Improvement of procedural approach to the production management at industrial enterprises

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Abstract. The importance of the process approach in the management of industrial enterprises is shown. The peculiarities of the implementation of the process approach in the pipe metallurgical industry, content of the processes and criteria of their efficiency are studied. An important problem for the implementation of the process approach is connected with the absence of a clear and reliable assessment of quality management processes. The method of the efficiency assessment of managerial decisions taken during the process is suggested and tested. It is done by means of use of a correcting ratio reflecting the managerial quality upon every criterion of the process and the calculation of an integrated index of the process efficiency on its basis. It is determined that the developed methodology allows assessing objectively the dynamics of the process, purposefully changing the characteristics of every process in the needed direction, interpreting definitely the condition of all processes of an enterprise taking into account the quality of the management.

1. Introduction

In the course of development of theory and practice of management the vertical, hierarchical, strictly functional systems of management at industrial enterprises were replaced by a managerial concept which analyzed an enterprise as a set of the most important processes from the point of view of its efficiency which provides the creation of rigid horizontal connections at all managerial levels.

The comparative analysis of functional and process approaches to management made by A.V. Kladov [2, P.147-148] showed that the process approach improves the way of division of labour existing in the enterprise between separate functional subdivisions. This approach integrates the fulfilled functions into a total efficiency of organizational management thanks to flexibility, adaptability, dynamism and transparency. From the point of view of O.V. Koltsov and V.I. Menshchikov [3, P.117] the process approach to management in contrast to functional approach directs the enterprise to the best final result of its activity.

The concept of process approach was finally formulated in 1980s of the last century and it was firstly written into the standards of the International Organization for Standardization (ISO) within quality management systems.

The main element of the process approach is generally meant a periodically repeated, adjusted consequence of actions which can be easily formalized [4, P.258]. According to the terminology of ISO Standard 9001-2000 «Systems of quality management. Requirements» a process is the activity using the resources and managed with the aim of the transformation of exits into entries. According to a justified opinion of V.G. Chebotarev and A.I. Gromov [1, P.14] the processes are considered as fundamental characteristics of an enterprise as an organizational system and the notion “enterprise management” for the moment is inseparable from the notion “management by business processes”.

The ISO standards determine the necessity of the identification by the organizations of the content of their processes and ways of management of these processes but they do not present the strict re-
requirements to their content and documentary formalization. The types of processes recommended by ISO that can be used by the organizations generally include four large groups: management processes, main production processes, implementation, monitoring, control and management.

For the documentation of the process approach the industrial enterprises as a rule use typical block schematic diagrams of processes which include such elements as the entry and the exit of the process, resources of the process, owner of the process, suppliers and consumers of the process, criteria of the process (qualitative or quantitative ones) which characterize the efficiency of a process. The use of a typical structure of processes according to the opinion of A. V. Kladov [2, P.146] allows joining the processes into a cyclical structure which is founded on the comparison of the result of every process and the reaction to the fulfillment of requirements.

An important impact on the creation of the structure and content of processes accompanying the activity of organizations has scientific research. For instance, A.G. Shapovalov [5, P.237] suggested to use the processes which characterize the introduction of new technological solutions in an organization. Ya. V. Grebnev [6, P.64] studied the opportunity of use of the process determining the degree of self organization in the course of management by organizational changes at the enterprises, process of the efficiency assessment of organizational changes and so on. A.V. Litvinova and A.V. Gorbunova [7] recommended the inclusion into the criteria of process assessment the criteria “Costs on process quality” for the reduction of the volume of useless (connected with the overuse of resources) of costs which can arise in the course of the realization of business processes.

Despite the availability of a number of methodological approaches to the organization of the process approach at industrial enterprises every from them is independent in the methods of the systematization of processes in their activity and determination of the elements of their processes. The differences mentioned above are clearly observed not only between enterprises but also between entire industries.

The pipe and metallurgical industry which used the process approach in compliance with the norms of ISO standards in early 1990 of the XX century had a considerable success in this sphere. The orientation to ISO standards specifically and a high level of the competitiveness achieved due to this fact contributed significantly to overcoming by Russian metallurgical enterprises of crisis tendencies typical for the Russian economy recently.

According to the results of 2017 the production index of metallurgical industry of the country made up 96,4% (in 2016 it was 97,7%) and the tube production in 2017 remained the leader of the industry. Thus the reduction of steel production, rolled steel was accompanied by a considerable growth of the volumes of the production of conductor weldless tubes (by 19,8%).

