
Formation of the System of Business Processes at Machine Building Enterprises

Ekaterina P. Garina¹, Viktor P. Kuznetsov², Anastasia O. Egorova³,
Aleksandr P. Garin⁴, Sergey N. Yashin⁵

Abstract:

The article studies approaches to determination of totality of business processes of machine building enterprises of the RF within structural & functional and process-oriented model of management. It was found that in functional management, algorithm is limited by six steps, and totality of business processes is “tied” to technological productive processes; that in process management, there are ten steps of determination and development of business processes, and their totality is limited by flow of value creation or by quality loop (life cycle of production). The authors offer an algorithm of formation of the system of business processes of large industrial enterprises which issue a range of technologically complicated products and are on the stage of transition from linear & functional management to process management. At the stage of transition from one model to another, it is offered to found the algorithm on the functional model of management through determination of “basic element of management” with further transformations of the system. Methodology of formation of the system of business processes of enterprises is developed which – within the PLM concept – allows: structuring activities in the sphere of different business processes, designing product and processes simultaneously, and integrating systems of creation of product of enterprises-members into the system of business processes of final manufacturer. Targeted indicators of evaluation of efficiency of main business processes are offered, which are received as a result of implementation of methodology in view of separate production of machine building enterprise of the RF which stipulate determination of the list of top-level processes, reflecting interests of most of external members of the system and of those processes which do not have reserves for improvement and are subject to changes in future.

Keywords: *technological processes, system of business processes, product creation, operational capabilities of production*

¹ PhD in Economics, Associate Professor, Kozma Minin Nizhny Novgorod State Pedagogical University, Chair of corporate economics, e-mail: keo.vgipu@mail.ru

² Doctor of economic sciences, Professor, Kozma Minin Nizhny Novgorod State Pedagogical University, Head of the Chair of corporate economics, e-mail: keo.vgipu@mail.ru

³ PhD in Economics, Associate Professor, Kozma Minin Nizhny Novgorod State Pedagogical University, Chair of corporate economics, e-mail: nesti88@mail.ru

⁴ PhD in Economics, Associate Professor, Kozma Minin Nizhny Novgorod State Pedagogical University, Chair of corporate economics, e-mail: keo.vgipu@mail.ru

⁵ Doctor of economic sciences, Professor, National Research Nizhny Novgorod State University named after N.I. Lobachevsky, Faculty of economics, e-mail: management@ef.unn.ru

Introduction

In Russia, works on problematics of business processes management are at the stage of development and are performed mainly in the sphere of organizational design, engineering, and production automatization. Most of theoretical research and applied developments are traditionally realized within narrow technical approach to solving the problems of organization of management of complex production & technical complexes. An obvious drawback of such works is weak adaptability of methods and means of modeling of integrated high-tech processes to conditions of national production. Up to this time, there has been no unified theory of systemic organization of production through construction of landscape of business processes with the use of process management. There is still necessity for scientific development of theoretical and practical approaches to management of business processes of machine building enterprises on the basis of formation of integrated system of business processes [3].

Study of the complex of business processes of enterprises, as institutional forms of portfolio of operational possibilities of production, is conducted in the works of the following foreign authors: B. Andersen, E. Deming, R. Kaplan, G. Martin, M. Hammer, and Russian scientists and practitioners: R. R. Zagidullin, V. G. Eliferov, Z.M. Magrupov, V. V. Repin. Approaches to design of the system of business processes at industrial enterprises are studies in works of R. Kaplan, E. G. Oykhman, M. Robson, F. Ullah, etc.

At that, existing results of scientific research in the sphere of methodology of formation of the system of business processes and the issues related to determination of the system of business processes in the moment of transition of enterprise from functional-oriented management to process management, which is popular in national production. Tasks of creation of well-balanced complex of business processes of enterprises during manufacture of high-tech product are not solved, which determined the choice of the topic.

The purpose of the research is to systematize theoretical provisions and develop methodological and practical recommendations as to formation of totality of business processes at national machine building enterprises.

The article suggests the following: 1) to develop algorithms for determination of business processes of large industrial enterprises which issue a big range of technologically complex products within structural & functional and process-oriented model of management, and which are at the stage of transition from linear & functional management to process management; 2) to develop methodology of formation of landscape of business processes of modern industrial enterprise which ensures unified terms, sufficient quantity of resources, and balance of business processes during manufacture of high-tech product.

Analysis of research results

A lot of treatments of the category “business process” predetermine differences in content and solution of these processes. At the same time, analysis of a range of works of researchers allows concluding that, on the whole, determining the business processes and their structuring into totality is possible from two positions [Garina, 2013]:

- determination of business processes on the basis of structural & functional system of enterprise;
- determination of business processes on the basis of process-oriented model of enterprises management.

