

# Development Practice of Production Systems — Systems of Product Creation in Domestic Production (On the Example of Reference Areas)



Garina E.P., Garin A.P., Romanovskaya E.V., Andryashina N.S., Smirnova Z.V., Mizikovskiy I.E.

**Abstract:** *The article considers modern approaches to improvement of production processes at the enterprise, practical application of production development methods, issues of realization of production technologies in industry. A necessary condition for development of production is disclosed - increasing the efficiency of using technological potential through realization of the potential for strengthening its control systems. The article is devoted to studying the variability of application of adaptive methods for improvement of processes, technologies, and systems. Also, the effectiveness of development methods is determined by the example of their adaptation to the practice of the economic entity. Solutions to increase the competitiveness of enterprises cover the sphere of production, development of organizational systems of management, and "Kaizen" system. Analysis of practice and modern approaches to increase competitiveness is carried out in the context of implementation of solutions by domestic producers. In the course of the research it is determined that to solve tasks, it is necessary to develop the technological process of manufacturing product, as well as elements of the production system in part maintenance and operation of equipment. It is proved that the implementation of production development program will increase the utilization of production capacities, reduce the cost of production, change the indicator of time maintenance of production machines and equipment, and reduce used production area.*

**Keywords :** *production, development, efficiency, efficiency, business processes*

## I. INTRODUCTION

In the modern world, functioning and development of enterprises is defined as a technological component - a significant number of methodological approaches to the

development of production processes, machine-building enterprises can be built in a certain gradation: improvement of processes, improvement of technologies, systems of interconnections and interdependencies, and organizational component - solutions to increase competitiveness of enterprises, covering the areas of organizational management systems, systems of inter - corporate interaction. The effectiveness of a management system is determined by reliability, quality, and speed of decisions; cost-effectiveness of expenses for maintaining and developing a management apparatus. The effectiveness of practical application of these solutions, which allow for efficient production management at a machine-building enterprise, is examined by the example of PJSC GAZ, one of the leading enterprises of the GAZ Group company. In particular, at the initial stage a number of problem areas in the production structure of JSC "GAZ" were identified

## II. THEORETICAL AND METHODOLOGICAL APPROACHES

In the research process, methods of measurement, observation, systematization and classification of objects, process approaches to the organization of production and production technology of a product by the industry enterprise were used.

## III. RESULTS OF THE STUDY

Consider the practice of implementing a set of development methods in domestic production on the example of reference sites. The company of PJSC "GAZ Group" and the contract production of Volkswagen Skoda improves their production. Due to the large amount of information, it is not possible to describe all the projects at the enterprise, so let's focus on five main projects.

The first project "Organization of unit flow machining of parts 7511-3509312 and 7511-1307180 - pulley" The purpose of the project "Organization of unit flow machining of parts 7511-3509312 and 7511-1307180 - pulley" consists of the following: reduce the level of work in progress in the flow by 35%; increase productivity at the production site by 3.7%. Tact time (Tt) for two modifications of pulleys is the same = 230 sec. During implementation, the company faced problems: a) batch work - large interoperating stocks at the workplace (2 days.); b) large transitions for washing parts on the washing machine; c) loss of time on the calculation of parts; d) low load of operators (Cz1 = 0,63; Cz2 = 0,61);

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\* Correspondence Author

**Garina E.P.\***, Minin Nizhny Novgorod State Pedagogical University  
[e.p.garina@mail.ru](mailto:e.p.garina@mail.ru)

**Garin A.P.**, Minin Nizhny Novgorod State Pedagogical University  
[rp\\_nn@mail.ru](mailto:rp_nn@mail.ru)

**Romanovskaya E.V.**, Minin Nizhny Novgorod State Pedagogical University  
[alenarom@list.ru](mailto:alenarom@list.ru)

**Andryashina N.S.**, Minin Nizhny Novgorod State Pedagogical University  
[natali\\_andr@bk.ru](mailto:natali_andr@bk.ru)

**Smirnova Z.V.**, Minin Nizhny Novgorod State Pedagogical University  
[z.v.smirnova@mininuniver.ru](mailto:z.v.smirnova@mininuniver.ru)

**Mizikovskiy I.E.**, National Research Nizhny Novgorod State University named after N.I. Lobachevsky  
[core090913@gmail.com](mailto:core090913@gmail.com)

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The second project is “Increasing labor productivity by 1 ODA through standardisation of workplaces parts of the “stabilizer rod”. The purpose of the project is to: reduce inventory of components in RM from 5 days to 1 day; increase labor productivity by 1 ODA by 16%.

