

# Strategic Planning of Production Capacities in Textile Enterprises

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## Abstract

In the article the author studied the process of planning production capacities at textile enterprises. The author considers the production capacity as a reflection of the maximum possible release of the ready-to-sell products of the relevant nomenclature within the established timeframe while effectively using the production potential of the enterprise. This implies the full use of all economic resources based on the use of advanced technology, advanced forms and methods of organizing labor and production. An important task for enterprises in the use of production capacity is to plan production capacity. Since in the case of not matching the production capacity to the parameters of the market environment, the enterprise has the risk of losing its target market due to the expectation of manufacturing an order or the capture of a larger market share by competitors. Otherwise, excess capacity will cause problems in the formation of market demand, which will inevitably lead to loss of income due to excessive costs to maintain the production system in an optimal state, such as: inventory, depreciation, staff salaries. Founded that solving the problem of planning production capacity lays the foundation for ensuring rhythmicity. The concept of strategic capacity planning relies on achieving economies of scale and development curves, focusing the capacity and flexibility of production. At the end of the article has been visually presented the process of capacity planning and suggests the decision tree, balance models, breakeven analysis and sensitivity analysis as evaluation methods for solving the design problem of production capacity.

## 1 Introduction

In 2017, 34 investment projects worth \$ 356.9 million were realized in Uzbekistan in the textile industry, writes *kommersant.uz*, citing data obtained by the Association of Textile and Clothing and Fabrics Enterprises (Uztekstilprom). The projects concerned modernization, technical and technological re-equipment of existing enterprises and the creation of new plants. Their export potential is estimated at 151.7 million dollars, whereas in 2017 the volume of exports of enterprises in the sector, according to preliminary estimates, amounted to 1.16 billion dollars.

Uzbek textile products are supplied to more than 50 countries. The share of products with high added value was over 40%. If in early 2017 there were 293 exporting enterprises, then by the end of the year their number had reached 350. The growth of export indicators of the sphere is supported by the work of 64 trading houses operating in different countries of the world. To date, about 7,000 enterprises of the industry are operating in the republic, capacity for production of cotton fiber in the amount of 1.4 million tons has been created, of which about 60% is used to meet the needs of domestic textile enterprises. And this causes the development of a strategy for the use of production capacity at textile enterprises (Yarnsandfiber, 2017).

## 2 Literature Review

The main methodological views of resource management were formed in the classical works of scientists N. Douglass (N. Douglass, 1994), A. Marshall (A. Marshall, 1879), C. J. McNair and Richard Vangermeersch (C.J. McNair and Richard Vangermeersch, 1998) and R.B. Chase (R.B. Chase, 1981). The most famous great contribution to the research and definition of the theory of control of production capacity was made by these scientists.

Also, the issues of production funds were discussed in the scientific works of CIS scholars of economists as well as V.A. Vodyanov (Vodyanov A., 2006), N.L. Zaitsev (Zaitsev N.L., 2004), I.M. Petrovich (Petrovich I.M., 2002), R.A. Fatkhutdinov (Fathutdinov, R.A., 2001). In their scientific works are considered the management of production capacities of industrial enterprises. In Uzbekistan theoretical questions were engaged in theoretical questions of management of the industrial enterprises and organizational features have been studied by leading local scientist-economists as M. Sharifkhodjaev (M. Sharifkhodjaev, 2001), S.S. Gulyamov (S.S. Gulyamov, 2006) and N.K. Yuldashev (N.K. Yuldashev, 2012). Results of research works about dynamic Capacity Management with General Upgrading was published by Yueshan Yu., Xin Chen and Fuqiang Zhang (Yueshan Yu. et al., 2005).

