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THE ENTERPRISES OF THE RK** »

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ABSTRACT

The observed tendency of increasing complexity and uncertainty of the external and internal environment of the functioning of economic entities becomes one of the key problems of effective and sustainable business development. Heads of industrial enterprises are forced to make managerial decisions in the context of reducing the life cycle of goods, reducing profitability of production, increasing speed of technology progress. In economic science and practice it is recognized that effective strategic management is an important factor determining the competitiveness of an enterprise and its ability to sustain development in unstable market conditions. Effective development and implementation of the strategy requires managers to respond flexibly and adequately to changes in external and internal business conditions. In a large number of cases, the management of enterprises is looking for sources of strategic flexibility in the area of financial activity, which, however, has an effect in the short term. At the same time, effective strategic development requires the adoption of agreed decisions in the area of basic, investment and financial activities, not only at the stage of strategy development, but also at the level of current management.

These recommendations determine the main steps to introduce lean manufacturing technology in the management and organizational processes of industrial enterprises.

Recommendations are developed on the basis of experience of practical application of lean manufacturing technology in pilot projects of the enterprise of the Republic of Kazakhstan.

The aim of the pilot projects was to improve processes aimed at increasing worker satisfaction, increasing efficiency and eliminating existing temporary, financial and other losses, and arranging workplaces that ensure the safety and comfort of employees.

The document describes in detail the recommended sequence of actions for the implementation of projects of improvements based on lean technology and provides examples.

АННОТАЦИЯ

Наблюдаемая тенденция повышения сложности и неопределенности внешней и внутренней среды функционирования экономических субъектов становится одной из ключевых проблем эффективного и устойчивого развития бизнеса. Руководители промышленных предприятий вынуждены принимать управленческие решения в условиях сокращения жизненного цикла товаров, снижения рентабельности производства, возрастающей скорости прогресса технологий. В экономической науке и практике признано, что важным фактором, определяющим конкурентоспособность предприятия и его способность к устойчивому развитию в нестабильных рыночных условиях, является эффективное стратегическое управление. Эффективная разработка и реализация стратегии требует от менеджеров гибкого и адекватного реагирования на изменения внешних и внутренних условий функционирования предприятий. В значительной части случаев руководство предприятий ищет источники стратегической гибкости в области финансовой деятельности, что, однако, приносит эффект в краткосрочной перспективе. В тоже время, эффективное стратегическое развитие требует принятия согласованных решений в области основной, инвестиционной и финансовой деятельности не только на этапе разработки стратегии, но и ее реализации на уровне текущего управления.

Настоящие рекомендации определяют основные шаги по внедрению технологии бережливого производства в управленческих и организационных процессах промышленных предприятий.

Рекомендации разработаны на основе опыта практического применения технологии бережливого производства в пилотных проектах предприятия РК.

Целью пилотных проектов было усовершенствование процессов, направленных на повышение удовлетворенности рабочих, увеличение эффективности и устранение существующих временных, финансовых и иных потерь, а также организация рабочих мест, обеспечивающая безопасность и комфортность работы сотрудников.

В магистерской диссертации детально описана рекомендуемая последовательность действий при реализации проектов улучшений на основе технологии бережливого производства и представлены примеры.

АҢДАТПА

Шаруашылық субъектілерінің жұмыс істеуінің сыртқы және ішкі ортасының күрделілігін және белгісіздігін арттыру үрдісі байқалды, бизнесті тиімді және орнықты дамытудың негізгі проблемаларының бірі болып табылады. Өнеркәсіптік кәсіпорындардың басшылары тауарлардың өмірлік циклын қысқарту, өндірістің табыстылығын азайту, технологиялық прогрестің жылдамдығын арттыру тұрғысынан басқарушылық шешімдер қабылдауға мәжбүр болады. Экономикалық ғылым мен практикада тиімді стратегиялық менеджмент кәсіпорынның бәсекеге қабілеттілігін және оның тұрақсыз нарық жағдайында дамуын қолдайтын маңызды фактор болып табылады деп танылады. Стратегияны тиімді әзірлеу және енгізу менеджерлерден сыртқы және ішкі бизнес жағдайындағы өзгерістерге икемді және лайықты жауап беруді талап етеді. Көптеген жағдайларда кәсіпорын басшылығы қаржылық қызмет саласындағы стратегиялық икемділік көздерін іздейді, алайда бұл қысқа мерзімде әсер етеді. Сонымен бірге тиімді стратегиялық даму стратегияны әзірлеу сатысында ғана емес, ағымдағы басқару деңгейінде де негізгі, инвестициялық және қаржылық қызмет саласындағы келісілген шешімдер қабылдауды талап етеді.

Бұл ұсыныстар өнеркәсіптік кәсіпорындардың басқару және ұйымдастыру үдерістерінде жасанды технологияларды енгізудің негізгі қадамдарын айқындайды.

Ұсынымдар Қазақстан Республикасы кәсіпорынының пилоттық жобаларында тәжірибелік қолдану технологиясының практикалық тәжірибесі негізінде әзірленеді.

Пилоттық жобалардың мақсаты қызметкерлердің қанағаттану деңгейін арттыру, тиімділікті арттыру және қолданыстағы уақытша, қаржылық және басқа шығындардың жойылуына және қызметкерлердің қауіпсіздігін және жайлылығын қамтамасыз ететін жұмыс орындарын ұйымдастыруға бағытталған процестерді жетілдіру болып табылады.

Магистрлік диссертация жетілдірілген жобаларды іске асыру бойынша ұсынылған іс-әрекеттердің дәйектілігі егжей-тегжейлі сипатталады және мысалдар келтіреді.

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LIST OF ABBREVIATIONS

RK – Republic of Kazakhstan

LP – Lean production (manufacturing)

LLP – Limited liability partnership

CIL – Central Institute of Labor

SOL – Scientific organization of labor

TPS – Toyota Production System

SMED – Single-Minute Exchange of Dies

JIT – just-in-time

MVS – The mapping of the value stream

ALCOA - Aluminum Company of America

APS - Alcoa Production System

DMAIC – define, measure, analyze, improve, control

PFIIDC– Program of Forced Industrial-Innovative Development of the Country

MINT – Ministry of Industry and New Technologies

NATD– National Agency for Technological Development

JSC - Joint Stock Company

ISO – International Organization for Standardization

GSTC – German Society for Technical Cooperation

TPM – Total Productive Maintenance

VSM - value stream map

VAT - value addition time

KPI - key performance indicators

1 INTRODUCTION

This chapter mainly focuses and explains the research outline of the study. The flow starts with highlighting the background of the intended study and the problem statement followed by research questions and research objectives. Significance of the study will be the last part for this chapter.

1.1 Background of study

In modern conditions, unstable development of market relations of Kazakhstan companies in the world market, for existence and competition it is required to pay special attention to increasing the efficiency of the production system. This forces business leaders to look for new methods and tools that help to reduce production costs and improve the quality of management itself. Most large companies, which are world leaders in their industries, are using the system on the basis of lean manufacturing principles. The production system, built on this principle, can significantly reduce the costs of production and non-production losses of products, improve their quality level, thereby increasing the competitiveness of the enterprise and gaining confidence from consumers. The essence of lean manufacturing is not to reduce costs, which can subsequently lead to a decrease in product quality, but, conversely, to reduce the losses that are present at each workplace. With the help of lean manufacturing tools, it is possible to look in detail at the entire flow of product value creation, highlighting those processes in which the company bears losses. The important point is that for the introduction of lean production does not require huge financial costs, but requires the readiness of senior management, because changes must occur, from the "top" and "to the roots".

1.2 Problem statement

Despite the wide interest in the concept of lean manufacturing around the world, the number of successful examples of the introduction of lean manufacturing in Kazakhstan enterprises is much less than those that ended in failure or were not completed. In many respects the problem lies in the lack of systematicity. The management selected specific directions and tools that they would like to apply to

improve the performance of a particular process, not always carrying out the necessary preparatory work or considering a complete and detailed implementation program for the entire enterprise.

Consequently, the relevance of the research topic is due to the fact that despite many studies conducted, examples of successful practices for the implementation of this concept, its practical implementation causes difficulties due to the underdevelopment of the relevant mechanisms regarding the application of the concept at the enterprises of the Republic of Kazakhstan. Degree of elaboration of the problem. The formation of lean production as a concept of enterprise management began in the first half of the 20th century, when F. Taylor, G. Gantt, Frank and Lilian Gilbert, G. Ford and G. Emerson laid the foundations of the classical school of management. In subsequent years, it was developed in the works of many Japanese researchers: T. Ono, M. Imai, C. Singo, J. Monden, as well as well-known American and European scientists such as E. Deming, J. Wumek, D. Jones , J. Liker, M. Mascon, M. Rother, J. Michael. The background, features and classification of approaches to the introduction of elements and strategies of Kaizen philosophy are reflected in the works of J. Wumek, E. Deming, D. Jones, M. Imai, J. Krafczyk. At the same time, despite the large number of scientific publications published by foreign scientists, the provisions, mechanisms and instruments for their implementation are in need of concretization and development with reference to the processes taking place in the Kazakh industry.

The aim of the work is theoretical and applied research of the formation and development of the lean manufacturing system, development and justification of the implementation algorithm at the enterprises of the Republic of Kazakhstan.

1.3 Research questions

Thus, the research question is aimed at organizational interaction in the application of lean production tools based on the example of the activities of industrial companies.

1.4 General Object of the study: Lean production system at the enterprises of the Republic of Kazakhstan.

1.5 Specific objective of the study

- 1) to study foreign and domestic experience of introducing the concept of lean production;
- 2) to identify the optimal stages of introducing principles of lean production at the enterprises of the Republic of Kazakhstan;
- 3) to develop recommendations on improving continuous improvements in the lean manufacturing system at the enterprise Corporation Kazakhmys LLP

1.6 Significance of the study

The practical significance of the research is that the results can be used when introducing the lean manufacturing system at the enterprises of the Republic of Kazakhstan aimed at improving the efficiency of the enterprise development, improving the product quality and competitiveness, in accordance with state standards developed in the Republic of Kazakhstan.

1.7 Organization of the study

The study is organized under five chapters. The first chapter is the introductory part which bears Background of the study, Statement of the problem, Research Questions, Objective of the study, Significance of the Study, Limitation of the Study. The second chapter deals with review of related literature and formulation of a model. The third chapter presents the research methodology part discussing the research design, sampling design, method of data collection, and source of data and method of data analysis. The fourth chapter deals with the data presentation of the respondents where in the data gathered is analyzed and interpreted. Finally, the last chapter attempts to summarize the findings; conclude and recommend based on the findings.

2 LITERATURE REVIEW

This chapter discusses the theoretical foundations of formation, as well as the structure, methods, functions, tools of lean production. The chapter also discusses the implementation and development of lean manufacturing concepts in foreign and Kazakhstani companies.

2.1 Theoretical foundations for the formation of prerequisites for lean manufacturing

In order to form and develop a system of lean production (now from the English lean production, lean manufacturing - "lean manufacturing"), individually for each enterprise, a detailed analysis and evaluation of existing works and work of scientists should be carried out. Many researchers have been engaged in the effective implementation of lean manufacturing at enterprises. In this master's thesis, the most outstanding personalities will be considered, whose contribution and experience has largely influenced the development of lean production as a concept of enterprise management.

In the late XIX - early XX century, for the first time, who touched the idea of maximizing the productivity of labor, was an American engineer, the founder of the scientific organization of labor and management, after the school of scientific management, American engineer Frederick Taylor (1856-1915).

Taylor and his contemporaries, who were also representatives of the school of scientific management, G. Gantt (1861-1919), Frank (1868-1924) and Lillian (1878-1972) Gilbert, G. Emerson (1853-1931) and G. Ford (1863-1947), were of the opinion that it is possible to improve the majority of manual labor operations and achieve their more effective implementation, using only observations, measurements, logic and analysis. Taylor proposed to plan in advance the methods of work and the entire production activity of the enterprise as a whole. Work in his system is a key source of efficiency. He argued that workers should receive a salary in proportion to their contribution [1].

Frank and Lilia Gilbert, contributed to the fact that they were engaged in research of work operations and proved the possibility of increasing output by reducing the effort spent on their production. Using cameras in conjunction with a microchromometer, the Gilberts analyzed the elements of operations on the frozen frames and concluded that it is possible to improve the efficiency of work by changing the structure of work operations, eliminating unnecessary, unproductive movements that do not add value. Later, there appeared such a notion as Muda (muda from Japanese - "loss") - any activity that consumes resources, but does not create value for the client.

The closest student of Taylor was G. Gantt, who paid special attention to the problems of human psychology. He worked on developments in the field of premium pay and made a significant contribution to the development of the theory of leadership. Gantt compiled maps for production planning (the so-called Gantt chart, Gantt chart), which are still in use at the project planning stage.

"The twelve principles of productivity" proposed by G. Emerson, in which he outlined his views on the rationalization of production, are effectively used in the practice of management today. Separating the process of organization of labor into components and carefully studying each of them, Emerson investigated the principles of labor activity in relation to any production, regardless of the nature of its activities.

Efficiency (productivity) - the concept introduced by him for the first time means the most favorable ratio between total costs and economic results [2].

Henry Ford believed: "A good organization of work, even with old equipment, is always better than a bad organization with new equipment." Unlike the Taylor system, where manual labor was central, Ford replaced manual labor with machines. [3]. He formulated the basic principles of the organization of production, one of the main principles, I believe, is the mechanization of transport operations. Thanks to the formulated principles, it became possible to create, a stream production, in which, as such, no intervention of the master was required. The worker was forced to adapt himself to the speed of the conveyor and other mechanisms.

Stream production is a production process, divided into separate, relatively short operations, performed on specially equipped, consecutive workplaces - production lines [4].

Creating his production line, Ford took on the arsenal of all the experience accumulated before him. He first separated the main work from her service. Everything necessary for work was submitted to the workplace well in advance and the worker did not need to be distracted to perform auxiliary operations, so he devoted all his working time to performing the operation assigned to him at his workplace.

In 1913, Ford introduced an advanced technology of conveyor production in its factories. The idea of moving tape Ford peeped in 1903 at a meat factory in Chicago, where the animal carcass moved on the conveyor past the butchers on either side of it. Each of them repeatedly made only one movement, cutting off from each carcass one and the same piece of meat and at the end of the technological chain there was only a bare skeleton. Thus, Henry Ford built a production organization system based on the division of workers, the maximum fragmentation of operations of the technological process and the location of technological equipment and workplaces in strict accordance with the sequence of operations performed.

Representatives of the school of scientific management should also include some Russian scientists, one of them Osip Arkadievich Yermansky (1866-1941). He created the concept of a physiological optimum, where he considered such quantities as the amount of useful results achieved and the amount of energy consumed to achieve this result. The main advantage of the concept is that it is necessary to maintain the intensity of labor at an optimal, scientifically sound level, since deviations from a rational norm in any direction result in irrational use of all forces. It was in his works that the first elements of the concept of modern management were born, based on rationalization, production optimization, embodied in the so-called scientific organization of work (SOL).

Scientific organization of labor (SOL) - the process of improving the organization of labor based on the achievements of science and best practices. The tasks that are solved

within the framework of the SOL are the improvement of the forms of the division of labor, the improvement of the organization of workplaces, the rationalization of labor methods, the optimization of the standardization of labor, and the training of workers [5].

