11. Law on Prohibition of Discrimination in BiH ("Official Gazette of BiH", No. 59/09, 66/16)

12. Law on Republic Administration of the Republika Srpska ("Official Gazette of the RS" No. 118/08, 11/09, 74/10 and 86/10)

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USE OF LEAN TOOLS AND METHODS IN INCREASING PRODUCTION CAPACITY USE

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Summary: One of the fundamental challenges faced by today's organizations is capacity management. The capacity of the organization is the sum of the capacities of all machines and devices, i.e. the capacities of all organizational employees. The capacity of organizational employees is determined by their efficiency. If employees maintain low efficiency, which is determined by the total duration of activities that add value and the total duration of the process, this is also reflected in the capacity of the organization. The organization, given the demand for its products and services, needs to manage and prepare capacities. For capacity planning and management, it is necessary to measure the current capacity and allocate resources based on it, i.e. to develop an organizational plan. Furthermore, given the changes in demand and changes in the market, one of the requirements placed on the organization is to increase flexibility towards demand. To increase flexibility, as well as to increase capacity, an organization can use a variety of tools and methods developed within the Lean philosophy. The fundamental goal of the application of such tools is to equalize the capacities of all components within the process as well as to increase the utilization of current capacities.

Keywords: capacity management, business processes, Lean philosophy

1. INTRODUCTION

One of the challenges facing today's organizations is maximizing business process capacity utilization. Business process capacity is the sum of all capacities that machines and devices have, i.e. the capacity of each employee involved in the process. Due to various constraints, such as variability in employee performance, variability in machinery and equipment, etc., the capacity of the business process in an organization can be significantly reduced. In parallel with the reduction of process capacity, there is a decline in the efficiency of employees and machines and devices.

A decline in employee efficiency can also mean the emergence of problems associated with the delivery of the ordered quantity of products or services by the customer, which can reduce the income of the organization. Furthermore, due to limitations in the capacity of machines and devices as well as limitations in the capacity of employees, organizational management approaches planning with significantly lower planned values. However, it should be noted that the planned values defined by the management in the plans depend on the quantity demanded, ie the quantity of products and services defined by customers.[98]

In order for an organization to be able to use the maximum capacity of its process, it is necessary to analyze the process and identify places in the process where there are bottlenecks. Bottlenecks in the process involve places of reduced capacity, which can be determined by a number of variables such as organizational employees, machine capacity, serial connection capacity between machines used in production, etc.[99]

One way in which an organization can increase business process capacity utilization is to use Lean tools and methods. Lean philosophy emphasizes the so-called lean organization that refers to an organization that does not exist or exists in a small percentage, process waste that reduces process capacity. The term process waste means unnecessary movements, unnecessary transport, etc.

The aim of this paper is to present the applicability of Lean tools and methods in increasing the capacity utilization of organizational processes as well as the application of Lean tools to increase or improve the efficiency of all components of the organization

2. CAPACITY MANAGEMENT

When talking about the capacity of the organization, it is necessary to make a distinction between qualitative and quantitative capacity. Quantitative capacity refers to the maximum amount of products and services an organization can produce with a given machine, device, and employee at a given time. On the other hand, qualitative capacity represents the ability of employees as well as the organization as a whole to use the available machines and devices and their quantitative capacity to make the most of their ability to produce or provide services.[100] Furthermore, quantitative capacity is determined by the demand for products and services and based on which the organization defines the minimum required quantitative capacity to be able to meet demand. Variability in demand can also result in lower utilization of quantitative capacity.[101] Thus, organizational management lies between two extremes, the decision on the required quantitative capacity and the utilization of once selected quantitative capacity with the uncertainty of future demand for products and services that the organization produces. Based on this, organizational management should define how much products and services it will produce in accordance with the profit it makes per unit produced in order to return on investment related to the

[98] Proştean, G. (2007). Operations Planning Based on Theory of Constraints Decision System. IFAC Proceedings Volumes, 40(18), 591-596.

