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ABOUT THE ADVANTAGES OF INNOVATIVE TECHNOLOGIES FOR MANUFACTURING COMPETITIVE HIGH QUALITY AND AFFORDABLE PRODUCTS

Abstract: In the article, the authors analyze the effectiveness of the software developed by them for forming the technological process of production of import-substituting products and determining the specific reduced costs, which allows calculating the statistical parameters of the effective technological process of production of high-quality products in various forms of production organization, and the software developed by the authors for calculating the receipt of funds from the technological process of production of quality products guarantees light industry enterprises to obtain stable TA and prevent them from bankruptcy providing them with financial stability.

Key words: financial stability, stability, profitability, profit, demand, availability, quality, demand, competitiveness, import substitution, Union of Federal, regional and municipal branches of government; innovation, economic policy, industrial policy, assortment, assortment policy.

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Introduction

UDC 519.47 : 685.37

The beginning of modeling the development of any organizational system is structural modeling, which is necessary to optimize projects (Figure 4.36). For structural modeling of the designed technological processes for the manufacture of a new range of shoes and optimization of existing technological processes, the procedure for preparing technological documentation is considered (Fig. 1).

The main feature of this procedure is that when preparing sets of design technological documentation, it is planned to develop not only promising, but also directive technological processes. Let us consider in more detail the main goals, objectives and differences of such technologies that allow, in the technological part of a reconstruction or technical re-equipment project, to reasonably answer the main questions:

- about new technological solutions;
- mechanization and automation of technological processes;
- the composition of the applied technological equipment, including imported;
- the use of low-waste and non-waste technological processes;
- the use of more progressive transport and technological schemes for the movement of packaged goods;
- new methods of technical control and testing of products;
- minimization of production waste, emission of harmful substances;
- determination of the composition of production processes for waste disposal.

In addition, a set of design technological documentation, promising and directive technological processes allow you to answer other important questions:

- on the calculation of fuel and energy and material balances of technological processes;
- assessing the need for basic types of resources for technological needs;
- labor input, machine input and maintenance output;
- calculations of the number of pieces of equipment, areas, number of employees;
- execution of drawings of technological layouts and equipment layouts.

Let's characterize the essential content and distinctive features of the technologies used in projects. Let's start this analysis with the definitions of the concepts of "project", "prospective" and "directive

technological process". They are defined in the Unified Process Documentation System as follows.

1. A promising technological process is a technological process that corresponds to the modern achievements of science and technology, the methods and means of implementation of which, in whole or in part, have to be mastered at the enterprise.

2. A set of directive technological documentation is a set of sets of documents for individual technological processes necessary and sufficient for carrying out preliminary enlarged engineering, organizational and economic tasks, when deciding on the launch of new products into production in relation to the conditions of a particular enterprise.

3. A set of design technological documentation is intended for use in the design or reconstruction of an enterprise. Working technological processes, i.e. technological processes carried out according to working technological and (or) design documentation during reconstruction and (or) technical re-equipment should be revised and replaced by new, more advanced technologies.

In the technological document flow diagram (Fig. 2), in accordance with the Unified System for Technological Documentation (ESTD), the following rules for the use of sets of technological documentation are adopted, which are linked to the stages and stages of design preparation for production.

In a typical shoe manufacturing technology, there are ready-made recommendations for performing the operations of making shoes for some of the most common types. However, in practice, there are often cases when it is required to develop a new technological process for making shoes, choose the most effective from the existing set of technological processes, or perform a comparative analysis of technologies at the cost of making shoes. All this is especially important in modern conditions of meeting market demand with a frequently changing assortment of shoes, the emergence of new types of shoe machines, technologies, forms of organization of production, etc.

Each production process is considered either as a set of changes that the objects of labor undergo, or as a set of actions of workers aimed at an expedient change in the objects of labor. In the first case, they talk about the technological process, in the second - about the labor process.

The technology determines the structure of the technological process, which allows, if necessary, to divide the main and auxiliary operations into elementary ones.

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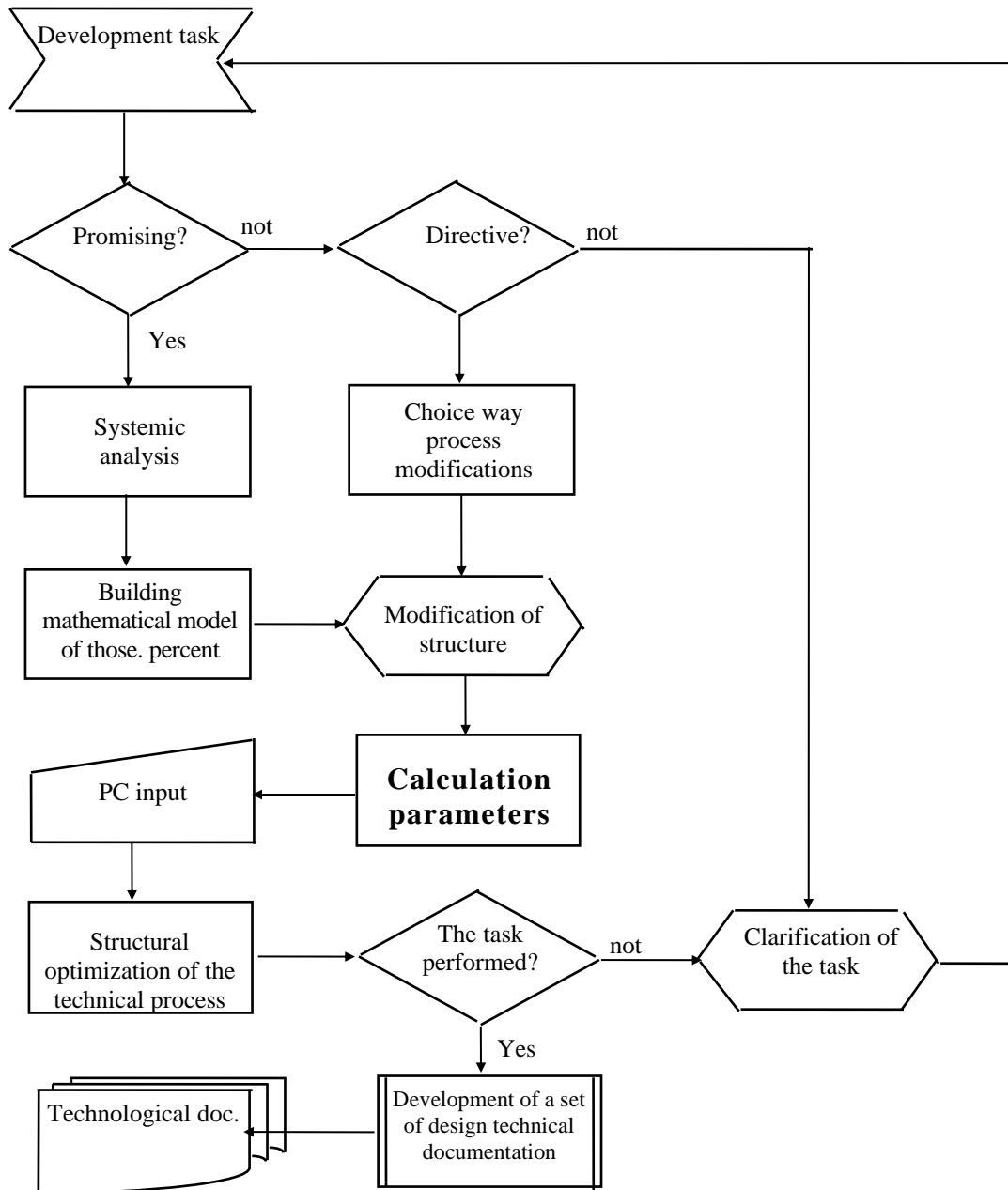


Figure: 1 - Information and functional diagram of the design of technological processes

Given the variety of technologies, equipment, characteristics and types of raw materials, the organization of shoe production with a wide range of products, it is advisable to combine shoe assembly operations into the following groups:

- preparatory operations preceding molding;
- molding the upper blank on the last;
- processing of a tightened shoe upper;
- attaching details of the bottom of the shoe;

- finishing of shoes.

A detailed description of these groups by operations is presented in the diagrams (Fig. 2-6).

Table 1 shows a generalized technological process for assembling shoes, a list of equipment and its characteristics.

At the present stage of economic development, technology has acquired particular importance in concretizing the strategy of resource consumption, reducing their scarcity, and increasing the efficiency of their use.