The stated models of enterprise management can be equally used at domestic enterprises. Each of them has a certain set of pros and cons which directly influence the content and structuring of business processes in economic landscape of enterprise. In particular, functional model continues to stay in demand in Russia, against the background of “habit” of domestic consumer as to “mass product”. On the other hand, increase of requirements to quality of products and necessity for reduction of production cost require implementation of process-oriented management, which leads to manufacturer being obliged to change decisions as to business processes – in particular, as to working process of performance. Besides, determination of processes on the basis of functional and process models of management has various performance technologies.

The conducted comparisons allowed determining a range of peculiarities:

- 1) The determined business processes have various messages depending on the used management model: in process management, the mechanism is oriented at construction of stable business process, the level of organization of which predetermines manufacture of high-quality products over long period of time; in functional management system, determination of business processes is aimed at preparation and realization of technological processes – at that, in next technological process, the determined totality of business processes is not repeated.
- 2) Structure and quantity of determined business processes vary – depending on the tasks being solved: in process management, totality of business processes is limited by either the flow of value creation, or quality loop (product life cycle); in functional management, business processes organization is based on structural business item of production, and business processes are “tied” to technological processes of production. As a result, a lot of business processes are formed, which – together with technological processes – can be initiators of several additional business processes which do not cross with other ones.
- 3) In process management, business processes are primary for change; after their modeling, organizational structure of enterprise is determined. In functional management, production & economic business item is primary for change.

Diversity of approaches to determination of business processes within two models of management predetermines difference in algorithms of formation of business processes landscape. Succession of actions which transform initial data into the final result within the two models is shown in Table 1.

Table 1. Comparison of algorithms of formation of landscape of business processes with functional and process management [Garin, 2013]

Functional management	Process management
<ol style="list-style-type: none"> 1. Analysis of all orders of enterprise in view of its structural & functional scheme and compilation of list of business processes which are connected to functioning and support of enterprise. 2. Structure of technological processes and corresponding planning units. In a model, planning unit is represented by technological process in the form of many operations. 3. Determination of business processes and supplementary production processes which are related to production and are indirectly connected to technological processes; their regulation. 4. Planning of all processes in time at all levels of enterprise. 5. Compilation of complex plan of all processes of enterprise with distribution in time. 6. Practical realization of system and monitoring of processes. 	<ol style="list-style-type: none"> 1. Determination of the limits of business processes. 2. Description of business processes with the use of notations. 3. Development of documented procedures (standards, instructions, provisions). 4. Conduct of evaluation of business processes risks 5. Development of well-balanced system of indicators of efficiency and effectiveness of business processes. 6. Selection of methods of monitoring and measurement of business processes. 7. Implementation of the audit system of business processes. Development of correcting actions by the audit results. 8. Analysis of implemented business processes and their further perfection on the basis of Shewhart-Deming PDCA cycle. 9. Reorganization of organizational structure of company, aimed at optimization of cooperation between departments for the purpose of increase of efficiency and effectiveness of business processes at the level of organization. 10. Optimization of existing business processes.

The conducted evaluation of the authors' works allowed determining that at the modern stage, it is advisable to use process approach which limits the totality of business processes and allows simplifying organization of management of production & technical complexes and increasing their effectiveness indicators. This is proved by experience of domestic enterprises [Egorova, 2014]. As a result of reduction of business system management, sales revenues, with preservation of pricing and assortment policy, increase from 15 to 40 % in 3-month time after implementation of process management; cost of business system, based on offers, increases by 20-30%; profitability of enterprise grows by 30%. However, most of domestic enterprises are at the stage of transition from linear & functional

management to process management. Therefore, in view of tough limitations within the algorithm of formation of business processes system, we allow transition from functional to process management from any stage of the system's state: adaptive management; process management of resources, etc. At that, transition to the system of process management begins from determination of "basic element of management", the role of which at industrial enterprises is performed by business process "product manufacture". In this case, methodology of modeling of processes takes into account four elements: incoming flows; new elements of system; business architecture of system and resource provision of system.

According to implemented limitations, algorithm of formation of the system of business processes of new generation at domestic enterprises of machine building industry includes the following steps [Nenad, 2008]:

1. Object modeling, which supposes technology of analysis of "incoming informational flows" (consumer's needs) within the cycle of business process.
2. Structure of "system business architecture".
3. "System expansion" – group of processes, responsible for development of new business processes.
4. Implementation of "incoming" production logistics.
5. Resource provision. Business processes of the flow control supply and use of resources.
6. System monitoring. Methodology DDS, used in the system with ARM-model, is very effective for monitoring of productive processes.
7. Change of processes.