A prominent figure in the field of scientific organization of labor and production was Aleksey Kapitonovich Gastev (1882-1939). He wrote a number of articles on this subject, from which it can be seen that successful attempts at introduction of the SOL have been made at domestic enterprises. In 1921 Gastev created and directed the Central Institute of Labor (CIL), where his scientific views and ideas were realized. He was convinced that the main element of the productive forces is man and his labor culture. Culture in the understanding of Gastev is not "erudition", but skill, and it is brought up not by agitation, but by training [6].

In a fundamentally different way than A.K. Gastev, approached the study of SOL and production management Platon Mikhailovich Kerzhentsov (Lebedev) (1881-1940). He singled out three elements in the scientific organization of labor: labor, production and management. And Kerzhentsev attached special importance to the last element and understood under the scientific organization of management the study of organizational methods and the definition of the most rational methods of executing administrative actions, such as the formation of organizational structures, the distribution of duties, planning, accounting, selection and use of personnel, maintenance of discipline. Kerzhentsev formulated his own principles of management, which included: setting goals and objectives, choosing the form of organization, drawing up plans, accounting and control, coordinating the use of human and material resources.

Thus, it can be said that the main focus of the founders of the school of scientific management was aimed at the creation of universal principles of management and the rationalization of production. An orderly idea of rationalization in the sphere of production and management organization is presented by the author in Table 1.

Table 1 -The main ideas of the school of scientific management

Education	<ul style="list-style-type: none"> - Professional training of employees to those functions for which they are suitable;
Staff	<ul style="list-style-type: none"> - Selection of workers and managers on the basis of scientific criteria, professional selection; - division into managers and executors; - a person and his work culture - the main element of the productive forces;
Production	<ul style="list-style-type: none"> - separation of main work from service; - specialization of functions in production; - performance by employees of certain functions; - a uniform distribution of responsibility between employees and managers; - accounting and control of ongoing work; - a priori planning of working methods and all production activities of the enterprise; - elimination of unnecessary, unproductive movements that do not add value; - mechanization of transport operations; - the prerequisites for on-line production; - introduction of advanced technology of conveyor production; - maximum crushing of operations of the technological process; - location of technological equipment and workplaces in strict accordance with the sequence of operations performed
Motivation	<ul style="list-style-type: none"> - the system of material incentives was reduced to the satisfaction of the utilitarian needs of workers (ie physiological); - wages are proportional to the contribution to the production process.

Analyzing Table 1. we note that one of the drawbacks of the school of scientific management was that the researchers did not fully understand the role and significance of the human factor and the relationships between employees, which, in the final analysis, are the main element of the organization's effectiveness. Therefore, it is worthy to pay tribute to the school of human relations, which focused on the management of personnel, as a way to increase the efficiency of work, both as an individual worker and as an organization as a whole.

Summarizing, we can conclude that the school of scientific management and the school of human relations are the initial stage in the formation of the prerequisites for a new concept of production management, which has been developed and is relevant at the present time.

2.2 The philosophy of the Japanese production system Toyota Production System

Since the middle of the last century, the Japanese model of the production system (Toyota Production System (TPS)) has been actively developing and developing in Toyota, aimed at reducing and eliminating losses.

In the literature, the concept of TPS is often used along with the expression "Lean Production (Manufacturing)". The term "Lean Production" was first mentioned in an article by John Krafchik titled "Triumph of the Lean Production System", which was published in the 1988 season [7]. In his article, D. Krafchik relies on two years of work as an engineer at a joint venture between Toyota and General Motors in the United States, which was established in 1984.

The literal translation of the American name of the production system "Toyota" ("Lean production") into Russian means thin, lean, lean, low-fat production. However, used in the literature, the most common translation of this term, implies the notion of "Lean Manufacturing".

At the heart of lean manufacturing is the concept of "Kaizen", which in Japanese means continuous improvement, the implementation of permanent improvements, changes for the better.

In order to further explore the lean manufacturing system, let's take a closer look at the concept of the Toyota Production System, the history of its origin.

What is meant by the word production?

Production is a collection of processes and operations.

Process - actions that transform material into products, consisting of a series of operations.

When analyzing the process, the flow of material or products is studied. When analyzing the operation, the activity of workers and machine tools for the transformation of the product is studied.

Any production carried out either in the shop or in the office should be considered as a set of functional processes and operations. To realize the effective improvement of production, it is necessary to clearly understand these basic concepts and their interrelationship.

In 1959-1960, Japan experienced an unusually rapid economic growth. Then the American style - mass production - was effectively used in many industries.

The system of production aimed at increasing the volume of lots (for example, the work of a stamp designed to increase the release of certain parts for a specific period of time) is impractical, not to mention that with this approach, a lot of losses appear. Ultimately, the main purpose of the Toyota production system was the production of a wide range of car models in small lots.

The acknowledged author of the Toyota Production System is the Japanese engineer and entrepreneur, Taiichi Ono (1912-1990). Having inherited the idea of creating a Production System from the founder of Toyota Toyoda Sakiti (1867-1930) and his son Toyoda Kiityrio (1894-1952), he designed and implemented it for 30 years [4].

Taiichi Ono said that "if the company has at least a small profit, it will never build a Toyota Production System, as it simply will not be able to do it. Companies that are on the verge of bankruptcy, who already have nothing to lose, have much greater chances. This is the advantage of those who are close to death. "

Immediately after the war, Toyota had absolutely nothing to lose. Taiichi It competently took advantage of this situation as a good opportunity to begin transformations, to which he was able to break in 1948, when he was appointed manager of the Toyota engine production department.

Three key statements that, when used together, determine the meaning of the Toyota Production System:

1. The basis of the Toyota Production System is the system of absolute elimination of losses;
2. The purpose of the Toyota Production System is to reduce costs;
3. After the Second World War, the main task was how to produce high-quality goods. However, after 1955, the question was - how to make the necessary exact amount.

This system is based on two principles:

- the principle of "just-in-time" (just-in-time);
- the principle of automation, or automation using intelligence.

The "just in time" principle is that during the production process, the parts necessary for assembly are on the production line strictly at the time when it is needed, and in a strictly necessary quantity. As a result, a company that consistently implements such a principle can achieve zero inventory.

An important feature of the Toyota production system is the gradual change in the relationship between the worker and the machine. This is the meaning of the second principle.

Automated machine with an intelligence element in the company of Toyota is a machine equipped with an automatic shutdown device. At all of the company's plants, most of the equipment, new and old, is equipped with similar devices, as well as various

safety mechanisms, precise stop systems, quick changeover devices and "poka-yoke" devices to prevent errors. Thus, the machines are given an element of the human mind.

Automation changes the essence of machine operation. If the workflow proceeds normally, the machine does not need an operator. Human intervention is required only when the machine stops due to a violation of the normal course of the process. Therefore, one operator can serve several machines. Thus, the number of operators is reduced and production efficiency is increased.

Thus, the main features of the Toyota Production System are:

- is a concept that is the basis of production management, based on the principle of subtracting costs; comprehensive exclusion of losses;
- reaction to demand is custom production; rejection of large lots;
- the slogan "minimum workforce"; Toyota recognizes the advantage of machines, whose work will not depend on workers;
- the kanban system;
- Toyota has transformed the traditionally passive production system and created an absolutely original system based on new principles.

2.3 Lean manufacturing system: structure, methods, functions, tools

As a rule, according to the above definitions, lean manufacturing is treated as a management concept / management philosophy / enterprise management concept / business presentation concept / integrated production system that seeks to completely eliminate all types of losses without significant capital investment, covering the entire company or organization as a whole, involving in the process of optimizing the business of each employee in order to create value for the consumer. Each point of view reflects one or another important aspect of the concept being analyzed. However, in my opinion, these points of view require further comprehension and addition. Let's define the term lean production from different points of view (Table 2):

Table 2 - Approaches to the definition of "lean manufacturing"

Author of the definition	Definition
Lean. Basic provisions and vocabulary.	the concept of representing business as a flow of creating value for the consumer, flexibility, identifying and reducing losses, continuously improving all activities at all levels of the organization, involving and developing personnel in order to increase the satisfaction of consumers and other interested parties.
Terminological Dictionary: Economics, Marketing, Management	the management concept created by Toyota and based on a steady desire to eliminate all types of losses (any actions that consume resources, but do not create value for the consumer). The BP involves involvement in the process of optimizing the business of each employee and the maximum focus on value for the consumer.
T. Ono, a Japanese engineer and entrepreneur, recognized author of the Toyota Production System	the basis of the new management philosophy, is one of the forms of non-linear management, based on a steady desire to eliminate all types of losses.
James P. Woomeck (Founder and President of Lean Enterprise Institute), Daniel Jones (Founder and Chairman of Lean Enterprise Academy)	breakthrough approach to management and quality management, ensuring long-term competitiveness without significant capital investment.
D.P.Hobbs, Certified Specialist in Production Management and Inventory Management	This is a technique aimed at systematic reduction of costs. Its task is to design and implement a production line that can produce

	different types of products exactly for the time that is really necessary for this.
U. Levinson (certified quality engineer, quality auditor, quality manager, reliability engineer, and Six Sigma Black Belt.), R.Rerik	an integrated approach consisting in the need to identify and eliminate from all areas of business any actions that do not create added value.
President of Leadership Excellence International (USA), Director of Lean Manufacturing Implementation Group	based on a constant desire to eliminate all types of losses. The central place in the concept is occupied by the consumer - the less losses will be allowed in the production of goods, the lower will be its price and higher quality
Lean Enterprise Institute	leveling resources to achieve the organization's goal and involving everyone in the development of processes to continuously solve problems, increase productivity and achieve the goal of consuming the least possible resources.
According to the dictionary APICS	production, which "emphasizes the minimization of the volume of all resources (including time) used in various types of enterprise activities."

Summarizing the above, regarding the interpretation of the notion of lean production, the following addition is suggested, which has significance in the current conditions of the functioning of companies, in particular in the Kazakhstan market: Lean production is a business philosophy with an appropriate corporate culture that extends to the whole environment of the company, with an integrated approach to understanding the

entire production flow from the point of view of efficiency and considering production as a set of functional procedures and operations.

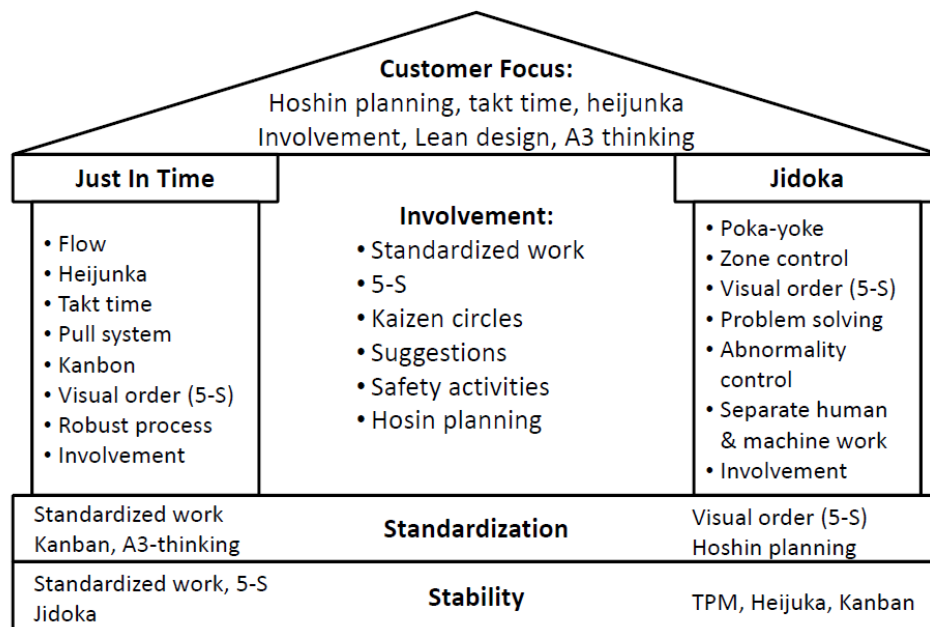
In this master's thesis, with further study of the concept of lean manufacturing and ways of its implementation in enterprises, I will adhere to the above point of view.

In Fig. 1 shows a visualized view of the lean manufacturing system and its tools, which will be discussed below.

The core of lean manufacturing is the process of absolute elimination of losses (from Japan, Muda - Muda), which does not contribute to the operation and does not create value for the consumer.

The creation of value is the basic principle of lean production.

Figure 1 - Lean Production House



Lean Production House [8]

Value is the utility inherent in the product from the point of view of the client. The value is created by the manufacturer as a result of a series of sequential operations [8].

All operations consist of three main components (Fig. 2)

Figure 2 - Components of operations

preparation and subsequent adjustment

* installation operations that are usually performed before and after production of each batch. Relate to useful operations.

main operation

- * basic operations
- * support operations

coercive actions

* these actions occur irregularly and refer to two types: personal (personal needs) and non-personal (not related to personal needs) actions

Components of operations prepared by the author [8]

In the past, most of the products were produced in large quantities, as the changeovers took a long time. Such production led to an increase in the undesirable amount of stocks (Mood). Shigeo Shingo proposed a one-minute Exchange of Die (SMED) system for improving productivity, which became an essential element in the development of Toyota's production system [9]. In fact, the SMED system is a technique that allows you to shorten the time of setup and adjustment operations.

Speaking of value, we note several common actions that create this principle:

1. the action is necessary for the consumer;
2. action changing the form / function of the product / service, thereby bringing it closer to the final state;
3. The action must be performed without defects the first time.

The consumer is willing to pay for compliance with the characteristics of the goods to their expectations. If there is any activity in the production process that does not add value, then this, as was indicated above, is loss.

Consideration of transactions shows that only the main operations add value. Other operations, such as replacing stamps, auxiliary operations and related actions, can be considered losses. Therefore, the improvement of operations is also a form of "elimination of losses".

In order to identify losses, we need to understand their essence, and in order to prevent and eliminate them, we need to consider and understand the essence of the techniques proposed in lean manufacturing. To present and consider in detail all the techniques within the framework of this master's thesis is impossible, since according to the description of each methodology, whole books are written. We will analyze only the most important ones that will be applied in this paper.

According to Titi Ohno, the production losses can be divided into the following categories [4]:

- overproduction;
- expectations, downtime;
- unnecessary transportation;
- unnecessary processing steps;
- superfluous stocks;
- unnecessary movements;
- losses due to the release of defective parts or products.

Jeffrey Liker, who, along with Jim Womek and Daniel Jones, actively explored Toyota's manufacturing experience, pointed to yet another loss: [10]

- Unrealized creative potential of employees.

Losses from overproduction. There are two types of overproduction:

- quantitative - produce more products than required;
- premature - make products sooner than required.

Many managers take as a basis the elimination of quantitative losses, while the premature type of losses of overproduction is pushed to a less significant role, which can lead to the idle time of very expensive products for a few days extra. The products that are in the warehouse are "frozen", and possibly lost money. To avoid this type of loss, the principle "just-in-time" (JIT) is applied [11]. This is one of the main principles of the Toyota production system, which implies that each process must be supplied with the

required products in the required quantity and at the required time, without any accumulation.

Losses from waiting, idle time. The inconsistency between the planning process and the production process, indicates the losses associated with waiting. Planning is a rather complicated process, because it requires analysis of a large number of factors: the structure of customer orders, the state of the raw materials market, the productivity of equipment, etc. As a rule, this process is pseudo-optimal and is based on the subjective approach of people who have some experience in the production.