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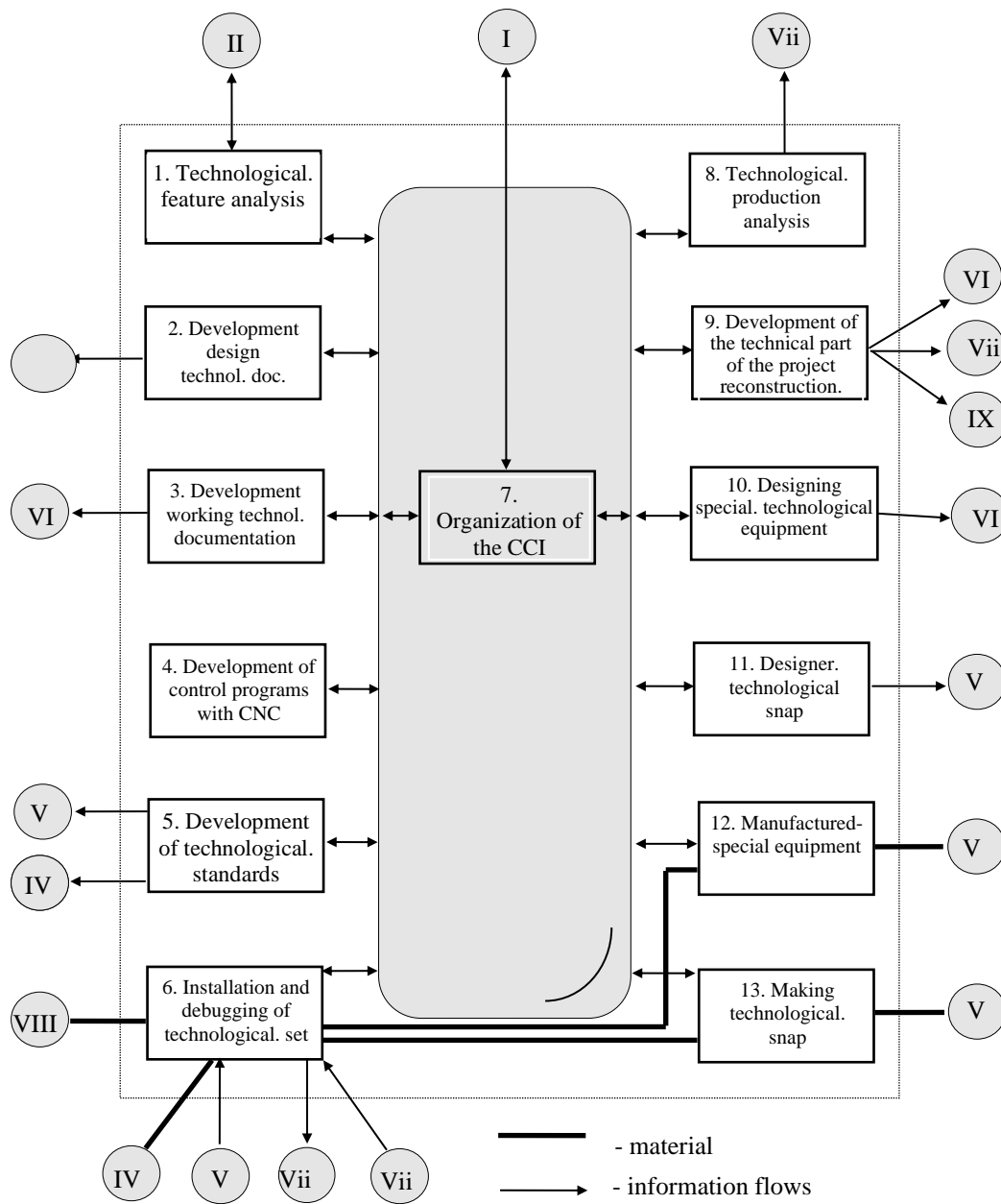


Figure: 2- Block diagram of technological preparation functions production

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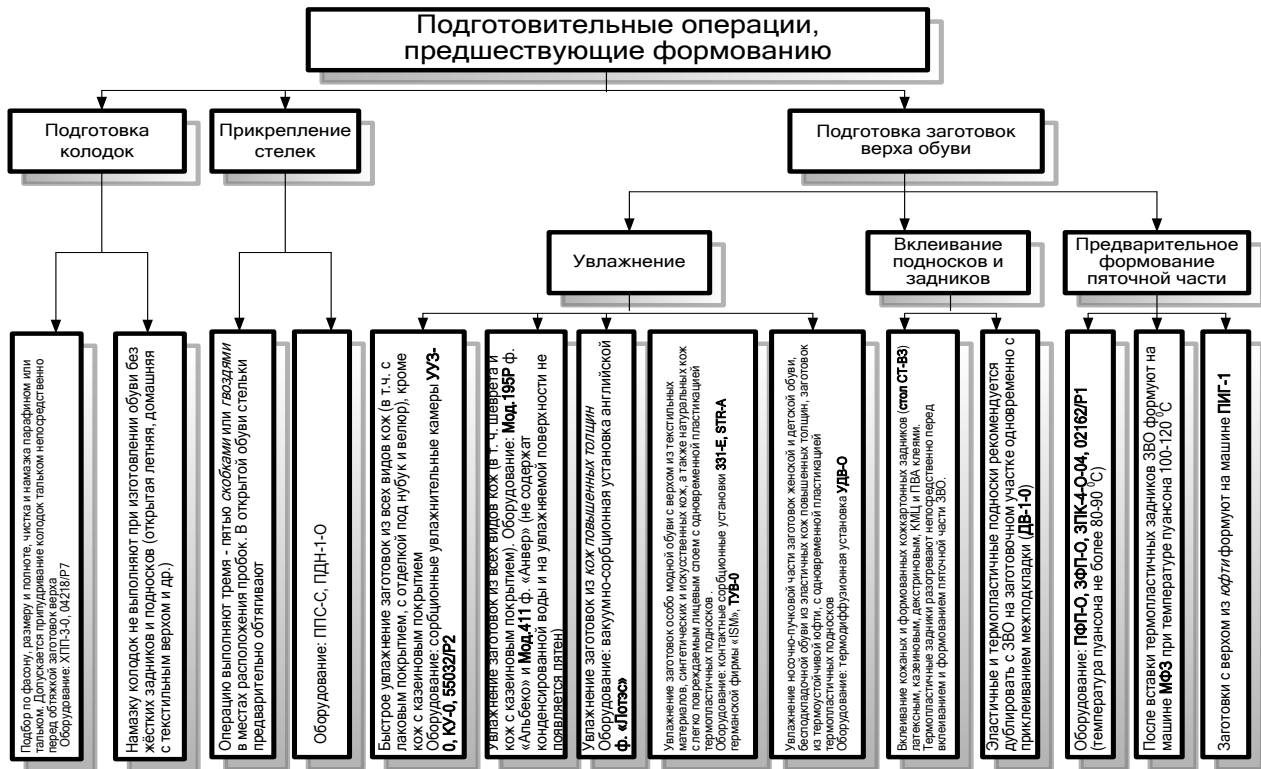


Figure 3- Preparatory operations prior to forming



Figure 4 - Molding operations of the shoe assembly technological process

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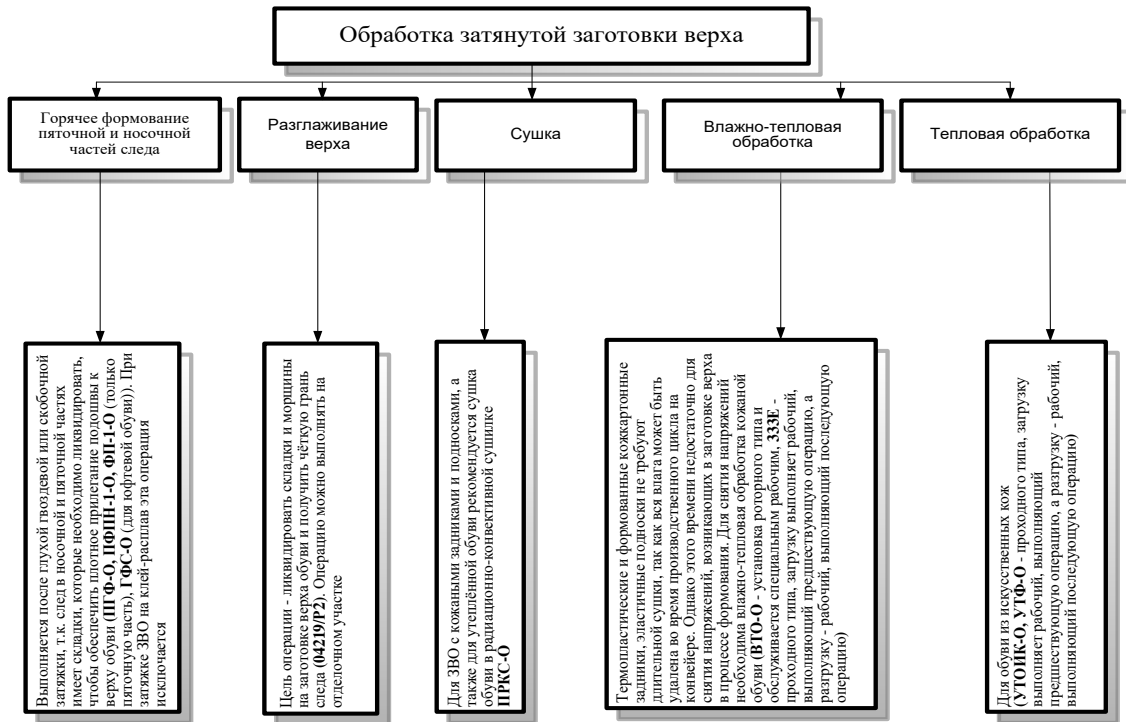


Рис. 3.41. Операции фиксации формы ЗВО технологического процесса сборки обуви

Figure: 5 - Operations for fixing the form of the ZVO of the shoe assembly technological process