Problems with which the enterprise faced: a) large periodic work 981 sec. on transportation of parts from the painting area to the RM assembly “stabilizer rod”; b) production of parts in batches; c) large stocks of components on the RM up to 4 days; d) paintwork chips during the transportation of parts.

The third project is the “Productivity Improvement Strategy at the Assembly and Welding Section of the Gazel-NEXT Engine Compartment”. The purpose of the project is to: a) increase productivity by 10%; reduce UP from 4275 to 2500. There are 7 ODA on this site. The main part of the site is on a podium of the 4th and 5th roll-out table, where the base is fed from the automatic line. Then, a “front guard assembly” is manually welded onto the base, which is first welded from parts on welding conductors and stationary machines. Welding workplaces are located at the bottom, next to the podium. During the implementation, the company faced a number of problems: (a) Operators work at different levels, which is unsafe and leads to the following problems: b) low load of operators (72%); c) complexity of rebalancing operations with even loading; d) for operators working on a podium, it is uncomfortable to take incoming parts (have to incline and/or descend from a podium); e) large interoperational reserves.

The fourth project is “Improving the productivity of the assembly section — welding sidewalls of Gazelle “Business”. The purpose of the project is to: a) increase in labor productivity from 5.9 to 9.2 pcs./person; b) reduction of unfinished production by 200 thousand rubles. Problems encountered by the company during the implementation of this project: a) hazardous production factors (work at different levels); b) low operator load (work with automatic line equipment).

The fifth project is “Optimization of logistics processes in the UVL “PGA”. The purpose of the project is to: a) exclude from the delivery process of CI — 15 ODA (3 ODA full-time, 12 ODA part-time); b) increase the number of pulling flows by 2.97% (from 12203 units (95.5%) to 12576 pcs (98,47%); total flows 12776 pcs (100%); c) increase productivity (cumulative total), the number of transported nomenclature (12,3% from 177,5 parts/person to 202,4 parts/person). Problems faced by the company in this area: a) in the process of delivery of CI involved 18 workers of expeditions to assembly conveyors; b) lack of pulling system on details supplied by expedition workers; c) technological equipment is not ready for delivery; d) lack of readiness for jobs and lack of special containers for parts and materials with an original design.

Having considered all the projects it is possible to conclude that the company faces problems: loss of time when sending part from one site to another; heavy physical work that takes a lot of time to empty; low operator productivity leads to reduced volumes production. Thus, it is clear that problems exist in all production sites. An analysis of the existing system revealed the following shortcomings: overproduction; loss of machine time; loss of product transportation; loss of processing; loss of stock; loss of movement; loss of defective parts. On the basis of which a

number of decisions on the identified deficiencies have been proposed:

The first project is «Organization of a single part machining flow – pulley». Changes to the project involve: 1) the introduction of protective screens on several pieces of equipment; 2) to supply blanks to the workplace, use special containers and movable racks, 3) reduce the time of equipment transfer; 4) exclude the operation «washing parts on the washing machine». The planned annual economic effect from the implementation of proposals is 426,370 rubles. (table 1) .

**Table 1 - Site Performance**

Indicator	Unit of measurement	Projected period		
		Before	After	Effect
UP 7511-3509312 pulley	pcs.	254	164	-90 (-35,4%)
UP 7511-3509312 pulley	rub.	30632.4	19778.4	-10854
UP 7511-1307180 pulley	pcs.	165	105	-60 (-36,5%)
UP 7511-1307180 pulley	rub.	19489	12543	-6946
Number of operators	pers.	3	2	1
Time cycle	sec.	Tc1 = 139,2 Tc2 = 138,4	185,9	-47,1
Load factor		CI1 = 0,625 CI2 = 0,61	0,92	-0,3025
Site Performance		1.198	1.243	+0,045 (+3,7%)
Number of equipment	units	8	9	+1

The second project is «Increasing labor productivity by 1 ODA through the standardization of jobs». Changes to the project involve: 1) remounting of equipment - reduced time loss for transportation of parts; 2) reduce the time for moving parts to 9 seconds due to changes in logistics; 3) reduce the number of slopes of the operator; 4) reduce the time for pressing the part to 4.5 seconds. The tasks are solved by: a) standardizing the work of the operator and the manufacturing process of parts; b) improve product quality; c) monitoring the production process (allows you to track the rhythm of production).

