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The algorithms for improvement regulatory provision of light industry

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S u m m a r y . Number and level of regulatory action in the production of light industry is still intuitively assign actions. The scientifically article are based matrix algorithm dynamics influence elements process with stages of normalization on quality products. Determined by the weight of the elements by using the peer reviews. With solving the matrix model is identified the necessary steps to ensure the weight of regulatory quality. Identified shortcomings of the current system of regulatory support.
K e y w o r d s : light industry, quality, regulatory support, the algorithm, the elements of the production process.

INTRODUCTION

The light industry is manufactures products which is specifically designed to meet needs of people. Therefore, the main requirement for it is the quality and competitiveness. Unfortunately, the quality in this industry so far are largely subjective and not always provided normative documents. Number and level of regulatory action in the production of light industry is still intuitively assign actions. Justification of such actions can increase the objectivity of the process to ensure quality and competitiveness of products.

OBJECTS AND PROBLEMS

The object of this study are process, the stages and elements of the manufacturing process of light industry. We are consider the industry related to the production of clothing and related industries, the manufacture of products from genuine leather. The subject of study is the impact of the regulatory elements of each process to ensure quality of each stage of production and the process in general. The problem is consist in the absence of scientifically requirements to the level of regulatory providing each stage of production.

RESEARCH ANALYSIS

The quality of light industry in a lot of cases is the determining factor, the level of which depends on the competitiveness of [3.20].

Production of light industry is a multi-stage process, each stage of which, to some extent affect the final quality of products. So, for the industry related to the of clothing, such steps, there are: pre-production process, the process of cutting, the connection process, the process of wet-heat treatment. For the preparation of each process to identify quality or semi finished materials [18, 21], which, in turn, need to know the methods to determine these parameters [2, 4, 5]. Final product quality is monitored at every stage and standards which are controlled [9.15]. It should be noted that the overall algorithm to ensure quality at every stage of a single, four stages (methods for determining the performance, quality of raw materials or semi-finished products, process, quality performance after the process). At the same time struck by the coincidence of the number of production steps to control the number of steps that can be implemented in building efficient symmetric algorithms [19], but so far this has not been done.

Each analysis can be performed for one more light industry is a production of genuine leather. It is desirable to distinguish five stages of production (process of choosing, process of cutting, process of seeing, process of correcting, process of drying) [22,23]: At each stage of quality control is ensured by five stages (material control methods, material parameter determination before process, Technical process, material control methods after process, material parameter determination). As we can see, in this case also suggests potential for the use of symmetric algorithms [17], which is not reflected in any publication.

Each review stage, or in the production method provided by the system of normative documents, which largely determine the level of production and quality. The main regulatory documents providing process manufacturing clothes, include a number of publications [11, 14], similar to the problems associated with natural leather industry are given in [10, 12]. Increasing quality requirements, the emergence of new processes, improving existing necessitate improvement of regulatory support of all of these processes. To systematize data on regulatory environment and justify the creation of new regulatory requirements of scientific support.

In this case, the extreme complexity of the problem, its novelty, lack of available information, the difficulty of mathematical formalization process solutions necessary to address the recommendations of competent professionals, well knowing the problem, they are experts. Their solution of the problem, the arguments, the formation of quantitative assessments, treatment last formal methods are called method of expert estimates. Method, as reflected in a number of publications, but not used until now in the problems of finding the weight of the stages of production and control process to ensure product quality.

Purpose is to scientifically substantiate the structure of regulatory quality of light industry products on the basis of the weight of expert evaluation stages of production, the introduction of matrix methods and symmetric algorithms.

MAIN RESULTS OF THE RESEARCH

Processes in light industry, as noted above, may be reduced to a linear algorithm of production, an example of which is shown in (fig. 1).

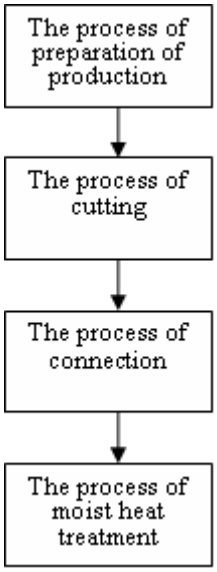

Fig.1. A linear algorithm in light industry

Preparation of garment production is one of the main functions of the enterprise [1, 16]. This is due to the steady increase in the rate and extent of renovation products in annual nomenclature clothing companies new product is more than 80%. Under market economic conditions there is an urgent need to develop methods to ensure comprehensive training organization garment production, to reconcile the interests of the company with the ever changing demands of the market, competitive products, improve garment production. For the methodological organization support of a comprehensive pre-production to quickly determine the properties of materials, to determine the rational technological and organizational modes of the production process.