Other reasons - different capacity of operations, planning is not for the needs of consumers, but for loading equipment and others.

Losses on transportation. Any production is a sequence of operations to convert raw materials to the final product.

But between operations, all these materials must be moved. For example, bring the raw materials to the conveyor belt or take the finished products to the warehouse.

Transportation is an integral part of production, but it does not carry values for the consumer. In addition, transportation is time and risk of damage to products.

In order to reduce losses during transportation, it is necessary to create a map of vehicle routes and conduct a thorough analysis of the expediency of a particular movement. After that, you should try to eliminate unnecessary transport due to redevelopment, redistribution of responsibility (so that you do not have to go through two workshops signed by the controller), etc.

Losses due to excessive processing. As already mentioned, the consumer is willing to pay only for those properties of the goods that are of value to him. For example, a person wants to buy a refrigerator, he has a number of requirements that he must have. One of these requirements is the gray case. The company produces only white, so after the refrigerator is produced, it must be repainted in gray so that it finds its consumer, because it corresponds to all other requirements. Repainting in this case will be an extra

processing, and this is an increase in the time of manufacture, unnecessary costs of raw materials and labor.

Source of loss: not understanding what the consumer wants, the imperfection of technology and the lack of a standard. Before ordering, the manufacturer must carefully study what properties a product should possess in order to eventually find its consumer.

Loss due to excess inventory. At first glance, it seems that the reserves bear the least losses, and in some cases do not carry any harm at all. Reserves seem to be needed, but:

- as already mentioned, stocks are "frozen" working capital;
- stocks need maintenance (storage areas, personnel, logistics, etc.);
- most importantly, the reserves conceal production problems: poor planning, strained relations with suppliers, uneven production flow, and so on.

In fact, reserves hide the losses of other species, creating the impression of a safe working environment. The solution to this problem will be the reduction of the production lot, the adjustment of the production planning and supply system.

Loss of unnecessary movement. Excessive, unreasonable, chaotic movements of workers, which lead to losses. From the side, such movements may seem like an imitation of stormy activity, but the concept of imitation plays a major role in this process. Unnecessary movements and movements do not contribute to creating value for the consumer. The source of the losses is poor organization of work. This includes the lack of necessary instructions, poor staff training or low labor discipline. This type of loss is distinguished by the fact that they can be easily detected and, after discovering, take quite obvious measures to eliminate them. Eliminating the loss of unnecessary movement can be achieved by applying the workplace system (5S).

5S is an instrumental technique of lean manufacturing, aimed at organizing an effective working space (Table 3) [12,13].

Table 3 - Stages of the 5S system

Name of the stage	Summary
Seiri (整理) - Sorting - sorting	release the workplace from everything that is not needed when performing current production operations. It is necessary to clearly identify the "red label zone" of items with red flags and carefully monitor it. Items that remain intact for more than 30 days are subject to processing, sale or disposal.
Seiton (整頓) - Straighten or Set in Order - rational location	Identify and designate a "house" for each item needed in the work area. This is a key condition for minimizing the time spent on unproductive searches.
Seiso (清掃) - Sweeping - cleaning	cleaning up your workplace at the beginning and / or at the end of each shift provides immediate identification of potential problems
Seiketsu (清潔) - Standardizing - standardization of works	This is a method by which you can achieve stability when performing the procedures of the first three stages.
Shitsuke (躰) - Sustaining - maintenance of achieved and improved	means that the implementation of established procedures has become a habit

Losses due to the release of defective parts or products. The release of defective products entails the costs of raw materials, working time, labor, the cost of processing and disposal of the marriage.

Elimination of this type of loss should begin with an analysis of the effectiveness of the functioning of the controlling units. It is necessary to clearly understand how the control services contribute to eliminating the causes of the appearance of defective

products. In any case, control is usually carried out only after the products are produced. Consequently, there is no possibility to influence the quality of the operatives in the controllers. The goal of "zero defects" can be achieved only through control, which will prevent defects, and not detect them.

To completely eliminate defects, tools and equipment must be upgraded, providing them with defect prevention devices.

Poka-yoke is an error prevention method in which work can only be done in the right way and the probability of a defect is to go to zero [14]. A few examples:

- if an error occurs in the work process, the part will not approach the tool;
- if a defect is detected on the part, the machine does not turn on;
- in case of error in the working process, the machine will not start machining the part;
- if one operation is skipped, the next step will not start, etc.

Quality control should become one of the stages of production in the structure of the processes performed.

Unrealized creative potential of employees. Loss of time, ideas, skills, opportunities for improvement and gaining experience due to inattention to employees.

One of the most important tasks to be solved in the implementation of lean manufacturing is the general involvement of personnel in continuous improvement activities - Kaizen, in order to fully utilize the potential of each employee.

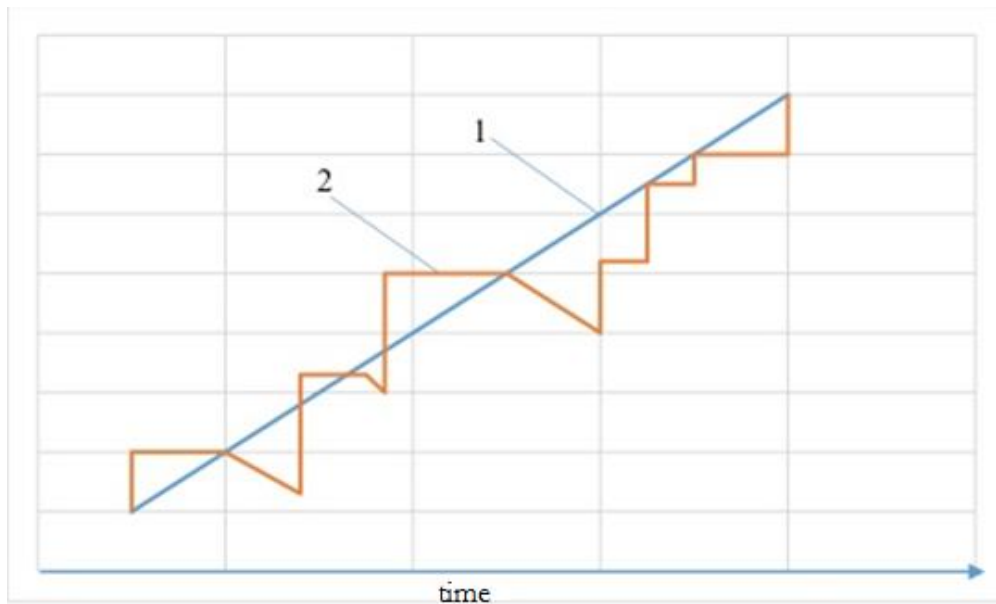
Kaizen is a philosophy of organization of activity, which originated in Japan in the middle of the last century. Translated from Japanese means Kai (Kai) - changes and Zen (Zen) - for the better, which is often translated as continuous improvement [15]. The meaning of Kaizen's approach is to continuously improve the processes of production, development, supportive business processes and management, which do not require significant costs. A striking example of how efficiently the continuous improvement in contrast innovations (innovation) - the effect of which is gradually reduced due to the intense competition and aging standards - can be considered in the comparison table 4.

Table 4 - Kaizen Difference from Innovation

	Innovation	Kaizen
1. Changes	Sharp, transitory nature	Gradual and continuous
2. The pace	Great steps	Small steps
3. Time interval	Periodically, spasmodically	Constant incremental increments
4. Effect	Short-term, but impressive	Long-term, steady, but not conspicuous
5. Approach	Strong individualism, personal ideas and efforts	Collectivism, group work, system approach
6. The driving force	Revolutionary technical solutions, new inventions, new technologies	Traditional technology and ordinary modern technical level
7. Practical requirements	Requires large capital investments, but the volume of current work is negligible	You do not need much resources, but great effort is required

Analyzing this table, we see that the Kaizen approach is a small step toward improvements that require large human investments from an emotional and psychological point of view and do not require great monetary costs. The use of this approach directly depends on how much management is willing to invest in employees. With the help of innovation, you can achieve a high level in the process of work, but this result will decrease if you do not regularly review and improve technology (Figure 3).

Figure 3 - Innovative approach and Kaizen approach



Innovative approach and Kaizen approach prepared by the author [15]

where 1 - application of the Kaizen approach; 2 - application of the innovative approach.

In order to achieve a better result, it is necessary to apply super technologies, it is enough to regularly improve the process that is already available, thereby obtaining no less result.

The most detailed description of Kaizen philosophy is found in the works of Masaaki Imai "Kaizen. The key to the economic success of Japan ", " Gemba Kaizen. The way to reduce costs and improve quality. "

The third principle of lean production is the creation of a continuous flow of work. Actions in the processes should be carried out so that between individual operations there are no expectations, downtime or any other losses. To losses of this kind are two sources of losses - Muri and Moore, which mean, respectively, overload and uneven flow.

Thus, having considered the main types of losses, we will determine how to identify their presence in the production process and eliminate them.

The mapping of the value stream (MVS) is the basis of lean manufacturing, as it allows to identify losses and eliminate them. This approach makes it possible to

understand in detail the process of creating the consumer value of the purchased products, to identify losses in the process, to improve the entire process as a whole, and not its individual parts [16,17,18].

To this end, in the first step, a detailed description of the entire production process should be made. If production is complex, the whole process can be broken down into subprocesses, which are described and analyzed separately. For the description of production processes, a visual schematic representation is used where there is a description of consumer value and consumption characteristics. Information flows from the consumer to the suppliers and the quantitative characteristics of each operation are indicated. The operations are lined up in a single chain. If there are "tributaries", they too can be designated or described separately.

The complete sequence of actions to eliminate losses includes the following steps.

1. Developing a process value flow mapping map.
2. Development of checklists that help to identify the causes of losses at each stage of the process.
3. Collection of statistical information on the time of creation of the value and time of losses, as well as any other information that proves the existence of losses, using the developed control sheets.
4. Building a future value stream map (without losses).
5. Analysis of the causes of losses and elimination of procedures that do not create value.
6. Standardization of working procedures and use in other processes.

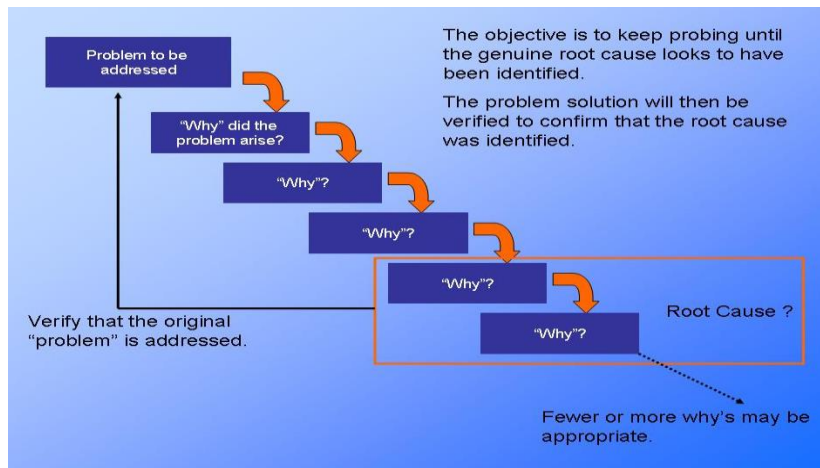
The essence of mapping the creation of a flow of value is that almost all losses are recorded on the flow map. The loss is spent resources, materials and time. If these losses are eliminated (excess stocks, transfers, waiting, transportation, etc.), it is possible to increase the speed of the process and reduce costs.

In order to understand the truth of the occurrence of losses, in practice the following lean manufacturing methods are used:

- The Five Why Method (5 Whys);
- cause and effect diagram Ishikawa.

The method "Five why?" Was proposed by the founder of the company Toyota - Sakichi Toyoda, in the middle of the last century. This is the simplest, most understandable and at the same time effective way to find and determine the root causes of non-compliance [19]. In order to find the cause-and-effect relationship of the problem, it is necessary to consistently ask the same question "Why?" And answer it. As a rule, five questions "Why?" enough to identify the essence and source of the problem. But, despite the fact that the method is called "Five why", the figure "Five" is conditional. To search for the reasons for a specific nonconformity, an unlimited number of questions may be asked in the logical chain, and if the answer solves the problem, determine the solution aimed at eliminating the cause (Figure 4).

Figure 4 - The Five-Why Method?

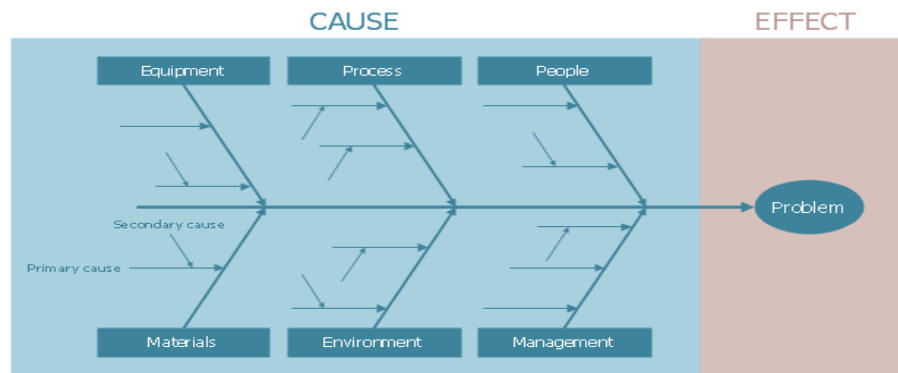


The Five-Why Method? prepared by the author [19]

This approach can be used both independently and as an integral part of various decision methods. The principle of "Five why?" It is advisable to use it together with the Ishikawa cause-and-effect diagram.

The cause-and-effect diagram of Ishikawa (the "fish skeleton") is one of the most common lean tools developed by Kaoru Ishikawa [20]. With the aid of the diagram, it is possible to visualize the causes of the problems and their consequences (Fig. 5).

Figure 5 - The causal diagram of Ishikawa



The causal diagram of Ishikawa prepared by the author [20]

The diagram is a specific problem, enclosed in a rectangle and located on the right side of a blank slate ("fish head"), the cause of which should be identified. From the problem to the left, draw a straight horizontal line - the "ridge". The arrows at an inclined angle to the "ridge" are the most significant parameters and factors affecting the analysis object, i.e. problem. Slope and size are not of fundamental importance. Next, arrows are displayed and secondary causes are recorded for the main causes already recorded. In turn, the arrows are written and the reasons for the third order are recorded for secondary reasons, etc., until the logical connection of each causal chain is built up. The previous arrow in relation to the next always acts as a cause, and the subsequent arrow as a consequence.

When constructing a chart, all causes, including minor ones, should be recorded. After the logical conclusion of the construction of the overall picture of the diagram, it is necessary to isolate the most significant factors that influence the studied problem and try to eliminate them.

Thus, it is very important to be able to see and correctly classify the losses that arise in the production stream, because in most cases the enterprise spends its resources on something that does not bear any value from the point of view of the consumer. Each tool is applicable to the elimination of one or another type of loss in conjunction with the rest, which allows creating a synergetic effect from their use and achieving the set goals.

Each tool and method has its pros and cons, which must be considered and learned before application in any company. The thoughtless introduction of any tool on one, limited area can lead to even greater losses.

