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OPTIMISATION MODEL OF PRODUCTION PROCESSES AS AN EXAMPLE OF THE COSMETICS SECTOR

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Abstract. In 2020, Europe reached 76.7 billion people. EUR of cosmetics sales in the retail market and according to this indicator is the largest market for cosmetic products in the world. 500 million European consumers use cosmetics and personal care products every day to protect their health and improve their well-being. With the high demand for cosmetic products, companies must ensure that products are produced at the right time and in the right quantities. However, in cosmetic manufacturing processes, inevitable losses occur in the supply chain and various losses in production that slow the shipments of cosmetic products. Continuous improvement of production processes, cost reduction measures, and quality assurance are necessary measures to obtain maximum profit and remain competitive. The object of the study is to improve production processes in the cosmetics sector. The purpose of the article is to identify the main problems of production processes in the cosmetics sector and to create a model for improving production processes. To achieve the goal, the following tasks are set: perform an analysis of scientific literature related to the improvement of the production process of the cosmetics sector; to choose appropriate research methods that will help identify the problems of improving production processes in the cosmetics sector; to present a model for improving cosmetic product manufacturing processes in cosmetic manufacturing companies. Research methods: analysis of scientific literature, observation method, expert assessment.

Keywords: optimisation of production processes, model, monitoring method, expert evaluation.

JEL Classification: M00.

Introduction

Cosmetics began to be used in prehistoric times when colours were used to attract animals for hunting, going to battles, performing religious ceremonies, and only much later with medicine (Kaur et al., 2021). Nowadays, a cosmetic product is defined as a substance or preparation intended for external parts of the body (hair, nails, epidermis, lips, and external genitalia) to clean, perfume, protect and maintain good condition, change the appearance, and correct the smell (Su et al., 2020). This definition of a cosmetic product is not universal. Products considered cosmetics in Europe (e.g., antiperspirants, anti-cavity toothpaste, sunscreens, etc.) may be classified as over-the-counter drugs in the United States due to the narrower definition of cosmetics (Costa & Santos, 2017; Ferreira et al., 2022).

Generally, cosmetics are a subset of personal care products consumers commonly used for daily hygiene and beauty activities (Turnbull, 2018).

Halla et al. (2018) classify cosmetics according to purpose, areas of use, functions, form of preparation, and age or gender of the user (Halla et al., 2018). According to the preparation forms, cosmetics are divided into emulsions, powders, gels, oils, pastes, aerosols, soaps, and solutions (Carli, 2020). According to the functions they perform, they are divided into cleaning (hair shampoo, soap), moisturizing (face cream, body lotion), beautifying (lipstick, blush), and protective (sunscreen) products (Baki & Alexander, 2015).

The cosmetics industry is a highly innovative, rapidly developing, and complex sector; it must be regulated to ensure the safety and quality of cosmetic products, thus avoiding adverse effects on consumers' health (Ferreira et al., 2022). Therefore, in Lithuania and other European Union countries, documents confirming the proper production of cosmetics are required. From July 2013, Regulation (EC) No. 1223/2009 of the European Parliament

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and the Council (from now on – the Regulation) entered into force in all countries of the European Union, which unified the requirements for the production of cosmetic products for all cosmetics manufacturers. Since the original legislation created in 1976, Directive 76/768/EC, the updated Regulation increases the safety of cosmetic products sold in the European Union (EU) by providing strict safety requirements to protect human health (Europos Sąjungos leidinių biuras, 2022; Kirk, 2018).

Cosmetic products are important consumer products that are essential to everyone's life. Cosmetic companies must continuously improve their products to survive in a highly competitive market where consumers expect more choice and ever-increasing efficacy (Bom et al., 2019; Secchi et al., 2016). The high competition encourages European cosmetic companies to constantly produce new and improved products or change the assortment to meet consumer expectations (Manteghi, 2017; Yaramenko-Gasiuk & Lukovets, 2021). Therefore, it is not for nothing that the European cosmetics industry is the world's largest exporter of cosmetic products, accounting for a third of the global cosmetics market (Manteghi, 2017).

Ensuring that all cosmetic manufacturing processes run smoothly and without losses is essential in a cosmetics manufacturing company. To speed up production processes and provide the required performance, companies must identify their weakest points and evaluate their improvement opportunities. To be a successful cosmetics production company, it is necessary to constantly improve the production stages and ensure good progress.

The article will aim to identify the main problems of production processes in the cosmetics sector and create a model for optimizing production processes.

