

# Theoretical Fundamentals of Introduction of Economic Production in Industrial Enterprises: Principles and Functions

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**Abstract.** This article explains the interpretation of the concept of "economical production" and reveals the theoretical essence of this concept.

**Keywords:** Cost-effective manufacturing, industry, product manufacturing, system, enterprise.

## I. INTRODUCTION

In the framework of this study, the systematization of the methodological apparatus of the modern state of economical production (TI) includes the concepts of economical production, theoretical and practical principles of economical production, comparative analysis of approaches and methods of introduction of economical production, the current composition of economical means of production containing Scientific works and articles of foreign and Russian researchers published in bibliographic databases of Scopus, ProQuest, e-Library information sources were used in the systematization of the methodological apparatus of the modern state of energy production.

## II. LITERATURE REVIEW

The concept of economy in production was first introduced by John Krafchik. By "saving" (Lean), the author understood that in a new type of production there is nothing superfluous at all. The term "lean" is understood to mean "the ability to work and work productively" (J. Vumek [1] and Dn. Jones). In the books on economical production, lean production in Uzbek has the options "correct", "flat" or "economical" production.

Issue of statistics of competition of small business and private entrepreneurs assessment methods were studied by Odilov R.[5], the empirical research on causal relationship between export and foreign investments in the economy of Uzbekistan based on granger test were made by Mustafakulov S. I.[6], econometric model of production capacity usage of textile enterprises in Uzbekistan were researched by Tursunov B.O. [7,10], Modernization and intensification of agriculture in the republic of Uzbekistan were investigated by Yuldashev N. K., Nabokov V. I., Nekrasov K. V. [8,11], Regional features of industrial production dynamics in the research of textile enterprises financial security in Uzbekistan were studied by Zarova E.V.[9] and et.al.

Many authors (Dennis P. Hobbs, Stefan Ruffa, George Alukal, Lauri Koskela, etc.) describe frugal production as an enterprise management philosophy based on frugal production principles.

However, scientists and practitioners agree in many ways on one thing - cost-effective production is focused on combating losses at all stages of product production and service. To ensure the efficient operation of the system, it is necessary to choose the right means of cost-effective production. The value of a product or service is created by the company's employees at every stage, so it is necessary to carefully train industry professionals who will be loyal and useful to the company.

The policy outlined above is reflected in the principles of frugal production and is implemented through strict adherence to these principles.

Table 1: Classical groups of principles of economical production

Groups of principles	Principles of cost-effective production (TI principle numbers correspond to generally accepted ordinal numbers)
Principles by J. Vumek and Dn.Jones	<ol style="list-style-type: none"> <li>1. Determining value for the consumer.</li> <li>2. Establish a consistent value creation flow.</li> <li>3.Ensure flow continuity.</li> <li>4. Ensuring that the need is "taken away" from the customer.</li> <li>5. Striving for perfection.</li> </ol>

<p>E.. Principles of change in deming</p>	<ol style="list-style-type: none"> <li>1. Make improving the quality of products and services a permanent goal.</li> <li>2. Understand the new philosophy of business management.</li> <li>3. Abandonment of dependence on overall quality management. Quality must be applied to the process of manufacturing a product or service.</li> <li>4. Refrain from selecting suppliers based solely on the price factor. It is necessary to establish a long-term reliable relationship with suppliers and find a single supplier for each product.</li> <li>5. Continuous improvement of production and service systems.</li> <li>6. Putting on-the-job training into practice.</li> <li>7. Leadership training. Management methods need to be reconsidered by managers and the operational management center.</li> <li>8. Minimize negative factors that affect employee performance.</li> <li>9. It is necessary to remove obstacles to inter-functional cooperation.</li> <li>10. Refrain from setting dry slogans and setting goals that are not dependent on employees.</li> <li>11. Change to goal-oriented and quantitative norms.</li> <li>12. Create an environment where employees are proud of their work.</li> <li>13. Incorporate into the curriculum and encourage self-improvement.</li> <li>14. Involve all structural units and staff.</li> </ol>
<p>J. Toyota Principles on Doing Business from Liker</p>	<ol style="list-style-type: none"> <li>1. Make a decision based on the long-term future.</li> <li>2. Organize continuous flow-like processes to identify problems.</li> <li>3. Using the "Pull" system.</li> <li>4. Optimization of workload - "heidzunka"</li> </ol>
<p>Groups of principles</p>	<p>Principles of cost-effective production (TI principle numbers correspond to generally accepted sequence numbers)</p>
	<ol style="list-style-type: none"> <li>5. Stop production to solve quality problems.</li> <li>6. Standard tasks that form the basis for continuous improvement and delegation of powers to employees.</li> <li>7. Use visual control to find the problem.</li> <li>8. Use reliable, proven technology.</li> <li>9. To cultivate leaders in the company who are masters of their profession, who support the company's philosophy and nurture future leaders.</li> <li>10. Build teams committed to the company's philosophy.</li> <li>11. Partnerships with suppliers and business partners.</li> <li>12. To understand the situation, it is necessary to see everything with your own eyes.</li> <li>13. Make a decision after careful consideration of all possible options and implement without delay.</li> <li>14. Creating a teaching organization through self-analysis (hansey) and continuous improvement (kaidzen).</li> </ol>