The important point is that for the introduction of lean production it does not require huge financial costs, but it requires the willingness of top management, because changes must occur, from the "top" and "to the roots".

2.4 Analysis of foreign experience in introducing the concept of lean manufacturing

After the Japanese cars conquered the US market, American experts in the field of manufacturing organization began to study the experience of Toyota in order to "extract" from it those techniques that could ensure the success of any organization that has mastered them in their practice. These techniques are called the concept of lean manufacturing.

The philosophy of the production system of Toyota is the benchmark of industrial companies, not because this production system is the best, even though it may be so, but because it is the best documented system that has proven itself for a long time. The appearance of the production system of Toyota was caused by the need for the company to stay "afloat" and in addition to enter the forefront of the production of cars in the conditions of slow growth of the country's economy.

Today, this concept is being introduced into the work process, regardless of industry, scale and state. Western enterprises in Europe and the United States on many examples show their ability to use the concept of lean manufacturing. At present, this concept is widely used among a number of the world's largest companies, such as Toyota, Ford Motor Co, Boeing, Alcoa, Airbus, GE, Scania, Xerox, United Technologies, General Motors, Delphi, American Axle, Art Iron and others.

Several of the listed companies are described and analyzed below, who had experience in implementing tools and methods of the lean manufacturing concept in various fields of activity.

For example, Boeing was one of the first companies to actively use Lean in its production, and by today it has achieved great results.

In early 1996, the American aircraft building company Boeing began to introduce Lean-technology in the production of passenger airliners. The process of transition to the new system took about ten years. At present, these principles have spread to all parts of the company - from the production level to the management level [21,22].

The reason for the introduction of lean production: the desire to improve the quality of services offered to customers, while strengthening their positions in an actively developing and highly competitive market, while not being able to expand production facilities.

The basis for effective implementation of the strategy was the involvement of employees. It all started with mass training, what Lean is, what terms and tools are used, how to apply it, etc. When most people have an understanding of the basics of the system, the next step was the slow introduction of local improvements. Lean allows you to simplify the work, increase output, improve its quality. Finding that the introduction of Lean makes the work easier and better, people began to treat the implementation of the system more loyal. At the same time, the introduction of new technology expanded naturally, as a chain reaction, without any pressure from above.

A dangerous moment in the process of introducing the Lean system was that employees began to appear at the expense of efficiency increase, not loaded with work. Then the company openly stated that no one will be dismissed as a result of Lean technology, and all released employees will be directed to increase the company's production capacity. Thus, the foundation for Boeing growth was laid, the performance indicators again went up. Evaluation of the production process leads to the implementation of four fundamental strategies applied in the company (Table 5)

Table 5 - Boeing Fundamental Strategies

Strategy	Description	Applied to Boeing
<p>Adopting a Systemic Vision</p>	<p>Concludes in the consideration of the entire production system of the enterprise as a whole instead of fixing it on separate functional units. Lean production is aimed at optimizing the entire system, but as inseparable segments.</p>	<p>For Boeing, the result of applying a holistic vision was the decision to stop purchasing raw materials in large quantities, although this is cheaper. This step led to an increase in costs at the level of the purchase of raw materials, but they were offset by a reduction in storage costs.</p>
<p>Competent development of the value chain</p>	<p>The value chain is "a series of specific actions to produce the final value - from the stage of constructing the concept to its implementation and delivering the goods to the consumer." A competent evaluation of the effectiveness of this process implies a systematic analysis of each of its stages, which allows to determine which steps do not create</p>	<p>In Boeing, this strategy was implemented through the launch of the Reorganization of Key Processes initiative. At one of the meetings, the working group analyzed the logistics chain of supply of Boeing 777 components, namely - seats and ceiling ceilings. As a result of successful work, the participants managed to change the transport route, excluding 8 days of transportation and 3 days of cargo inspection, and for each of the routes it took half the transport.</p>

	values and can be excluded or reconstructed	
Application of a cross-functional approach to production	The inefficiency of the analysis of production processes is often rooted in the division of it into various functions, which deprives the researcher of the opportunity to cover the whole process. A cross-functional process is a process in which several top-level units participate.	The purpose of this work was to develop specialized units - cells that integrate processes and equipment from different functional areas of the enterprise so that with the involvement of employees from different departments to produce the product from beginning to end in one place in small batches, immediately ready for delivery. This "honeycomb", or cellular, organization of production helps to solve problems on the spot and do not separate the functions from each other.
Focus on manufacturability (DFM, Design for Manufacturability)	Is the maximum simplification of product production. Typically, this is achieved through the use of standard parts or parts of simplified assembly, the elimination of unnecessary components or their integration, etc.	For example, in the cabin Boeing 777 was made from a single plate, rather than a lot of metal segments, which reduced the number of components from 40 to 26.

The next step was the change in the storage standards for chemicals. Elimination of losses associated with excessive movement. Instead of a single warehouse, to which workers were forced to constantly go for the materials, the chemicals were stored in small batches at the place of direct use, with all precautions, taking into account the organization of workplaces (5S).

Another step in the implementation of this strategy was the introduction of kanban-card system technology, designed to organize "pulling" by informing the previous production stage that it is necessary to start work. Such a system was first introduced at the wing wing production division. To control the number of delivered batches of parts, the cart holds only one set of panels. Returning an empty cart is a signal that Boeing needs another set. Using kanban technology allowed the company to reduce the rate of simultaneous storage of fiberglass panels from 14 to 4.

For a more graphic illustration of the effect of introducing lean manufacturing technologies, we give the following data on the improvement of the supply chain:

- The total length of the route was cut and transportation by rail was excluded, so there was no longer any need to distill empty trucks from the train station in Kansas City back to Tulsa.

- The transportation period was reduced by eight days, the inspection period was three days.

- The savings amounted to about \$ 7,900 per lot, which is \$ 396 thousand per year.

- Volumes of storage of metal structures were reduced by 25% due to the fact that the components are delivered directly to the assembly site at the time when they are needed.

- Each lot requires 50% less transport. Previously, the company supplied to Everett half of the required set of seats on trucks, and the other half - by train through Seattle. Now the whole set is sent from suppliers in Tulsa immediately to the assembly shop in Everett.

- With the exception of unnecessary steps to move cargoes, the use of resources - for example, fuel, labor and time for loading and unloading - has also decreased.

- In response to the change in the logistics chain Boeing, the company has adjusted its own production schedule, in turn, to unload warehouses and produce components in time for their acceptance by customers from Boeing.

At Boeing, to date, a robust thrift culture has been formed, in which employees of different levels regularly contribute their proposals for improving production, and the Lean Team, coordinating the Lean Production Promotion Group, includes employees from different departments, which makes it possible to develop a truly cross-functional approach to solving the problems that arise in the process. Regular growth of professionalism is promoted by regular seminars and meetings of working groups, which brings its fruits and allows to consider lean production as a reliable engine of the company's self-development in a highly competitive environment.

The well-known American metallurgical company ALCOA, having taken as a basis the "Toyota Production System" (TPS) and shifting it to its industry, has developed its corporate business system (APS - Alcoa Production System). ALCOA is the world's third largest aluminum producer, after Rio Tinto Alcan and RUSAL, which has branches and subsidiaries in 14 countries around the world [23].

In the mid-1990s, the company faced the problem of lower profitability, as it became dependent on volatile spot prices for aluminum. At that time, the company's management developed a strategy to increase productivity throughout the value chain- from raw materials to supply to consumers- and made every effort to eliminate losses, improve customer interactions, and reduce inventories. After long consultations with specialists in lean manufacturing, including specialists from Toyota, ALCOA, similarly to Toyota production system, has developed its production system ALCOA Production System, that is a set of standards, tools and measures that contribute to a permanent reduction of losses.

Savings from the introduction of the system of harmonious production for three years, from 1996 to 2000, reached \$ 1 billion. In addition:

- The average annual growth rate of ALCOA sales was 15%;
- net income in this period increased by 30%;
- the ratio of capital expenditure to sales decreased by 35%.

It is impossible to implement lean production at once in the whole enterprise. Typically, implementation begins with the optimization of a single area, process or business unit and only then gradually spreads to the entire organization. So, ALCOA began to implement the principles of lean manufacturing at the plant in Lafayette, Indiana.

The main attention was paid to increasing the productivity in the supply chain, for which the production and quality control systems were established, and investments were made in personnel training. And only when the project proved itself well, at the company in Indiana the company began a large-scale program of training managers of all business units and factories of the company from different countries in order to launch a program of lean production in all its plants in the next two years.

The three main principles of the Alcoa Production System are:

1. Manufacturing for use - the principle based on the fact that the products produced can be immediately used by the customer, and not sent to the warehouse.
2. Eliminating unnecessary actions - this principle reflects the desire to identify and solve problems where and when they arise, to continually improve the cost, quality and speed of our production and business processes.
3. The principle of "The main driving force of the system are people" is the desire to create an environment that would involve all participants in the production process in identifying and solving emerging problems.

In the report on sustainable development of ALCOA for 2016, according to the CEO, the company has a simplified approach to sustainable development, which is

focused on their main problems and opportunities. Through this approach in 2016 the following results were achieved:

- The SUSTANA TM line of aluminum products has been introduced, which allows producing products with low carbon emissions and content of recycled aluminum;
- Reduced greenhouse gas emissions and energy consumption by 19%;
- 23% less fresh water and 2% reduction in freshwater use intensity;
- 86,500 tons of stored waste were eliminated;
- Achieve a 21 percent reduction in our days, limiting and transferring (DART) security;
- The talent management approach has been transformed and modernized to give employees the opportunity to make Alcoa better every day;
- Linked annual variable compensation to the achievement of significant aspects of strategic sustainability goals.

For a more sustainable future, continuous improvement is required, and ALCOA remains the leader in its industry today.

Positioning the company: "We will never stop looking for ways to be more productive, efficient, innovative and sustainable, to deliver the best products and results to our customers and shareholders."

In the early 2000s, the leadership of the corporation Xerox decided to use a new model of quality management: "lean manufacturing + six sigma."

The Six Sigma methodology is a methodology that measures and enhances the company's performance by identifying and identifying defects in production or service delivery processes [24].

Sigma is a sign that is used in statistics to denote the standard deviation of values in the general population. "Six Sigma" - this is the level of the efficiency of the process, in which for each million opportunities or operations, there are only 3-4 defects.

The purpose of the Six Sigma methodology is to reduce deviations in the production process and improve it by implementing the so-called "Six Sigma"

improvement project, which breaks down into a series of DMAIC steps (define, measure, analyze, improve, control): definition, measurement, analysis , improvement and control.

In 2002, Xerox realized that it was increasingly difficult to ensure the necessary growth in sales. The main enemies in the struggle for quality of work with customers were the excessive movement of documents and unnecessary people involved in the processing of orders.

The new method, applied in the company Xerox, was called Xerox Lean Six Sigma [25]. Its main advantage was that it allowed to make the process of quality improvement uninterrupted. Xerox Lean Six Sigma did not offer radical novelties, except one: it had to involve all personnel in the optimization of business processes, and not separate groups of employees from the quality department, as before.

The effectiveness of the lean manufacturing + six sigma method is ensured by the fact that the best of the two known management techniques was mastered [26]. According to Xerox's management of efficiency and quality, the methodology was free from the flaws inherent in each of the methods: Lean manufacturing could not streamline the order processing process and standardize the execution time, since its goal was to reduce manufacturing defects. And the six sigma methodology did not meet the company's second important need - to increase the speed of orders, while reducing costs, although it helped to find and eliminate the causes of errors and manufacturing defects. " Here are a few points of what was taken from each technique and synthesized into one system (Table 6).

Table 6 - The contribution of "six sigma" and lean manufacturing to the Xerox Lean Six Sigma

Six Sigma	Lean manufacturing
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specific binding to the interests of the customer, orientation to customer requests;	analysis of the value stream (it is necessary to create a continuous flow that effectively adds value);
the use of universal, unified for all criteria processes (metrics);	the method of maximizing the speed of the process (the time that incomplete work is without movement, it is important to reduce to a minimum);
creating a sustainable infrastructure for improving processes;	the principle of "pulling" (it is necessary to strive to satisfy the customer's requests precisely in time and in the right amount, while avoiding the accumulation of surplus products).
use of the model "determine the measure-analyze-improve control", etc.	

The company was subject to change, including a hierarchical structure. In addition to the terms "first level managers", "second level managers" or "ordinary employees", the company introduced such names as "yellow", "green" and "black belts", borrowed from the six sigma technique. New titles were introduced to distinguish employees working in groups to improve the quality of processes, from those who optimize activities on the ground, implementing the ideas of working groups.

"Yellow Belts" is a minimal basic training in lean manufacturing + six sigma techniques that all who worked in the company - from beginners to the president - had to pass through. The received theoretical and practical knowledge were checked by testing. According to the program of "green belts", its owners for two years leave the main activity in the company and completely switch to project management. And then, if the employee shows good results, knowledge is increased to the "black belts".

According to the logic of Six Sigma, the "green belts" are always considerably smaller than the "yellow" ones, and the "black belts" make up only 1% of the total number of the company's employees. At the end of 2003 in Xerox the number of "black belts" was 0.5% of the total number of personnel, but by the end of 2004 this figure had reached the norm.

The ongoing work to improve the quality of the company was divided into separate projects. Implementation of one of these projects allowed to shorten the time of placing the order (from clearance to dispatch to the logistics center) from three days to four hours, reducing the number of strings in this section from three to one person. Initially, there were 15 stages in the process, but the company managed to reduce the chain almost twofold: up to nine steps.

It is important that in the company for quality improvement, not one quality department is fighting, as it was before, but all units with participation in projects of all employees.

At present, on the official website of the Xerox Corporation, according to the Chief Technical Officer, the following is written: "The business of open innovation is what PARC has been improving since its inception in 2002. Mastering the innovation process is not just the development of new technologies, it is the need for a deep understanding of human behavior and environment, and the ability to invent new business models to obtain the final products and services for the market. "

Thus, analyzing the experience of introducing the concept of lean production in foreign enterprises, we can say that this concept can be successfully implemented not only in companies specializing in industrial production, but also in companies with non-industrial activities. The erroneous view is that the concept of lean manufacturing is a supranational phenomenon. For example, Toyota has 46 plants producing 45% of production outside of Japan and they all work according to general rules. The considered companies Boing, ALCOA, Xerox also have a lot of subsidiaries and affiliates around the world, including in Russia, operating under uniform standards.

An important feature of the introduction of the concept in each of the examples discussed above is that none of them copied exactly all the steps for the successful implementation of lean tools. Each company uses a certain set of tools. In the future, these tools become components of the operating system, and have a unique name for the company in which these tools are used.

Summarizing, we can say that the companies were following the classical pattern of implementation:

- studying the principles of lean production; designing the basic ideas for your own example; development of its own corporate system;
- Pilot projects in selected areas (where you can see measurable results);
- organization of value streams throughout the enterprise;
- Organization of the work of the office in accordance with the principles of lean manufacturing;
- Work with suppliers (active assistance).

2.5 Analysis of domestic experience in introducing the concept of lean production

The concept of lean manufacturing in Kazakhstan is relatively young. The problem of improving the production processes in Kazakhstan now requires special attention. Most of Kazakhstani enterprises are built on the concept of mass production, which does not allow to remain at the leading positions or, in principle, to develop with the existing market requirements. In this regard, there is a need to modernize the production system of enterprises, which requires a reference to the well-known concept of lean manufacturing. The use of such a production system is quite a labor-intensive and complex process, with many nuances and requiring an integrated approach.