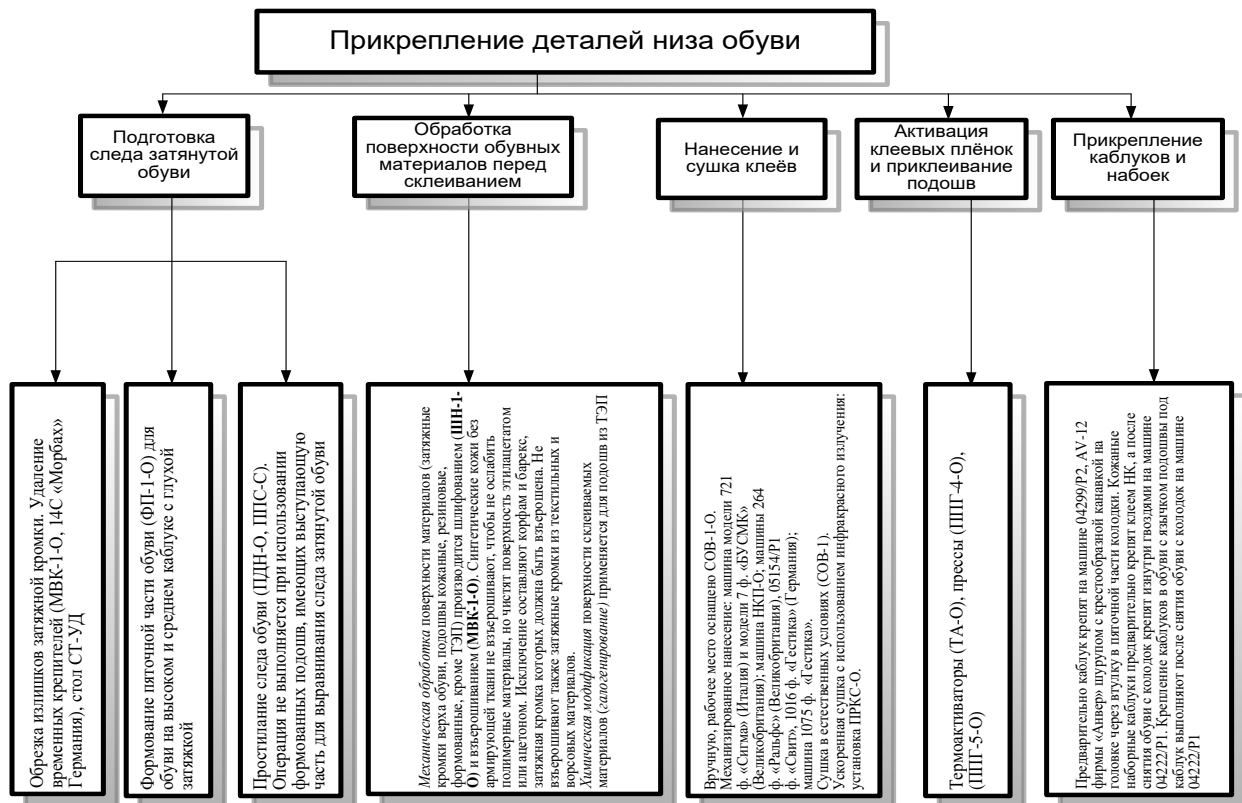


Figure: 6- Periods of attaching details of the technological process of shoe assembly

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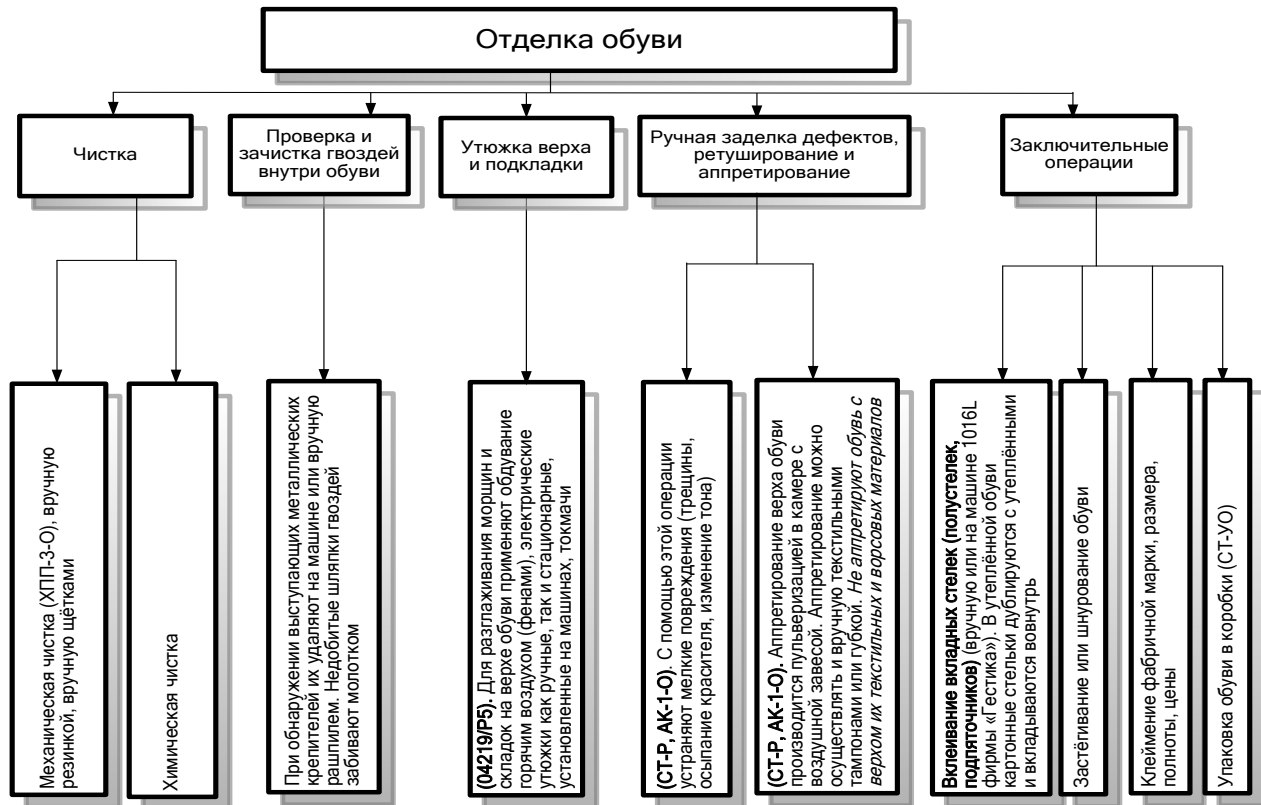


Figure: 7 - Finishing operations of the shoe assembly technological process

Table 1- Generalized technological process of shoe assembly

N o.	the name of the operation	Discharge		Time rate, min / mash / manual		Production rate, steam (machine / manual)	amount workers, people (machine / manual)	Equipment	Capital investments for equipment, rubles	Area, occupied equipment (m2)	Power engine	Performance equipment
		m	R	m	R							
1.	Launching blanks on the conveyor	2		0.3	3	1454.55	0.5	conveyor	500,000	57,360	1.1	150
2.	Moistening the workpiece	3		0.1	4	3428.57	0.2	URP / 2	150,000	1.603	26.12	
3.	Attaching the insoles to the last	2		0.2	8	1714.29	0.4	10/11 / C	250,000	0.720	0.5	250
4.	Spreading talcum powder		2	0.5	5	872.73	0.9	ST-B		0.360		96
5.	Toe insertion, overlap and pre-molding of the toe section of the ZVO with thermoplastic toe cap	3		0.5	9	813.56	0.9	02253 / P1	254000	0.265	0.3	250
6.	Bonding leather-cardboard backs		2	0.6	2	774.19	1.0	ST-VZ		0.507		175
7.	Pre-molding of the heel	3		0.6	0	800.00	1.0	02021 / P2	168000	1,360	five	150