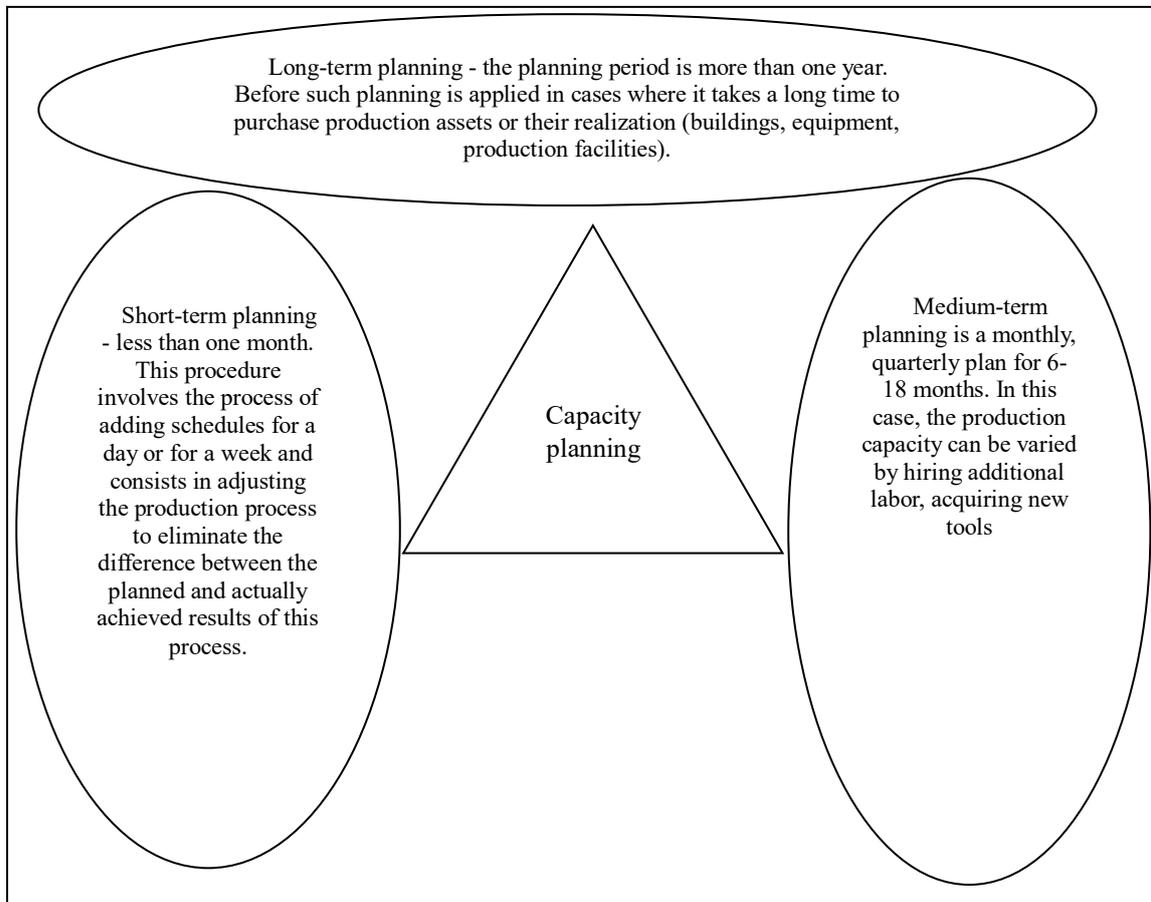
## 3 Production Capacity and Capacity Planning Types

### 3.1 Capacity Planning Types

Capacity planning in project management means obtaining or creating the necessary capacities in the form of suitable employees. In doing this, you have to constantly look ahead. At the same time, you have to consider the company's strategic goals – the basis for corporate success (theprojectgroup, 2108).

Capacity planning is a long-term solution that establishes the overall level of the company's resources. It extends far beyond the forecast horizon for the acquisition of resources. Decisions on the volume of capacity affect the

duration of the production cycle, the response of consumers, production costs and the competitiveness of the enterprise. Inadequate capacity planning can lead to loss of consumers and business. Excessive capacity can deplete the company's resources and prevent investment in more profitable enterprises. Depending on the period of the period for which the capacity utilization planning is carried out, the long-term, medium-term, and short-term are distinguished (Fig.1.).



*Figure 1. Scheme of Capacity Planning Types.*

It should be noted that the long-term capacity planning should be handled by senior executives and they must also approve a plan. In the process of independent study of the deep assimilation of the position on capacity planning will contribute to understanding the concept of capacity planning. In the world practice at the present stage, the concept of the best operational level is widely used. The best operating level is that capacity for which the average unit cost is at a minimum. Note that as we move down the unit cost curve for each plant size, we achieve economies of scale until we reach the best operating level. and then we encounter diseconomies of scale as we exceed this point (theoperationsmanagement,2018).