Kazakhstan positions itself as a state with a developing, stable economy integrated into the world community. In 2006-2007, Kazakhstan ranked 56th out of 125 countries in the Global Competitiveness Report (The Global Competitiveness Report) of the World

Economic Forum, in 2012-2013 - 51st out of 144 countries. Having developed Strategy-2030 in 1997, Kazakhstan was the first among the post-Soviet states to apply long-term planning for modernization of the economy aimed at effective integration into the world market, balanced development, preservation of stability and internal security. The need for these guidelines is due to global challenges and opportunities that have emerged from the state, located in the most dynamically developing region of the planet. Located in the heart of the Eurasian continent, the Republic of Kazakhstan (RK) connects the largest markets of China, Europe, CIS countries, provides transport routes to the countries of Central Asia and the Persian Gulf. By 2020 the region is expected to increase the volume of trade between neighboring countries by 1.5 times.

One of the largest projects in the newest history of the RK is the Program of Forced Industrial-Innovative Development of the Country (PFIIDC) for 2010-2014 [27]. The industrial and innovative development of Kazakhstan is expressed not only in the achieved quantitative indicators (in 2010-2012 537 objects were put into operation, 117 thousand jobs were created), but also in the influence of the program on various sectors of the country's economy. At the first stage of the implementation of PFIIDC, the priority task for the state is to create conditions for economic diversification - a departure from raw dependence. At this stage, emphasis was placed on the introduction of production facilities, the creation of the necessary basic infrastructure, high-tech production and the activation of innovative activities of enterprises. The second stage (a new phase of industrialization) is oriented towards the transition to a "green economy". In 2013, a strategy was planned for the country's transition to a "green economy", i.e. industrial-innovative, the development of which paves the foundation for the further development of the non-primary economy, along with high standards of production and consumption, will ensure independence from the global conjuncture for hydrocarbons. To implement the innovation policy, the National Agency for Technological Development Joint Stock Company (NATD) was created - a single operator of the authorized body (Ministry of Industry and New Technologies - MINT) in the Republic of Kazakhstan to coordinate the

innovation and technological innovation development processes and provide state support measures. The activities of JSC "NATD" formed a positive trend towards the growth of the basic indicators of innovative activity of industrial enterprises: in 2010-2012, the number of innovation-active enterprises, the cost of technological innovations, the volume of innovative products produced in the country increased. In the costs of technological innovation of industrial enterprises, changes occurred: if in 2007-2009 the expenses for the acquisition of machinery and equipment related to technological innovations prevailed, then in 2010-2011 the costs for industrial design, production preparation for release, introduction and transfer new products.

One of the constraints of innovative development of enterprises is the orientation towards regional markets. While industrial enterprises compete mainly between themselves and the enterprises of the post-Soviet countries. more than twenty years of post-Soviet development has been insufficient to integrate the manufacturing industry into the international division of labor, while it is outside the sphere of global competition.

In the framework of PFIIDC, state support measures are applied to introduce management technologies; co-financing of developments carried out by enterprises independently; information support. At present, the system of subsidizing the activities of enterprises aimed at increasing their motivation, interested in the transfer of highly effective management technologies, is being streamlined. The European Bank for Reconstruction and Development and the German Society for Technical Cooperation are co-financing these projects to 75% of the project cost. JSC "National Innovation Fund" cooperates with consulting companies that independently implement management technologies at enterprises. NATD implements 9 types of innovation grants, one of which is the introduction of management and production technologies, which means 5 types of innovative development tools: the introduction of ACS technologies, technologies, energy-efficient or "green" technologies, effective project management and implementation of the ISO standard .

Within the framework of innovative development, 7 types of ISO will be implemented on energy efficiency, project management, safety engineering, environmental protection, project management and innovative innovation. The work plan for state standardization for 2013 includes more than 500 standards, taking into account the priority directions of PFIIDC and projects. Maps of industrialization, a key mechanism for the implementation of the PFIIDC, which allows the state, together with business, to develop the right investment decisions and to ensure the interconnection of private sector projects with the infrastructure development and the country's resource potential [28]. The main attention is paid to the introduction of the lin-production system (Lean Thinking-American version production system "Toyota"), the implementation of which involves the introduction of a complex of modern management "Toyota" iCal technology based systems.

With strategic technologies, strategic development, organizational culture, marketing management, planning system, production organization and personnel management of enterprises are linked. B2012g. This tool is provided in accordance with the Law on State Support of Industrial Innovative Activities as one of 9 new types of innovation grants within the priority areas. The grant for the implementation of management and production technologies includes technology Lean, Kaizen [29]. In 2009, the line technologies were introduced at 15 enterprises, in 2010 - by 13, in 2011 - by 8. in 2012, 36 enterprises used the state support tool (Lean technology, Kaizen). NATD implements projects with real sector enterprises to receive service tools, such as the introduction of modern management and production technologies and the involvement of highly qualified specialists. in 2009 the enterprises of the two largest industrial regions of the Republic of Kazakhstan took part in the state program for the introduction of modern management technologies. MINT the battery factory (Taldykurgan city), ZHERSU POWER LLP (Almaty), heavy engineering plant (Petropavlovsk), Asia Auto JSC (Ust-Kamenogorsk), oil equipment plant Aktobe) and others. as a result of the measures taken at the enterprises, the production business

processes were optimized, bottlenecks in the production areas were identified, and lean tools were introduced.

In 2010, these technologies were introduced at 13 enterprises. LLP "Kainar AKB" from the introduction of the Kaizen system for 2 months received more than 208 million tenge of net profit, the economic effect from the introduction of management technologies in the conditions of JSC "Munaymash" was 47 million tenge. Such city-forming enterprises as Gordorremstroy JSC, Caspian Beverage Holding JSC, Ecostroiservice JSC, Petropavlovsk Heavy Engineering Plant JSC, Kostanai Minerals JSC, Aktobe Oil Equipment Plant JSC have reduced the time for production of a unit of production, increased labor productivity and quality of products. The car assembly plant "Asia Auto", the flagship of the Kazakhstan automobile industry, is an active participant in the program for the introduction of the system of "lean manufacturing" at the enterprise.

He entered the top ten enterprises involved in the republican project "implementation of modern management technologies" in the framework of the PFIIDC. After conducting training seminars on Lean production, a group of employees and managers of the enterprise was created at the enterprise, which plans, organizes and implements activities for practical application of lean production tools and methods. Since 2011, this budget program has entered the "Productivity 2020" program in As a service tool for supporting innovation [30]. Participants in the state program for the introduction of modern technology were companies representing engineering, building materials and fans. In accordance with the general principle of providing state support to participants under the "Productivity - 2020" Program, the innovation support tool assumes co-financing based on the results of services provided for the development of a management and production technology implementation plan, which will also be implemented under the Productivity-2020 Program, but due to the budgetary program "Support for the creation of new, modernization and improvement of productions."

The introduction of management and production technologies by the enterprises of Kazakhstan was preceded by a large preparatory work. In 2010, a training seminar on "Competitiveness and Lean Manufacturing Leadership" was held for managers and leading experts on the effectiveness of enterprises in the Republic of Kazakhstan with the participation of President Lean Plus Inc. (Colorado Springs, USA) and Director of the Center "Orgprom" (Russia). The seminar was organized by the Kazakhstan Investment Promotion Center in conjunction with the "Center Orgprom", the leading Russian provider of lean techniques (Lin, Kaizen, Toyota Production System).

The goal was to show the enterprises of the RK one of the ways to global competitiveness and leadership, proceeding from the experience of the leading companies of the USA, India, Thailand, Malaysia and Russia. The example of such companies as Toyota, General Electric, Caterpillar, Nissan, Xerox, Boeing, KAMAZ, GAZ, using the tools of Lean production, shows that the lean production at the current stage of economic development in the conditions of the highest competition in all markets is one of the most effective lines of business. As a result of implementation of programs to introduce modern management and production technologies, two lin-forums were held.

I Kazakhstan Linforum, called to become a traditional dialogue platform for discussion of the introduction of modern management technologies in the RK, was held in 2010. with the participation of international experts. The forum summed up the introduction of management technologies at Kazakh enterprises in 2009-2010, the public-private partnership schemes were discussed in the medium term. In 2011, the II Kazakhstani Lin-Forum was held, organized by JSC "National Innovation Fund" with the support of the Ministry of Energy of the Republic of Kazakhstan. The Forum summed up the implementation of the budget program for the introduction of modern management technologies, the popularization of the philosophy of lin-technologies among potential program participants. More than 500 enterprises from various sectors of the economy, development institutions, universities, international experts, government agencies, financial institutions participated in the forum. During the forum, international experts -

representatives of the Kaizen Institute (India), the Fraunhofer Institute (Germany), Solving Efeso (France), "Strategy Partners Group", and "Orprom" (Russia) - shared their many years of experience in the implementation of lin- at the enterprises, especially at the initial stages, introduced the participants to the real business cases of successful projects on the introduction of lin-technologies. Following the results of the I Lin Forum, memorandums were signed with the German Society for Technical Cooperation (GSTC) GmbH in the framework of the program "Assistance to Regional Economic Cooperation in Central Asia" and the Russian Lin-school. Memorials were signed with the Union of Project Managers of the Republic of Kazakhstan, the Kaizen Institute, the companies Solving Efeso and Orgprom in the field of lean production to train specialists for the introduction of modern management technologies; assistance in attracting international experts in management technologies; providing experts during the organization of seminars, conferences. Kazakhstan is the only country in the world where Lin forums are initiated and conducted by the state. Participation in the forums, being an integral part of the development of the technology transfer system, allows for the gradual preparation of Kazakhstan specialists in the field of technology transfer and commercialization through acquaintance with new world innovative technologies and developments.

In 2010-2011, under the implementation of memorandums, 800 specialists from leading enterprises of the Republic of Kazakhstan received training in lens technology, 14 certified line experts work at JSC "National Innovation Fund", a kaizen club was created in the country, which unites around Kazakhstan experts [31]. In October 2012, the first regional forum on lean management and production in Central Asia, the Lin Forum, held by the GIZ program (the German Society for International Cooperation) "Promoting Regional Economic Cooperation in Central Asia" and the BASP-EBRD Business Advisory Program took place in Kyrgyzstan. The purpose of the forum was to reveal the benefits of lean management / Kaizen (modern management technology of growth), presentation of the results of using lean tools on enterprises of Central Asia, to acquaint with the state program of the RK on supporting similar projects, to reveal the

possibilities of international donor organizations for the development of projects on lean management in production, in the service sector, in administration.

Changes in the economy of the Republic of Kazakhstan, associated with the formation of a multi-sectoral economy, the renewal of the industrial structure of production, the transformation of the labor market, are conditions of market transformations.

3 METHODOLOGY

3.1 Introduction

Methodology chapter has special importance regarding the quality of the research and the credibility of the findings. Research design, research method, as well as collection and analysis methods of data have profound effects on the reliability and validity of the findings. This chapter is divided into two subchapters as “ Sample characteristics” and “Data management, field works and analysis”. While “Research Design” gives information about the research methodology, “Data Collection and analyses” handles data sources, how they are analyzed and quality of data.

The company under investigation is a large mining and metallurgical company. The Group operates in the mining industry, the main activity of the group is the extraction and processing of copper ore into cathode copper and copper rod, refining and sale of precious metals and other by-products obtained as a result of mining and processing of copper. Therefore, the main focus of the company's efficiency and competitiveness.

3.2 Sample characteristics

Respondents of this survey were employees of Kazakhmys Corporation LLP. Each respondent was provided with a questionnaire in Russian. In total, responses were received from 10 employees, also from the management. The survey assessed 11 performance indicators for lean manufacturing. The survey consists of 33 questions, where the answers to questions were evaluated in points. As a consequence, the size of the sample used was 10 respondents. The fact that the respondents' data were collected from the number of workers will not lead to negative results.

3.3 Data management, field works and analysis

A survey of employees was also conducted to assess the work in the lean manufacturing organization. The survey was conducted in Russian. To assess the 11 performance indicators for lean production in the enterprise, it was necessary to answer

the questions in Table 7. The answers to questions were evaluated in scores from 0 to 3, where:

0 is the absence of a characteristic

1 point - work is conducted at an extremely low level, no result

2 points - work is under way, results are there, but there are reserves for activation of activities

3 points - active work, continuous improvement of activities in this direction

Table 7 - Survey Questionnaire.

Company				
Position				
№	Valuation indicators	Score in points		
		1	2	3
1	Adoption of managerial decisions takes place taking into account strategic goals			
2	The presence and upbringing of leaders who profess the philosophy of the company and training employees			
3	Each employee has a clear idea of the current objectives of his activities in the enterprise			
4	The enterprise is forming a self-learning organization			
5	At the enterprise there is a program of development of creative abilities of employees in the field of problem solving			
6	Records are taken of both realized ideas and the total number of kaizen proposals			
7	The operational processes at the enterprise are regularly improved through specially launched programs for their improvement			
8	The leveling of work is carried out			
9	Create a process in the form of a continuous value stream			
10	The organization records the results of work with the consumer			
11	Built-in quality control			
12	Most employees of the organization can in their own words formulate the mission of the organization and agree with it			
13	Formation and work of teams professing the philosophy of lean production			
14	There is a system for monitoring the achievement of performance targets			

15	Leadership with a personal example demonstrates a commitment to the philosophy of lean production			
16	The personnel of the enterprise regularly undergoes training in the "Lean Manufacturing"			
17	At the enterprise the high share of the realized offers from registered and approved by management			
18	At the enterprise the share of divisions in which tools of lean manufacture (5C) are introduced are high,			
19	The enterprise defines the main flows of value creation			
20	At the enterprise maps of streams of creation of value			
21	The organization assesses the level of customer satisfaction			
22	There is work to identify sources of possible improvements			
23	Strategic objectives are reviewed from time to time, depending on the requirements of the time			
24	The philosophy of lean production was reflected not only in declarations and principles, but also in the practical activities of each employee			
25	Each employee has a clear idea of the current objectives of his unit			
26	In our organization, a high degree of trust between employees and management			
27	At the enterprise there are working cross-functional groups			
28	At the enterprise the share of the personnel participating in submission and realization of offers is high			
29	Is there an attempt at the enterprise to move from 5C to 6C			
30	There is regular work to identify and eliminate losses			
31	There was a transition from an ejection system to a pulling system			
32	The organization constantly examines the market and consumers for new opportunities and new requirements			
33	The needs, suggestions and complaints of buyers are regularly studied			

Among the respondents there were workers with the post of blasting work leader, road master, precinct geologist, mining engineer, electrician, crusher, mine surveyor, mining mine surveyor, etc.

Interpretation of the results of the survey is estimated by the indicators of work on lean production at the enterprise table 8.

Table 8. Valuation indicators

Valuation indicators	Number of answers / questions corresponding to the indicator
Presence of strategic management	1, 12, 23
Presence of the philosophy of lean production	2, 13, 24
KPI - key performance indicators	3,14, 25
Involvement of top management	4, 15, 26
Cohesion of employees	5, 16, 27
Availability and quality of kaizen offers	6, 17, 28
The presence of 5C	7, 18, 29
Reduction of losses	8, 19, 30
Using the Extrusion System	9, 20, 31
Study of customer requirements	10, 21, 32
Improving the quality of products	11, 22, 33

4 RESULTS AND FINDINGS

4.1 Introduction of lean manufacturing principles in Kazakhstan companies

The application of the philosophy, principles and tools of lean manufacturing in Kazakhstan companies, at the current time, is a necessary condition for maintaining market positions.

