

# Development of EPM Systems: Management Principles and Tools

Dmitry Isaev<sup>1</sup>[0000-0002-8302-8126]

<sup>1</sup>National Research University Higher School of Economics, 20, Myasnitskaya Street, Moscow  
101000, Russia  
disaev@hse.ru

**Abstract.** This paper focuses on management issues related with implementation and development of enterprise performance management (EPM) systems. Such systems are used for certain management tasks – strategic analysis, management by objectives, corporate planning and budgeting, corporate reporting. Implementation and development of EPM systems should rely on appropriate methodological approach and supporting technologies. However, at present a holistic approach to EPM systems development management is unavailable. The aim of the research is to determine peculiarities of EPM systems development, basic management principles and management tools applicable on different stages of the development process. Here the management principles proposed are system approach (considering the system as a set of structural components and interrelationships between them), going concern (assumption that an organization intends to continue its activities in the foreseeable future), program-based approach (considering an EPM system development program as a set of interrelated projects), competitive consideration (forming few alternative development programs and selecting one of them for implementation), simulation (modeling of development programs and their consequences taking into account stochastic factors), comprehensive assessment (comparison of alternative programs relying on both quantitative measures and qualitative factors), value for money (comparison of investments with the system’s maturity represented by non-financial indicators), aggregated resources (considering resources in aggregate, as total amounts of related payments) and monitoring (analysis of the system’s changes over time, both historical and forecasted). Appropriate management tools comprise conceptual modeling, maturity assessment, discrete-event simulation and multi-criteria decision making. These management principles and tools are essential for creating comprehensive methodology of EPM systems development.

**Keywords:** Performance Management, EPM System, Development Program, Management Principle, Management Tool.

## 1 Introduction

These days many companies face with certain problems related with information support of corporate governance and strategic management. Such problems include in-

Proceedings of the XXII International Conference “Enterprise Engineering and Knowledge Management” April 25-26, 2019, Moscow, Russia

consistency of strategic, tactical and operational management levels (so called “strategic gap”), lack of business agility, shortcomings in timeliness and accuracy of corporate reporting. Enterprise performance management (EPM) systems allow managers to solve or, at least, mitigate such problems. An EPM system is an instrument for management, but it is also a management object: it should be implemented, monitored and developed. Therefore, it is a question regarding a comprehensive methodology of EPM systems development management. Such methodology should rely on certain principles that, in turn, are derived from key features of EPM systems.

## **2 Nature and Key Features of EPM Systems**

There are different definitions of EPM systems. For example, Ferreira and Otley define performance management in wide sense, as “evolving formal and informal mechanisms, processes, systems, and networks used by organizations for conveying the key objectives and goals elicited by management, for assisting the strategic process and ongoing management through analysis, planning, measurement, control, rewarding, and broadly managing performance, and for supporting and facilitating organizational learning and change” [1]. Other (but similar) definitions are advanced by Coveney et al. [2], Cokins [3], Broadbent and Laughlin [4], and some others. Appropriate software is developed by leading IT vendors – Oracle, IBM, SAP, SAS and some other companies. Despite certain differences in definitions, few important characteristics of EPM systems may be highlighted.

One of the features is complexity and modular structure of an EPM system. The system comprise special methods, models, information systems, management processes, as well as management personnel involved into these processes. Regarding management functions, EPM covers strategic analysis, management by objectives, corporate planning and budgeting, and corporate reporting (including preparing consolidated financial statements).

EPM systems have large-scale scope: they cover entire organizations, large business segments or groups of companies. As a result, management personnel involved into the performance management processes may be located in different geographical points.

Regarding time span, EPM systems consider long horizons of planning, accounting and analysis. This distinguishes them from well-known enterprise performance management (ERP) systems, which deal with individual operations.

From the point of view of data processing, EPM systems deal with aggregated management information, which may be both financial and non-financial. This again distinguishes them from ERP systems, that process detailed operational data.

The foregoing features seem essential for further formulation of peculiarities and principles of EPM systems development management.

### **3 Existing Developments Related to EPM Systems**

There are four groups of works associated with EPM systems, their implementation, maintenance and development. All of them are valuable in some aspects, but also have certain limitations.

The first group includes works describing nature and scope of EPM systems (some of such books and articles are mentioned above). These publications answer questions about the concept of performance management and its role in modern business. The importance of the theoretical developments is that allow to define main functional features of EPM systems and their linkage with real management tasks. However, these works do not examine methods and tools for creating and developing EPM systems.