As part of the study of the theory of frugal production and its current state, the undisputed principles of frugal production have been critically analyzed. An analysis of the composition of these principles showed that there are three classical groups (Ed. Deming's Principles of Improvement, J. Vumek and Dn. Jones's Principles of Economical Production, and J. Laker's Toyota Principles of Doing Business) (see Table 1).

Although the authors differ on the formation of a program of changes in the introduction of cost-effective production and which group of principles of cost-effective production should be based on the organization of production in the enterprise, the basic postulates, including value, means of achievement, corporate culture, continuous improvement participates. Thus, the principles of cost-effective production serve as the foundation for the creation of an "economical enterprise".[12]

The strategic goal of leading a firm in the context of cost-effective production is to achieve the efficiency of the enterprise by reducing costs. Additional goals and objectives in the process of achieving the main (main) goal - optimal delivery schemes aimed at achieving operational and efficient, normative return on equity, uninterrupted customer service, modern production that meets ISO standards, transportation and warehousing costs creation of an enterprise capable of achieving the strategic goals of establishing partnerships with foreign enterprises.

In the context of operational (production) management, cost-effective production management is one of the approaches to the development of industrial enterprise.

There are currently four approaches to operating system management:

- Reserve replenishment system;
- Weak point recovery system;
- Pushing system;
- Traction system.

To determine the best approach to modern enterprise management, a comparative analysis of existing approaches was conducted. Based on various information sources Scopus, ProQuest, e-Library database, it was concluded that there are several ways to introduce cost-effective production in foreign and Russian practice.

The production system (derived from the Toyota production system) approach is mostly used by foreign companies integrated into international activities. Under this approach, the main emphasis in production management is on inter-agency cooperation. Proponents of the production system approach are Jeffrey Liker and Dennis Hobbs.

The Lean system (known as Lean production in many sources) is primarily aimed at saving costs by identifying and eliminating losses and thereby creating value for the consumer. Proponents of the Lean system approach are James Vumek and Daniel Jones.

Disadvantages of U.S. production methods and concepts include: general descriptive nature, business characteristics, lack of consideration of the current situation in the company (conditions for applying cost-effective production), suitability for more manufacturing companies.

The business system approach is used more by large enterprises and corporate business structures. According to this concept, it is planned to apply the methods and tools of management of production systems to all processes and structures of the enterprise. The business system approach is used in conjunction with several other concepts, models, and approaches, such as the Lean system. It should be noted that Lean system and TOC, Lean system and 6 Sigma, Lean system, TOC and Kaizen, Lean system, TOC and 6 Sigma combinations are used in the management and organization of production systems. Thus, the company management tries to take into account the advantages of each approach. However, a single approach is deeply mastered before moving to a format that uses a combination of several approaches.

The Kaizen approach is a basic concept of all production systems. This approach is aimed at continuous improvement of the work and includes quality circles, TPM system, Kanban and other systems.

Recently, the Japanese approach to the introduction of energy-efficient production in Russia - the "20 keys" method proposed by Ivaio Kobayasi - is actively developing. The Japanese version of setting up and managing a production system is a very modern, well-designed and universal approach, which is more expensive for most Russian companies.

There is a new model that has been little studied by Russian researchers and practitioners, and that is the 3S model. Using this model, the authors Bilaerts, Plis, Voeten and Santema propose to manage innovative processes in the value creation system from three perspectives - Continuation, Configuration and Conception, and to evaluate the integration of cost-effective production in the enterprise on the basis of "economy". .