The implementation of oil and gas projects, recovery of industrial production in the world market is observed today. The large scale programs of technological modernization, strengthening of the ruble exchange rate, trend for import replacement existing today contributed to the recovery of pre crisis positions of national tube and metallurgical enterprises. For instance in February 2017 “Gazprom” company announced the purchase of almost 600 thousand tons of large diameter tubes for the gas pipeline “Sila Sibiri” (Power of Siberia). The suppliers of tubes became six leading tube producing companies of the country [8,9].

The leaders of pipe and tube metallurgical production in Russia are PC “Vyksunskiy metallurgical plant”, PC “Chelabyinsk pipe rolling plant”, PC “Pervouralskiy new pipe plant”. PC “Northern pipe plant”, PC “Novosibirskiy metallurgical plant named after Kuzmin”, PC “Izhorskiy tube plant”, PC “Uraltubprom”, PC “Almetievskiy tube plant”, PC “Gazpromtrubinvest”. The leading enterprises of pipe and tube production in the Volgograd region are PC “Volzhskiy tube plant” (part of the group PC “Tube metallurgical company”), Closed Corp. “Tube plant “Prophil-Akras”” in Volzhskiy.

The Closed Corporation “Tube plant “Prophil-Akras”” named after V.V. Makarov specializes on the production of electro welded pipes, gas pipelines and heating systems, pipes of square, rectangular, oval, plane oval section. Also it focuses on the production of various constructions. The annual volume of production reaches more than 120 thousand tons. The plant is one of top three in Russia
upon the production of shaped tube and has the 7th rank upon the volume of production of small diameter pipes. The plant has an active policy in quality management using the process approach.

The goal of the research is the study of peculiarities of the implementation of the process approach at the enterprises of pipe and tube production, identification of problems and development of measures directed on its efficiency growth.

2. Materials and Methods (Model)

The analysis of the implementation of process approach in the Closed Corporation “Pipe plant “Prophil-Akras” was founded on the study of the composition and the content of process and on the efficiency criteria used in an enterprise.

The enterprise uses a typical for the tube metallurgical industry approach to the systematization of processes (Table 1).

| Process | Main processes |
|---------|----------------|
|         | Criteria       |
| Determination, planning and analysis of requirements of consumers and production | 1. Gathering of demands for the beginning of the planned period (month) |
|         | 2. Provision of production in compliance to the demands for the end of the planned period (month) |
|         | 3. Satisfaction of consumers |
|         | 4. Fulfillment of the plan of the shipped production, share of exports in the total volume of shipment |
| Purchase of basic materials | 1. Provision of the demand for production in basic materials and compliance of purchased materials to set requirements |
|         | 2. Delays in the work of electric welding pipe workshop |
|         | 3. Volume of inappropriate basic material |
|         | 4. Qualification of suppliers of main materials |

All processes in the enterprise are divided into three groups: basic, managerial and supporting ones. The efficiency of every process is characterized by the corresponding criteria. When developing the composition and content of criteria at the enterprise the management assumes that when the number of criteria grows the safety and reliability of the assessment of every process increases. However a general drawback for all processes at the enterprise is clearly observed. It is the absence of efficiency assessment of managerial decisions taken in the course of their realization.

Meanwhile in terms of the standard ISO 9001-2015 «Explanatory text. Requirements. Guide for introduction» the process approach is directed on the systematic definition and management of processes and ensuring of interaction in a way that helps to reach the targeted results in compliance with the policy and strategic direction of the firm’s activity. The achievement of this goal in the opinion of the authors is possible only on the basis of the growth of process management qualities and the systematic assessment of the efficiency level of the taken managerial decision from the point of view of their timeliness, operational efficiency, justification, flexibility, objectivity, multivariance, consistency of the goals set earlier and taken decisions, availability of the implementation mechanism. It is obvious that the absence of the efficiency assessment of managerial decisions taken for the management under the conditions of a quickly changing internal and external environment of the enterprise prevents achieving the goals of the process approach.

