ASSESSMENT OF PROCESS-BASED MANAGEMENT SYSTEM MATURITY IN INDUSTRIAL ENTERPRISES

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ABSTRACT
Determining the level of process management achieved by an industrial enterprise is an urgent task for business. The solution to this problem is currently implemented using the Gartner scale, the CMMI methodology, the five-level BI maturity model, the People-CMM model; and classification of the process management system conditions in industrial enterprises. Within the framework of this paper, the existing toolkit has been supplemented by two ways of assessing process maturity: based on the technology of studying business processes and the stages of implementing process management, taking into account the applied methodologies. The advantages and shortages of the toolkit were revealed. The shortage of determining the enterprise management system maturity based on the technology used to study existing business processes is the absence of a scale for assessing the maturity, as well as the subjective factor influence on an expert assessment. The shortages of the existing process management system maturity classifications are specific. When choosing a classification (scale), it must take into account its unique features that affect the results of the analysis. The shortage of assessing the process management maturity based on the stages of process management implementation and applied methodologies is the possibility of simultaneous implementation of the process management stages, which complicates determination of the achieved maturity level. The paper presents the table developed by the author and comprising possible combinations of stages in the development of process management, which systematizes this relevant information for its subsequent practical application.

Keywords: stages of the process approach implementation, process management levels, business processes maturity, management system, industrial enterprise.

INTRODUCTION
Interest to enterprise management technologies based on the process approach in the Russian business community grows, as evidenced by the results of studies by consulting organizations "ABPMP Russia" and "Logic BPM" [1, 2]. About a half of domestic companies are at the initial stage of establishing a process management system or are only planning to implement a process approach. Since process management is based on several basic methodologies with different research subjects [3], this introduces certain confusion in the theoretical bases for the introduction and development of process management, and also calls for a more detailed consideration of the stages of the process management system formation in the context of process methodologies.

MAIN PART
Evaluation of process management system maturity of an industrial enterprise allows determining the totality of activities necessary to move to a higher level, and also to calculate the cost of their implementation. In our opinion, the analysis of process management system maturity in industrial enterprises can be carried out in three ways based on:
1. Technologies for studying existing business processes.
2. Classifications of development levels of a process management system.
3. Stages of process management implementation and applied methodologies.
Let's consider them.
1. **Technologies for studying existing business processes** are characterized by the following features: coverage, degree of decomposition of business processes, applied rules (notations), and software products for their description.

Let's consider classifications based on these characteristics:
1. 1. With regard to completeness of the business processes coverage [4]:
   a) Description of single business processes;
   b) Description of all business processes in an enterprise;
   c) Description of "related" business processes of suppliers and consumers for the enterprise (including integration at the level of information systems).

1.2. By the degree of decomposition of business processes [5]:
   a) Low level of decomposition: a detailed description of business processes up to individual actions performed in the workplace;
   b) Average level of decomposition: description at the level of subprocesses.
   c) High level of decomposition: description of business process names, definition of their output products, interrelations between business processes.

1. 3. According to the applicable modeling rules [6]:
   a) Formalized notations (for example, IDEF0, IDEF3, BPMN, ARISeEPC);
   b) Own original modeling rules.

The study of existing business processes will be carried out in conjunction with the parameters considered. On the basis of this combination, it is possible to determine the process management maturity level by the method of expert assessments. The shortage of this method is the absence of a scale for assessing maturity, as well as the influence of the subjective factor in expert assessment.

2. Let's consider the existing **classification of the development levels of the process management system**, in particular, the Gartner scale, the CMMI methodology, the five-level maturity model BI, the People-CMM model; and the classification of process management system conditions at industrial enterprises proposed by Karamyshev A.N., Makhmutov I.I., and Sych S.A. [7]

2. 1. The "Gartner" scale.

In accordance with the Gartner scale, five levels of process maturity at an enterprise are distinguished: "Understanding of inefficiency"; "Knowledge of processes"; "In-process automation and control"; "Inter-process automation and control"; "Value chain management"; "Adaptive business structure". In our material [8], we have pointed out the following shortages of the presented scale:

1) Lack of classification features, on the basis of which maturity levels are distinguished.
2) Disagreement with the scale stage sequence, in particular, the fifth stage "Adaptive business structure". In our opinion, the enterprise becomes adaptively-manageable after modeling business processes, determining their object relationships, as well as relations with the external environment. Automation allows them to partially accelerate the implementation of business processes.
3) Lack of criteria for understanding inefficiency at the first level of maturity.
4) Lack of criteria for determining the degree of decomposition of business processes at the second level of maturity.
5) Procedure of "Value chain management" is not given.