It's no secret that in the business world there are organizations, so-called leaders, whose experience is trying to adopt many different companies. Of course, you can copy and try to implement management techniques, styles, etc., but you cannot wait for a positive result. What gives a positive effect to one enterprise may not lead to the same result on the other. In accordance with this, it is possible to single out a number of the most important reasons, the presence of at least one of which, during the implementation, guarantees failure:

1. Lack of detailed analysis of the external and internal environment of the enterprise, where a lean manufacturing system is expected to be introduced;
2. Lack of universal involvement in the process, including senior management;
3. Expectation of a "momentary" significant result;
4. Lack of a thoughtful, holistic implementation program;
5. The team lacks a common vision of why it is planned to introduce lean manufacturing.

Also, an analysis of the implementation of lean manufacturing at Russian enterprises has shown that enterprises do not receive the expected result in large part because of the lack of algorithmization of the implementation process. This is said by the fact that today a fairly large volume of philosophical and methodological knowledge has been formed in this field, which are reflected in books, scientific articles, monographs, etc., where there is no theoretical basis for concrete steps to introduce lean production with possible outcomes. In order for managers of companies to use the entire lean

production tool (Table 9) in the proper way, it is necessary to systematically study all available material and understand how everything works [32.26].

Table 9-Essential Lean Manufacturing Instruments

Basic Tools	Purpose of the method
5S (system of rational organization of workplaces)	Creation of conditions for the efficient execution of operations, saving time, increasing productivity and safety of work; creation and maintenance of order and cleanliness at each workplace
Visual process control	Displaying information in real time for its transfer to employees and making the right management decisions
Standardized work	Achieving the best, reproducible way of doing the job, ensuring the proper level of safety, quality and performance
General Equipment Maintenance (TPM)	Planning and implementation of measures to prevent and eliminate losses associated with equipment
Quick changeover (SMED)	Reduction of the time required for adjustment, adjustment of equipment from the production of one type of product to the production of another type of product
Protection against unintentional errors (Poka-Yoke)	Prevention of unintentional errors and their prompt removal
Kanban	The production of the volume of products required by the internal and external consumers at the exact time, on the basis of the principle of stretching.
Mapping the value stream	A visual representation of the value stream, its characteristics for the purpose of finding and reducing losses, and improving the flow in terms of reducing all types of losses and satisfying customer requirements

We will analyze several algorithms for the introduction of lean manufacturing, including the modern concept of Lin Six Sigma.

In Appendix A, algorithms for the implementation of the lean manufacturing system by D. Liker and D. Hobbs are considered. A significant contribution to the advancement of LEAN was made by James Wumek and Daniel Jones, who propose the activity of the initiator of changes from the private to the general [33]. The LEAN implementation algorithm includes eight steps:

a) choose the "conductor of changes", which, according to the authors, should be a leader, have respect among employees, have lean tools, and have experience in successful innovation in the enterprise;

b) forming an implementation team and organizing training. The implementation team needs to undergo basic training in the basics of lean manufacturing and key tools;

c) identify or create a crisis. There are problems on any, even the most stable enterprise. If necessary, it can be submitted as a "cause of the crisis" to induce employees to eliminate it. The crisis can serve as a good impetus to the implementation of LEAN, as evidenced by the experience of many companies around the world;

d) to start implementation from a small site. Starting the introduction of lean production is not necessary with a global review of the entire production process. At the initial stage, you can push employees to eliminate losses wherever they notice them. Later, after the first successful experience, you can move on to more complex tasks, focusing on the specific objectives of the enterprise (order time, product cost, quality);

e) mapping of value streams - production process in the form of a flow map, if necessary broken down into separate processes, each of which forms a flow map, which allows to detect bottlenecks, problems and losses; the possibilities of their elimination are explored and a map of a more perfect (future) value stream is being developed;

e) start of work in key areas: by drawing up a flow map and dismantling weak points, it is necessary to move to the implementation of plans in practice, during which all information on the results of implementation should be open to all employees;

g) the desire for quick results, despite the fact that lean production is a long-term strategy, it is better to focus on immediate results at the initial stages;

h) Launching the Kaizen system based on the involvement of employees in the process of continuous improvement at each stage of the activity.

This algorithm is quite relevant among consultants and trainers in Kazakhstan. According to the step-by-step instruction, the introduction of lean production begins with reference sites. The problem of the considered algorithm is that many people find it difficult to move from the level of one site to the whole enterprise, and many managers stop there. In recent years, the synthesis of the two Six Sigma and Lean Production systems (Table 10), known as Lean Six Sigma (Lean Six Sigma), is very popular abroad.

Table 10 - Comparison table of the Six Sigma and Lean Manufacturing System

Methodology	Six Sigma	Lean
Theoretical basis	Reduction of variability	Elimination of losses
Main stages	1. Definition	1.Determine the value
	2.Measurement (measure)	2. Determine the flow
	3. Analysis	3. Align the flow
	4. Improvement	4. Extrude
	5. Control	5.Continuous improvement
aim	Problem	Flow

According to the author of the book "Lean production + six sigma. Combining the quality of six sigma with the speed of lean production " - Michael George, at the moment this synthesis is the last word in the technology of production management. The

implementation of the "lean manufacturing + six sigma" method at the enterprise, according to M. George, includes four stages:

Stage 1: assessment of readiness - all factors that should be taken into account when deciding how to use Lean Production + Six Sigma are determined for more effective implementation of the company's strategy; includes the following actions:

a) choosing a "champion" for further work related to the preparation and deployment of this program;

b) to make a "snapshot" of the current state of the organization, which will serve as a reference point, in addition to analyzing the adaptation of the program in other companies: how programs are adapted to their style of work, culture, business needs, etc;

c) interviewing top management - are required to analyze how management is managed and how conflicts are resolved, are closely linked to decision making; study approach to decision-making;

d) attracting recognized leaders through focus groups and interviews;

e) an assessment of the impact of the factors that were found.

Stage 2: implementation of the engagement strategy - encourages people and motivates them to apply Lean Six Sigma, demonstrating to them that this method can help achieve annual and quarterly targets;

Stage 3: mobilization - involves the creation of a top management team to monitor the implementation of changes; the preparation of infrastructure that determines the decision-making environment; organization of a training program; Identification of first wave projects and development of tasks; selection of unified indicators;

Stage 4: implementation and monitoring - implementation of the program "Lean Production + Six Sigma"; preliminary planning and control; creation of conditions for intensive intra-corporate exchange of advanced methods of implementing the provisions of the concept of "lean production + six sigma"; creating a "platform for improvement", which will make possible future innovations.

The main point of the considered concept: "lean production + six sigma" changes the duties of each and every one. The main task is that everyone should influence the improvement of the process for which he is responsible. The only thing that can prevent this is the management's lack of skill in demonstrating the benefits that people can derive from this.

Thus, considering this algorithm for the basis for the introduction of lean manufacturing at Russian enterprises, there are several shortcomings:

- in many organizations there is no connection between people who are engaged in the implementation of the Lean Production + Six Sigma program and the managers of independent units;

- simultaneous implementation of too many projects can lead to the dispersion of resources;

- Lack of proper tracking of results; reliable means of evaluating project results and their consequences;

- Absence of full involvement of the whole team.

Summing up, we can conclude that today, there is no universal algorithm for implementing the implementation of the lean manufacturing concept at the enterprise, largely due to the lack of identical conditions for implementation, the same projects, and so on.

Further, within the framework of this master's thesis, recommendations on the introduction of the lean manufacturing concept for Kazakh enterprises were developed and algorithmized, taking into account a number of features.

First, the internal specifics of the enterprise, the level of current development, the level of automation of production, the presence of conveyor assembly, the technological complexity of operations, the orientation of end users.

Secondly, the presence of the Kazakh specifics of production activities: Russian enterprises are aimed at a quick result, which would not require drastic changes at the

level of the top management of enterprises; management is ready to invest significant resources to improve results, while continuous improvement is a long process with an unclear economic effect; slow response to changes in the external environment.

Thirdly, the successful experience in implementing the lean manufacturing concept and a number of steps and actions that Russian enterprises are ready to use at the present stage of development of production forces and relations were taken into account. The proposed algorithm for introducing the concept of lean manufacturing, shown in Fig. 6

At the first stage there should be a conscious need to introduce lean manufacturing principles at the senior management level, which should be ready for laborious and long-term work with their colleagues. As practice shows, the introduction and development of this concept takes several years or more.

The next stages should be the parallel learning of the entire management and employees of the enterprise while simultaneously spreading the idea of lean production throughout the enterprise in the form of audio, photo, video images. For the most effective action, the training of employees should be carried out only in the production itself in the form of practice and in exceptional order in a theoretical manner. Given that each employee must get used to the new enterprise philosophy, the addition to theory and practice should be visual and audio information near each workplace.

After a certain period of time, practically parallel to the training of employees, the following stage should be carried out: analysis of the internal and external environment of the enterprise; current state of the business process. It is necessary to compare the position of your enterprise with the world's best production indicators in order to reveal how effective the company is in the long run. Conduct analysis, draw conclusions. At this stage, methods such as mapping the value stream, SWOT analysis, PEST analysis, and the like are applicable.

The fourth stage is the development of a vision of the production system for the reporting period. This includes reporting to each employee mission, goals and objectives

of the enterprise. Now the main principle of the organization should be the relationship between people. From this follows the next stage.

The fifth stage is the construction of a new corporate culture based on respect for the individual. The philosophy of lean production is the philosophy of relations between people. The further result will depend on how well the leaders successfully and effectively build relationships with their subordinates. It is necessary to create such conditions that everyone would understand the meaning of changes in themselves and in their approach to work. It is very important to properly motivate employees to achieve their goals.

The next stage is the introduction of the main tools of lean production in the activities of the enterprise based on the implementation of pilot projects that do not require the attraction of significant resources. Pilot projects show the employees of the organization the effectiveness of lean tools, including, it is possible to identify what lean tools are effective at this enterprise, and which are ineffective. Personal projects of managers activate employees, thereby allowing to consistently involve and motivate all employees.

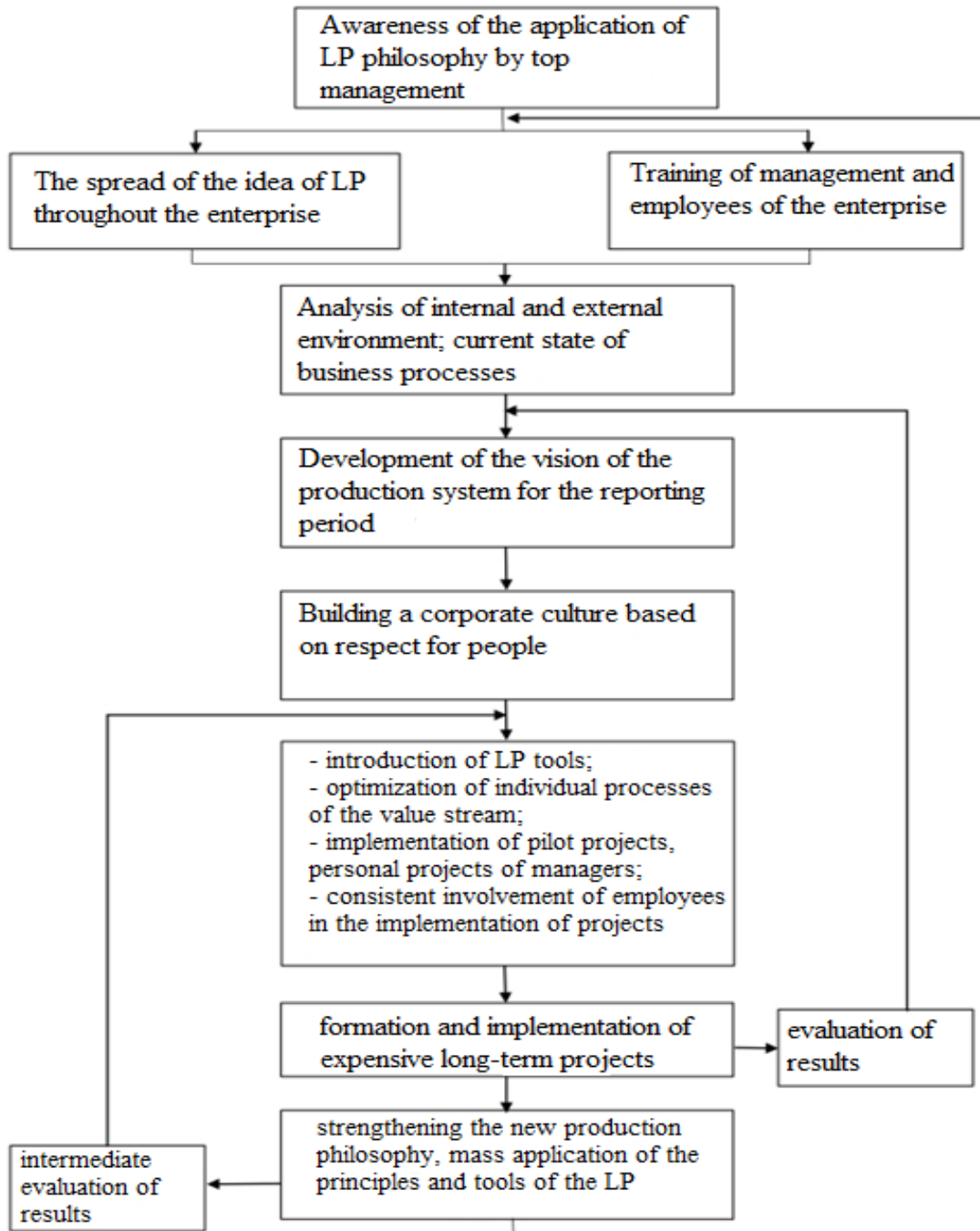
Kazakhstan's production culture predetermines the fact that at almost every stage it is necessary to evaluate the actions being taken and look at how much the results correspond to what is expected. At the seventh stage, it is necessary to consistently implement costly long-term projects that significantly reduce all types of losses throughout the enterprise.

The final stage is the strengthening of the new production philosophy, perhaps with its already developed additional steps, standards and rules. When the apparent losses are eliminated, the cycle begins again to identify and eliminate new losses.

Broadcasting the application of the concept of lean manufacturing to branches, subsidiaries with, thereby spiraling its own philosophy of doing business. At the core of the algorithm for lean manufacturing is the elimination of production and non-production

losses, customer-oriented production is not the result, increasing the company's efficiency in the producers' market.

Figure 6 - Algorithm for introducing the concept of lean manufacturing at Kazakh enterprises



4.2 Analysis of lean manufacturing principles at the enterprise Corporation Kazakhmys LLP

In the conditions of globalization and constant growth, increasing the efficiency of production processes of any enterprise is the main task. All companies in a tough competitive environment and rapidly changing situation should not only focus on the internal state of affairs in the company, but also develop a process of work that would allow them to respond quickly to changes in their environment. The mining industry in Kazakhstan, which plays an important role for the economic stability of the state, did not become an exception.

One of the enterprises of this branch is Corporation Kazakhmys LLP engaged in the implementation of separate tools of the lean manufacturing concept.