1. Theoretical background

Recently, optimisation of production has been directly related to the search for models that ensure the sustainability of production. It is mainly perceived as the balance of the social, economic and environmental pillars of development activities (Daneshjo et al., 2023), one of the goals of which is to improve the quality of life. Consumers using cosmetic products have become more aware of environmental issues and It is even more so thus encouraged the industry to develop greener products and production methods (Bozza et al., 2022; Manteghi, 2017). Consumer influence is, therefore, a key driver of sustainable product development.

1.1. Sustainable production in the cosmetics sector

A product is considered sustainable if:

1) it is sustainable for consumers, meaning it has no short-term and long-term potential dangerous effects for consumers;
2) it is produced from sustainable and environmentally friendly production processes and sources raw materials, manufactured, packaged, distributed and sell products in an ethical manner (Feng et al., 2018).

The most significant environmental concerns arose from the pollution and consumption of natural resources. Implementing sustainable systems is a fundamental requirement of modern manufacturing to reduce ecological and health problems and conserve energy and natural resources (Kishawy et al., 2018). The main aspects of sustainability focus on environmental, economic and social directions to achieve better requirements for the efficient use of resources (Fortunati et al., 2020; Kishawy et al., 2018).

The need to rethink unsustainable production and consumption behaviour has been recognized by international organizations for many years. This condition has awakened the interest of consumers and other stakeholders in sustainable companies. Due to its importance and growth worldwide, the cosmetics industry has been strongly influenced by this demand (Kolling et al., 2022). The cosmetics industry must adapt and innovate to develop products and processes to improve the sector's sustainability, operating along the entire value chain and always considering consumer safety and compliance with relevant legislation. Focusing on each stage of the product life cycle makes it necessary to understand which factors need to be considered for sustainability (Bom et al., 2019).

Sustainability in the cosmetics industry is emphasized through the influence of each phase of the cosmetics life cycle. Regarding the production phase, production should be focused on efficient technologies that help reduce water and energy consumption, emissions and waste (Acharya et al., 2021; Bom et al., 2019). Companies trying to achieve more sustainable production recommend and usually use the following measures: changing energy sources to solar or wind energy; rainwater collection systems; temperature reduction during production; optimization of cleaning procedures to use less water and temperature for washing; building insulation measures that reduce energy consumption for heating and air conditioning; optimization of production planning and replacement of old equipment with new energy-saving electrical devices to "recycle energy" from hot water or air (Bom et al., 2019).

According to (Kishawy et al., 2018) identify and analyze the concept of sustainable production through three primary levels: product, system and process. The interaction of these levels allows the sustainability of the cosmetics sector. At the process level, energy consumption, hazards and toxic waste are reduced using an optimized technological process associated with an effective process planning methodology. The overall sustainability of the system is achieved through an effective supply chain system that considers all stages of the product life cycle. The expectations of a sustainable production process are presented as follows: reduction of energy consumption; waste removal/reduction; improving product durability; elimination of health hazards; production quality assurance; recycling and reuse; development of renewable energy resources.

To achieve a sustainable production system, some practical aspects need to be implemented at the product, process, and system levels:

- Apply the principles of non-hazardous and recyclable used materials and costs;
- Create and plan production processes to reduce energy, material, and water consumption;
- Use renewable energy that does not affect the natural environment;
- Create a product design that can be reused, remanufactured or recycled;
- Extending design concepts using fewer resources and quickly reproducible methods;
- Use efficient transportation and logistics systems (Kishawy et al., 2018).

Thus, the application of sustainable production concepts provides various advantages: reducing energy and waste consumption, extending the life of the cosmetic product, ensuring a better quality of the working environment, increasing the overall productivity of the system and production processes, and efficient use of resources. Since the demand for cosmetics is very high and production remains almost stable, it is necessary to take into account all stages of the life of the cosmetic product and their sustainability.

1.2 Production processes in the cosmetics industry and their optimisation

The cosmetics production process in the company is one of the essential elements since the product is created in the company. The production process is the joining of production resources into their appropriate combination using personal capabilities to develop a specific product (service) and sell it (Reschke & Gallego-García, 2021; Zinkevičiūtė & Vasiliauskas, 2013). Kučerová et al. (2015) claim that the production process can be described as a creative process whose function is to represent the company's activities and provide added value (Kučerová et al., 2015). Products are manufactured according to the specifications and relevant standards developed during their development. At best, the goal is to have the manufacturing process planned and executed to produce a good product the first time. To achieve the quality of the production process, the following elements are essential: production activities (these are the methods applied in the organization that allow the production of products that meet the expectations of consumers and meet the goals of the organization) and the efficiency of its process (allowing to check whether the results of the production process fully meet the purposes of the organization) (Zinkevičiūtė & Vasiliauskas, 2013).