The offered algorithm allows improving qualitative indicators: reducing reaction time of business system to changes of environment; performing "depersonalization" of management system; increasing its transparency and controllability.

The offered methodology of formation of the system of business processes of new generation of domestic enterprises is based on the following primary conditions [Oswaldo, 2010]:

- globalization of the sectors of industry determines necessity for competition between main manufacturers, where each member either keeps relatively low market prices for products or keeps them on a relatively high level, but constantly introduces new technologies and invests into product;
- in car industry, such technologies are: business solutions as to the issue of creation of product in industry; organizational & technical systems of management; systems of inter-corporate cooperation, etc.

In case of realization of the first position – technologies related to product creation in industry, the offered methodology of formation of the system of business processes of new generation should include the following steps:

1st step: development of product concept – its initialization which covers idea of creation, selection, and conceptual testing. Expected result – provision of positioning of the systems of product creation in the landscape of business processes of company and determination of their interconnection with other systems;

2nd step: realization of product concept. At this stage, development, testing marketing, and product’s entering mass production are performed; system of business processes of enterprises is formed. It is based on detailed elaboration of the product through the use of the method “Design for production capabilities”.

In case of realization of the above steps, the system of product creation is integrated with the system of business processes of enterprise through [Gupta, Krishnan, 2009]:

- 1) Elaboration of configuration of business processes system;
- 2) Management;
- 3) Software.

The offered methodology of formation of the system of business processes of new generation allows solving the following tasks:

- structuring (improving) activities in the sphere of heterogeneous business processes;
- designing product and processes – i.e., complex technical systems;
- integrating systems of product creation into landscape of company’s business processes.

Targeted indicators of evaluation of efficiency of main business processes, received as a result of implementation of methodology in view of linear production of enterprise GAZ Group are shown in Table 2.

Table 2. Indicators of evaluation of efficiency of main business processes which characterize the level of development of enterprise GAZ Group in view of metallurgical production [Garin, 2013]

Process	Indicators of business process efficiency	Targeted value of indicator	2013	2014
Production	1. Plan completion, %	100	100	100
	2. Growth of production volume as compared to previous year, %	20	5	10
	3. Expenditures for rework, % of production cost	0	0.25	0.02
	4. Items delivery to quality department at first demand, %	98	98	98
	5. Share of losses from waste during production, %	0	2	0
	6. Number of technology violations	0	5	2
	7. Number of waste confirmation acts	0	2	0
	8. Reduction of direct expenditures, %	5	5	5

	9. Reduction of overhead costs, %	4	4	4
Planning of material & technical provision	1. Share of raw materials and materials without certificate, %	0	0	0
	2. Share of raw materials and components which have not passed acceptance control	0	0	0
	3. Materials and components accepted during acceptance control on first delivery, %	90	90	90
	4. Number of complaints for spare parts	0	0	0
Connection with consumers	1. Share of completed orders among the taken orders	100	100	100
	2. Number of completed contracts	150	150	150
	3. Number of new contracts	10	20	20
Monitoring of consumer's satisfaction	1. Number of accepted complaints	0	10	9
	2. Growth of sales volumes as compared to previous year, %	20	10	10
	3. Number of complaints for storage, freight handling, and transportation	0	0	0
Management of products which do not conform to the set requirements	1. Share of products which do not conform to the set requirements, %	0	0	0
	2. Number of orders for inappropriate products	0	0	0
	3. Share of performed measures, developed according to orders for products which do not conform to requirements.	100	100	100
	4. Share of expenditures for rework in production cost, %	0	0	0

On the basis of determination of levels of efficiency of processes according to the Harrington scale, it was found that most of the processes (80 %) possess “high” level of efficiency, and “middle” level accounts for 20 %. Indicator of efficiency of

integrated system of management on the basis of received indicators of efficiency of business processes and weight coefficients equals 0.81, so it is possible to conclude that integrated system of business processes of enterprises functions efficiently, but it is necessary to develop slight correcting actions.

Conclusions

Algorithm of formation of the system of business processes of large domestic industrial enterprises which issue large line of technologically complex products is limited by six steps in functional management, and totality of business processes is “tied” to technological productive processes, There are ten steps for determination and development of business processes in process management, and their totality is limited either by flow of value creation or by quality loop (product life cycle). At the stage of transition from one model to another, algorithm should be based on functional model of management through determination of “basic management element” with further transformations of system. At that, in our opinion, the system of business processes of manufacturer should be integrated with corresponding systems of enterprises-members through unified technological chains from the moment of development of product concept, which will allow increasing the added value share which accounts for OEM-manufacturer.