As a result of production activity for 9 months of 2017, Kazakhmys Corporation produced 169.4 thousand tons of copper in cathode equivalent. This figure exceeded the same period of the past (2016) by 6 thousand tons (+ 3.7%). The average grade of copper in the ore for 9 months was 0.99%, which is higher than the average copper content in the same period of 2016 (0.95%) and above the target of 8.1%.

However, in order for the company to improve the quality of its products, it needs to have a well-established production process that allows production of a value-bearing product for the buyer.

From the point of view of lean manufacturing, to determine the efficiency of processes, a number of special tools and methods are proposed, one of which is the value stream map (VSM). The application of VSM helps to identify the possibility of reducing the overall production cycle and excluding those activities that are excessive, unnecessarily expensive or do not add value to the product. The mapping of such processes involves the use of standard symbols and symbols showing material flows and other important data.

Stages of construction of VSM include:

- a) build a map of the current state of the value stream;
 - Identify the main production processes and their main parameters (the time of the production cycle, the processing time, the time of adjustment, the level of stocks of raw materials, components, the number of employees involved in this process, etc.);
- b) analyze the current flow of value creation, find the existing losses in the processes and in their interaction;
- c) develop a map of the future state of the value stream;
- d) identify activities for the transition to the future state of the value stream; ways to solve problems.

The aim of the project was to develop proposals for improving the site's productivity.

In order to understand how much the current production process is effective and add value to the product, a value stream map was compiled.

A survey of employees was also conducted to assess the work in the lean manufacturing organization. The survey was conducted in Russian. To assess the 11 performance indicators for lean production in the enterprise, it was necessary to answer the questions in Table 10. The answers to questions were evaluated in scores from 0 to 3, where:

0 is the absence of a characteristic

1 point - work is conducted at an extremely low level, no result

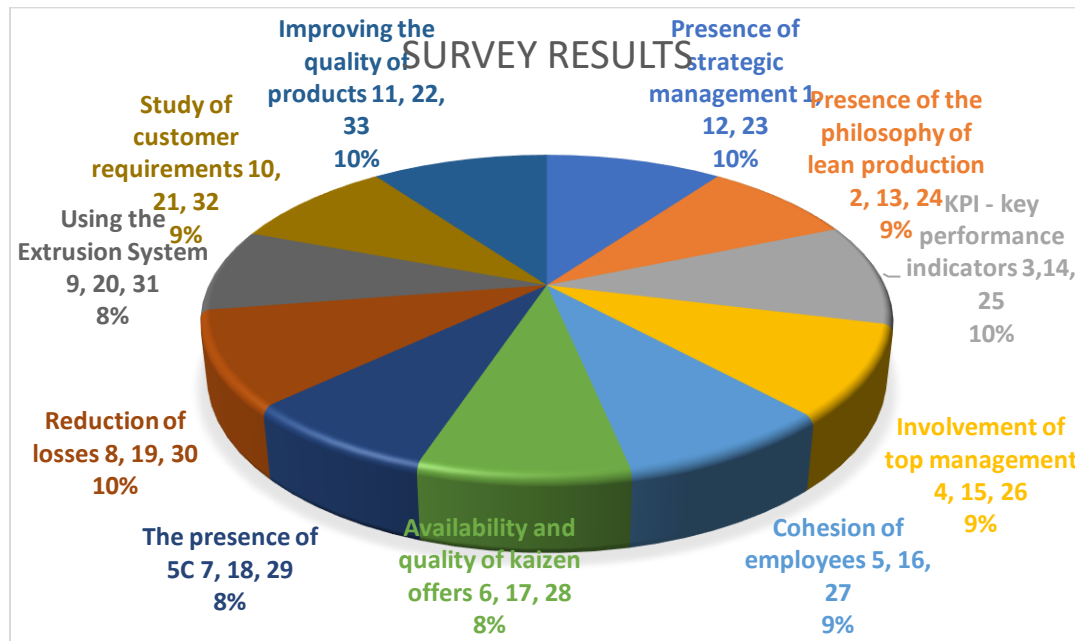
2 points - work is under way, results are there, but there are reserves for activization of activities

3 points - active work, continuous improvement of activities in this direction

Among the respondents there were workers with the post of blasting work leader, road master, precinct geologist, mining engineer, electrician, crusher, mine surveyor, mining mine surveyor, etc.

Summarize the scores on the survey, we can see a diagram that indicates the need to step up work on individual areas of Figure 9

Figure 7 Servey results



Considering the diagram it can be noted that the indicators "Availability 5C" and "Use of the drawing system" must be activated and improved in the company. It can also be noted that the results of the survey in the company indicators "Presence of strategic management", "KPI - key performance indicators" and "Improving the quality of products" is activated at full speed.

On the basis of the highlighted problems, the next chapter of this master's thesis will offer recommendations for optimizing production processes using lean manufacturing techniques.

4.3 Development of recommendations on optimization of production processes

Within the framework of optimization of production processes, it was suggested to use various lean manufacturing tools, the choice of which depended on the specific problem that arose in the enterprise.

First of all, on the way to elimination of losses, the organization of the workspace was proposed on the 5S system in conjunction with the standardization of work with an accurate description of each action, procedure and rules for their implementation. At the end of the working shift, everyone should prepare a workplace for the next shift.

The next item is the introduction of the TPM (Total Productive Maintenance) system. The method of universal care of equipment is based on the stabilization and continuous improvement of maintenance processes, the system of preventive maintenance, work on the principle of "zero defects" and the systematic elimination of all sources of losses. It is necessary to develop a maintenance schedule for the purposeful maintenance of the equipment, as well as to place a feedback board near the repair and mechanical service, which will allow monitoring the implementation of preventive maintenance plans. The application of this method will reduce the loss of equipment downtime, as well as the loss of time spent by employees in order to convey information about the detected breakdowns. Another point is the use of such tools as visualization of the workspace. The installation and labeling of the rack for spices will shorten the time to find the necessary spices and a long wait for their collection. Thus, within the framework of the proposed plan, not one but immediately a set of interrelated problems is being solved.

The main result was a reduction in organizational losses, which do not require monetary costs from management and the connection of an additional number of specialists.

Accordingly, it is necessary to continue to follow the concept of lean manufacturing, continuously, step by step improving not only the production process, but also human resources.

5 DISCUSSION AND CONCLUSION

5.1 Introduction

The purpose of this research was the formation and development of a lean manufacturing system, the development and justification of an implementation algorithm at enterprises of the Republic of Kazakhstan.

5.2 Discussion

The need to optimize the production processes of modern Kazakh enterprises is associated with several reasons. First, there is an intensification of international competition, during which the attractiveness of products becomes the determining factor for determining the position of the RK in the markets. Secondly, for many enterprises there is a shortage of investment resources, which reduces their ability to develop and increase competitiveness. In this connection, the use of the lean manufacturing concept, which contributes to increasing the competitiveness of the enterprise and optimizing production processes without significant financial costs, becomes particularly topical. With all the need to introduce this concept at Kazakh enterprises, its use in practice is hampered by a number of reasons: - Lack of detailed analysis of the external and internal environment of the enterprise where lean manufacturing tools are supposed to be applied; - Absence of general involvement in the process, including top management; - expectation of a "momentary" significant result; - Lack of a thoughtful, holistic implementation program; - the team lacks a common vision of why it is planned to introduce lean manufacturing. As a result of this work, a number of tasks were performed: 1. The theoretical foundations for shaping the prerequisites for lean manufacturing, the philosophy of the Japanese TPS production system were investigated, and the main tools and methods of the lean manufacturing system were considered.

If we compare all the existing definitions of the concept of lean production, then, as a rule, many of them are treated as minimization of losses in production, which is not entirely true. Systematization of the basic concepts of the lean manufacturing system has

shown that the essence of the concept lies in the philosophy of doing business, management. By definition, philosophy is one of the forms of social consciousness - the science of the most general laws of the development of nature, society and thinking. The application of technologies of this production makes sense, when the whole company operates according to unified standards and principles. 2. The domestic and foreign experience of introduction of the lean manufacturing concept was analyzed, the optimal stages of implementation of this concept were identified. To date, the concept of lean manufacturing is being introduced into the workflow, regardless of industry, scale or state. At any enterprise, it takes a long time to get a meaningful result. One of the indicators through which companies have the opportunity to successfully apply the concept of lean production is the one hundred percent involvement of the team in the system of continuous improvements, beginning with senior executives. It is quite possible and even necessary to implement lean manufacturing in the RK. However, successful implementation can be expected only if, on the basis of the available knowledge, our own system of production improvement will be built. 3. Within the framework of this master's thesis, recommendations for the introduction of the lean manufacturing concept for Kazakhstan enterprises were developed and algorithmized. One of the most important stages introduced into this algorithm, as a stage to the successful implementation of the concept, is the building of a new corporate culture based on respect for the individual. The philosophy of lean production is the philosophy of relations between people. The further result will depend on how well the leaders successfully and effectively build relationships with their subordinates. It is necessary to create such conditions that everyone would understand the meaning of changes in themselves and in their approach to work. It is very important to properly motivate employees to achieve their goals. 4. The efficiency of the production system has been evaluated and recommendations have been recommended.

5.3 Conclusion

The conducted studies of the production flow of the copper extraction site showed that its flow efficiency. The efficiency was calculated by comparing the time of adding value to the time of the operation. This result is due to the presence of losses of various kinds. As part of the improvement of production processes, it was proposed to use various lean manufacturing tools, the choice of which depended on the specific problem that arose in the enterprise. Such tools and methods as organization of workspace - 5S, standardization of work, general maintenance of equipment (TPM), visualization were involved. Accordingly, it is necessary to continue to follow the concept of lean manufacturing, continuously, step by step improving not only the production process, but also human resources. Summing up, we can say that in the current conditions of the conscious need to increase the efficiency of enterprises, the introduction of lean manufacturing is a required measure to ensure the competitiveness of the enterprise and the sustainable development of the future.

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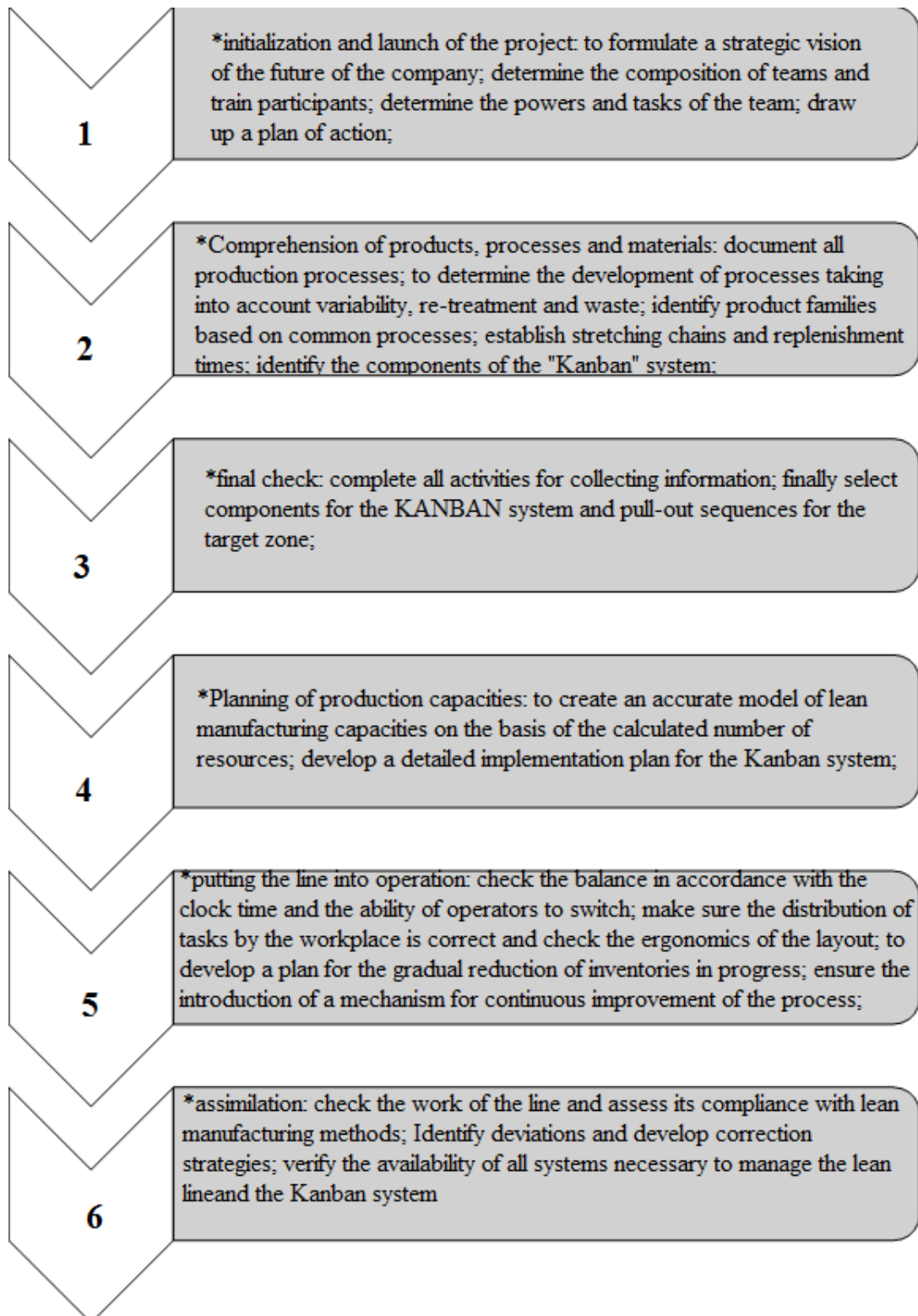
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APPENDICES

Appendix 1: Algorithm for lean manufacturing system implementation by Dennis Hobbes



Appendix 2: 14 principles of management by Jeffrey Laiker

Take management decisions with a long-term perspective even if this is detrimental to short-term financial goals	<ul style="list-style-type: none">• System and strategic approaches in setting goals.• Conceptual understanding of one's purpose - the foundation of all other principles.
A continuous flow process helps to identify problems.	<ul style="list-style-type: none">• Revise the process to create a continuous flow that effectively adds value.• This stream should become part of an organizational culture that is understandable to all. This is the key to continuous improvement and development of people.
Use the pull system to avoid overproduction	<ul style="list-style-type: none">• The basic principle: with the "just in time" system.• MINimization of work in progress and stockpiling• Susceptibility to daily fluctuations in
Distribute the amount of work evenly (heijunka): work like a turtle, and not like a hare.	<ul style="list-style-type: none">• Uniform distribution of the load in all processes associated with production and maintenance.
Do stop production to solve problems part of the production culture, if required by quality.	<ul style="list-style-type: none">• Quality for the consumer determines the manufacturer's value proposition.• Creation of equipment that is capable of independently recognizing problems and stopping at their detection.
Standard tasks are the basis for continuous improvement and delegation of authority to employees.	<ul style="list-style-type: none">• Use of stable, reproducible methods of work.• Fixing the accumulated knowledge about the process, standardizing the best methods at the moment consumer demand.
Use visual control so that not a single problem goes unnoticed.	<ul style="list-style-type: none">• Use simple visual aids.• Creation of simple visual control systems at workplaces, which help maintain flow and stretch.• Reduce the volume of reports to one sheet, even if it is a matter of major financial decisions.