[99] Velumani, S., & Tang, H. (2017). Operations status and bottleneck analysis and improvement of a batch process manufacturing line using discrete event simulation. Procedia Manufacturing, 10, 100-111.

[100] Corsten, H., & Stuhlmann, S. (1998). Capacity management in service organisations. Technovation, 18(3), 163-178.

[101] Herrmann, J. W. (Ed.). (2006). Handbook of production scheduling (Vol. 89). Springer Science & Business Media.

purchase of machinery and equipment, or to make a profit that will be used for further development of the organization. The basic goal is to determine the optimal amount of production, and given the cost and expected profit.

Capacity management is usually associated with a reduction in operating costs as well as meeting the required quantity of products and services. In the research, it was identified that there are two streams of scientific papers that talk about capacity and capacity management in terms of investing in machinery and equipment to increase capacity or reduce costs, and on the other hand the authors talk about the need for capacity management.[102] Given that investing in machinery and equipment as such is a venture that requires large financial resources, a capacity management-based approach is much better as the organization seeks to maximize current capacity as well as reduce the costs associated with it.

Basically, the planning and capacity management of an organization is based on an analysis of the current demand for products and services in the market. Current demand is the basis for creating production plans, ie the deployment of employees in the organization to places in production. When deploying employees, it is necessary to take into account their competencies, ie knowledge and abilities to use machines and devices, while minimizing costs. With the developed plan, the implementation of the same is started, where a number of indicators are monitored, on the basis of which it is possible to identify whether the planned capacities are met or not and whether there are opportunities for improvement.[103]

Since demand, as well as market conditions in general, is a variable that is subject to change, it is necessary to develop mechanisms based on which the production capacity, ie the capacity of machines and devices can be adjusted to the current market demand. This approach places requirement on the organization related to ensuring the flexibility of organizational processes, i.e. the capacity that the organization has to be able to meet demand. In other words, capacity management in such situations is of particular importance and can be essential as insufficiently good planning and insufficiently optimized production can result in increased costs as well as inability to meet customer-defined requirements.

One of the ways an organization can increase the utilization of current capacity is, i.e. increase the flexibility of its processes is the use of tools and methods derived from the Lean philosophy, which aims to increase process efficiency by eliminating all activities that do not add value.

2.1. CAPACITY MEASUREMENT

In order for the organization to be able to approach capacity planning, i.e. capacity management, it is necessary to measure the capacity available to the organization. Capacity measurement consists of identifying the quantitative capacity of machines and devices available to the organization as well as the current capacity of organizational employees, and given their work routine as well as the organization of the work in the process. [104] The total capacity of organizational employees is calculated by subtracting from the total time available in the shift in which each employee works the duration of the meal break, the time employees spend preparing work, time spent preparing machines and devices, or replacing tools that are used on the machine, the time of cleaning the production plant, the time required to deliver resources, etc. The higher the number of such activities, the lower the used capacity of employees.

Capacity measurement is of particular importance when it comes to series production where a line of machines and devices is often used to produce several different products, and given the modifications that must be made to machines

[102] Gunasekaran, A. (2001). Agile manufacturing: the 21st century competitive strategy. Elsevier.
[103] Ibid.
[104] Nelson, R. A. (1989). On the measurement of capacity utilization. The Journal of Industrial Economics, 273-286.

and devices can significantly reduce line capacity utilization. Based on this, one of the basic goals when measuring capacity is to identify, ie measure how much time is needed for a particular operation performed by organizational employees and how you can improve that operation to reduce the time required to prepare the machine.

On the other hand, it should be noted that capacity can be significantly reduced if an organization produces non-compliant products. The basic goal is to convert all raw materials, ie all resources, into output products in the first passage through the line, since each subsequent passage through the line increases costs and reduces the efficiency of the process.