A study of the theory and modern foundations of frugal production has shown that the development of frugal production has been influenced by Taiichi Ohno [Ono, 2008], Masaaki Imai [Imai, 2010], David Mayer and Jeffrey Laiker ( Jeffrey Liker) [Layker, 2010], Edwards Deming (Edwards Deming) [Deming, 2009; Foreign authors and scientists, inventors and industrialists such as Article 14 of the Deming Program for Management]

(see Table 2) have made significant contributions.

**Table 2**

**The double contribution of American and Japanese scientists to the formation and development of energy-efficient production**

Researcher	List of works
Tayichi Ono (Taiichi Ohno)	Toyota - "Toyota Production System" (1950-1970), "Just in time" - "Just-in-Time" (1980) SMED system - "Single minute exchange of die" (1950-1969) Seven latent losses in production created production systems
Sigeo Singo (Shigeo Shingo)	He created a visual management tool in production - "poke-yoke" (1949-1950)
Masaaki Imai (Masaaki Imai)	«Kaizen» концепцияси муаллифи (1986 й.)
James P. Womack and Daniel Johnson	Five principles of the concept of "economical production". Introduced the term "thinking company" - "Lean Thinking" (1996)
David Mayer and Jeffrey Liker	The eighth loss of production marked the 'untapped potential of workers'. The authors of "14 principles of doing business in the style of Toyota."
Edwards Deming	"14 Principles of Deming" (1950) A scientific-rational approach to the management of people and production operations based on the plan-do-see approach (1982)
	Contribution to the development of quality management (1950-1980) Theory of Deep Knowledge (1924)
Joseph Juran	"Quality Spiral" (1951) Annual Quality Improvement, AQI (1964) - author of the concept of annual quality improvement  General quality management system - "Total Quality Management", contribution to the theory and practice of TQM (1950-1960)
Kaoru Ishikawa	"Fish Skeleton" - "Fishbone Diagram" graphical method of analysis of cause-and-effect relationships (1920) Quality Circles (1962)
(Walter Shewhart [Donald, 2004])	"Control cards" - a statistical method of quality management (1924)
Armand W. Feigenbaum	Total Quality Control System (1950)

Russian researchers Adler Yu.P. and Shper V.L., Feldman G.N. and others in their scientific work have studied the origin of Lean from a historical point of view. Foreign and domestic researchers have noted that the formation of modern production approaches to the organization and management of the enterprise was influenced by the developments of G. Ford, F. Taylor, V. Schuhart, E. Deming, J. Juran, I. Goldratt, A. Feichenbum and others.

Based on the results of foreign and domestic research on the introduction and development of energy-saving production and research of various scientists on the development of energy-saving industry, the sequence of development of energy-saving tools from the invention to the present state is described (see Figure 1.8) .

The classical groups of principles of economical production form its basis, and these principles are realized due to a certain set of means of economical production. Determining the sequence of development of energy-saving means of production and the results of research conducted in our country allowed to describe the composition of the means of modern energy-saving production system.

Today, cost-effective production consists of 14 tools: 5S - workplace organization; Haijunka - leveling the production and work schedule; Hansey is constantly self-analyzing; JIT - "just in time" / Just - in - Time system; Kaizen is a constant improvement; Kanban - reduction of inter-operational reserves; MRP - Material Resource Planning; SMED - quick reset / Single-Minute Exchange of Dies; Standard work - standardization of work; Team

work; TPM - Total Productive Maintenance; TQM - quality management system / Total Quality Management; Visual control - visual control; VSM - Value Creation Streaming Mapping / Value Steam Mapping.

The tool differentiation method developed by Taichi Ono is recognized as a traditional method and was developed so that employees and suppliers can understand the ideology of Toyota production system. The system of cost-effective means of production consists of 5 blocks: principles, foundations, conceptual foundations, ideological orientation and tactical means.

The American method of distinguishing between the means and principles of economical production was proposed by James Vumek and Daniel Jones.

The use of cost-effective means of production (taking into account the principles of TI) depends primarily on what changes are required in the activities of the enterprise and how deeply the introduction of cost-effective production in the enterprise. As a result of the study of the theory and practice of the use of economical production, it became clear that the apparatus of economical production is understood at many levels (philosophical, methodological and instrumental).