This is the level of production capacity for which the production process was designed and, consequently, the volume of production (the cost of production), at which the average unit cost of production is minimal. The definition of this minimum is a complex task, since in the course of its solution it is necessary to take into account the relationship between the distribution of fixed overheads and the cost of overtime, the degree of equipment wear, the level of marriage and other costs. An important indicator is also the utilization factor of production capacities. Designing production capacities is a field of strategic decisions related to a significant amount of capital investments. The design capacity, on the one hand, sets the upper limit of the possible output volume, and on the other hand - determines the lower limit of the required operating costs. The goal of strategic planning of production capacities is to create the necessary level of consumed resources - production space and equipment, the total volume of labor - in order to implement the company's long-term competitive program. The established level of production capacity directly influences the choice of strategic approaches to the management of the production system, as well as the indicators of strategic evaluation of the performance of the enterprise: - the ability to respond in response to the actions of market competitors - to block their attacks; - adaptation of production following fluctuations in market demand - systematic increase or decrease in output; - transformation of the value chain and changing the structure of production costs in order to ensure a competitive advantage; - selection of a general policy for managing inventories - a positioning strategy products; - efficiency of management of production personnel - selection, reception and rotation of staff.

### 3.2 Proportionality of Production

In the event that the production capacity does not match the parameters of the market environment, the company may lose its target market due to slow customer service (waiting time for order making) or the competitors' capture of a larger market share. Otherwise, excess capacity will cause problems in the formation of market demand, which will inevitably lead to loss of income due to excessive costs to maintain the production system in an optimal state (inventory, depreciation, staff salaries). Solving the problem of strategic production capacity planning paves the way for the formation of a rational model of the production rhythm by creating the necessary conditions in the implementation of key principles of production organization. First, the required degree of conformity of the production program of the enterprise (according to the nomenclature, volumes of output and labor intensity) of its production capacity is provided (in the context of each planning period for all levels of the hierarchy - workshop, site, workplace), which means the realization of the principle of proportionality. Proportionality of production is supported by the timely replacement of tools, increasing the level of mechanization and automation of production. This, in turn, requires a systematic approach to solving the issues of reconstruction and technical re-equipment of production, planning the development of new production capacities. Secondly, carefully planned development of production capacity ensures compliance with the principle of the continuity of the production process by minimizing losses due to the continuous loading of workplaces and the continuous production of labor items, which determines the key condition for the most efficient production process. Third, one of the main tasks of capacity planning is to ensure the necessary level of production flexibility - labor mobility, the rapid transition of production sites to the production of new products, the use of alternative technologies and methods for obtaining blanks.

### 3.3 Conceptual Bases of Strategic Planning.

The need for a strategic approach to the design of production capacities lies in the company's desire, on the one hand, to maximize the effect of output scale and achieve the highest degree of productivity growth; on the other hand, to limit the number of tasks performed to improve management efficiency and to ensure maximum flexibility of production systems. The concept of the scale effect of the issue determines the possibility of gaining advantages in the field of logistics, organization of the production process, product distribution system, strategy and marketing tactics due to the increase in sales volumes. A direct possibility of obtaining additional economic benefits is associated with a decrease in average unit costs per unit of output. Expansion of production capacity in this case will lead to a greater market share, which means a further growth in production, ensuring a progressive reduction in the cost of production. With the increase in the volume of output, the value of fixed costs per unit of output tends to decrease:

$$C/Q \rightarrow \min, \quad Q \rightarrow \max$$

here  $Q$  – volume of production in natural or value units;

$C$  – constant costs associated with the production and sale of products.

Savings are primarily due to a reduction in the costs of operation and maintenance of production equipment, general workshop and general factory costs. The gain can be obtained due to the purchase of significant volumes of the initial components of production: both circulating assets - raw materials and materials, and fixed production assets - design and purchase of production lines. Efficiency is increased due to a more complete use of production resources - increasing the shift and utilization ratio of equipment, optimizing material (transport) flows on the basis of rational choice of the movement of labor objects on the operations of the technological process. In the final analysis, the development of such a situation positively affects the maintenance of the rhythm of production through the organization of the highest degree of continuity on the basis of a full and proportional resumption of the production process. However, at a certain stage in the development of production, there arises the problem of a negative effect (Galloway L., 2001) - limiting the ability to match the parameters of market demand. With the growth in production scale, in order to continuously support demand at a level that provides full capacity utilization, a company can (and in some cases simply have no choice) to make significant discounts from the price of the manufactured product, which negates the scale effect. The theory of the effect of mastering production (learning curves) is a reduction in the cost of production as experience is accumulated. If there is a development effect in the industry, the company, which first started manufacturing products, can get a competitive advantage due to low costs:

$$V_c \rightarrow \min, \quad Q_{\text{output}} \rightarrow \max$$

here  $Q_{\text{output}}$  – accumulated (over time) output;

$V_c$  – variable costs per unit of output.