No efficient production is possible without an essential aspect of the production process – components. Thus, for the production process to take place, the presence of the following elements must be ensured: materials; capital; employees, energy and technology – knowledge of the production process and equipment (Reschke & Gallego-García, 2021).

Depending on the purpose, the general production process consists of several interacting subsystems or process types: main, auxiliary and service or managerial. During the main functions, the properties of work objects (products) are changed: shape and dimensions, internal structure, physical and chemical properties, appearance or the position of individual parts about each other; this is a transformation function. Their direct result is the output that creates value for external users. Auxiliary processes are intended to support the primary operations; they create value for the organisation's internal use. Such methods can be like producing specific tools and repairing devices. Service/Management processes support the continuous execution of leading and supporting functions from the organisation's strategic level to the management of daily operations. These processes include transport and storage operations or quality control (Ulbinaitė & Gribovskis, 2020).

According to Gilchrist (2022), cosmetic manufacturing processes start from planning to finalising the cosmetic product and shipping the product to the customer (Gilchrist, 2022).

All production processes are evaluated according to the criteria described in the scientific literature, which allows for to assess not the production performance:

- Time – the time during which the production process is carried out. Saving time equates to cost reduction and value creation;
- Quality indicator – evaluation of product characteristics according to consumer needs;
- Productivity – efficient use of resources within the available time;
- Flexibility – the company's ability to quickly respond to changes, reducing process duration and costs;
- Costs are various resources used to produce a product: raw materials and materials, fuel, cash, electricity, labour, time and other resources (Sahu & Pradhan, 2016; Ulbinaitė & Gribovskis, 2020; Wątróbski et al., 2020).

In summary, it can be said that production processes consist of primary, auxiliary and administrative processes, of which the main cosmetic production processes are: product development, dosing, production, bottling and packaging. The performance of all production processes is evaluated according to time, quality, productivity, and flexibility and cost criteria. After proper assessment of cosmetic product production processes, they can be improved by using optimization tools.

Sooner or later, manufacturing companies face difficulties when results are no longer satisfactory. Then process improvement becomes significant, i.e., methodologies that evaluate existing processes and adapt them to increase productivity. During process improvement, a strategy is selected that ensures the most important benefits for the company. One of the main strategies for improving production processes is process optimization, which aims to reduce production costs, increase

productivity and improve the quality of manufactured products, which can only be done by working under optimal conditions (Afteni & Frumuşanu, 2017). Optimization of production processes is one of the most critical production management tools (Kazlauskas & Merkevičius, 2019), which aims to improve production processes. The authors describe the term process optimization differently (Table 1).

In general, process optimization is selecting the best method to minimize the production process time to achieve the best possible efficiency.

Table 1. Definitions of process optimization

Authors	Definition
(Kazlauskas & Merkevičius, 2019)	Process optimization is a field of science whose goal is to achieve maximum results and maximum production efficiency with the lowest costs by selecting production operations and their technological parameters.
(Afteni & Frumuşanu, 2017)	Process optimization is an activity that selects the best possible solution to a problem, which is evaluated according to a predetermined criterion, for example, cost of production.
(Sabadka et al., 2017)	Process optimization is reducing the production process time as much as possible to increase production productivity.
(Tsakalidis & Vergidis, 2017)	Process optimization – automated process improvement using predefined performance indicators (goals).

Optimization of production processes cannot be a process of modifying only one specific area (in this case, production). The optimization process must include all the activities of the organization, which would aim at comprehensive performance improvement by integrating the improvement of production processes into the company's activities (Kazlauskas & Merkevičius, 2019).

Optimization of production systems can be carried out in various directions. It may include using machinery, technological aspects or maintaining the number of employees. All these criteria can be used to control the production process. To optimize production processes, the first step is to evaluate the performance of the process. Therefore, production systems are considered according to performance indicators, which measure the main criteria – costs, productivity, quality, time and flexibility (Wątróbski et al., 2020).