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8.	Insertion of thermoplastic heels and pre-molding of the heel of the ZVO	3		0.94	510.64	1.57	G504CF	110,000	0.5670	1,2	350
9.	Putting the workpiece on the last and installing the heel	4		0.44	1090.91	0.73	02015 / P5	250,000	0.598	0.23	270
10.	Tightening and tightening of the toe-bundle part of the ZVO with preliminary moistening and plasticization of the sock	6		0.62	774.19	1.03	K73STI K	1576800	1,436	5.5	90
11.	Tightening the glue part with hot melt glue with temples	6		0.46	1043.48	0.77	01211 / P1	1,200,000	1.011	7	270
12.	Heel tightening	4		0.39	1230.77	0.65	640 C	1,150,000	0.861	1.5	90
13.	Tightening the nose-beam part of the ZVO with melt glue	6		0.39	1230.77	0.65	PAL-G	1,500,000	1,500	4.86	140
14.	Tightening of the heel with tex and the heel with hot melt glue	6		0.39	1230.77	0.65	PIC K 24SZ, Cerim	1,851,000	1,715	5.5	120
15.	Covering ZVO		five	1.73	277.46	2.88	ST-R		0.360		
16.	Glueing the lingering edge and insoles with glue, drying	2		0.54	888.89	0.90	ST-R		0.360		
17.	Heel tightening	4		8.00	60,00	13.33	ST-R		0.360		
18.	Hauling bundles and stretching	4		2.83	169.61	4.72	ST-R		0.360		
19.	Tightening the toe-beam part of the ZVO	4		9.90	48.48	16.50	ST-R		0.360		200
20.	Tightening the gel part of the ZVO	4		2.92	164.38	4.87	ST-R		0.360		113
21.	Wet-heat treatment of shoes	2		0.80	600.00	1.33	wet heat treatment chamber "Granucci"	142840	1,766	27.9	200
22.	Hot air wrinkle removal	2		0.83	578.31	1.38	04219 / P5	154740	0.353	0.18	113
23.	Removing staples or tex from insoles	2		0.36	1333.33	0.60	ST-UD		0.992		130
24.	Hot molding of footprint	2		0.91	527.47	1.52	04286 / P22	140350	0.671	2.7	125
25.	Trimming and tufting excess trailing edge, dust removal	3		0.64	750.00	1.07	automatic K71S	165000	0.855	2.7	240
26.	Attaching the shank	2	2	0.51	941.18	0.85	02015 / P5	105000	0.299	0.7	175
27.	Forgiveness of the footprint	2	2	0.81	592.59	1.35	02015 / P5	105000	0.299	0.7	150
28.	First glue on the tightening edge, drying	2		0.87	551.72	1.45	02068 / P4, COB	127900	2,582	2.7	150

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29.	Second spreading with glue on the tightening edge, drying	2		0.87	551.72	1.45	02068 / R4, PRKS-O	173900	4.442	15.38	125
30.	Treatment of the slow surface of the soles	3		0.89	539.33	1.48	MVK-1-O	174700	0.671	2.7	100
31.	Solvent treatment of non-running soles (halogenation)	2		0.30	1600,00	0.50	A200 / D	100,000	0.661	0.08	
32.	Glue soles (soles and heels)	2		1.30	369.23	2.17	car 1066 "Fortuna" Germany	80,000	0.671	2.7	300
33.	Thermal activation of adhesive films	4		0.94	510.64	1.57	133, Italy	130,000	0.528	0.16	125
34.	Bonding soles and heels	4		0.93	516.13	1.55	press AS 1800K	127000	0.280	0.16	150
35.	Cooling shoes	3		0.50	960,00	0.83	refrigerat or compartment FR3200	198000	0.409	4,3	75
36.	Milling the edge of the sole (lateral surface of the heel)	6		1.39	345.32	2.32	04105 / P6	58500	0.657	2.2	75
37.	Attaching heels	2		1.89	253.97	3.15	ST-B		0.360		
38.	Milling heels	3		0.47	1021.28	0.78	04105 / P6	58500	0.657	2.2	75
39.	Sanding the edge of the soles and the side of the heel	3		1.91	251.31	3.18	04059 / P1	95000	0.528	0.75	138
40.	Sanding soles	3		1.81	265.19	3.02	04059 / P1	95000	0.533	0.75	138
41.	Cleaning the top and bottom of shoes	2		0.87	551.72	1.45	04207 / P1	84790	0.650	1.9	198
42.	Removing shoes from the last	3		0.54	888.89	0.90	1200, Italy	186000	0.459	1.1	250
43.	Attaching the plastic heel from the inside	4		0.77	623.38	1.28	04222 / P1	238740	0.440	0.42	250
44.	Checking and cleaning nails inside shoes	2		0.50	960,00	0.83	device PES-R		0.360		
45.	Bonding of heels and insoles	2		0.58	827.59	0.97	car 1066 "Fortuna" Germany	80,000	0.671	2.7	300
46.	Inserting insoles	2		0.32	1500.00	0.53	ST-B		0.360		
47.	Hand finishing shoes	5		0.83	578.31	1.38	ST-B		0.360		
48.	Lacing, fastening finished shoes	2		0.65	738.46	1.08	ST-B		0.533		
49.	Shoe packaging	2		0.44	1090.91	0.73	ST-UO		0.533		

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The output parameters of the technological process of shoe manufacturing are described by complex multifactorial dependencies and are influenced not only by deterministic, but also by random parameters and their interconnections, therefore, the technological processes of shoe assembly were chosen as the object under study as the most theoretically and experimentally studied, the most acceptable for setting and solving the problem of forming and evaluating the effectiveness of an agile workflow.

Influence of the organization of production and manufacturing technology on the cost of shoes

The process of technological preparation of shoe production has an equifinal character. So, each model of footwear can be made according to several different technological processes, and the finished footwear will be included in the same classification group and have the same cost. Of all these options, it is necessary to select exactly the one technological process that allows you to make shoes of the required design and get the best performance of the assembly flow.

In the general case, the technological process of assembling shoes is a discrete movement of the object of labor (parts, semi-finished products) with a change in its characteristics at various stages of processing. The technological process consists of a number of operations, the interconnection system between which corresponds to their sequential execution. Moreover, each subsequent operation is a continuation of the previous one, i.e. indicators of this operation are a function of not only time, but also one or more indicators of the previous operation.

The technology of manufacturing footwear with the given means of production determines both the required raw materials and the cost of labor resources. From the point of view of efficiency, an important role is played by the cost indicator per unit of output, taking into account the range of options for its quantitative and qualitative indicators within the framework of the technology under consideration.

The effectiveness of organizing a flexible technological process for a multi-assortment flow is estimated by the period of time the product is in production and sale, i.e. the longer the life cycle of a leather product, the more efficiently their production is organized.

The organization of production is designed to determine effective relationships between individual elements of the production process and create conditions for increasing the competitiveness of the manufactured footwear and the enterprise as a whole.

The degree of perfection of forms, methods and ways of implementing production processes in space and time characterizes the level of production organization. The nature of specific measures to improve the organization of production is largely determined by the characteristics of the enterprise and the current state of affairs.

Most of the activities for organizing production are complex and affect all elements of the production process: performers, tools and objects of labor. The effectiveness of work to improve the organization of production manifests itself after a more or less long period of time and affects a number of production links.

Depending on the sources of education, the results of organizational activities can be obtained in the following areas:

- improving the use of labor instruments;
- improving the use of labor resources;
- improving the use of objects of labor;
- improving product quality;
- increased production flexibility.

The effect of improving the use of labor instruments is ensured by increasing the continuity and proportionality of production processes by: more complete loading of equipment and reduction of equipment downtime for organizational and technical reasons; more complete use of the technical capabilities of the equipment, reducing the time of adjustment, changeover and stay in repair; release of equipment and production space.

With the improvement of the use of labor resources, the economic effect is determined by the possibilities of increasing labor productivity on the basis of a more complete workload of workers, taking into account their qualifications, improving the structure of personnel, as well as reducing losses and unproductive costs of working time.

The effect arising from the improvement of the use of objects of labor is characterized by a reduction in the duration of the production cycle by reducing the time spent on parts, products and their transportation.

The economic effect of improving the quality of products provides an opportunity to increase the output of high-quality products, improve the technical and economic parameters of manufactured products by reducing losses from intra-production defects, defects, complaints and reducing the cost of quality control.

One of the important factors in increasing production efficiency is the improvement of the forms of its organization, providing monetary savings for a number of cost items and profit growth.

Improvement of the forms of organization of production provides an increase in productivity and creates conditions for reducing losses associated with refueling streams in the development of a new range of footwear. At the same time, prerequisites are created for the conditional release of the number of employees and the receipt of monetary savings on wages.

At the same time, a reduction in losses associated with the development of new types of products, an increase in labor productivity with a constant number of employees contributes to an increase in production volumes and, as a result, obtaining additional profits.

With the RINK-system, conditions are created for differentiating the time for processing different pairs of shoes at a given operation, depending on the properties

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of semi-finished products arriving for processing, and make it possible to provide organizational conditions for a better performance of the operation in relation to each pair of shoes. This contributes to creating conditions for improving the quality of shoes and reducing the cost of claims. The same possibilities of time differentiation in a number of cases allow working with minimal technological allowances, which contributes to a certain reduction in the cost of basic materials.

In addition, the creation of organizational conditions for the multi-assortment production of footwear and the timely renewal of the assortment, of course, helps to accelerate the sale of competitive footwear.

At present, the following are used on the assembly lines of shoe enterprises: the in-line method

of organizing the main production using non-conveyor production lines; conveyor and RINK systems.

General cost price changes depend on the ratio of cost changes for each costing item. Let's trace the change in cost items as a result of improving the organization of production (Table 2).

Labor costs directly determine the efficiency of production, measured by the ratio of results to costs, as well as the amount of wages of workers. The degree of this influence is determined mainly: the lower the cost per unit of output, the higher the production results, since the reduction in labor costs (labor intensity of production) is one of the main factors in reducing the cost. Therefore, competition, forcing manufacturers to reduce prices, gives rise to an interest in reducing the labor intensity of products.