Reduction of variable costs is primarily due to the growth of labor productivity due to improved methods of organizing production. At the first stages of the development of production, considerable involvement of labor and material resources is needed, which is expressed in high costs. A further increase in the volume of production of new products determines the tendency to reduce the labor intensity of its production. In turn, the dynamics of labor input conditions the process of reducing the variable costs attributable to the manufacture of one product. The effect of product development is most clearly manifested in conditions of mass and serial production. In a single

production, it is almost invisible. Using the opening opportunities in terms of economies of scale, the enterprise gets certain advantages in the competitive struggle due to the organization of production with lower costs and the implementation of an aggressive strategy in pricing and increasing market share. Initially, having designed significant production capacities, the company gets an opportunity to produce more than its competitors, which leads to price leadership. Keeping this strategy, the company can rapidly increase production volumes, which will allow it to increase the speed of advancement along the curve of experience, which means that it will reduce costs and increase the volumes of possible production (Brazhnikov M.A. and Khorina I.V.,2006).

However, in order for such a strategy to have certain chances of success, certain conditions must be in place. First, the produced products must meet the needs of consumers in terms of quality, functional parameters and service support. Secondly, the level of demand (by segments of the planning horizon) should be large enough to support significant production volumes. The concept of focusing production - the greatest efficiency of production - is achieved if the company concentrates on the performance of a limited number of specific production tasks. No company is simply unable to ensure simultaneous achievement of maximum results for all indicators of production efficiency:

- striving for low costs (cost of products) and ensuring the quality of products; - growth in the coefficient of development of production of new products and increase in the operational reliability of products;
- reduction of the time of preparation of production and minimization of the amount of capital investments for technical re-equipment;
- compliance with the deadlines for the execution of the received order and the development of adaptability of production to the conditions of market demand.

As follows from the presented (far from complete) list of indicators of production efficiency, often the tasks outlined simply contradict each other. In other words, the desire to expand the scale of production rests on the barrier of negative effect, which was mentioned just above. In addition, in huge corporations it is difficult to provide the necessary level of management effectiveness due to slowing the speed of decision-making. Because of this, the company can provide the required level of efficiency, only focusing on a limited number of production tasks that most meet the requirements of implementing operational and corporate strategies. The concept of focusing capacities in practice is often realized through a so-called "plant in the plant" - PWP (Plant within Plant). The capacity focus concept that can be operationalized through the mechanism of plant (Quizlet,2018).

With the uniform consolidation of production tasks (technological operations) behind individual production units, the prerequisites for the optimum utilization of production capacities and the reduction of the time of the production cycle are created. Implementation of this approach, in turn, leads to increased productivity and leveling of fluctuations in output volumes - consistent proportional increase in output. Focused production can include several units, each with its own organizational structure, the composition of the equipment used, the management policy, and the methods of controlling the production process. Allocation of productions allows you to concentrate more precisely on the achievement of certain indicators of the efficiency of the production process (highlighting the distinctive competences), simplifying the achievement of rhythmic production (by limiting the scope of the task). The principle of flexibility of production capacities is the ability of an enterprise to react quickly to changes in market demand, increasing (or reducing) production volumes, and also mastering new types of products. A sufficiently high mobility of production can be realized by providing an integrated approach to the design of production capacities. Under these conditions, the task of achieving the effect of mastering production from the point of view of capacity planning should be considered as widely as possible. This is not only the acquisition of savings within the established nomenclature, but also the continuous updating of the composition of manufactured products. From this perspective, the planning of production capacity is the design of a production that has the capacity for rapid reorganization in connection with the development of new products with minimal losses of time and money. This, in turn, requires extensive efforts to coordinate the work - to establish the interrelationship of various participants in production and the development of external production cooperation. In other words, the implementation of the principle of flexibility is a complex task that requires strategic solutions in the context of three key areas: developing the mobility of the production structure, ensuring mobility of the technologies used, and increasing the universality of production personnel.