Properly optimizing production is not an easy task; it requires the following aspects: knowledge of production processes and, mathematical expertise and optimization methods, specification of capabilities of devices in production (Rao, 2011). The types of optimization should also be appropriately identified: single-criteria optimization when the ideal production state depends on one evaluation criterion, and multi-criteria optimization when achieving the perfect production state depends on several evaluation criteria (Tsakalidis & Vergidis, 2017).

According to Joppen et al. (2019), efficient and flexible production can be achieved in various ways: comprehensive production replanning, equipment parameter optimization or process improvement tools (Joppen et al., 2019). Which will be covered in more detail in the following sections.

1.4. Production optimization tools

The "Lean" system includes production and management systems and is focused on organizational learning through continuous improvement of the company's processes.

Using Lean in manufacturing helps eliminate all non-value-added activities. Eliminating these activities that do not create added value reduces cycle time and costs, making organizations more competitive, agile and responsive to customers (Čiarnienė & Vienažindienė, 2014).

The main principles of Lean are distinguished (Table 2), which focus on the identification of value-added and non-value-added components in the course of the production process (Leong et al., 2019).

Table 2. Basic principles and functions of Lean

"Lean" principles	Functions
Define Value	The essence of this principle is to determine the customer's needs for a specific product. The focus will be on value-added products to determine what is essential to the customer.
Identify Value Stream	The manufacturing team can understand the entire product life cycle by identifying the value stream. The purpose of the principle is to remember actions that do not add value to the product.
Create Smooth Value Flow	Identification of materials or processes by applying a continuous flow method to reduce production time.
Implement Pull-Based Production	The aim is to focus on getting value for the customer from the manufacturer, not the other way around. Production will be carried out only after receiving the customer's order. This requires high production flexibility in managing the entire supply chain.
Strive for Excellent	This principle encourages the pursuit of continuous improvement to eliminate activities that do not add value. It is a gradual process in which labour standards are maintained and improved.

Lean guiding principles encourage an organization to assess who its actual customers are and what those customers value, making it easier to define aspects of a product or service. Considering all this, production processes are easier to manage, production costs are reduced, and

efficiency is increased (Thangarajoo & Smith, 2015). The essence of these Lean principles is to create value in the production system based on customer needs and wants (Bauer et al., 2018; Thangarajoo & Smith, 2015).

Implementing the Lean concept is a continuous improvement process that allows companies to remain competitive in the market. In the face of significant global competition, manufacturing companies seek to make various operational factors and processes more efficient. The application of the "Lean" methodology is not limited to production processes; it is related to all company activities, starting from product development, tool purchase or distribution process (Agung & Hasbullah, 2019; Shah et al., 2017).

Kaizen is a gradual, small-scale process improvement method that consists of small, mutually independent process innovations generated by company employees (Carnerud et al., 2018). According to Kaizen principles, production process improvement is impossible without all team members. In the event of deviations or malfunctions, employees and the manager must propose a solution and eliminate the malfunctions using the available knowledge (Helmold, 2020). Therefore, this method encourages teamwork, and decisions are made without complex techniques or expensive equipment that would require new investments (Mekonnen, 2019). When personnel are involved in the company's activities, they become more interested in their activities and results. As a result, the turnover of employees is reduced because there is an opportunity to realize your ideas (Statkus, 2018). According to (Carnerud et al., 2018), organizations that have adopted the core principles of Kaizen can achieve the following goals: properly define and improve processes, generate a large number of ideas for process improvement, strengthen all levels of the organization and involve all company employees, clearly identify process steps and perform them correctly. Kaizen focuses on quality, technologies, procedures, organizational values, profitability and security (Chikkaballapur Balaji et al., 2021). Therefore, this approach is highly recommended when starting a Lean manufacturing implementation initiative (Leksic et al., 2020). Kaizen encompasses many techniques, one of which is the just-in-time concept.

The essence of the Just in time (JIT) strategy is to use the right amount of raw materials to produce only at the right time and only as much as is ordered (Bhushan et al., 2017; Pinto et al., 2018; Taghipour et al., 2020). With the help of this technique, the production process can be accurately planned, which allows the company to organize work efficiently (Taghipour et al., 2020). Although a relatively easy methodology, the JIT theory helps:

- Facilitate production flexibility, which provides a competitive advantage because the company adapts more easily to environmental changes and customer wishes (Taghipour et al., 2020);
- Eliminate non-value-added activities and measures (Pinto et al., 2018);
- Improve quality (Pinto et al., 2018);
- Reduce inventory holding costs (Chikkaballapur Balaji et al., 2021; Kiran, 2019);
- Speed up production processes (Bhushan et al., 2017);
- Improve relations with suppliers (Taghipour et al., 2020).