2. 2. The CMMI methodology

In accordance with the CMMI methodology, five levels of process maturity at an enterprise are distinguished: "initial", "manageable", "defined", "quantitatively-managed", and "optimized". The definition of the process maturity level is determined on the basis of responses to 101 questions in 22 thematic areas. [9]

In our opinion, the shortages of this methodology are:

1) Automation issues are not reflected in the maturity levels presented. This is an important shortage, since automation is one of the most important goals for implementing the process approach in the enterprise (54% according to ABPMP Russia [1]).
2) Management capabilities are not described at the levels of "initial", "manageable", "optimized", and "defined". In our opinion, a higher level of process management should provide additional opportunities in the preparation and adoption of managerial decisions.

2.3. People-CMM model
The model assumes the definition of process maturity of an enterprise through the prism of personnel management. The model is derived from the CMMI methodology.

According to the "People-CMM" model, five levels of process maturity of an enterprise are distinguished: "initial", "manageable", "defined", "predictable", and "optimized" [10].

The shortages of this model, in our opinion, are:
1) Evaluation of the process management system maturity based only on human capital will be one-sided, in our opinion.
2) Management capabilities at each of the model levels are not defined.

2.4. Classification of the states of the process management system at industrial enterprises (proposed by A.N. Karamyshev, I.I. Makhmutov, S.A. Sych).

The classification distinguishes five levels of the process management system maturity: "Traditional Management", "Self-knowledge", "Adaptive Management", "Process Resource Management", and "Striving for Excellence". Each level is assessed according to the following parameters: the level of business process regulation, the basic control element, the relationship between the basic elements of business process management, the technology of calculating the cost of auxiliary business processes, the mechanism for allocation of the costs of auxiliary business processes onto the cost of marketable products, the algorithm of transfer of auxiliary business process to the outsourcing.

In accordance with this classification, enterprises that did not implement a process approach are consistent with the level of "Traditional Management" which has little tools for making informed management decisions. Such tools are provided from the second to the fifth levels, and their opportunities to support management decisions expand with the transition to a higher level of process management system maturity [7].

A common shortage of the toolkit for assessing the maturity of process management presented above is the lack of process methodologies, with which the transition to new levels of process management system maturity and the opportunities provided by them is carried out.

3. **Standard stages of implementation and development of the process approach** are: a) modeling of business processes in an "as-is" state, their regulation and rationing of resources for the performance of business tasks; b) analysis and optimization of business processes in the state of "how it should be"; c) automation of all business processes; d) systematic improvement of business processes. The maturity of process management can be determined on the basis of the achieved stage.

It should be noted that some of these stages can be carried out simultaneously, which causes some confusion in the development of the process management system of an enterprise and assessment of its maturity. In order to understand this issue, the table with possible combination of the process management development stages was formed by the author (see Table 1). The standard stages of process approach implementation were changed, namely, stages were identified for analyzing and optimizing the main and auxiliary business processes. This is due to the availability of various process methodologies for analyzing and optimizing the main (production) and auxiliary (supporting) business processes.

<table>
<thead>
<tr>
<th>Stage</th>
<th>2. Analysis and optimization of business processes that ensure the quality and necessary characteristics of marketable</th>
<th>3. Analysis and optimization of auxiliary business processes at the enterprise</th>
<th>4. Automating the implementation of all business processes on the basis of business process models within the framework of</th>
<th>5. Continuous and justified improvement of the main and auxiliary business processes</th>
</tr>
</thead>
</table>

Table 1. The works performance order for introduction of process management (author's development)
<table>
<thead>
<tr>
<th>Stage</th>
<th>products</th>
<th>individual software products and information platforms</th>
</tr>
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<tbody>
<tr>
<td>1. Modeling of business processes, their regulation and rationing of resources for the performance of business tasks</td>
<td>1.2. It is possible to perform these tasks in parallel. Optimization of basic business processes is possible on the basis of the methodologies &quot;Lean Manufacturing&quot; and &quot;Six Sigma&quot;</td>
<td>1.3. It is possible to perform these tasks in parallel. At the same time, optimization of auxiliary business processes is possible on the basis of SCOR methodology.</td>
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<td></td>
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<td>1.4. It is impossible to perform these tasks in parallel.</td>
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<td>1.5. It is impossible to perform these tasks in parallel.</td>
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<tr>
<td>2. Analysis and optimization of business processes that ensure the quality and necessary characteristics of commercial products</td>
<td>2. 3. It is possible to perform these tasks in parallel. At the same time, the optimization of auxiliary business processes is possible on the basis of the SCOR methodology, and the optimization of the main ones is possible on the basis of Lean Production and Six Sigma methodologies.</td>
<td>2. 4. It is possible (but not expedient) to perform these tasks in parallel.</td>
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<td></td>
<td></td>
<td>2. 5. It is impossible to perform these tasks in parallel.</td>
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<tr>
<td>3. Analysis and optimization of auxiliary business processes of the enterprise</td>
<td>*</td>
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<tr>
<td></td>
<td>3. 4. It is possible (but not expedient) to perform these tasks in parallel.</td>
<td>3. 5. It is impossible to perform these tasks in parallel.</td>
</tr>
<tr>
<td>4. Automating the implementation of all business processes on the basis of business process models within the framework of individual software products and information platforms</td>
<td>*</td>
<td>*</td>
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<tr>
<td></td>
<td>4. 5. It is possible to perform these tasks in parallel.</td>
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</table>
Let's consider the proposed table.