First of all, mobility is ensured due to the flexibility in locating the structural divisions of the enterprise: the use of easily movable equipment, mobility of partitions, traffic flows - all this allows to increase the enterprise's adaptability to changes in operating conditions in real time. Designing mobile, quickly reconfigurable to new operating conditions of production systems is one of the most controversial tasks in the strategic design of production facilities. The complexity of solving such a problem is concluded, as some authors rightly point out, in overcoming the contradictions between the dynamic content and the inertia of the production structure of the enterprise. On the one hand, this is the trend of continuous renovation of facilities and means of production, the development of which is predetermined by changes in the conditions of competition to most effectively meet market needs, and on the other hand, the solution of the issue of ensuring the stability of the production structure due to the increasing complexity of advanced technology, modern technologies and improvement of methods of

organization of production. As a promising condition for overcoming these contradictions, it is possible to recommend the design of production sites based on the use of automated software-controlled equipment, flexible complexes, processing centers and mobile automatic systems, which allows to increase the speed of production switching to the production of new products using advanced technological processes, (costs) of these processes. The second condition is determined by the fact that flexibility depends on the technological processes used - alternative routes for processing parts, the use of structural substitute materials. Such approaches to the organization of production allow you to move quickly and with little time and resources from the production of one type of product to another. In this case, the enterprise can provide economies of scale by producing different types of products in combination with each other.

One of the possible directions of such development is the application of a technological process with a small number of operations performed, which greatly simplifies the organizational structure of the production system, changes the composition of not only the main technological operations, but also auxiliary works. In turn, this leads to a reduction in the required number of units of technological equipment, a decrease in capital intensity, and in some cases, material intensity and energy intensity of production, ultimately simplifying coordination in the performance of production activities. The third component lies in the fact that the mobility of production is determined by the flexibility of industrial and production personnel-the command organization of labor, the combination of professions, the raising of the level of qualification. The implementation of the principle of staff flexibility requires a modern approach to management not only motivating the performance of production tasks, but also improving the methods of production scheduling that can ensure the timely and accurate change of production tasks. (Brazhnikov M.A., Khorina I.V., 2006.)

## **4 Modelling of Capacity Planning.**

### **4.1 Calculation of Production Capacity.**

The production capacity reflects the maximum possible output of ready-to-sell products of the relevant nomenclature within the established time frame with the effective use of the production potential of the enterprise. This, in turn, implies the full use of all economic resources based on the use of advanced technology, advanced forms and methods of organizing labor and production. Ideally, the composition and structure, as well as the volume of production capacity should be in exact accordance with the factors of the market environment and ensure the optimal placement of work assignments in production units of the enterprise. However, from a practical point of view, the absolute balance of power is impossible due to the uncertainty of the parameters of the external environment and changes in the internal potential of the enterprise. The magnitude of the production capacity of an enterprise or its subdivision is determined by the ratio of the corresponding fund of the equipment operating time to the labor intensity of a unit of production. At the machine-building enterprises, the production capacity is set by the leading workshops, in which the largest part of the installed technological equipment is concentrated. In this case, the annual capacity is usually determined for each group of the same type of process equipment as the ratio of the effective annual fund of the equipment operating time (established units of a certain technological group) to the labor intensity of the output. Based on the calculation of the production capacity of individual units and groups of equipment, sections and workshops of the enterprise, so-called "narrow" and "broad" places are identified and measures for equalizing capacity are planned, including by introducing new equipment or redistributing work assignments. The degree of effective use of the projected production capacity is determined by the ratio of the use of capacity - the ratio of the annual output to the average annual capacity. The need for renewal of production capacity is a search for a possible trade-off between the costs of modernization (bottlenecks) and potential losses (the amount of lost profits and the probability of consumers moving to competitors), as a result of the discrepancy in the level of demand.

### **4.2 Solving the Problem of Designing Production Capacity.**

The costs associated with the renewal or expansion of production capacity include the following items. First, the direct costs of eliminating the output of equipment and direct costs for the procurement, transportation and installation of new equipment. Secondly, the costs of training personnel (hiring and training) and losses associated with the development of equipment (output to design capacity). In general, the process of planning production capacity can be represented by the following sequence.