At the level of tools, cost-effective production is a set of tools for the development of production at different stages of business processes, the organization in general, or its various functional areas. For example, at the tool level, "kaidzen" allows you to improve individual operations, processes and processes. In contrast to the level of tools, at the methodological level of understanding cost-effective production arises the possibility of systematic use of cost-effective means of production. At the methodological level, "kaidzen" is the improvement of the system of basic, management and support processes that provide methodological, informational and organizational support for decision-making. Philosophically, "kaidzen" is a culture of continuous improvement that is unique to the entire community of an enterprise.

### **III. PRINCIPLES AND FUNCTIONS OF LEAN PRODUCTION**

The company's management is also changing the way it understands the importance of kaidzen tools in the process, from solving local problems to changing the way tools are used and business management philosophy.

The use of cost-effective means of production also depends on the organizational components of the company's activities (tasks, quality of staff, organizational structure, applied technologies) (see Figure 1.10). The listed components are inextricably linked with the level of understanding of cost-effective production. The tasks set are local at the tool level. The quality of employees is determined primarily by their professional qualifications. Changes in the structure are reflected in the assignment of new tasks to employees in the course of daily work. The organizational component of "technology" means the development of new means of cost-effective production.

At the methodological level of understanding frugal production, changes in technology require changes in production methods. The quality of employees is assessed by how well the work team is involved in the change process. In the organizational structure, changes in inter-functional coordination may be necessary. The tasks set at this level may involve a comprehensive approach to making changes.

At the philosophical level of understanding of thrifty production, tasks are of strategic importance, special attention is paid to the company's new value system focused on thrifty production, the management structure of the organization is restructured, the whole system of business processes of the company is developed.

At the heart of the proposed method of introduction and development of energy-saving production is a multifaceted conceptual model of the modern content of energy-efficient production. It includes the classical principles of cost-effective production described above, the modern composition of cost-effective means of production, the possible levels of understanding of cost-effective production in the organization, the organizational components of cost-effective production and the scope of changes required.

In order to use the theoretical and methodological apparatus in the company's activities, it is necessary to determine what conditions motivate enterprise managers to understand and use cost-effective means of production at different levels of change with different organizational components. In order to be able to apply the methodological approach being developed, it was necessary to study the practice of applying cost-effective Ini.

Recognition of human resources as a source of increasing the productivity of the organization implies the effective use of employees, creating conditions for them to demonstrate and develop their potential. "Energy-saving technologies" are a topical and in-demand management tool today. Their essence is that losses are eliminated consistently and thoroughly, and, at the same time, production efficiency is increased by maintaining respect for the person. "Energy-saving technologies" are universal and can be adapted to any enterprise and organization. Let's look at the essence of the concept of "economical production".

The concept of "economical production" is formed at the intersection of different disciplines: scientific organization of labor; quality management; psychology; production technology; strategic management; financial management; innovation management; production management; organization of production; human resource management.

Using the presented concepts of "economical production", scientific organization of labor (MIT), theories of product quality and human resource management, the author identified a number of functions of labor activity that determine the productivity of employees.

Quality management is a coordinated activity that ensures that the products (services) produced meet the standards.

The introduction of "economical production" involves the involvement of human resources in the process of optimization. In this case, the "unrealized creative potential" of employees is a kind of loss. Employees are the main resource that ensures the increase of production efficiency in the enterprise (organization). Such a system of personnel management is especially relevant when the organizational structure changes; if labor is optimized; if employees are constantly evolving and their interests are taken into account when making management decisions.