In the process of training, in particular to determine the optimal combination of materials, angles and positions with the cutting of parts of the lower and upper limit of the size of the lot of garments manufacturing term party garments, depending on organizational and technological characteristics of the production process.

Of cutting materials stage [8, 13] is solving important issues of quality and resource conservation. It is known that the clothing industry is a material-production, where it is at the stage of preparation of materials for cutting and cutting laid such basic parameters of the product quality, competitiveness, cost. In the process of cutting address issues of system approach for computer-aided design process, issues of resource conservation for multi layouts, energy conservation.

Connection process takes one of the greatest places in the process. Quality of the process due to both hardware requirements and the properties of materials, as well as the organization of the process.

Step humid heat treatment plays an important role in ensuring the appearance of products. It is the most energy-intensive process, requiring the consideration of the material properties.

To ensure quality at every stage of production requires a set of quality control methods.

Quality problem in the modern world is universal. Analysis of the quality of garments by three methods: organoleptic, measuring and sociological. Unfortunately, the dominant is the organoleptic method with often subjective. Thus, the quality of the product landing on a figure or a mannequin is determined visually. This product is wear on a person or mannequin is fastened to the neck and is known belt (if applicable). Evaluated the product meets the size and shape of the human body, fashion, product integrity composition, the presence of structural defects (horizontal folds, vertical folds, inclined folds, corner creases and balance disorders, and ease of use small details (pockets, belts, valves, fasteners and other .) and convenience in static and dynamic). Quality technology garment determined visually on the table. Product is placed on the table wrong side up, assessed the quality of the product from the wrong side, then from the front. Determined is measuring the size of defects, and the symmetry of paired parts.

In general, the generalized process control, production control can be represented as a linear algorithm (fig. 2).

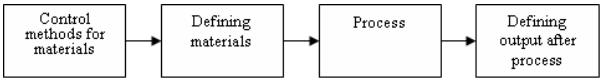

Fig. 2. Linear control algorithm

We pay an attention on the similarity of processes with the production stage. We note that despite the fact the physical nature of the processes are different, the formal sequence uniform. When you combine the stages of production in one model can be a rectangular structure that shows a symmetric algorithm garment production (fig. 3). The result of any production must act with its products of quality, competitiveness, energy, etc.

Obviously, each step of system elements can be associated with some measure of weight, which contributes to the overall effect of production denote the weight of a single element of the symbol E_{ij}, where i - number of the stage production, j - number of the quality assurance process. We also denote R_i - the weight indicator of quality.

We come back for the issue of ensuring the individual elements of the system shown in (fig. 3). Despite these shortcomings in the regulatory process ensuring each element provides a certain system of standards, specifications, test methods and production monitoring.

The hypothesis of our study consist is is a link between the achievement of each element of the system and the effectiveness of regulatory support. For each stage, we denote this performance X_i. In this case, a formalized model for quality in the light industry can be demonstrated by (fig. 4).

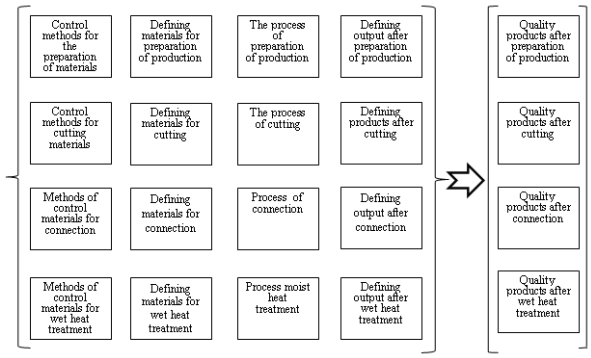

Fig. 3. The rectangular structure of the stages of production in the apparel industry

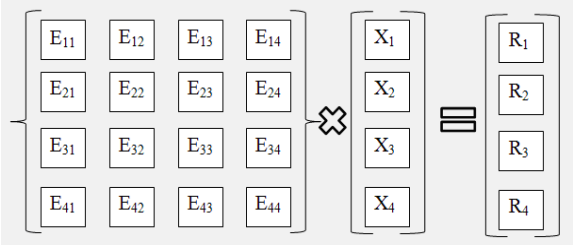

Fig. 4. A formalized model of quality

The similar analysis for the light industries consist with production of products from natural leather provides a more complex result, which is implemented in a square system of five cells horizontally and vertically, shown in (fig. 5).