1. Forming a set of alternative options for designing (expanding) the production capacity. The creation of such an array is dictated by the instability (uncertainty) of market demand in the future period and the degree of validity of the forecast relative to the key factors determining the development trends of the market.
2. Selection and calculation of the assessment indicator (criterion) for each of the options. As a criterion, you can use the size of the expected profit, the amount of sales, the required capital costs, the total costs of production and sales, an increase in the company's market share.
3. Determination of the probability of the development of events: an assessment of the degree to which the production capacity corresponds to the level (conformity of volume) and the nature (conformity of the nomenclature) of market demand.

4. Calculation of the mathematical expectation of the analyzed indicator (evaluation criterion), taking into account the probability of scenario development, on the basis of which the optimal variant of capacity expansion is selected. In a simplified form, the economic and mathematical formulation of the task of forming a production program (in accordance with the established production capacity) can be represented as follows:

We should find the plan  $X = \{x_j\}$ , characterizing the optimal volume ( $x_i$ ) for each product ( $j$ ):

$$Q_m^{\min} \leq x_j \leq Q_m^{\max} \quad (1)$$

$$F_i - \Delta_i \leq \sum_{j=1}^n t_{ij} x_j \leq F_i + \Delta_i \quad (2)$$

$$D_k(X) = \sum_{j=1}^n x_j \cdot d_k(x_j) - \max(\min) \quad (3)$$

$Q_m^{\min}$ ,  $Q_m^{\max}$  – the maximum possible and minimum volume of output within the framework of the considered (m) homogeneous group of products;

$F_i$ ,  $\Delta_i$  – normative value and permissible deviation for each type of limiting resource (i) - time fund, material costs;

$t_{ij}$  – rate of resource consumption (i) per unit of output (j);  $d_k(x_j)$  – the result of the utility function (f) per product (j) - gross profit, production costs, sales volume, market share;  $D_k(X)$  – integral result of the utility function according to plan (X).

Expression (1) reflects the requirement that production opportunities match the nature of market demand. Condition (2) ensures the rationalization of the use of limiting (scarce) types of resources within the limits of permissible deviations. The objective function (3) necessitates the maximization (minimization) of the integral result in terms of gaining a market share, reducing costs, increasing sales volumes and increasing profit or other indicators characterizing the operation of the production system. As evaluation tools (methods) for solving the problem of designing production capacity, you should use decision tree, balance models, breakeven analysis and sensitivity analysis. Effective use of production capacity is a complex problem that not only covers the issues of investment and use of equipment, but is also closely related to the organization, planning, technical preparation and management of production, and also to the increased interest of the enterprise in better use of fixed capital. Low scales of renewal of fixed capital, as some authors note, impede the improvement of the structure of production and largely determine (partial) loading of production capacities at the level of 60%. The effectiveness of substitution and capacity building is ultimately determined by the extent to which the volumes and structure of output correspond to the level and nature of market demand.

If the growth rate of demand exceeds the development of production capacity, then at best the enterprise suffers from loss of potential income - some orders simply remain unfulfilled. The desire to satisfy unreached orders leads to a disruption in the production rhythm. The share of overtime (emergency) work increases, which leads to arrhythmia in the loading of equipment, production workers and direct violations of the technological process, as a result of which quality control of the products is deteriorating. The development of the situation can lead to a sensitive loss of the market share of the company, which means the loss of real (and not potential, as in the previous case) income. Otherwise, if the value of production capacity exceeds the market potential, the enterprise suffers from excessive (unproductive) costs, which again affects the loss of cash flows (income). The surplus of production capacities in conjunction with the desire for maximum use often leads to violations of the proportionality and continuity of the production process, which is expressed in the creation of excess stocks of work in progress. The functioning of a modern enterprise in a dynamically changing environment makes it necessary to solve mutually exclusive problems, a number of authors, developing the thesis of a strategic contradiction noted above - to move quickly to the production of new products and simultaneously introduce new technologies and equipment, improve the quality of products and reduce production costs. From these positions, the general main drawbacks of machine-building production, which hamper the solution of these problems, are the excessive diversity of manufactured products and technological support facilities, the low level of use of technological means - this leads to duplication of technological processes, and hence of the work performed.