It is worth mentioning that in a series of scientific research devoted to the problems of the implementation of process approach at industrial enterprises [7,10,11,12], a serious attention is paid to the improvement of qualitative assessment of efficiency processes. However the research allowing to assess the efficiency of managerial decisions taken during their realization do not exist. At the same time E. M. Malkova and E.V. Konovalova [12] fairly assume that the main effect from the introduction of process management is the growth of the manageability of business processes and as a result the reduction of costs for their realization, growth of operational efficiency and competitiveness of the enterprise. From this point of view the assessment of the process management becomes a first order task.
Purchase of additional materials 1. Provision of the need of production in supplementary materials and compliance of the purchased materials to set requirements 2. Qualification of suppliers of supplementary materials

Production of goods 1. Implementation of production schedule 2. Implementation of norms for unsuitable production in the total volume of production 3. Technological delays

Storage and shipment of final production 1. Implementation of shipment schedule 2. Remarks on the storage conditions of final product

Activity planning 1. Implementation of expenditures budget 2. Profitability of shipped production 3. Implementation of profit budget 4. Implementation of profit plan

Organization and analysis of the activity 1. Assessment of quality management system from the point of view of top management 2. Achievement of goals set in the sphere of quality 3. Production discipline observing

Infrastructural management 1. Delays of mechanical equipment 2. Delays of electrical equipment 3. Implementation of schedules of the equipment repairing 4. Implementation of check schedules of measurement and equipment control 5. Implementation of schedule of building and construction inspection

Personnel management 1. Satisfaction of the demand in personnel 2. Implementation of personnel training plan 3. Turnover of employees

Production environment management 1. Realization of measures on labour safety 2. Traumatism level

For the efficiency assessment of managerial decisions taken in the course of the process it is suggested to adjust every process criteria for a correcting coefficient reflecting the degree of achievement of the acknowledged in theory and practice of management indices of managerial decisions efficiency (Table 2). The assessment should be made taking into account the understanding of quality management historically existing at the given enterprise, experience and qualification of specialists engaged in the process approach or in first turn the owners of process. It also should be accompanied by a detailed analysis of deviations which caused the reduction of process efficiency [13].

Table 2. Values of correction coefficients which determine the efficiency of managerial decisions taken in the course of processes

| Process efficiency characteristics                                                                 | Values of coefficient of efficiency of managerial decisions $K_i$ |
|---------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Timeliness, operational efficiency, justification, flexibility, objectivity, multivarience, consistency of the goals set and taken decisions, availability of the mechanism of implementation of managerial decisions | 1.0                                                            |
| Justification, flexibility, objectivity but insufficient operational efficiency, timeliness and flexibility of managerial decisions | 0.8                                                            |
| Insufficiency of justification of taken managerial decisions                                     | 0.6                                                            |
| Flexibility, objectivity and operational efficiency of taken managerial decisions but absence of a real mechanism of its realization | 0.4                                                            |
| Managerial decisions contradict the goals set and decisions taken                               | 0.2                                                            |
| Taken managerial decision did not provide the achievement of the set goals of the process        | 0                                                              |
It is suggested to carry out the efficiency assessment of managerial decisions taken in the course of the process by means of the aggregation of the values of all the criteria into an integral index of the process efficiency. This integrated index should take into account the correction of every criteria for a coefficient which determines the degree of managerial decisions’ efficiency:

\[ P = \sum d_i * K_i / n \]

where \( P \) – integral coefficient of process efficiency;
\( i \) – cardinal number of the process criterion (\( i=1,..,n \));
\( n \) – number of criteria;
\( d_i \) – factual value of the process criteria, % from the normative value;
\( K_i \) – coefficient determining the efficiency of managerial decisions taken in the course of process.

3. Results and Discussion

The methodical approaches to the calculation and determination of normative values of process criteria used in Closed Corporation “Pipe plant “Prophil-Akras” named after V.V. Makarov are presented on the example of the process “Purchase of basic materials” (Table 3). The goal of this process is to provide the production with the basic material (metal) in compliance with technical norms and delivery terms.

Table 4 shows an adjusted description of the process “Purchase of basic materials”, its planned and factual values of their criteria taking into account the coefficients which determine the efficiency of managerial decision taken in the course of the process. In order to specify the normative values of process efficiency we used as a target the maximally admissible normative value of every criterion within the limits of an accessible band of values. It allows identifying the maximal deviation of the efficiency coefficient of managerial decisions during the process.