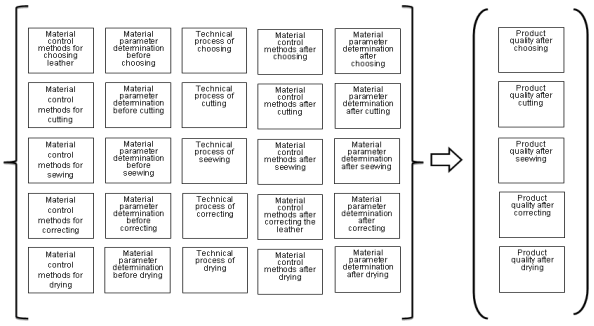

Fig. 5. The rectangular structure of the stages of production in the manufacturing of natural leather

Described of matrix of the fourth order for the garment industry mathematical model in this case would look as

$$\begin{Bmatrix} E_{11} & E_{12} & E_{13} & E_{14} & E_{15} \\ E_{21} & E_{22} & E_{23} & E_{24} & E_{25} \\ E_{31} & E_{32} & E_{33} & E_{34} & E_{35} \\ E_{41} & E_{42} & E_{43} & E_{44} & E_{45} \\ E_{51} & E_{52} & E_{53} & E_{54} & E_{55} \end{Bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \\ X_4 \\ X_5 \end{bmatrix} = \begin{bmatrix} R_1 \\ R_2 \\ R_3 \\ R_4 \\ R_5 \end{bmatrix}. \quad (1)$$

In general, therefore, the model in light industry can be represented as

$$\{E\}[X]=[R]. \quad (2)$$

Where: $\{E\}$ - the matrix elements of the production process,

$[R]$-vector of indicators of quality,

$[X]$ - vector of regulatory support.

At this stage, we are not known, most indicators of system elements. Unfortunately, the development of formal methods for their determination is an elusive goal. For indicators of the weight to perform a complex expert research in the garment industry in Kharkov. The basis of the research was the Delphi method, which is a method of group survey.

Statistical characterization of the group of the answer is that our group is the metric value, containing the views of the majority of experts, this point of view, which could accept most of the group.

For each phase was conducted ranking sequence control and production, that is the location of objects in descending order of importance of the process.

This was followed by direct measurement. Range of the characteristics of an element of the system is divided into separate intervals, each of which is assigned a certain score (score), from 0 to 10. Then determines the share of each item by dividing the amount of points received a separate item on the total number of points for each stage.

In order to form a generalized assessment of the expert group used averages.

Point estimate was determined for a group of experts, which is calculated as the arithmetic mean:

$$\overline{W} = \frac{\sum_{k=1}^{m} W_k}{m}. \quad (3)$$

And identifies how a particular factor is important in terms result. In this case, determine the weight of each factor.

Determination of weights produced in that order. Let x_{ij} - evaluation factor i, this j-th expert, n - the number of objects to be compared, m - number of experts. Then the weight of the i-th unit, calculated estimates of the experts (w_i), is:

$$\overline{E} = \frac{\sum_{k=1}^{m} E_k}{m}. \quad (4)$$

where: w_{ij} - weight of i-th unit, calculated estimated j-th expert, is:

$$E_{ij} = \frac{Y_{ij}}{\sum_{i=1}^{m} Y_{ij}}. \quad (5)$$

In case of participation in a survey of several experts differences in their assessments are inevitable, but the magnitude of this difference is important. Group assessment can be considered sufficiently reliable only if good consistency answer individual specialists.

To analyze the spread and consistency of ratings used statistical data - measures of variation.

The standard deviation, calculated from the known formula:

$$\sigma = \sqrt{\frac{\sum_{j=1}^{m} \left(E_j - \overline{E}\right)^2}{m-1}}. \quad (6)$$

where: E_j - assessment of the j-th expert;

m - the number of experts.

Determine the coefficient of variation $V = \frac{\sigma}{\overline{E}} \cdot 100\%$, which showed consistency expert opinions.

As a result of expert research, was compiled table 1 the weighting elements system of production in the apparel industry.

Table 1. Indicators weighting system of production in the apparel industry

	Control methods	Defining materials	Process	Defining output
preparation	0,15	0,22	0,43	0,2
cutting	0,1	0,17	0,44	0,29
connection	0,12	0,19	0,47	0,22
treatment	0,17	0,25	0,35	0,23

Illustration of the results obtained may serve as a weighty volume chart the different stages and elements shown in (fig. 6).