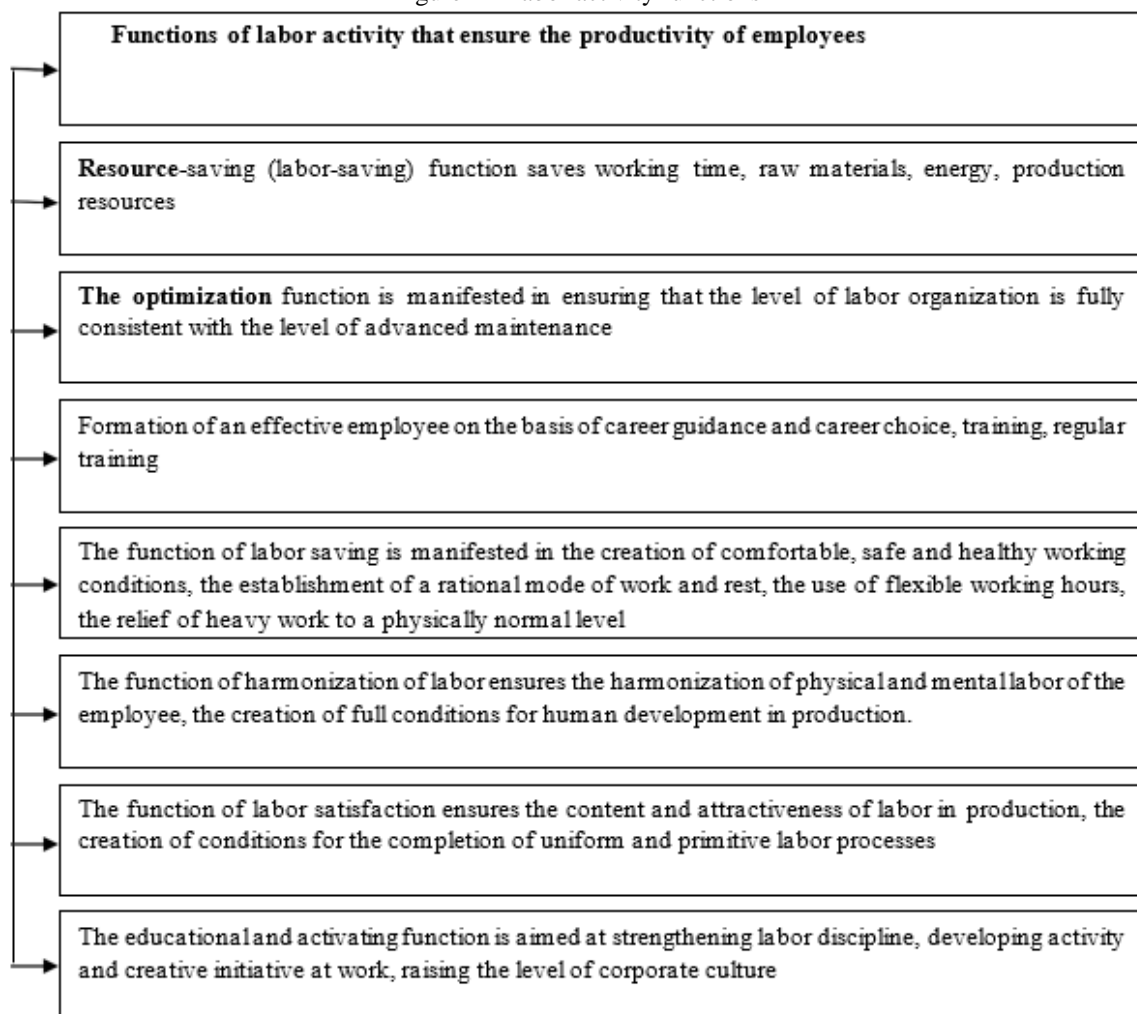
Let's look at the essence of the concept of "economical production". According to the concept's author, Tahiti Ono, "cost-effective production" is a system in which time-consuming but non-value-generating actions are eliminated and conditions are created so that the remaining value-creating actions are streamed into a continuous stream that the consumer "pulls".

According to Liker, "economical production" is a method whose task is to involve all employees in the optimization of processes. The goal of engagement is to continuously improve and increase efficiency through the effective development and realization of human potential on the basis of mutual respect between owners, management and employees.

D. Vumek and D. Jones noted that "cost-effective manufacturing" is a management concept created by Toyota Automotive Corporation and based on the pursuit of seamless elimination of all types of losses. The concept envisages the involvement of each employee in the process of optimizing the business and directing all processes to the consumer as much as possible.

E.A. According to Bashkardin, "economical production" is a complex production system that includes the organization of the workplace, production areas, maintenance and repair, logistics, accounting, other administrative and ancillary services, that is, the planning of the company in general.

Figure 1 - Labor activity functions



N.S. Davidova notes that “economical production” is based on the constant reduction of non-production costs and the continuous improvement of the production process.