The second group of existing developments deals with requirements to EPM systems. The examples are different codes of corporate governance [5] and studies in the field of strategic management [6]. Establishing goals of EPM systems these developments, again, do not consider implementing and developing matters.

The third group is associated with methods, models and technologies that make up internal content of EPM systems. In this regard, there are works in the fields of management accounting [7], scorecarding [8, 9], planning and budgeting [10], financial consolidation and business analysis [11]. All this is important for understanding components of EPM systems and their peculiarities for organizations of different types and industries. However, the questions regarding integration of the components and consistency of their implementation are not discussed.

Finally, existing works of the fourth group deal with different aspects of information systems development management: decision making in the IT sphere [12], IT scorecarding [13], IT project management [14, 15] and enterprise architecture [16]. At the same time, such particular aspects are not completely integrated and therefore do not form a holistic methodology. Furthermore, they have general nature and do not consider key features of EPM systems, which distinguish them from other classes of management systems.

Therefore, a comprehensive methodological approach to EPM systems development should rely on existing developments of all four groups, which in aggregate define the nature of such systems, their purposes, main components and some aspects of their development. At the same time, the proposed methodological approach has two important distinctive features: its integrity (considering relationships between key management aspects) and focus on EPM peculiarity (taking into account distinctive features of such systems). These two points form the basis for formulating basic principles of EPM systems development management.

### **4 Principles of EPM Systems Development Management**

There are three basic peculiarities of EPM systems development management. First, economic benefits from implementing and developing such systems are implicit, because improved management information has indirect effect on financial position of

organizations. Second, there are factors of uncertainty related with development projects and their impact on the EPM system. Third, some of the development projects are complicated: there are projects with uncertain outcomes, iterative projects (with possibility of re-executing) and projects with multiple variants of implementation. Taking into account features of EPM systems and peculiarities of their development the following management principles may be formulated.

The system approach principle means considering EPM system as a set of structural components and interrelationships between them.

The going concern principle is similar to one formulated in the International Financial Reporting Standards [17]. It means that an organization intends to continue its activities in the foreseeable future.

The program-based approach principle means that EPM system developing is realized through certain projects, which in aggregate form a development program.

The competitive consideration principle implies forming potential (alternative) development programs based on business needs and financing limits. Then the most preferable of these programs is to be selected for implementation.

The simulation principle is related with discrete-event simulation of potential development programs and their consequences. The results of such modeling is the basis for evaluating alternative programs and selecting the most preferable one.

The principle of comprehensive assessment of potential development programs means that their comparison is based not only on quantitative measures (results of simulation) but also on qualitative factors. In this regard, expert judgments are reasonable.

The value for money principle means comparison of investments in EPM system development with non-financial indicators characterizing the system's maturity and its dynamics.

The principle of aggregated resources means that resources required for an EPM system development are not considered in details. Instead, they are evaluated in aggregate, as total amounts of payments related with individual projects. An assumption that all the resources are unlimited and assessable is also applied.

The principle of EPM development monitoring refers both to the system's development history, and forecasting its state in the future.

## **5 Management Tools**

The foregoing principles of EPM systems development explain applicability of few management tools that can be used on different stages of the management process. Such tools include info-logical conceptual modeling, formation of EPM maturity models, discrete-event simulation and multi-criteria decision making. Let us to consider these tools in more details.

## 5.1 Conceptual Modeling

An info-logical conceptual modeling comes from the system approach principle. A conceptual model describes an EPM system as a set of functional blocks, functional modules and information flows between them [18]. There are four major functional blocks: strategic analysis and strategic choice, management by objectives, corporate planning and budgeting, and corporate reporting. Each block contains few functional modules. For example, the block of strategic analysis and strategic choice includes modules for monitoring, forecasting, corporate appraisal and positioning, goals setting, global strategic initiatives determining, and high-level objectives setting. The management by objectives block includes modules for scenarios determination, targets setting and objectives achievement analysis. The block of corporate planning and budgeting includes two modules: plans and budgets preparation and budgetary control. Finally, the corporate reporting block also includes two modules: corporate statements preparation and corporate statements analysis.

The model also describes certain external (i.e. located outside the EPM system) objects – external environment, external stakeholders, accounting systems, sources of qualitative information and operational management systems.

The information flows connecting functional blocks, functional modules and external objects include environmental and accounting information, goals and objectives, strategic initiatives, forecasts and plans, results of objectives achievement analysis and budgetary control, as well as external and management statements.