Table 2- Change in cost items depending on the forms of organization of production

Key figures / costing items	Production organization form		
	pipelineless	Conveyor flow	rink system
1	2	3	4
1. Raw materials and basic materials	Zm	Zm	Zm·f where f<1
2. The main and additional wages of production workers with OESN	RFP	RFP·fromwhere<1	RFP·fromwhere "<c
3. Costs for fuel and electricity, for technological needs	Zel.en.	Zel.en·m where m>1, because ∃ conveyor flow motor	Zel.en·m 'where m '>mf the level of mechanization is higher than in the conveyor stream
4. Costs for RSEO	ZRSEO	ZRSEO·n where n>1, because the cost of the conveyor stream is added	ZRSEO, if the technological process does not change (ZRSEO·k where k>1)
5. General production costs	Ztseh	Ztseh	Ztseh·and where a>1
6. General business expenses	General farm	General farm	General farm
7. Selling expenses	Zkomm	Zkomm	Zkomm

In turn, the reduction in labor intensity is due to the use of modern materials and new equipment, more productive, versatile, and often more expensive than existing ones, which ultimately will affect the increase in the cost of shoes due to an increase in equipment acquisition costs and depreciation charges. In each case, a careful study of the results obtained and the choice of the best solution in terms of achieving the ultimate goal of the enterprise is required. Optimal, economically justified mechanization and automation of the technological process of shoe production will reduce losses due to defects and the need for rework, but also prevent losses from excessive processing. The task is relevant both for established enterprises with a formed equipment park, and for new enterprises with

an unlimited choice of equipment. Both the first and the second contributes to a reasonable choice of technology for the manufacture of a new range of shoes. To solve the problem, it is necessary to determine the degree of influence of the fullness of the technological process on all items of the enterprise's costs. Based on the results obtained, the most important indicators are selected, and then, on their basis, a list of indicators is formed that characterizes the advantages or disadvantages of a particular technological scheme for the manufacture of shoes, equipment, technological objects, etc. To solve the problem, it is necessary to determine the degree of influence of the fullness of the technological process on all items of the enterprise's costs. Based on the results obtained, the most important

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indicators are selected, and then, on their basis, a list of indicators is formed that characterizes the advantages or disadvantages of a particular technological scheme for manufacturing shoes, equipment, technological objects, etc. To solve the problem, it is necessary to determine the degree of influence of the fullness of the technological process on all items of the enterprise's costs. Based on the results obtained, the most important indicators are selected, and then, on their basis, a list of indicators is formed that characterizes the advantages or disadvantages of a particular technological scheme for the manufacture of shoes, equipment, technological objects, etc.

In market conditions, the main criterion for the viability and profitability of an enterprise is profit, one of the main factors for increasing which is a decrease in production costs. Therefore, an important lever of market influence on the cost price to maximize profit is the positive results of one of the organizational forms for determining the range and output.

Specific changes for each article depend on many factors:

- type and kind of footwear;
- categories of complexity of the top preparation;
- materials used;
- method of fastening the bottom of the shoe;
- way of work, power, etc.

All costs for the production and sale of footwear shows the full cost, which reflects qualitative changes in technology, technology, organization of production and labor.

The largest share in the costs of industrial production falls on raw materials and basic materials, and then on wages and depreciation deductions. In light industry, the share of raw materials and basic materials is 86%, and wages with OESN are about 9%. Changes in the nomenclature and assortment of footwear produced is an important factor affecting the level of production costs.

With different profitability of certain types of footwear (in relation to the cost price), shifts in the composition of products associated with an increase in production efficiency can lead to both a decrease and an increase in production costs.

With the help of the Maple 9.5 software package, the paper analyzes the costs of producing men's closed shoes with thermoplastic elastomer soles according to calculation items, taking into account the production program (Tables 3-4)

With an increase in the shift program from 500 to 1000 pairs per shift, the cost of a costing unit decreases, as can be seen from the graph of changes in the cost of a costing unit (100 pairs), taking into account the production program (Fig. 8).

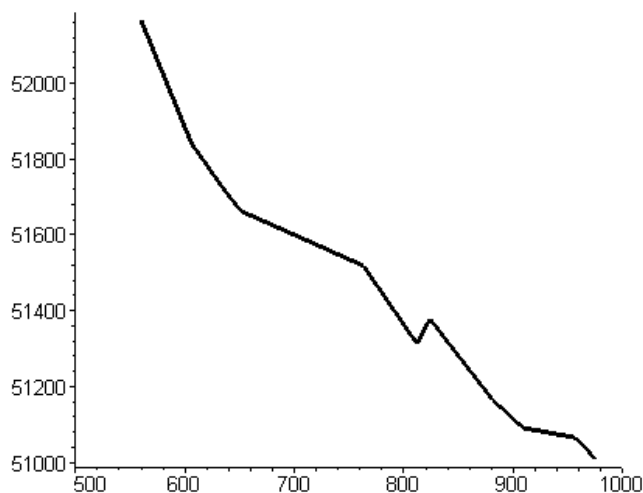


Figure: 8 - Cost of a costing unit (100 pairs) taking into account the production program

Table 3- Calculation of the cost of a costing unit (100 pairs)

Name of articles	The amount of costs, taking into account the production program, rubles										
	560	606	636	651	763	812	824	881	909	957	975
1. Raw materials and basic materials	363	363	363	363	363	363	363	363	363	363	363
	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	4	4	4	4	4	4	4	4	4	4	4
2. Supporting materials	207	207	207	207	207	207	207	207	207	207	207
	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14

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3. Fuel and electricity for technological needs	548.56	506.92	483.01	483.45	414.32	411.64	405.65	379.40	367.72	475.44	466.66
4. Basic and additional remuneration of production workers with OESN	2934.97	2927.55	2945.49	2945.39	2988.98	2954.82	2993.12	2987.55	2992.10	2972.76	2971.27
5. Expenses for development and preparation of production	23.29	23.23	23.38	23.38	23.72	23.45	23.75	23.71	23.75	23.59	23.58
6. Expenses for the maintenance and operation of equipment (RSEO)	2621.31	2470.26	2383.52	2357.07	2334.58	2291.46	2267.29	2161.45	2114.32	2077.43	2050.73
7. General production costs	1377.28	1272.73	1212.70	1185.11	1012.66	952.40	938.81	878.07	851.03	809.06	794.13
8. General operating expenses	5280.85	5267.48	5299.76	5299.57	5377.99	5316.51	5385.43	5375.39	5383.58	5348.78	5346.10
Production cost	51241.75	50923.66	50803.34	50749.45	50607.73	50405.77	50469.54	50261.05	50187.96	50162.54	50107.96
9. Selling expenses	922.35	916.63	914.46	913.49	910.94	907.30	908.45	904.70	903.38	902.93	901.94
Full cost	52164.10	51840.28	51717.80	51662.94	51518.67	51313.07	51377.99	51165.75	51091.34	51065.47	51009.90

Table 4 - Items of calculation in percentage terms

Name of articles	The amount of costs, taking into account the production program, rubles										
	560	606	636	651	763	812	824	881	909	957	975
1	2	3	4	five	6	7	8	nine	ten	eleven	12
1. Raw materials and basic materials	69,748%	70.184%	70.350%	70.424%	70.622%	70.905%	70.815%	71.109%	71,212%	71,248%	71.326%
2. Supporting materials	3.972%	3.997%	4.007%	4,011%	4.022%	4.038%	4.033%	4,050%	4,056%	4,058%	4,062%
3. Fuel and electricity for technological needs	1.052%	0.978%	0.934%	0.936%	0.804%	0.802%	0.790%	0.742%	0.720%	0.931%	0.915%
4. Basic and additional remuneration of production workers with OESN	5.626%	5.647%	5.695%	5.701%	5.802%	5.758%	5.826%	5.839%	5.856%	5.821%	5.825%
5. Expenses for development and preparation of production	0.045%	0.045%	0.045%	0.045%	0.046%	0.046%	0.046%	0.046%	0.046%	0.046%	0.046%
6. RSEO	5.025%	4.765%	4.609%	4.562%	4.532%	4.466%	4.413%	4.224%	4.138%	4,068%	4,020%
7. general production costs	2,640%	2,455%	2,345%	2,294%	1.966%	1,856%	1,827%	1.716%	1,666%	1,584%	1.557%
8. General operating expenses	10.124%	10,161%	10.247%	10.258%	10.439%	10.361%	10.482%	10.506%	10.537%	10.474%	10.481%

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Production cost	98,23 2%	98,23 2%	98,23 2%	98,23 2%	98, 23 2%	98,23 2%	98,23 2%	98,23 2%	98,23 2%	98,23 2%	98, 23 2%
9. Selling expenses	1,768 %	1,768 %	1,768 %	1,768 %	1,7 68 %	1,768 %	1,768 %	1,768 %	1,768 %	1,768 %	1,7 68 %
Full cost	one hundr ed %	one hundr ed %	one hundr ed %	one hundr ed %	on e hu ndr ed %	one hundr ed %	one hundr ed %	one hundr ed %	one hundr ed %	one hundr ed %	on e hu ndr ed %