To implement this system in a company, the necessary factors are needed: quality, teamwork, education and communication (Bhushan et al., 2017). The JIT system will only be effective if every employee of the organization participates (Chikkaballapur Balaji et al., 2021) because it includes both production and purchasing and sales departments. Therefore, employees must understand the condition of the equipment and be able to ensure its quality (Pinto et al., 2018).

Although it is theoretically relatively easy to understand that the JIT concept contributes to the improvement of waste elimination and operational improvement, it is pretty challenging to implement JIT production. This requires many organizational changes related to processing redesign and information flow management (Pinto et al., 2018).

Single Minute Exchange of Die (SMED) is one of the many Lean production tools aimed at reducing inventory and improving the flexibility and efficiency of production processes (Díaz-Reza et al., 2017; Singh et al., 2018). The goal of SMED is to reduce production equipment costs and downtime caused by the stoppage process (Mayr et al., 2018). The essence of this method is to divide all operations when production equipment is used into internal and external activities. Internal activities must be performed when the equipment is turned off. External activities are those actions that can be done during the operation of the processes. To reduce downtime as much as possible, it is necessary to outsource some internal functions so that they can be performed while the machine is running (Konieczna et al., 2018; Singh et al., 2018). In this way, the replacement time of production equipment is reduced, and more of it is devoted to the production process (Sabadka et al., 2017). SMED means that the change must be done in less than ten minutes. If this is not possible, the time reduction is an improvement, and the knowledge learned will be applicable in the future (Singh et al., 2018).

Advantages of the SMED method:

- Increased production flexibility allows for the production of smaller quantities, as a result of which too many raw materials are not stored;
- Faster response to changing customer orders;
- The process change time is shortened;
- Productivity of production processes and equipment increases;
- Lean losses are eliminated (Díaz-Reza et al., 2017; Konieczna et al., 2018; Mayr et al., 2018; Singh et al., 2018).

Shortstop times are essential for producing small quantities of various products, which is the basis of lean manufacturing. Reducing equipment downtime is

necessary for flexible and lean manufacturing (Ekincioğlu & Boran, 2018).

The essence of the implementation of all "Lean" methodologies is to reduce the time of the production process, increase productivity, so that the processes run as efficiently as possible and the necessary goods reach the customer faster. Correct implementation of the Lean system can positively affect the entire production process and lead to change. But first, in order to implement methods of improving the system, it is necessary to find out the main problems of the cosmetic production processes and the reasons for this.

2. Methods

Two methods were used to achieve the set goal. The following methods were chosen based on the analysis of the scientific literature as one of the most suitable qualitative research methods for collecting, processing and presenting conclusions. The observation method directly assesses events, processes, behaviour or other phenomena during which their behaviour is observed in the natural environment (Pandey & Pandey, 2015; Tidikis, 2003). This article applies scientific observation, which is carried out in a targeted, systematic and purposeful way to determine the reasons that lead to the occurrence of losses in the production processes of cosmetic products and the reasons for which the production processes take a long time, direct observation without participation was chosen (Ciesielska et al., 2018; Tidikis, 2003).

The expert evaluation method is a specific type of survey of a specially selected group of people who know a particular area. The knowledge of experts in a specific field about the evaluated object allows one to achieve scientific objectivity. Therefore, according to (Tidikis, 2003), the evaluation method of an expert survey is perfectly suitable because the data is reliable and reasonable. Considering the complexity of the evaluation, the appropriate number of respondents is chosen. Expert research is considered reliable only when the consistency of experts' answers is evaluated. The level of concordance of experts' opinions is assessed according to concordance coefficients, and Kendall's concordance coefficient W is usually used, which varies from 0 to 1 (see Formula 1).

$$W = \frac{12S^2}{m^2\left(k^3 - k\right)},$$

here: m – number of experts, k – the number of alternatives presented.

If experts' opinions are similar, this coefficient is equal to 1, if experts' assessments are contradictory, Kendall's concordance coefficient is equal to 0 (Riazanova & Žilinskienė, 2019).

3. Results

3.1. Results of the observation method

During observation of the leading cosmetic production processes: dosing, production, bottling and packaging, the following was observed:

The unnecessary movement was detected during the dosing process when additional raw materials needed to be brought from a different warehouse due to the improper layout of the premises. Another problem is waiting for raw materials; the material is not ordered on time due to the production plan not being made. A proper production plan ensures timely production because all the necessary raw materials, materials or other means are available. Without all this, the next stage of cosmetic production is stopped, which leads to worker downtime.