Further developments in the field of conceptual modeling include developing approaches and procedures for forming individual and industry related models for organizations of different types and industries.

## 5.2 EPM Maturity Model

Maturity modeling of EPM systems derives from the principles of system approach, value for money and development monitoring. The aim of such models is representing qualitative and quantitative capabilities of EPM systems according to the stages of their maturity, in terms of threshold levels – from initial to improved [19].

The maturity model is a base for determining framework for monitoring and planning EPM systems development. For this purpose, two target maturity levels are considered: lower (satisfactory) and upper (advanced). The target levels may be permanent or changing over time, depending on external conditions, new technological solutions and an organization's vision. Target maturity levels, in turn, define three maturity zones: unsatisfactory (below the lower target maturity level), satisfactory (between the lower and upper levels) and advanced (above the upper maturity level).

The trajectory of an EPM system development represents changing the system's maturity index over time with respect to threshold maturity levels. The trajectories can be of different types – actual, planned, forecasted or simulated.

Further developments in this field are associated with methodology of forming the performance management index for individual organizations, as well as indicators characterizing effectiveness of EPM development programs.

### **5.3 Development Program Simulation**

Another management tool is associated with simulation of EPM development programs, according to the simulation principle. Simulation seems essential because many parameters (duration of projects, usage of resources, impact on maturity level) are stochastic.

First of all, simulation refers to potential alternative programs – to obtain information about their executing and results, for subsequent selecting a program for implementation. However, simulation may also be applied for an approved program that has already started, for forecasting purposes. In any case, we mean simulation of discrete-event type, which describes behavior of the modeled system as a discrete sequence of events in time [20]. This is explained by the nature of development programs: each of them consists of a set of interrelated projects affecting both EPM maturity and financial metrics. So, implementation of a program can be presented as a sequence of discrete events: beginning and ends of projects, as well as impacts on maturity index and financial metrics.

Simulation seems quite effective for complicated projects – with uncertain outcomes, possibility of re-executing and multiple options of implementation. This is explained by the fact that parameters of such projects (for example, specific outcome or certain way of implementation) are also stochastic.

There are special information systems applicable for discrete-event simulation, such as Arena [21, 22, 23], AnyLogic [24] and some others. Details of using such software, as well as determining key elements of the simulation models and constructing special indicators of aggregated modeling results may be considered as further research areas.

### **5.4 Multi-Criteria Decision Making**

Multi-criteria decision making deals with a broad range of practical tasks in all areas of human life, including business, public administration, engineering, politics, medicine, etc. [25, 26]. In our case, decision making is required for comparing alternative development programs and selecting one of them for implementation. This is relevant to aforementioned principles of competitive consideration (selecting a program for implementation) and comprehensive assessment (availability of several assessment criteria). Additionally, the value for money principle means that criteria of assessment may be financial and non-financial, quantitative and qualitative.

Financial part of the assessment is related with resources used for EPM development. According to the principle of aggregated resources, all of them are considered as cumulative expenditures assigned to the time scale. Financial figures, as well as maturity related quantitative indicators are obtained from the simulation process. Additionally semi-structured, informal qualitative factors may be taken into account. Such factors can not be measured, but may be estimated by experts. Moreover, the role of experts may be expanded: they may be invited for interpreting some (or all) quantitative figures.

Therefore, the decision is made relying on analysis and generalization of few factors (criteria), which have different nature. Such analysis should rely on simulation results and experts' judgements. Consequently, an approach to evaluating the alternatives and subsequent decision making is essential. This point is also a subject of further research.

## 6 Conclusion

Enterprise performance management (EPM) systems have certain specific features – modularity, large-scale scope, long-term planning horizons and using aggregated management information. These features lead to peculiarities of EPM development – implicit economic benefits, factors of uncertainty, complicated projects. All this allows us to formulate principles of EPM development management – system approach, going concern, program-based approach, simulation and comprehensive assessment of development programs, value for money, aggregated considering of resources and monitoring of development. In turn, these principles explain reasonability of applying such management tools as info-logical conceptual modeling, using maturity models, simulation of development programs and multi-criteria decision making.

The defined principles and tools are compliant with existing developments related with nature and scope of EPM systems, requirements to them, their components and different aspects of their development management. However, the difference between the proposed methodological approach and existing developments is explained by its integrity and taking into account specific features of EPM systems.

Foregoing features, principles and management tools are closely interrelated. Taken together, they form reliable basis for detailed study of particular aspects of EPM systems development management and creating a comprehensive methodological approach in this field.

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