On the one hand, the use of universal technological means (especially in the conditions of individual production) allows to ensure the production of a variety of nomenclature positions, differentiating the market offer of the enterprise. At the same time, the application of specific technological operations involves only a small percentage of their technological and production capabilities. On the other hand, as a result of a certain unpredictability of market demand, an enterprise simply needs to have a knowingly superfluous set of technological means, some of which will somehow be unclaimed. Thus, the decision of the issue of strategic planning of production capacities is an integral part of the overall task of optimizing production. The indicator of the level of utilization of the production capacity of an enterprise characterizes the efficiency of using the active part of fixed production assets. Taking into account the accumulated practical experience and the need to reserve production capacity in order to achieve the required level of reliability of the production program implementation, the indicator in question should be used in the system of restrictions of the projected economic-mathematical model.

### 4.3 Ways to Expand Production Capacity.

In general, strategic decisions on capacity planning are related to the justification of an economically feasible size for a long-term period based on the forecast of maximum market demand. The general procedure for determining the value of production capacity can be represented in the form of performing three consecutive tasks or stages:

- development of the forecast of sales volume for the nomenclature positions of the issue - drawing up a forecast plan, choosing a method and developing a model for forecasting trends in the development of market demand;
- determination of the need for equipment (labor) in order to determine the compliance with the magnitude of the forecasted demand identification of a group of resources that limit production opportunities;
- development of a general (conditional) plan for loading equipment and use of production personnel during the planning horizon - determining the total work time fund and estimating the value of the production reserve. Reserves of production capacity expansion.

Due to the fact that the level of production capacity is determined by the size of the available fund of the operating time of the production equipment and the laboriousness of the output program, the expansion of existing production capacities (bottlenecks) is possible within two (see table) of the main directions:

- due to the increase in the available time fund;
- due to the reduction of the labor intensity of the products.

Increasing in disposable fund Time	Reducing labor intensity manufactured products
Increase the number of units installed equipment	Improvement of technological process of manufacturing of objects of labor
Improving the organization system repair and maintenance of equipment	Increase serial production for an increase in the volume of output nomenclature positions Improving the organization system repair and maintenance of equipment
Increase in the coefficient of shifts equipment operation	The expansion of the unification, normalization, standardization of objects of labor
Reduction of individual components production cycle	Updating and upgrading of the established of equipment
Improved use production areas	Increasing the level of technological equipment
Rational execution planning production work	Increased scientific validity of standards time
Deepening of specialization on the basis of development cooperation units	Rational organization of work on workplaces

*Table – 1. Ways to Expand Production Capacity*

Thus, the solution of the task of strategic planning of production capacities lays the basic foundations for the rational organization of the production process and the development of operational production plans. The key task is to search for a compromise between the projected structure of the basic production assets (proportionality of the equipment composition) and the dynamism of the organizational system (the required degree of process flexibility). Strategic decisions on the planning of production capacity in aggregate form are connected with the justification of the required value, determined in the long term based on the forecast of maximum market demand.

## 5 Conclusion

In order to achieve the required level of reliability in the performance of the production program, the indicator of the level of production capacity should be regarded as an unconditional parameter in the system of constraints in modeling the rhythm of production. The need to expand production capacity should be considered in the context of increasing the available time fund and reducing the labor intensity of products. The identification and development of these reserves will not only ensure the expansion of production capacities, but also increase their flexibility. Defining the concept of long-term development of production capacities, it is necessary to find a strategic compromise in resolving conflicting trends. First and foremost, between the desire of the enterprise to maximize the economies of scale and the optimization of the management system (scale reduction - simplification of production), as well as between the tasks of achieving the highest productivity and ensuring the required flexibility of production capacities. It should be stressed once again that the strategic approach to capacity planning reflects the validity of the required production value, determined in the long term based on the maximum values

of the projected level of market demand. Tactical opportunities for varying the production capacity are related, first, with a reduction in the labor intensity of manufactured products; secondly, with the increase in the available time fund for the operation of the installed equipment.

In view of the modeling schedules noted above, it is important to ensure the uniformity of the utilization of the capacities used for interchangeable groups of workplaces in the context of each planning and accounting period. AT volume-dynamic model of the production rhythm, it is necessary to combine the processes of manufacturing products and processes of loading production capacities both in space and in time. The model defines the key elements of the process control mechanism:

- unidirectional material flows in the form of typical schemes of movement of objects of labor on operations of the technological process;
- complex planning and accounting units (homogeneous groups of products);
- the composition of reasonable calendar and planned standards that ensure the stability of the production system;
- a dynamic method for planning the course of production based on minimum advances between the stages of the production process, ensuring the timeliness of the production program and the continuity of the loading of production units.

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