company development and shows the synergism phenomena at the system level – in the system genesis. The genesis of system in the case of complex systems is based on the adaptation of key organizational values to changes in the environment, considering the typical cases of system behavior in terms of external and internal changes [21].

### Conclusions

For decades there was a contradiction between the recommendations for implementation of new projects, which managers received from textbooks on management, leadership and guidance of the company, and too much dependent from the adopted organization corporate culture.

An important advantage of value-oriented management is the ability to use and align the interests of company owners and the interests of projects on the base of evaluation of company performance values.

The article formalizes the conceptual foundations of enterprise sustainable development through the implementation of project portfolio where portfolio management processes are considered as means of implementation of strategic decisions. This enables to obtain efficient combination of organizational change and sustainability management based on existing standards of project management.

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