When observing the process of manufacturing cosmetic products, one of the significant disturbances determining the long duration of this process is the unnecessary movement due to improper equipment placement. Workers spend much time walking between equipment placed inconsistently or too far from the production site. The duration of the process is determined not only by the unnecessary movement to reach things but also by redundant work and the possibility of defects. If the ingredients are not correctly added or not properly mixed, the cosmetic product can be completely irreparable, which requires the re-dosing of the raw materials. Other factors determining the complexity of the cosmetic product production process are lack of knowledge or employee competence, which lead to direct losses. Therefore, only a properly trained employee can produce cosmetic products successfully and without casualties.

After the cosmetic product is made, another process is carried out – bottling. It has been observed that the long process time is caused by a defect where the wrong volume is filled into the cosmetic product container. This happens due to incorrect setting of equipment parameters. Then each cosmetic product container must be supplied to the required volume, which leads to high time costs. Equipment repairs also increase the time of the bottling process, especially if you need to hire a technician and wait for him to arrive. Workers must wait until the equipment is repaired and they can return to work. Employee downtime is when equipment is being repaired, and disruptions occur in previous processes that prevent the cosmetic product from being received for bottling on time.

The final process of the cosmetic product is packaging, the most extended cosmetic production process observed since this process is not automated. Cosmetic products are packed by hand, i.e. the main reason for such a long process duration. Due to improper preparation of the production plan, during packaging, we have to wait for various raw materials: boxes, stickers or other materials, which also increases the duration of the process.

3.2. Results of the expert survey

According to the obtained research results, it can be said that the most complex processes of cosmetics production are considered to be the processes of planning and product development. Experts consider packaging and shipping of products to be uncomplicated cosmetic production processes.

During the survey, experts were asked to select what losses occur during the production and bottling processes of cosmetic products (see Figure 1).

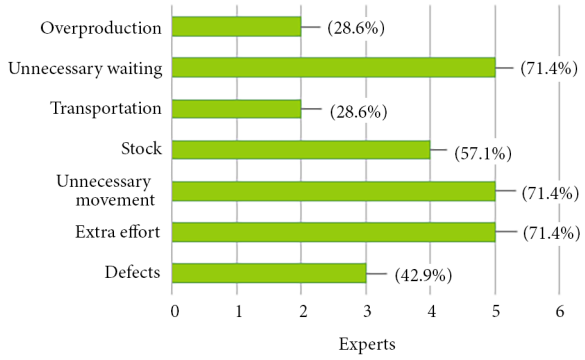

Figure 1. The most common losses in the production process

71.4 per cent of experts singled out unnecessary waiting and movement and additional efforts as the most remote production activities. 57.1 per cent of respondents believe that inventory is the next most common disruption in production.

Meanwhile, during the bottling process, as many as 85.7 per cent of respondents consider unnecessary movement as the primary disturbance of this process (see Figure 2).

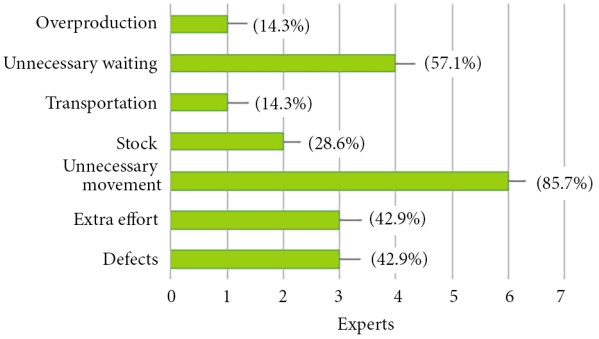

Figure 2. The most common losses in the bottling process

57.1 per cent believe unnecessary waiting is the second most common obstacle at the bottling stage. In both the cosmetic product manufacturing and bottling processes, experts noted the most frequent disruptions – unnecessary movement. In contrast, transportation and overproduction of products seemed to experts to be the least disruptive during the bottling and manufacturing processes.

Based on the results of the expert survey, it can be stated that lack of knowledge of the process, lack of competence of employees and improper placement of equipment are among the most significant factors determining the complexity of the cosmetic product production process. Experts agreed that the possibility of a defect could lead to the occurrence of losses or a long duration of the process.