The offered methodology of formation of the system of business processes of modern industrial enterprise allows: structuring activities in the sphere of heterogeneous business processes; designing product and processes, i.e., complex technical systems; integrating the systems of product creation into landscape of business processes of company and enterprises-members of the process within the PLM concept.

References

- Andryashina N.S. Innovative activities of industrial enterprises: problems and perspectives / N.S. Andryashina, V.P. Kuznetsov // *Bulleting of Penza State Pedagogical University named after V.G. Belinskiy*. – 2012. – No. 28. – P. 408
- Garina E.P. Business solutions on the issue of product creation in industry / E.P. Garina // *Bulletin of Minin University*. - 2014. – No. 1 (5). - P. 2.
- Garina E.P. Tendencies and perspectives of development of domestic car building industry on the basis of implementation of PLM-strategy / E.P. Garina, A.P. Garin // *Modern science-based technologies. Regional supplement*. – 2013. – No. 2(34). – P.26-32
- Garin A.P. Development of landscape of business processes at enterprises of machine building industry: Ph.D. thesis / A.P. Garin; Mordovia State University named after N.P. Ogarev. – Saransk, 2013. – 166 p.
- Egorova A.O. Mechanism of development and realization of competitive strategy of machine building enterprises: monograph / A.O. Egorova, V.P. Kuznetsov. – N.Novgorod: Nizhny Novgorod State Pedagogical University named after Kozma Minin. – 2014. – 180 p.

- Egorova A.O. Formation of organizational & economic mechanism of development and realization of competitive strategy of machine building enterprises: Ph.D. thesis / A.O. Egorova; Nizhny Novgorod State University named after N.I. Lobachevskiy. – Nizhny Novgorod, 2013. – 183 p.
- Udalov F.E. Study of methods of process management of industrial enterprise / F.E. Udalov, V.P. Kuznetsov, E.P. Garina // Bulletin of Nizhegorodsky State University named after N.I. Lobachevskiy. – 2011. – No. 5-2. – P.232-237
- Dassisti M. (2010), HY-CHANGE: a hybrid methodology for continuous performance improvement of manufacturing process/International Journal of Production Research, vol. 48, no. 15, pp. 4397-4442.
- Gupta, S., V. Krishnan (2009). Integrated component and supplier selection for a product family. *Production and Oper. Management* 8(2), pp.163-181
- Kuznetsov V.P., Romanovskaya E.V., Vazyansky A.M., Klychova G.S. (2015), Internal Enterprise Development Strategy. *Mediterranean Journal of Social Sciences* 6 (1), pp.444-447
- Liberatore, M.J., A.C. Stylianou (2003) Expert support systems for new product development decision making. A modeling framework and applications. *Management Sci.* 41(August), pp. 1296- 1316
- Nenad P. (2008). Conceptual Modelling of Complex Production Systems. *JIOS*, Vol 32 No 2, pp.115-122
- Oswaldo A. N. Borges de Menezesa (2010), Manufacturing Strategies in Action /Brazilian Journal of Operations & Production Management, Volume 7, Number 1, pp. 09-35
- O’Leary D. ERP-systems: modern planning and management of resources. –M.: OOO Vershina, 2004
- Organisation for Economic Co-operation and Development (OECD). 2010. Measuring Innovation: A New Perspective. http://www.oecd.org/document/22/0,3746,en_41462537_41454856_44979734_1_1_1_1,00.html. Accessed 16 June 2011.
- Product creation system in the industry and their development [Text]: Monograph / [V.P.Kuznetsov, EP Garina et al.] - Nizhny Novgorod: Nizhny Novgorod State. ped. Univ them. Kuzma Minin, 2014. - 176 p.
- Pahl, G., W. Beitz (1988). *Engineering Design: A Systematic Approach*. Springer, New York, 12(8), pp. 126-138 Pahl, G., W. Beitz. 1988. *Engineering Design: A Systematic Approach*. Springer, New York, 12 (8), pp. 126-138
- Solodyashkina Y., 2014. Process management as a concept of modern management/ Innovation Management and Company Sustainability. Proceedings of the 2nd International Conference 26 – 27 May, 2014? pp.150-155
- Toma Noda & Joseph L. Bower, (1996), Strategy making as Iterated Processes of Resource Allocation. *Strategic Management Journal* 17, pp. 159–192.