**Table 2 — Productivity increase per ODA**

Indicator	Before	Goal	After	Result
Productivity increase by 1 main production worker, %	0.686	0.748	0.748	+0,0,62 (8,28%)
Reduction of components stocks on RM, day.	4	2	2	-2

Process time, sec.	1099.29	256.82	103.89	-995,4
Equipment, unit.	6	4	4	-2

The third project is «Performance Improvement Strategy for the Reference Area». Changes to the project involve: 1) making a podium for installing welding equipment on it; 2) a decrease in the time of welding of elements of parts; 3) a change in the sequence of welding operations due to a change in equipment. The planned annual economic effect from the implementation of the proposal will amount to 358.5 thousand rubles; time saving - 28 seconds.

**Table 3 — Productivity Improvements in the Gazelle NEXT Engine Compartment Assembly and Welding Section**

	Before	After
Capacity, pcs. /people	14.48	15.26
Number of operators, people.	10	7
Loading operators, %	69	78

The fourth project is «Improving the productivity of the assembly of the GAZelle Business» elements. Changes to the project involve: 1) combination of working areas; 2) changes in production technology; 3) automation of production; 4) the creation of working standards. The planned annual economic effect from the implementation of the proposals: a) saving of the wage fund 1.61 million rubles, reduction of stock balances by more than 200 thousand rubles.

**Table 4 — Assembly Site Performance**

Indicator	Before	After	Result
Labour productivity, pcs. /per 1 ODA	5.9	9.3	+3.4
The number of main production workers, people	12	9	-3
The load of the main production workers on average, %	61	89	+28
Foundation welding equipment, units.	16	13	-3
Unsteady welding equipment, units	13	9	-4
Welding conductors, units.	10	8	-2

The fifth project is «Changing Logistics at UVA «PGA». For the transformation, it is proposed to introduce: a) reduction of losses on the movement of parts (reduction of the production cycle time); b) a decrease in the number of support staff; c) the formation of a multi-disciplinary team of performers. The achieved result for 2017 is shown in table 5.

**Table 5 — Project Logistics Change**

Indicator	Before	After	Result
Reducing the number of support staff, persons	14	9	-5
Reduced loss of movement of parts, the number of parts	12203	12480	+277 (2,22%)
Labor productivity change	177.5	183.9	+3,48%

The costs of the project include the costs of the totality of work, which include: development of plan and estimate of works on improvement of QMS, reorganization of the quality service, distribution of responsibilities in QMS, training of personnel in the basics of QMS, performing

corrective actions, approval of the quality manual, carrying out self-evaluation of QMS and all. (table 6).

**Table 6 — Investment costs for improvement of QMS**

Name	Duration of work, days	Number of specialists, persons	Daily wage rate, rub.	Cost, thousand rubles	Share of costs, %
Analysis and assessment of the quality system «as is»	2	2	900	3600	0.91
Quality Policy Development	3	2	1000	5000	1.50
Development of plan and estimate of works on improvement of QMS	2	2	900	3600	0.40
Reorganization of the quality service	30	3	1000	90000	40.66
Distribution of responsibilities in QMS	1	2	800	2400	0.50
Training of personnel in the basics of QMS	40	2	1000	80000	19.64
Internal audit of QMS	10	3	900	27000	6.88
Performing corrective actions	5	2	800	8000	1.40
Approval of the quality manual	1	2	900	2700	3.21
Carrying out self-evaluation of QMS	7	2	900	12600	2.76
Carrying out QMS certification	3	2	2500	12500	22.14
Total:	104	-	-	247400	100

## IV. CONCLUSION

Thus, it is clear that problems exist in all production sites. Workers, faced with problems in the workplace, offer measures to improve them, due to which production strives to save time, ease of labor, which leads to increased efficiency production. To assess the management system, the dynamics of implementation of improvements were analyzed, the economic evaluation of proposals to improve the efficiency of a contract production management system was carried out by industrial enterprise PJSC «GAZ». Based on the implementation of proposed measures, expected incoming cash flow in the project period is 202,168,479 million rubles. The annual output increased by 22,000 units.

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## AUTHORS PROFILE

Garina Ekaterina Petrovna, Minin Nizhny Novgorod State Pedagogical University

Garin Alexander Petrovich, Minin Nizhny Novgorod State Pedagogical University

Romanovskaya Elena Vadimovna, Minin Nizhny Novgorod State Pedagogical University

Andryashina Natalia Sergeevna, Minin Nizhny Novgorod State Pedagogical University

Smirnova Zhanna Venediktovna, Minin Nizhny Novgorod State Pedagogical University

Igor Efimovich Mizikovsky, National Research Nizhny Novgorod State University named after N.I. Lobachevsky