Improperly setting the equipment parameters will not fill the exact volume of the cosmetic product, which is the primary goal of the bottling process. Such inaccuracy can lead to high costs. Most experts disagree that the probability of defects leads to losses and long process times and that employee downtime can contribute to long process times.

After analyzing the scientific literature, it was found that to improve production processes, it is first necessary to evaluate their performance. According to experts, packaging and shipping are the most efficient operations in the production of cosmetics.

85.7 per cent of experts agree with the statement that the performance of the production and bottling processes is affected by the disruptions that have occurred.

Time and flexibility are the main criteria that determine productivity, so these criteria are more suitable for evaluating the performance of the production process. Another possible criterion for evaluating production performance is productivity, supported by 87.7 per cent of respondents.

Time and productivity are the main criteria that can be used to evaluate the performance of the bottling process. Also, 71.4 per cent of experts believe that flexibility is a suitable criterion for assessing the bottling process. Experts agree that production and bottling processes' main performance evaluation criteria are time, productivity and flexibility.

According to the results of the expert evaluation, unnecessary waiting and movement and additional efforts are the main factors of the production and bottling processes that determine the complexity of these processes. To improve all production processes, it is necessary to eliminate disturbances (see Figure 3).

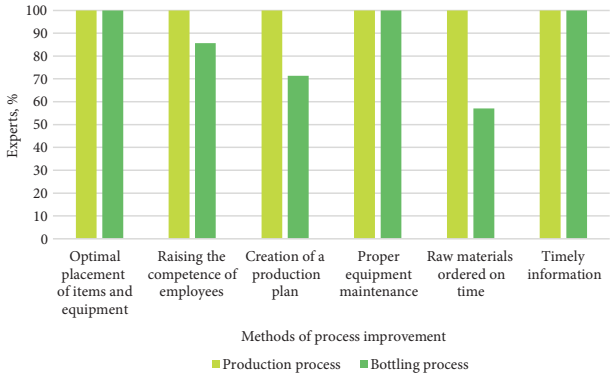

Figure 3. Development methods suitable for production and bottling problems

Experts emphasize that the optimal arrangement of objects and equipment, competence of employees,

creation of a production plan, proper maintenance of equipment, timely ordering of raw materials and convenient transfer of information are the areas that can be improved to achieve good production results.

42.9 per cent of the experts who participated in the study indicated the Kaizen concept as the most suitable for solving the problems of cosmetic products' production and bottling processes. Kaizen management encourages continuous improvement of production processes and work areas and involves all team members.

4. A model for improving cosmetic product manufacturing processes is proposed for cosmetic manufacturing companies

Based on the analysis of the scientific literature on the improvement of production processes, after evaluating the respondents' answers about the possibilities of improving the production processes of cosmetics, a model of the progress of the production processes of cosmetic products was created and divided into two stages (see Figure 4).

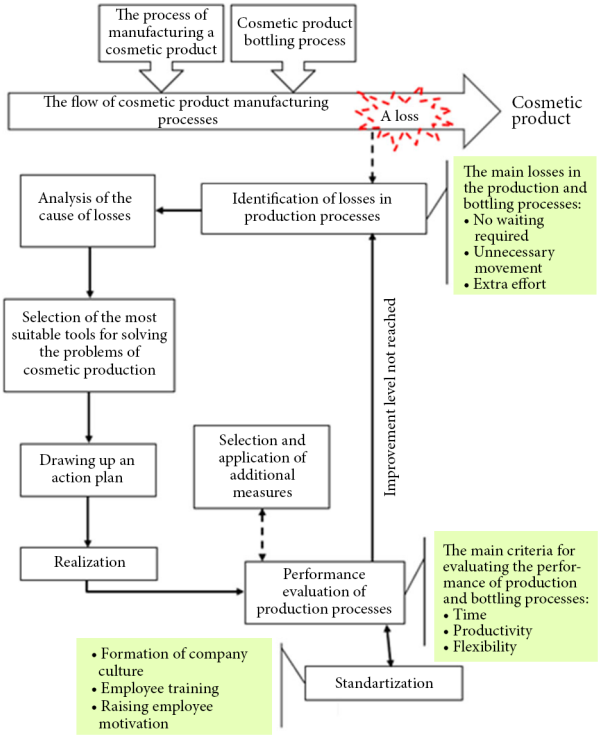

Figure 4. Model for improvement of cosmetic product production processes

To start improving the production processes of cosmetic products, it is necessary to have a clear production plan based on customer needs. Drawing up a plan allows you to assess whether the company can fulfil the order. Depending on whether the order can be fulfilled or not, the production planning steps are selected. If the order can be fulfilled:

– all the necessary materials are available, it is required to proceed to the next step – the production of cosmetic products;
– but there is a lack of materials; purchasing raw materials and components is necessary. After receiving the required details, a cosmetic product is produced.