- The cell "1.2". For successful application of the process methodologies "Lean Production" and "Six Sigma", the models of production business processes are not required, therefore the stages "Modeling of business processes, their regulation and rationing of resources for the performance of business tasks" and "Analysis and optimization of business processes providing quality and necessary characteristics of commodity products" may be carried out in parallel.
- Cell "1.3". Optimization of auxiliary business processes can be carried out by the SCOR methodology in terms of logistics operations.
- Cell "1.4". Automation of business processes requires detailed knowledge about the technology of the business process, therefore the stage "Modeling of business processes, their regulation and rationing of resources for the performance of business tasks" precedes the automation stage.
- Cells "1.5", "2.5", and "3.5". Continuous and justified improvement of the main and auxiliary business processes is possible, in our opinion, only if there are a network of business process models, detailed knowledge of the parameters of their implementation and interrelationships. This is necessary to determine the impact of local management decisions on the economic efficiency of the business processes network at the enterprise.
- Cell "2.3". Parallel analysis and optimization of the main processes (Lean Production and Six Sigma methodologies) and subsidiary (SCOR methodology) business processes are possible. These process methodologies were considered by us in [11-14].

The shortage of this method lies in the possibility of simultaneous process management stages implementation, which complicates the determination of the achieved level of maturity.

METHODS

In the course of the research, the following methods were used:
1. A selective analysis of specialized literature with a high citation index for the topic specified in the title of the paper. In particular, we have studied the existing approaches to assessing the process management maturity at an enterprise and their methods (Gartner scale, CMMI methodology, five-level maturity model BI, People-CMM model, and the state classification of the process management system in industrial enterprises).
2. The formed array of information was systematized for the purpose of further analysis. In particular, algorithms for determining the process maturity of an enterprise by these methods were studied.
3. The analysis of the collected information was carried out with the purpose of revealing the merits and shortcomings of the considered methods and evaluation in the possibility of their practical application.
4. The results obtained were given with the author's interpretation, conclusions were drawn.

RESULTS

On the basis of the foregoing, the following conclusions can be drawn:
1. The analysis of process management system maturity at industrial enterprises can be carried out in three ways based on: a) technology for studying existing business processes; b) classifications of development levels of the process management system; c) stages of process management implementation and applied methodologies.
2. The shortage of the first method is the absence of a scale for assessing maturity, as well as the influence of the subjective factor in expert assessment. The second method involves the possibility of applying several classifications of process management system maturity with its specific shortcomings. The shortage of the third method is the possibility of simultaneous implementation of the process management stages, what complicates determination of the achieved level of maturity.
3. In our opinion, table of possibly overlapping stages in the process management development created by the author is of considerable interest, which systematizes this relevant information for its subsequent practical application.
DISCUSSION
The reason for the study is an objective need to improve the management systems of enterprises and the development of theoretical bases for their management. As the process approach to management is dominant today, it was decided to analyze the methods for determining the development level of the process management system at an enterprise. In our opinion, with an increase in the management system maturity, the ability to support management decisions should increase. For this reason, in our opinion, methods for assessing the management system maturity should cover the subsystems of the enterprise as fully as possible. In our opinion, the considered process methodologies need in improvement in order to eliminate the specified shortcomings. With a view to systematizing the theory and eliminating the problems of techniques application in practice, we developed a table of possible overlapping stages in the process management development.

CONCLUSIONS
The paper analyzes the existing methods for assessing the maturity of the enterprise process management system, in particular, using the Gartner scale, the CMMI methodology, the five-level BI maturity model, the People-CMM model; and classification of the process management system conditions in industrial enterprises. The existing toolkit is supplemented by two ways of assessing process maturity: based on the technology of studying business processes and the stages of implementing process management, taking into account the applied methodologies. The advantages and shortages of the instrument were revealed, as

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REFERENCES