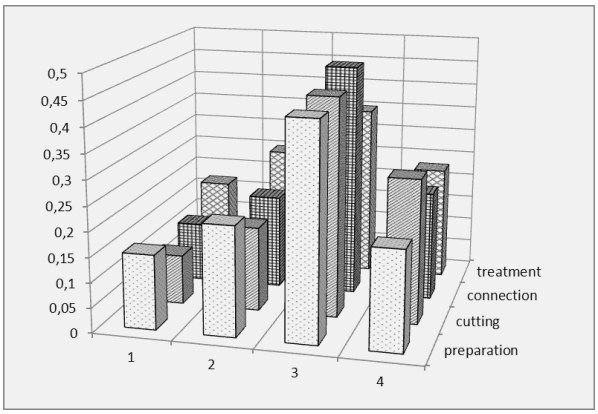

Fig. 6. The weight factors of production according to expert estimates

A similar study for the weight of quality at every stage of the data showed the following (fig. 7).

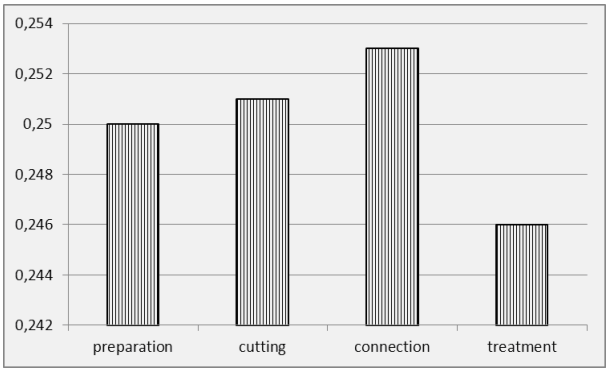

Fig. 7. The weight of quality production in stages

We pay an attention to the fact that the mathematical model in the form of (2) is nothing but a system of linear equations with unknown parameters of regulatory support. The solution is determined by the weight of a legitimate need regulatory support (fig. 8).

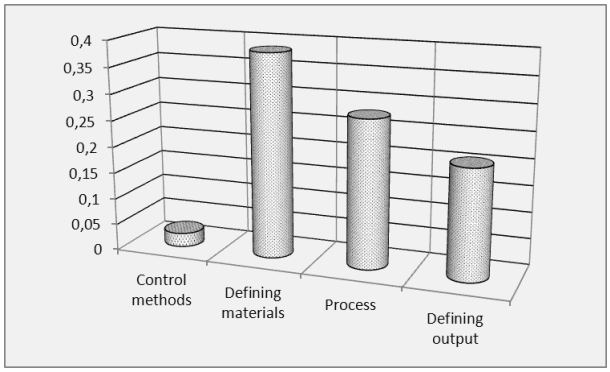

Fig. 8. Required the weight of regulatory support

Drawn to the fact of the contradictions between the existing system of regulatory support, the weight is shifted to the initial methods and distributed between the last point. Meanwhile, according to evidence-based methodology, the greatest weight should be provision in the preliminary direct control. We draw attention to the lack of regulatory control processes to ensure the preparation of connecting actions and especially in the control of materials in the preparation of wet heat treatment [6,7].

CONCLUSIONS

Scientifically article is based on matrix algorithm dynamics effect elements process with stages of normalization on quality of products is an effective means of identifying reserves to improve the quality in determining the weight of the elements of regulatory support production processes and controls in light industry. Determined by weight of the elements using the peer reviews. By solving the matrix model identified the necessary steps to ensure the weight of regulatory quality. Identified short comings of the current system of regulatory support.

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АЛГОРИТМЫ УСОВЕРШЕНСТВОВАНИЯ НОРМАТИВНОГО ОБЕСПЕЧЕНИЯ ЛЕГКОЙ ПРОМЫШЛЕННОСТИ

Ольга Мокшина, Александр Рябчиков, Светлана Челышева

Аннотация. Количество и уровень нормативных действий в процессе производства продукции легкой промышленности до сих пор является интуитивно назначаемыми действиями. В статье научно обоснован матричный алгоритм описания динамики влияния элементов технологического процесса совместно с этапами нормирования на показатели качества продукции. Определены весомости элементов с помощью метода экспертных оценок. Путем решения матричной модели выявлены необходимые весомости нормативного обеспечения этапов обеспечения качества. Выявлены недостатки существующей системы нормативного обеспечения.

Ключевые слова: легкая промышленность, показатель качества, нормативное обеспечение, алгоритм, элементы производственного процесса.