### Table 3. Composition, content and methods of calculation of criteria of the process “Purchase of basic materials”

| №  | Criterion                                                                 | Measurement unit | Method of calculation                             | Normative value | Rank of importance |
|----|---------------------------------------------------------------------------|------------------|--------------------------------------------------|-----------------|-------------------|
| 1  | Provision of the need of metallic production and correspondence of purchased materials to requirements set by laws on purchases | %                | Ratio of factual supply of metal (tons) to the need in purchase of metal according to production schedule (tons) | 100 (±5)        | 5                 |
| 2  | Percentage of delays in the work of electric welding pipe workshop        | %                | Ratio of nominal time for technological process to the time of delays in the work of the workshop | 0 (±0)          | 3                 |
| 3  | Volume of inappropriate metal                                             | %                | Ratio of the volume of the sorted metal (tons) to factual supply of metal (tons) | 2 (+0;-0.5)     | 4                 |
| 4  | Qualification of suppliers of main materials                             | %                | Ratio of the number of qualified (assessed upon five criteria and obtained more than 2.5 grades in 3 grade scale) of suppliers to the total number of suppliers | 50 (-25,+50)    | 5                 |

### Table 4. Values of the criteria of the process “Purchase of basic materials” with the account of the coefficient of the managerial decisions efficiency

| Criterion                                                                 | Meas- | Value of criterion | Value of Factual |
|---------------------------------------------------------------------------|-------|-------------------|-----------------|

The data in Table 4 show that at the provision of production with metal (coiled stock), the number of delays in the work of electric welding pipe workshop and the volume of inappropriate metal, there exists the non fulfillment of the maximal normative values of process criteria. At the same time a low efficiency of managerial decisions taken during the process is observed. The managerial decisions are assessed according to two criteria: percentage of delays of work of electric welding pipe workshop and the volume of inappropriate metal. A high efficiency is observed upon the following criteria: qualification of suppliers of basic materials and the provision of production with metal. The specificity of the metallurgical production is that the purchase of metal (strips, iron plate) is made in advance of factual production and it is the main condition of provision of the continuity of a technological process. Despite the fact that for the beginning of production process the provision with basic material made up 98%, the managerial decisions which are taken in time which are directed on the delivery of metal from the store room for the provision of continuity of the technological process and the implementation of the plan allowed assessing maximally high the efficiency of managerial decisions taken in compliance with the criteria “Provision of demand for metal production”.

The results of the calculation of an integral index of process efficiency “Purchase of basic materials” upon the data of the factual value (percentage from the normative value) of its criteria is presented in Table 5.

Table 5. Results of the calculation of an integral index of efficiency process “Purchase of basic materials”

| Variants of calculation of an integral index of efficiency process | Value of integral index P, % |
|------------------------------------------------------------------|-------------------------------|
| Calculation on the basis of normative values of criteria         | 100.0                        |
| Calculation on the basis of factual values of criteria without the use of efficiency coefficient of managerial decisions | 97.2                         |
| Calculation on the basis of factual values of criteria with the use of coefficients of managerial decisions efficiency | 75.3                         |
The data of Table 5 show that the value of the integral index calculated on the basis of factual values of process criteria with the use of the efficiency coefficient of managerial decisions are 21.9% lower than the value of the integral index calculated without this coefficient. The value of the integral index with factual values is lower than the integrated index which is calculated on the basis of normative values of criteria by 24.7%. The reasons which caused such deviations should be identified by means of the analysis of parameters determining the quality of managerial decisions within every process. They deal with specific problems: economic issues (cost of raw material supplies, material, volume of store of final goods and so on), production (specifity of technology and organization of production, regularity of supplies, functioning of equipment and workers) and so on. The identification of the most important reasons of unfavourable deviations in the value of process criteria and development of measures directed on the elimination of deviation reasons will allow channeling the process under analysis into a stable condition.

4. Conclusion

The method of the calculation of an integral index of the process efficiency allows improving the process approach to the management which is used at the enterprises of tube metallurgical industry due to the following reasons:

- aggregation of heterogeneous, with various dynamics, process criteria into an integral index of its efficiency;
- objective assessment of dynamics of process productivity with the account of the quality of managerial decisions taken in the process of its implementation and as a result there should be a targeted change of parameters of every process in the required direction;
- clear interpretation of the condition of all the processes at enterprises presented into an aggregated view for every moment of time within the whole system of an enterprise’s management, forecasting of their further development, optimization of the structure and content;
- implementation of variants of calculation of process management at an enterprise in dependence on its external and internal environment and real resource provision.

The suggested methodology has a universal character and can be used at industrial enterprises of various forms and types of activity.

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