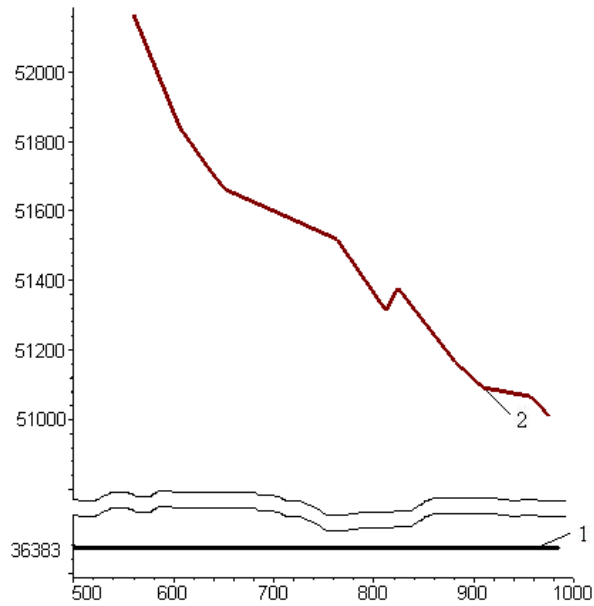


Figure: 9 - Cost ratio by item "Raw materials and basic materials" and cost in kind: 1 - raw materials and basic materials; 2 - cost price

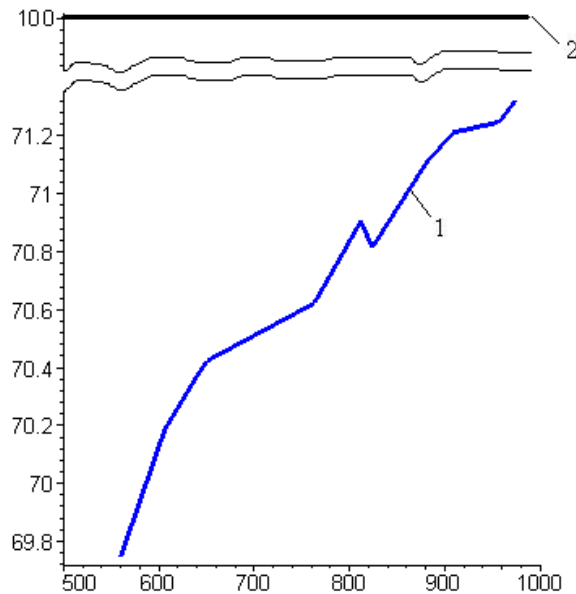


Figure: 10 - Percentage of costs for article "Raw materials and basic materials" in the composition cost price: 1 - raw materials and basic materials; 2 - cost price

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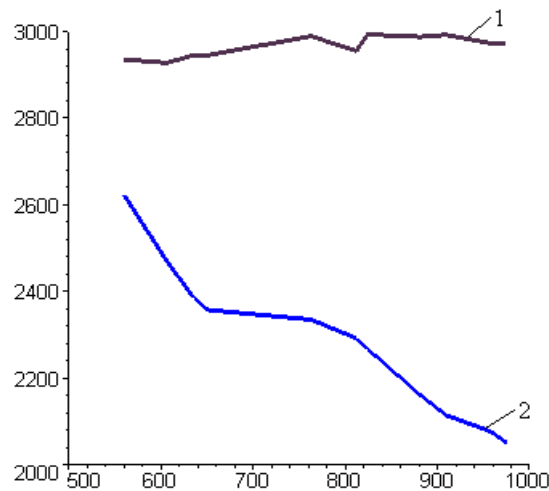


Figure: 11 - Costs per cost unit (100 pairs) under the articles "Basic and additional remuneration of production workers with OESN" (1) and "Expenses for the maintenance and operation of equipment" (2) in kind:

- 1 - expenses for the maintenance and operation of equipment;
- 2 - basic and additional wages of industrial workers with a deduction for the unified social tax

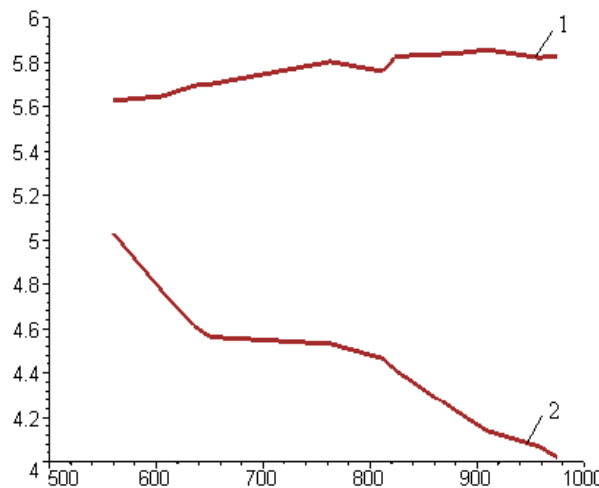


Figure: 12 - Costs per cost unit (100 pairs) according to the articles "Main and additional remuneration of production workers with OESN (1) and "Maintenance and operating costs equipment "(2) in percentage terms from the cost:

- 1 - expenses for the maintenance and operation of equipment;
- 2 - basic and additional wages of production workers with deductions for the unified social tax

With an increase in the shift program from 500 to 1000 pairs per shift, the number of workers increases from 27 to 40 people (labor intensity remains constant); the cost of a calculating unit (100 pairs) is reduced due to the attribution of conditionally fixed costs to a larger volume of output, the costs under the item "Raw materials and basic materials" in the cost price do not change, which is a natural phenomenon.

The ratio of costs for the item "Raw materials and basic materials" and the cost in kind is shown in Figure 9, in percentage terms - in Figure 10. A visual representation of how the cost is reduced is shown in

Figures 11 and 12 for the example of changes in the cost items "Basic and additional wages of production workers with OESN" and "Expenses for the maintenance and operation of equipment".

As a percentage of the cost, the increase in labor costs for workers is expressed in the amount of 0.2% with an increase in the number of workers by 13 people. The cost of maintaining and operating equipment per calculation unit decreased by an average of 1–1.5% with an increase in the number of equipment from 39 to 49 units. In general, the decrease in the cost

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of making shoes with an increase in output from 500 to 1000 pairs is 2%.

Considering that the total cost of the considered types of footwear includes both direct costs for their manufacture and indirect costs, usually not directly related to a specific type of product. when making a final decision on the release of a particular type of footwear, they are guided by the situation that is dictated by the demand for it.

If the demand is significant, then even with high costs for the manufacture of shoe models, an increase in its production is economically profitable. As soon as the demand for a particular type of product began to decline, the decision is again made to release another or several models at the same time in order to ensure their best life cycle. But at the same time, it is already necessary to strive to reduce the share of costs under the item "Raw materials and basic materials", assuming the production of summer unlined shoes, footwear using artificial and synthetic leather and textile materials. It is always more profitable because the assortment of these materials is much wider, diversified, and cheaper, which allows, while reducing the total cost, to get a greater profit, provided there is a steady demand.

The validity of such a decision is also justified by the fact that the use of these materials creates the prerequisites for a significant reduction in costs for the second, no less important item of costs for the main and additional wages of production workers with deductions for the unified social tax. In this case, it is supposed to use efficient and flexible technological processes of their production based on highly efficient technologies. Constant monitoring of the share of costs for the manufacture of the proposed multi-assortment production of footwear in a market economy will allow the enterprise to independently plan the amount of profit based on forecasting the cost of production and sales of products, market conditions, inflation growth, tax policy at the federal, regional and municipal levels, ensure a significant increase in the life cycle of products and get the highest profit. Only then should one expect that the existing and newly created enterprises and firms in the South of Russia will be able to produce competitive footwear in the required volume to meet the demand of various groups of the population.

Development of functional models of business processes production of leather goods

Functional modeling methodology SADT (Structured Analysis and Design Technology) is a set of methods, rules and procedures designed to build a functional model of an object of any subject area. The SADT functional model reflects the functional structure of the object, i.e. the actions it performs and the connections between these actions.

A functional model that displays the results of business processes for the production of leather goods and the information space in which their activities take place, allow us to understand how the shoe production system functions from the standpoint of system analysis.

The main idea of the SADT methodology is to build a tree-like functional model of business processes. First, their functionality is described as a whole, without details. This description is called a context diagram. Interaction with the external environment is described in terms of input (data or objects consumed or modified by a function), output (the main result of the function's activity, the final product), management (strategies and procedures that govern the function) and mechanisms (necessary resources). In addition, when creating a context diagram, the modeling goal, area (description of what will be considered as a component of the system, and what - as an external influence) and point of view (the position from which the model will be built) are formulated. [18]

The Function Block (or Function) converts Inputs to Outputs (i.e., input to output), Control determines when and how this conversion can or should occur, Executors directly perform this conversion.

Associated with arcs are natural language labels (or labels) that describe the data they represent.

Arcs show how functions are interconnected, how they exchange data and control each other. Arcs can branch out and connect. Outputs of one function can be Inputs, Controls, or Actors for another.

The functional block, which represents the system as a single module, is detailed in another diagram using several blocks connected by interface arcs. These blocks represent the main sub-functions (sub-modules) of a single source module.

This decomposition reveals a complete set of submodules, each of which is represented as a block, the boundaries of which are defined by interface arcs. Each of these sub-modules can be similarly decomposed for more detailed presentation.

Building an IDEF0 model begins with representing the entire system as a simple component - a single block and arcs representing interfaces with functions outside the system. Since a single block represents the entire system as a whole, the name given in the block is common. The same is true for interface arcs - they also represent the complete set of external interfaces of the system as a whole.