Thus, ‘economical production’ is a management philosophy based on the systematic identification of non-production losses and the improvement of the production process. The introduction of "efficient production" requires new approaches to human resource management based on the recognition of employees as the main source of improving the efficiency of the enterprise.

Table 3: Types of losses specific to manufacturing and non-manufacturing enterprises

Losses of manufacturing enterprises	Losses of non-manufacturing enterprises
Excessive processing (operations that do not add value to the product from the consumer's point of view)	Repetition: employees repeat the same function; the need to enter data multiple times, presenting the same data to different components
Excessive effort (staff walking from place to place, moving items and tools. It does not increase the value of the product from a consumer perspective)	Excessive actions (excessive movement of staff for documents, instructions, etc.)
Defects and defects (products that require inspection, replacement and disposal)	Correction of errors in documents, making plans that do not take into account the real situation, plans that are not mutually agreed
Waiting (people, raw materials and supplies, things and tools of labor, breaks related to waiting for information)	Lack of work regulations. Waiting for decisions, documents to be agreed. Consumer service, waiting time for a response, extended service times. There is a risk that the consumer will leave to competitors
Inventories (surplus raw materials, materials, semi-finished products)	Storage of stationery, blanks, office equipment in excess
Transportation (transportation of raw materials and semi-finished products within the enterprise)	Inefficient organization of the employee's workplace, prolongation of the labor process, submission of reports in paper form, lack of clear division of functional responsibilities
Inefficient organization of the employee's workplace, prolongation of the labor process, submission of reports in paper form, lack of clear division of functional responsibilities	Fill in various reports where information is repeated

Based on the above, we express the basic principles of "economical production":

1. Understanding Value - It is important to understand what is valuable to the consumer.
2. Determining the cost-generating flow - It is necessary to study the process of creating value and identify losses that are not related to production.
3. Dealing with losses - reducing or eliminating the main types of losses (waiting, overproduction, transportation of materials, overproduction, stocks, walks from here to there, defects).
4. Product flow - to ensure that the product moves in a continuous flow from the raw material to the finished product through special production cells.
5. ‘Withdrawal’ of production - no work is done unless it is used in subsequent operations, there should be no large stock in the warehouse.
6. Continuous improvement is the process of continuous reduction of losses, reduction of time for work operations, product cost, etc.

When talking about the principles of economical production, Jones and Vumek emphasize that a product or service is valuable in the first place. They say: “... The concept of value is misinterpreted almost everywhere where traditional organization and technology, an outdated notion of scale savings, predominate. Managers around the world say, “We can do this with the equipment at our disposal. If consumers don't like it, we'll lower the price or run a sensational advertising campaign. ” In fact, the concept of value must be radically reconsidered through the eyes of the consumer. ”

In economical production, the goal is not only to make a profit, but also to create a product or service that satisfies the consumer to a high degree, that is useful to him, that he feels needed, that is valuable to him. To do this, marketers constantly study the market, conduct surveys, study the experience of using a similar product, study in detail the similar products or services of competitors. Such studies make it possible to determine both the

required product and its properties, description and functions. Determining the value of a product is precisely the first principle of economical production.

Another important principle of frugal production is to establish a flow of value creation. It is with its help that simple production becomes economical production. The main content here is concentrated in the word 'flow'. A value creation stream is a set of all operations performed to produce a particular product. "Flow" means their continuity and uniqueness.

Japanese engineers changed the philosophy of flow. In organizing all the processes and directing the flow, the main focus is on the continuous movement of the body and products. They should always be at work, not lying in an unknown amount near a warehouse or workplace. This philosophy became the prelude to economical production. According to Vumek and Jones, "All people should refrain from trying to divide the work into parts and do it piece by piece, because there is a more efficient method in which the product is continuously processed as it travels from raw material to finished product. In order to increase efficiency, all attention should be paid not to the enterprise and equipment, but to the product and its needs.

Economical production is able to not only change the situation with a little correction, but also radically change the order in the firm. It's not when you and your employees work badly. Simply put, the introduction of cost-effective production in the enterprise will reduce the time spent on production, reduce waste and increase productivity.

The basic principle of thinking in the form of economical production is to create value. Value is the behavior that the consumer is willing to pay for. The action that creates value must meet the following three criteria: the first is that the action is necessary for the consumer. The second is that this action changes the form / function of the Product / Service, thereby bringing it closer to its final state. Third is the training to take on the attitude of success and achievement while undergoing emotional states.