2.2 CAPACITY PLANNING

Capacity planning is a method for estimating the production capacity that an organization needs to meet the changing requirements for its products. Project capacity is the maximum amount of work that an organization is able to perform in a given period of time in terms of capacity planning. Furthermore, the ability of the organization is the total amount of work that the organization is able to do in a given period of time due to limitations such as concerns about quality, delays, handling of materials, etc.[105]

The difference between an organization's capabilities, or its capacity, and customer requirements results in inefficiencies, either in unused resources or in unmet customer demand. The goal of planning is to eliminate that difference. Demand for a company's capacity varies depending on changes in production, such as increasing or decreasing the amount of production of an existing product. Existing capacity can be best exploited by changes in the overall performance of machinery and equipment, by adding new methods, equipment and materials, by increasing the number of staff or machinery, by increasing the number of shifts or by obtaining additional production facilities, capacity can be increased.[106]

In terms of capacity planning, two principles are key - critical directions and bottlenecks. Unlike other options, a bottleneck is a process that has the ability to produce a significantly smaller amount of product than the rest of the whole. This has a cascading effect as capacity is reduced throughout the process. In the case of a specific individual or department, measures should be identified and defined to reduce or eliminate the bottleneck.[107]

Therefore, for capacity planning, it is necessary to analyze or measure the current capacity available to the organization and based on current capacity and coping with market demand, or the ordered quantity of products, to undertake activities aimed at increasing capacity.

3. LEAN PHILOSOPHY

The Lean philosophy originated within Toyota's production system, or TPS, after the end of World War II. The basic goal of the Lean philosophy at that time was to increase the flexibility of the organization, i.e. production, so that the organization could compete with the much more developed economy of the United States, i.e. so that it could use the limited resources available to the organization. [108] As such, Lean philosophy emphasizes the importance of eliminating process waste from the organization, and process waste means unnecessary movements, unnecessary transport, non-compliance, overproduction, inventory and intellectual waste, or insufficient use of potential employees. The presence of such activities in the process

[105] Buxey, G. (1989). Production scheduling: Practice and theory. European Journal of Operational Research, 39(1), 17-31.

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significantly prolongs the duration of the process, i.e. significantly affects the efficiency of organizational employees.[109]

For each type of process waste, the Lean philosophy defines a set of tools and methods by which such activities can be reduced, or by which the business process can be improved, and thus employee efficiency. Employee efficiency is seen as the ratio of value-added activities to the total duration of the process. In other words, the longer the duration of value-added activities, the lower the efficiency of the process, and thus the lower the capacity utilization of the organization.

However, one of the fundamental principles that is of particular importance when talking about increasing the capacity utilization of the organizational process, and on which lies the Lean philosophy is the constant improvement of the process, i.e. reducing the duration of all activities that do not add value. In other words, this approach focuses the focus of employees on activities that are aimed at meeting the requirements of stakeholders and customers.

4. TOOLS AND METHODS OF LEAN PHILOSOPHY FOR INCREASING CAPACITIES

One of the fundamental challenges faced by today's organizations is better capacity utilization, and based on the challenges that can be identified in organizational processes, it is necessary to define measures to eliminate all bottlenecks in the process, and to make existing capacity as possible used more. To achieve greater capacity utilization, the organization can apply the tools and methods developed within the Lean philosophy, which, along with their application, are shown in Table 1.

As can be seen from Table 1, the Lean philosophy and the application of the tools and methods of the Lean philosophy represent the optimal way to increase the capacity utilization that an organization has. Through the application of 5 + 1S tools, the organization can significantly influence the better organization of the workplace, ie the position of the tools used by organizational employees. On the other hand, all obstacles due to which employees would move more slowly around the production plant are eliminated, the ergonomics of employees' work is increased, which in the long run can result in reduced time needed for organizational employees to perform certain activities in the process. Consequently, it increases the time that employees spend performing activities that add value, which also affects the increase in capacity utilization. [110]

Table 1: Tools and methods for increasing the use of capacities

Method name	Description	Impact on capacity
5S+1S	It refers to achieving workplace cleanliness, better workplace organization, easier access to tools and machines used in the process.	Employees reduce unnecessary and unwanted movements resulting in their greater efficiency.
Just in time	It refers to delivering all the necessary resources on time to the organizational process thus	Arriving resources at a precisely defined place at a precisely defined time reduces the need to wait,

[109] Arunagiri, P., & Gnanavelbabu, A. (2014). Identification of major lean production waste in automobile industries using weighted average method. Procedia Engineering, 97, 2167-2175.