However, the client should be offered alternatives if the order cannot be fulfilled. If the proposed solution method is suitable, it is possible to proceed directly to the production of cosmetic products or, depending on the need, to order the necessary materials to fulfil the order. Failure to draw up a proper production plan, inability to collect raw materials on time and lack of alternatives for the customer results in the loss of the customer.

The first stage of improvement of production processes ensures timely delivery of high-quality products to the market, good use of resources to fulfil orders, and uninterrupted production. In the progress of cosmetics production processes, planning is essential and further steps – proper execution and analysis of production processes.

The second stage of the improvement model is dedicated to the execution and analysis of production processes. During production processes, when unforeseen disturbances occur, one of the most critical steps is the identification of the resulting losses. It is essential to pay attention to one of the most complex basic cosmetic production processes – the production and bottling of the cosmetic product. Many problems occur during these cosmetic manufacturing processes. After identifying the weakest points in the entire course of production processes, the causes of problems are sought. Knowing what causes certain losses, it is possible to choose the most optimal way to solve the problems of production processes. Choosing the right tools ensures fast and efficient production.

After choosing the measures, an action plan must be drawn up to refine the work and process steps that will need to be carried out to achieve maximum efficiency from the improvement methods. After the natural and physical implementation of improvement ideas, it becomes essential to evaluate the performance of production processes using evaluation criteria. The performance of the production and bottling processes can be assessed by the main criteria: time, productivity and flexibility. Process performance evaluation identifies whether the means to solve production process problems have been appropriately chosen and whether production processes that previously had disturbances run faster and more efficiently.

After receiving the assessment, the results are analyzed, and, if necessary, additional measures are applied to eliminate production process disturbances. However, if the level of improvement is not achieved and the problems in the production processes cannot be resolved, it would be worthwhile to review the progress of the production processes and identify the losses.

After choosing the proper methods and solving the problems that arise during the production processes, this process of improvement of the production processes must become a standard. Practical and flexible production can

only be achieved by formulating such an approach. It is essential to draw up an accurate production plan, order raw materials on time, and identify problem areas. In the standardization phase, the aim must be to involve every company employee in continuously implementing changes by raising his motivation and using various pieces of training because it depends on the employees whether they will be interested in achieving a common goal, improving the processes in the company, generating many ideas for enhancing production processes and maintaining the achieved level of improvement. Applying these steps in cosmetic manufacturing will produce a fast, high-quality cosmetic product.

Conclusions

The production process can be defined as transforming production resources into a specific output. Production processes are divided into primary, auxiliary and service operations. The main functions of cosmetics production are product development, dosing, production, bottling and packaging, during which the final cosmetic product – is obtained. However, to produce cosmetic products faster and more efficiently, it is necessary to improve production processes to achieve a sustainable business. One of the possible ways to improve production processes is the application of the "Lean" methodology. Based on the analysis of scientific literature, it can be assumed that applying the elements of this methodology in production processes would reduce production cycle time and costs, increase production efficiency and productivity, improve the quality of products and procedures, and eliminate production process losses.

Using observation and expert evaluation methods, it was established that the main problems of cosmetics production processes and decreased productivity are caused by losses occurring during the production process. The results of the study showed that the central disturbances in the production process are unnecessary movement (of employees, transmitted information) and waiting (for raw materials, equipment repair) and additional efforts (of employees, equipment); 71.4 per cent of experts agree with this, the losses of the bottling process are unnecessary waiting (57.1 per cent) and movement (85.7 per cent). During the monitoring, it was found that these losses were caused by improper setting of equipment parameters, ignorance of the process, lack of competence and wrong equipment arrangement. Therefore, Kaizen management, aimed at improving cosmetics, could be a possible solution, supported by 42.9% of experts – production processes.

The results of the study showed that problems might arise in the course of cosmetics production processes. Hence, the two-stage model for improving cosmetics production processes is the chosen solution method. The first stage is designed to assess the company's ability to fulfil orders and properly distribute materials; the second stage is designed to identify losses, find out the reasons for their occurrence, and by choosing the best way to solve problems, increase the productivity of production processes.

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