The next principle of economical production is to eliminate losses.

Any action that does not create value is a loss. There are 8 types of losses:

- Overproduction
- Excess reserves
- Defects
- Actions that do not create value
- "Wait."
- Excessive effort
- Transportation
- Unused potential of employees.

If the habituation process is observed, it can be seen that all behaviors that are not focused on value creation occupy 50-90 percent of the production cycle.

The principle of process flow / product and information flow continuity is in continuous motion FROM BEGINNING to END. The goal of any process is to organize the product or information to be in constant motion flow from beginning to end. Difficulties that prevent flow:

Flow inefficiency. All efforts should be aimed at controlling the flow, and action should be taken if discrepancies are identified.

The flow is out of bounds. In doing so, the process goes beyond its capabilities. It is important that professionals working with flow understand its limits. Going beyond the boundaries of the process also leads to losses.

The "pull" principle is characterized by having a clear idea of how many products are needed, which allows you to know in advance the amount of raw material needed and how often it needs to be replenished. The "withdrawal" system is also characterized by the small size of lots and the low level of work in progress and inventories. The "pull" system forms a management style characterized by the presence of notification and signaling systems, as well as an advanced communication system.

The main goal of any process is perfect efficiency. For economical production, creating a lossless, invisible and perfect production flow will be the solution to this task.

What are the main means of economical production?

5S Method (Selection, Organization, Order, Standardization, Discipline, (+1) Security).

Elimination of losses.

Determining the clock and speed time required for the process.

Creating and using a kanban system (alarm system). The goal is to reduce work in progress and losses.

Using the Poka Yoke method (Error Protection System). Detection of errors from the beginning.

Creating a rhythmic raw material / information flow.

Reduce the time spent on shift shifting to a few minutes (instead of hours).

Andoni method, or the use of a visual alarm system to indicate that the workshop requires attention.

When it comes to the principles of economical production, it would be wrong not to mention a principle that is



simple at first glance, but difficult to implement. Without this principle, all plans will remain on paper. It requires the fulfillment of two conditions for the introduction of economical production. The first is a firm intention to set up and adhere to cost-effective production. This intention should occur in the management of the enterprise and become a tool to guide the whole team in the right direction. Economical production is not a one-time event, but a way of working and a direction of action for all employees. Economical production is not applied externally, for example, by order from above or by invited consultants. It's not that counselors can't help, they can really help. The point is that the leader and management should lead, not supervise or control this process.

The second and very simple condition is the mastery, practical application and creative development of the principles and means of economical production. It requires constant study of theory, study of the experience of other enterprises, training of employees.

#### **IV. CONCLUSION**

The experience of introducing cost-effective technologies shows that no matter how much employees improve the process, no matter how "economical" it is, new ways of eliminating losses are emerging. The process of improvement and value creation is accomplished through the efforts of employees. Employees are the main asset of the enterprise and the owners of the cultural value of economical production.

An enterprise becomes an "economical" production only if all employees of the enterprise, from the business owner (top management) to the ordinary worker, follow the principles of economical production. For the principles of cost-effective production to be consistent, existing and newly hired employees need to be constantly trained. In addition, not only the operating core, but also the operating system objects, including suppliers, business partners, are involved in the learning process. The concept of hansey is used to complete the logic of economical means of production. Hansey is a part of the company culture and an integral part of the company that constantly enhances knowledge. Constant change, innovation and flexibility have become an integral part of successful business and an indispensable condition for operating in the 21st century without facing a crisis. The new approach requires the development of reading skills. In order to realize the innovative idea put forward by the project team, thrifty enterprises use conscious balancing and standardization. These innovative ideas are standardized and used until a new approach is found. Standardization, combined with innovation reinforced by new standards, forms the basis of a new approach to teaching and the creation of a permanent learning enterprise.

Training in a constantly evolving and training enterprise also includes suppliers. Efficient production expands its boundaries and a complex process of merging independent suppliers into a single network begins. Such a structure is called a 'teaching economy'. Collaborative learning is done through hands-on workshops to improve production, with the supplier being responsible for learning outcomes. These workshops will test different approaches to organizing the work of suppliers.

The successful operation of a "learning economy" requires skilled top management of the manufacturing company, cooperation with suppliers, a culture of continuous improvement and joint training.

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