Then the block, which represents the system as a single module, is detailed in another diagram using several blocks connected by interface arcs. These blocks represent the main sub-functions of the original function. This decomposition reveals a complete set of sub-functions, each of which is represented as a block, the boundaries of which are defined by interface arcs. Each of these sub-functions can be similarly decomposed for more detailed presentation.

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The block-and-arrow graphics in IDEF0 diagrams show manufacturing operations as a block and relationships with operations as arrows entering / leaving a block. In order to represent actual manufacturing operations, blocks can be interpreted as activities associated with other blocks, with interface arrows that determine when and how operations are switched or controlled.

Let's represent the processes of creating flexible production and modeling flexible technological processes in the form of IDEF0 diagrams. Each diagram is a unit of the system description and is located on a separate sheet.

The beginning of modeling a functional model of agile manufacturing in SADT involves the creation of diagrams A0 and A-0, which tell about the created system with a minimum degree of detail. The context diagram of the A-0 flexible manufacturing process, presented in Figure 13, is the top of the diagram structure and represents a general description of the system and its interaction with the environment, showing all the main inputs, controls, outputs and functions of the system. After describing the system as a whole, it is split-decomposed on another diagram A0,

shown in Figure 14, into five structural blocks connected by interface arcs.

The context diagram A-0 of the process of modeling and evaluating flexible technological processes is shown in Figure 15, the decomposition diagram A0 is shown in Figure 16, decomposition A1 - in Figure 17, decomposition A4 - in Figure 18, decomposition A6 - in Figure 19. A generalized scheme for decomposition of the modeling process and evaluation of flexible technological processes is shown in Figure 20.

The developed functional model gives an idea of the business processes of shoe production as a whole and allows you to understand the relationship of all its components.

The considered methodology does not limit the number of levels of decomposition. This, in turn, makes it possible to obtain a model of each procedure that constitutes the technological process with the required degree of detail. Thus, having constructed a set of diagrams, we obtain a formal description of the organization of the current technological process of making shoes.

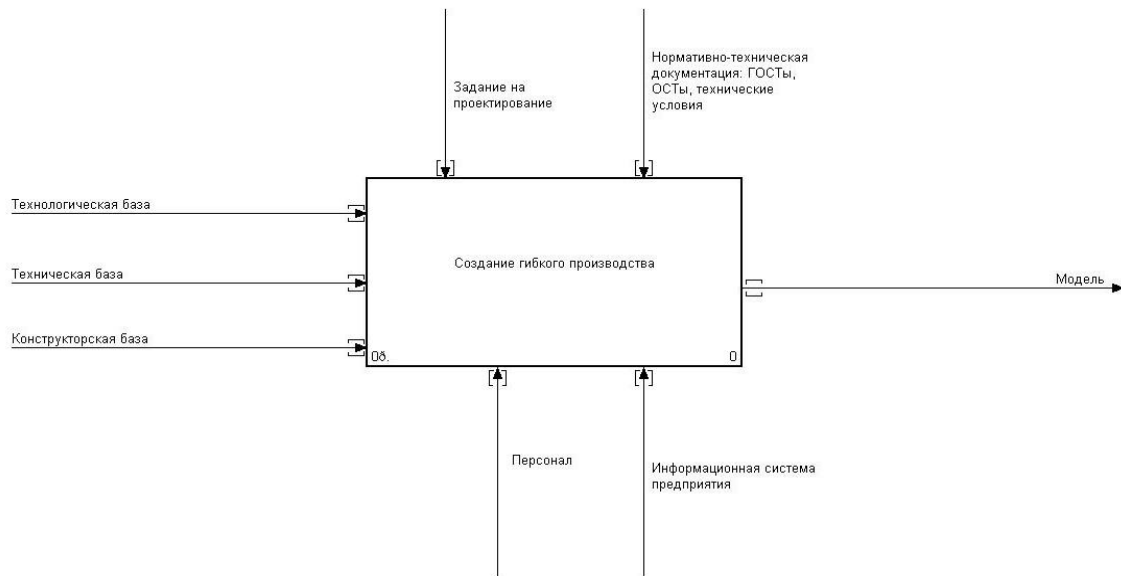


Figure: 14 - Context diagram of the process of creating flexible manufacturing A-0

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Figure: 15 - IDEF0-decomposition diagram A0

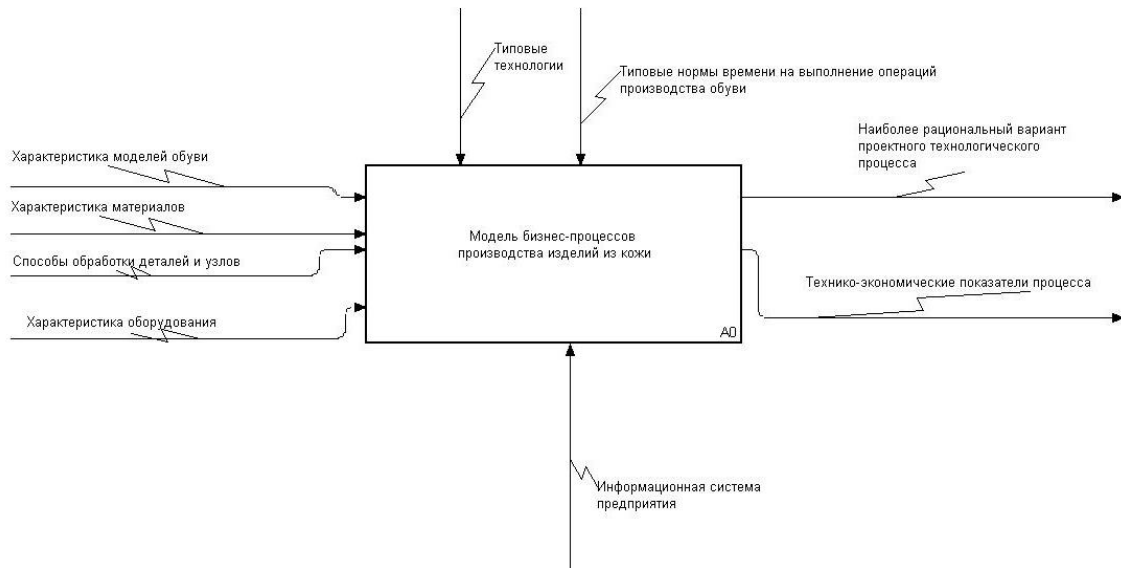


Figure: 16 - Context diagram of the process of modeling and evaluation of flexible technological processes A-0

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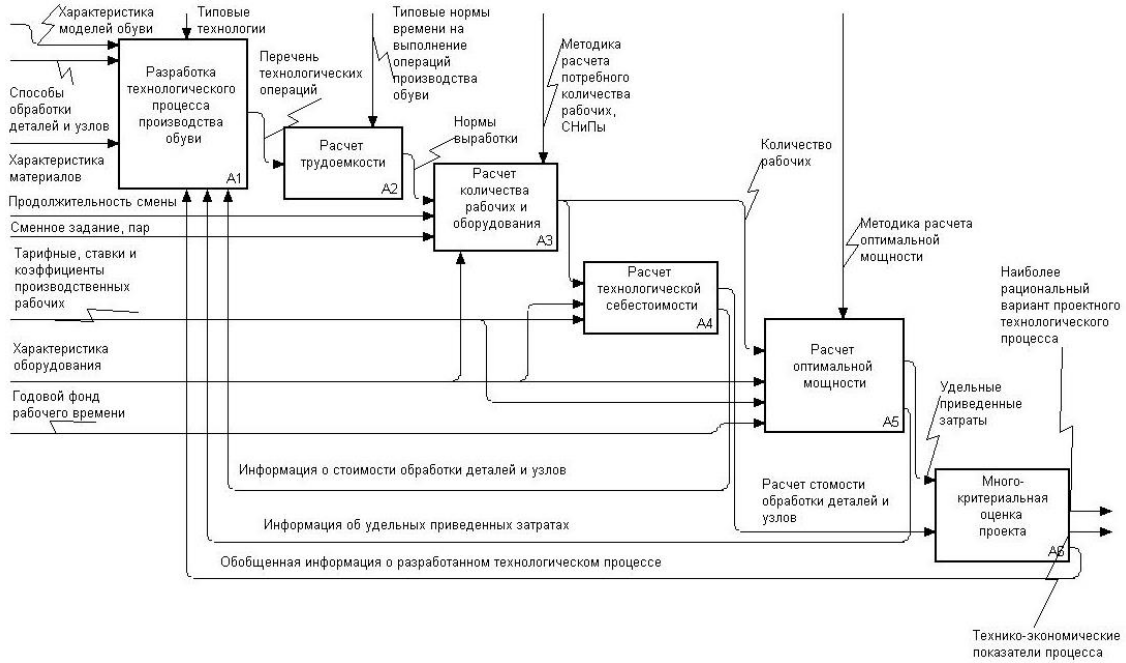


Figure: 17 - IDEF0 process decomposition diagram for modeling and evaluating flexible technologies processes A0