[110] Omogbai, O., & Salonitis, K. (2017). The implementation of 5S lean tool using system dynamics approach.

	reducing waiting.	and thus increases efficiency.
SMED	It refers to the process of simplified replacement of individual parts of machines and devices so that they can be adapted to the new series.	By reducing the time of replacement and preparation, i.e. cleaning, the utilization of machines increases.
Kanban	It means simpler inventory management as well as simpler and better workplace organization.	Because of the clarity of the tasks that need to be done, employees are significantly faster and get the job done as well as ordering supplies on time which reduces waiting times.
Heijunka	It refers to the equalization of the output of each of the machines and devices used in the process..	It has a significant reduction in the queue or through the equalization of the capacity of each machine; the input and output of each machine are equalized.
Poka-Yoke	It refers to the reduction of the possibility of problems in the process, i.e. the possibility of reducing employee error, and thus reducing the need for rework.	By defining the way in which employees must do their job, activities are standardized, i.e. the possibility of employee error is reduced.
Jidoka	It refers to automation in the process, i.e. automation of all activities that are performed manually, and thus reduces the possible variability that may occur when employees perform the same activities.	Through automation, the acceleration of the process is significantly influenced, which also increases the capacity in the process.

Source: Author work

In addition to the application of 5S + 1S, the organization can also apply the SMED method, which involves the organization of the replacement of machine tools in production, in the shortest possible time. Therefore, shorter preparation time of the machine, i.e. its cleaning increases the possibility of using its capacity, which affects the overall efficiency of the organizational process. Furthermore, one of the approaches to the organization of stocks, i.e. reducing the need for stocks is the delivery of the necessary resources on time to the process, or in accordance with the process. This approach significantly increases employee efficiency as employees do not have to move for resources, but resources get to where employees work.[111]

In addition, through the application of the kanban system, organizational employees may notice in time that certain resources needed for production are missing as well as

[111] Sousa, E., Silva, F. J. G., Ferreira, L. P., Pereira, M. T., Gouveia, R., & Silva, R. P. (2018). Applying SMED methodology in cork stoppers production. Procedia manufacturing, 17, 611-622.

that they can order them in time. Furthermore, by applying the kanban board, which implies defining the activities that need to be performed as well as defining the employees who are in charge of performing a particular activity. Thus, the organization of work is significantly affected, as well as the better utilization of work, i.e. organizational employees.[112]

However, one of the most important tools that an organization can use to make better use of capacity is heijunka, which means equalizing production, i.e. equalizing the output of all machines used in the plant. This reduces the possibility that a single machine or individual employee produces significantly more than the rest, which will result in the creation of queues, especially if it is a serial connection between machines and devices, or organizational employees.[113]

5. CONCLUSION

The capacity of each organization is determined by the amount of products and services that the organization can produce in a given time. The capacity of the organization should be planned because the demand for products or services that the organization offers in the market is subject to variability, and thus comes to the application in the required quantity. Given that, in order for an organization to meet demand as much as possible, it is necessary to manage capacity as well as plan capacity. Through capacity planning, operating costs in the process can be significantly reduced, which also affects the final profit of the organization.

Based on this, one of the goals of every organization is to increase capacity utilization, ie to increase the efficiency of employees involved in the process. The lower the efficiency of employees, the lower the utilization of organizational capacities. In order to make the most of the capacity of the organizational process or the capacity of the organization as a whole, the organization can use a number of tools and methods derived from the Lean philosophy, which aim to increase the flexibility of the organization. By increasing the flexibility of the organization, the ability of the organization to respond to requests for products and services, ie to adapt to demand, is significantly influenced. Organizational flexibility, given the variability in demand, is one of the characteristics of competing organizations due to the growing changes in the market and the imperative for organizations to adapt to emerging conditions.

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