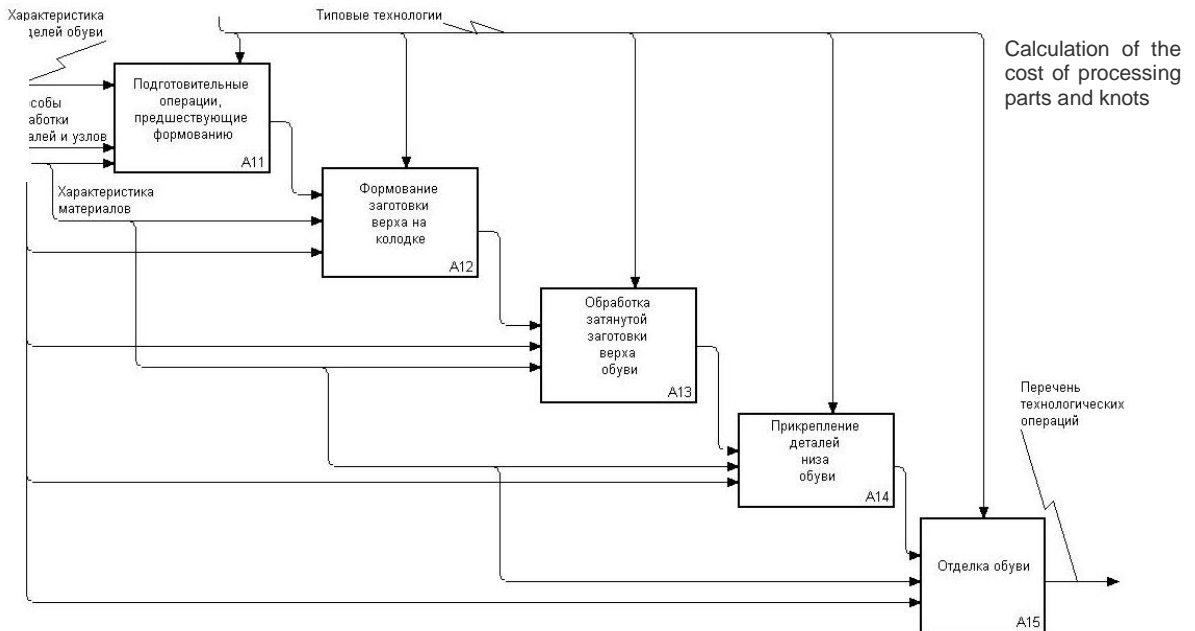


Figure: 18- IDEF0 Process Decomposition Diagram A1 shoe production

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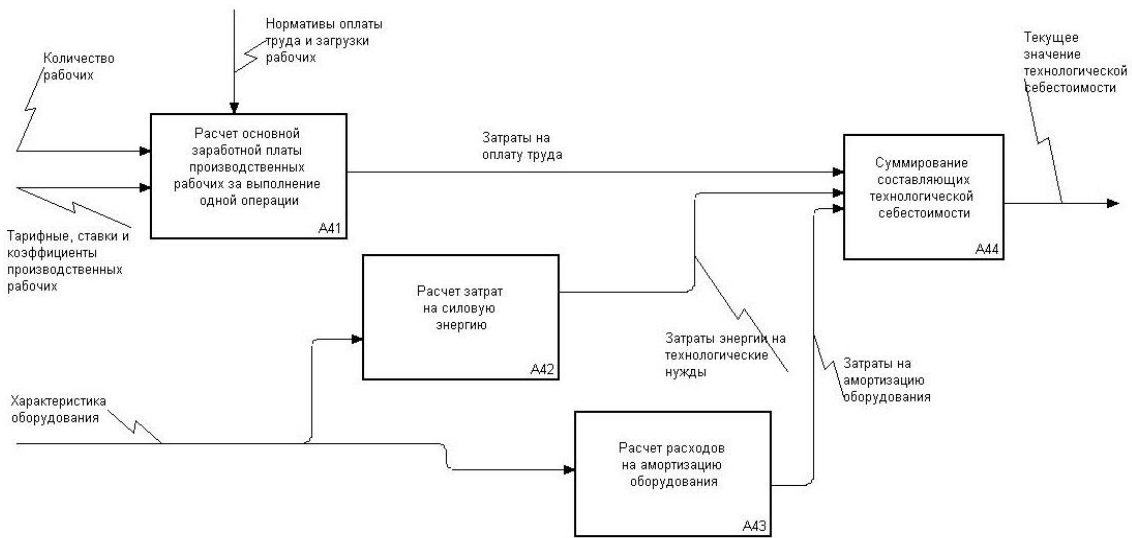


Figure: 19- IDEF0-diagram of the decomposition of the process of calculating the technological cost A4

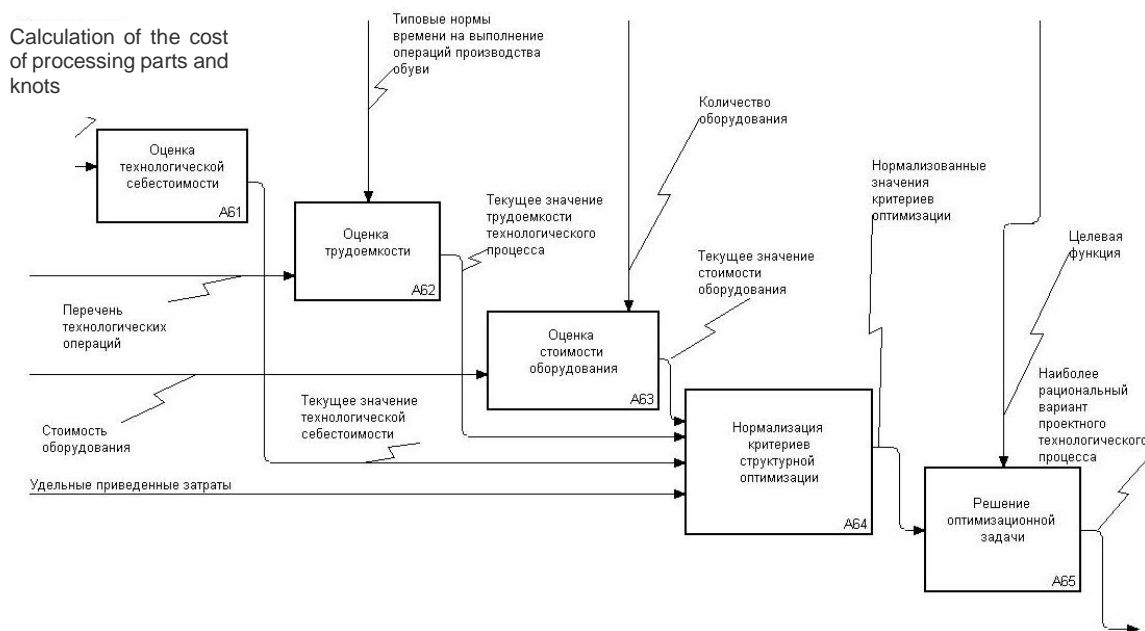


Figure: 20 - IDEF0-diagram of the decomposition of the process of assessing the effectiveness of the project A6

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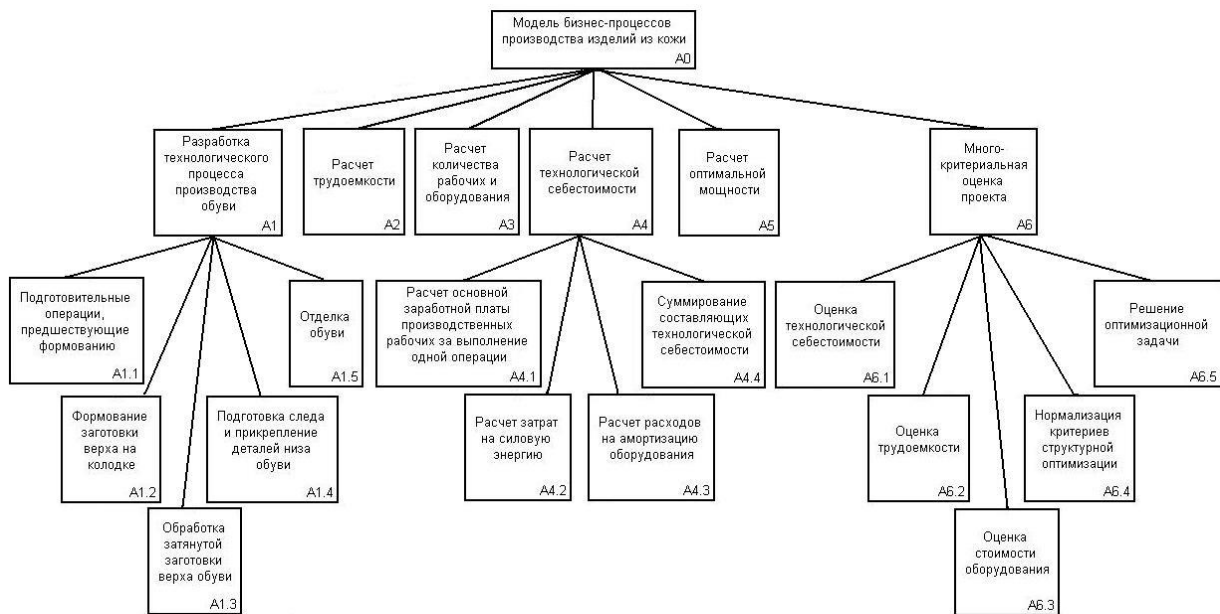


Figure: 21 - Generalized process decomposition scheme for modeling and evaluating business processes production of leather goods

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