<p>Use only reliable, proven technology</p>	<ul style="list-style-type: none"> • Before the introduction of new technology and equipment, tests should be carried out in real conditions.
<p>Bring up leaders who thoroughly know their business, profess the philosophy of the company and can teach it to others.</p>	<ul style="list-style-type: none"> • A good leader should know his daily work like his own five fingers, only then he can become a real teacher of the company's philosophy.
<p>Bring up outstanding people and form teams professing the philosophy of the company.</p>	<ul style="list-style-type: none"> • Creation of a strong, stable production culture with long-term value orientations and beliefs shared and accepted by all.
<p>Respect your partners and suppliers, set them challenging tasks and help them improve.</p>	<ul style="list-style-type: none"> • Creating conditions for partners, stimulating their growth and development. Then they will understand that they are appreciated. Set them challenging tasks and help them solve them.
<p>To understand the situation, you need to see everything with your own eyes (genti genbuutsu).</p>	<ul style="list-style-type: none"> • Everyone, including senior executives of the company and department heads, should see the problem with their own eyes, only then the understanding of the situation will be genuine, not superficial.
<p>Take a decision not hurrying up, on the basis of consensus, weighing all possible options; introducing it, do not delay</p>	<ul style="list-style-type: none"> • Do not make an unequivocal decision about the mode of action, until all the alternatives are weighed. • Nemavasi is a process of joint discussion of problems and potential solutions, involving all.
<p>Become a learning structure relentless self-analysis (hansei) and continuous improvement (kaizen)</p>	<ul style="list-style-type: none"> • Once the process has stabilized, continuous improvement tools should be used to identify the root causes of inefficient work, and take effective action.

Appendix 3: Answers for survey questionnaire

Анкета для опроса				
Предприятие	ЧКФКоррал			
Должность	Горно-работчик на мармеладной фабрике			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей			✓
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников			✓
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии		✓	
4	На предприятии происходит формирование самообучающейся организации			✓
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем	✓		
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений		✓	
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию		✓	
8	Осуществляется выравнивание объема работ		✓	
9	Создание процесса в виде непрерывного потока создания ценности	✓		
10	В организации проводится учет результатов работы с потребителем		✓	
11	Встроенный контроль качества	✓		
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней	✓	✓	
13	Формирование и работа команд, исповедующих философию бережливого производства		✓	
14	Существует система контроля за достижением целевых показателей эффективности		✓	✓
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства			✓
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»			✓
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством			✓
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)			✓
19	На предприятии определены основные потоки создания ценности			✓
20	На предприятии построены карты потоков создания ценности			✓
21	В организации проводится оценка уровня удовлетворенности потребителей			✓
22	Идет работа по выявлению источников возможных улучшений			✓
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени			✓
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника			✓
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения			✓
26	В нашей организации высокая степень доверия между сотрудниками и руководством			✓
27	На предприятии существуют рабочие межфункциональные группы			✓
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений			✓
29	Происходит ли попытка на предприятии перейти от 5С к 6С			✓
30	Происходит регулярная работа по выявлению и ликвидации потерь			✓
31	Произошел переход от системы выталкивания к системе вытягивания			✓
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований			✓
33	Потребности, предложения и жалобы покупателей регулярно изучаются			✓

1 балл- работа вводится на крайне низком уровне, отсутствие результата
2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности
3 балла- активная работа, постоянное совершенствование деятельности в данном направлении

Анкета для опроса

Предприятие	г. Комарат			
Должность	чл. маршеидер			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей			✓
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников			✓
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии		✓	
4	На предприятии происходит формирование самообучающейся организации		✓	
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем			✓
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений			✓
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию			✓
8	Осуществляется выравнивание объема работ			✓
9	Создание процесса в виде непрерывного потока создания ценности			✓
10	В организации проводится учет результатов работы с потребителем			✓
11	Встроенный контроль качества			✓
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней			✓
13	Формирование и работа команд, исповедующих философию бережливого производства			✓
14	Существует система контроля за достижением целевых показателей эффективности			✓
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства			✓
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»			✓
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством			✓
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)		✓	
19	На предприятии определены основные потоки создания ценности		✓	
20	На предприятии построены карты потоков создания ценности			✓
21	В организации проводится оценка уровня удовлетворенности потребителей			✓
22	Идет работа по выявлению источников возможных улучшений			✓
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени			✓
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника		✓	
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения			✓
26	В нашей организации высокая степень доверия между сотрудниками и руководством			✓
27	На предприятии существуют рабочие межфункциональные группы		✓	
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений		✓	
29	Происходит ли попытка на предприятии перейти от 5С к 6С		✓	
30	Происходит регулярная работа по выявлению и ликвидации потерь			✓
31	Произошел переход от системы выталкивания к системе вытягивания		✓	
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований		✓	
33	Потребности, предложения и жалобы покупателей регулярно изучаются			✓

1 балл- работа вводится на крайне низком уровне, отсутствие результата

2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности

3 балла- активная работа, постоянное совершенствование деятельности в данном направлении

Анкета для опроса

Предприятие	рубрика «Космос»			
Должность	дорожный мастер			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей		✓	
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников	✓		
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии			✓
4	На предприятии происходит формирование самообучающейся организации		✓	
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем	✓		
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений		✓	
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию		✓	
8	Осуществляется выравнивание объема работ			✓
9	Создание процесса в виде непрерывного потока создания ценности		✓	
10	В организации проводится учет результатов работы с потребителем		✓	
11	Встроенный контроль качества		✓	
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней		✓	
13	Формирование и работа команд, исповедующих философию бережливого производства	✓		
14	Существует система контроля за достижением целевых показателей эффективности			✓
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства		✓	
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»	✓		
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством	✓		
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)	✓		
19	На предприятии определены основные потоки создания ценности	✓		
20	На предприятии построены карты потоков создания ценности	✓		
21	В организации проводится оценка уровня удовлетворенности потребителей	✓		
22	Идет работа по выявлению источников возможных улучшений		✓	
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени			✓
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника		✓	
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения			✓
26	В нашей организации высокая степень доверия между сотрудниками и руководством	✓		
27	На предприятии существуют рабочие межфункциональные группы	✓		
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений		✓	
29	Происходит ли попытка на предприятии перейти от 5С к 6С	✓		
30	Происходит регулярная работа по выявлению и ликвидации потерь	✓		
31	Произошел переход от системы выталкивания к системе вытягивания	✓		
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований		✓	
33	Потребности, предложения и жалобы покупателей регулярно изучаются	✓		

1 балл- работа вводится на крайне низком уровне, отсутствие результата

2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности

3 балла- активная работа, постоянное совершенствование деятельности в данном направлении

Анкета для опроса

Предприятие	ТОО КТТТ Инжиррес			
Должность	Руководитель ББ			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей		✓	
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников			✓
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии			✓
4	На предприятии происходит формирование самообучающейся организации		✓	
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем	✓		
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений		✓	
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию		✓	
8	Осуществляется выравнивание объема работ	✓		
9	Создание процесса в виде непрерывного потока создания ценности		✓	
10	В организации проводится учет результатов работы с потребителем			✓
11	Встроенный контроль качества		✓	
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней		✓	
13	Формирование и работа команд, исповедующих философию бережливого производства	✓		
14	Существует система контроля за достижением целевых показателей эффективности		✓	
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства		✓	
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»			✓
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством			✓
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)		✓	
19	На предприятии определены основные потоки создания ценности		✓	
20	На предприятии построены карты потоков создания ценности	✓		
21	В организации проводится оценка уровня удовлетворенности потребителей		✓	
22	Идет работа по выявлению источников возможных улучшений		✓	
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени			✓
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника		✓	
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения		✓	
26	В нашей организации высокая степень доверия между сотрудниками и руководством		✓	
27	На предприятии существуют рабочие межфункциональные группы			✓
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений		✓	✓
29	Происходит ли попытка на предприятии перейти от 5С к 6С		✓	
30	Происходит регулярная работа по выявлению и ликвидации потерь		✓	
31	Произошел переход от системы выталкивания к системе вытягивания	✓		
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований		✓	
33	Потребности, предложения и жалобы покупателей регулярно изучаются			✓

1 балл- работа вводится на крайне низком уровне, отсутствие результата

2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности

3 балла- активная работа, постоянное совершенствование деятельности в данном направлении

Анкета для опроса

Предприятие	рудник "Конырат"			
Должность	дробильщик			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей	✓		
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников		✓	
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии	✓		
4	На предприятии происходит формирование самообучающейся организации		✓	
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем		✓	
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений			✓
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию	✓		
8	Осуществляется выравнивание объема работ		✓	
9	Создание процесса в виде непрерывного потока создания ценности			✓
10	В организации проводится учет результатов работы с потребителем	✓		
11	Встроенный контроль качества		✓	
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней		✓	
13	Формирование и работа команд, исповедующих философию бережливого производства			✓
14	Существует система контроля за достижением целевых показателей эффективности		✓	
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства	✓		
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»	✓		
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством	✓		
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)		✓	
19	На предприятии определены основные потоки создания ценности			✓
20	На предприятии построены карты потоков создания ценности		✓	
21	В организации проводится оценка уровня удовлетворенности потребителей		✓	
22	Идет работа по выявлению источников возможных улучшений			✓
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени		✓	
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника		✓	
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения			✓
26	В нашей организации высокая степень доверия между сотрудниками и руководством		✓	
27	На предприятии существуют рабочие межфункциональные группы	✓		
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений	✓		
29	Происходит ли попытка на предприятии перейти от 5С к 6С		✓	
30	Происходит регулярная работа по выявлению и ликвидации потерь		✓	
31	Произошел переход от системы выталкивания к системе вытягивания			✓
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований		✓	
33	Потребности, предложения и жалобы покупателей регулярно изучаются	✓		

1 балл- работа вводится на крайне низком уровне, отсутствие результата

2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности

3 балла- активная работа, постоянное совершенствование деятельности в данном направлении

Анкета для опроса

Предприятие	Издательство "Конкорд"			
Должность	Исполнительный директор			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей		✓	
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников			✓
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии		✓	
4	На предприятии происходит формирование самообучающейся организации			✓
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем	✓		
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений	✓		
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию		✓	
8	Осуществляется выравнивание объема работ			✓
9	Создание процесса в виде непрерывного потока создания ценности	✓		
10	В организации проводится учет результатов работы с потребителем	✓		
11	Встроенный контроль качества			✓
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней			✓
13	Формирование и работа команд, исповедующих философию бережливого производства	✓		
14	Существует система контроля за достижением целевых показателей эффективности	✓		
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства	✓		
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»		✓	
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством	✓		
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)	✓		
19	На предприятии определены основные потоки создания ценности	✓		
20	На предприятии построены карты потоков создания ценности	✓		
21	В организации проводится оценка уровня удовлетворенности потребителей		✓	
22	Идет работа по выявлению источников возможных улучшений	✓		
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени		✓	
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника		✓	
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения	✓		
26	В нашей организации высокая степень доверия между сотрудниками и руководством		✓	
27	На предприятии существуют рабочие межфункциональные группы			✓
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений	✓		
29	Происходит ли попытка на предприятии перейти от 5С к 6С		✓	
30	Происходит регулярная работа по выявлению и ликвидации потерь		✓	
31	Произошел переход от системы выталкивания к системе вытягивания	✓		
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований		✓	
33	Потребности, предложения и жалобы покупателей регулярно изучаются			✓

1 балл- работа вводится на крайне низком уровне, отсутствие результата

2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности

3 балла- активная работа, постоянное совершенствование деятельности в данном направлении

Анкета для опроса

Предприятие	Рудник "Косарск"			
Должность	Энергетик горного участка			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей		✓	
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников			✓
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии			✓
4	На предприятии происходит формирование самообучающейся организации			✓
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем			✓
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений		✓	
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию		✓	✓
8	Осуществляется выравнивание объема работ			✓
9	Создание процесса в виде непрерывного потока создания ценности		✓	
10	В организации проводится учет результатов работы с потребителем			✓
11	Встроенный контроль качества			✓
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней			✓
13	Формирование и работа команд, исповедующих философию бережливого производства			✓
14	Существует система контроля за достижением целевых показателей эффективности			✓
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства			✓
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»		✓	
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством		✓	✓
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)		✓	
19	На предприятии определены основные потоки создания ценности		✓	
20	На предприятии построены карты потоков создания ценности			✓
21	В организации проводится оценка уровня удовлетворенности потребителей			✓
22	Идет работа по выявлению источников возможных улучшений			✓
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени			✓
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника			✓
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения			✓
26	В нашей организации высокая степень доверия между сотрудниками и руководством			✓
27	На предприятии существуют рабочие межфункциональные группы			✓
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений		✓	
29	Происходит ли попытка на предприятии перейти от 5С к 6С		✓	
30	Происходит регулярная работа по выявлению и ликвидации потерь			✓
31	Произошел переход от системы выталкивания к системе вытягивания			✓
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований			✓
33	Потребности, предложения и жалобы покупателей регулярно изучаются		✓	
<p>1 балл- работа вводится на крайне низком уровне, отсутствие результата 2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности 3 балла- активная работа, постоянное совершенствование деятельности в данном направлении</p>				

Анкета для опроса

Предприятие	рубрика "Комоград"			
Должность	участковой мастер			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей			✓
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников		✓	
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии			✓
4	На предприятии происходит формирование самообучающейся организации	✓		
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем	✓		
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений	✓		
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию		✓	
8	Осуществляется выравнивание объема работ			✓
9	Создание процесса в виде непрерывного потока создания ценности		✓	
10	В организации проводится учет результатов работы с потребителем			✓
11	Встроенный контроль качества			✓
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней		✓	
13	Формирование и работа команд, исповедующих философию бережливого производства		✓	
14	Существует система контроля за достижением целевых показателей эффективности			✓
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства		✓	
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»		✓	
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством			✓
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)	✓		
19	На предприятии определены основные потоки создания ценности			✓
20	На предприятии построены карты потоков создания ценности			✓
21	В организации проводится оценка уровня удовлетворенности потребителей		✓	
22	Идет работа по выявлению источников возможных улучшений			✓
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени			✓
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника	✓		
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения			✓
26	В нашей организации высокая степень доверия между сотрудниками и руководством			✓
27	На предприятии существуют рабочие межфункциональные группы		✓	
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений		✓	
29	Происходит ли попытка на предприятии перейти от 5С к 6С	✓		
30	Происходит регулярная работа по выявлению и ликвидации потерь			✓
31	Произошел переход от системы выталкивания к системе вытягивания	✓		
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований		✓	
33	Потребности, предложения и жалобы покупателей регулярно изучаются		✓	

1 балл- работа вводится на крайне низком уровне, отсутствие результата

2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности

3 балла- активная работа, постоянное совершенствование деятельности в данном направлении

Анкета для опроса

Предприятие	<i>ИДНХ "Косврат"</i>			
Должность	<i>инженер на производственных работах</i>			
№	Показатели оценки	Оценка в баллах		
		1	2	3
1	Принятие управленческих решений происходит с учетом стратегических целей		✓	
2	Наличие и воспитание лидеров, исповедующих философию компании и обучающих сотрудников		✓	
3	Каждый сотрудник имеет четкое представление о текущих целях своей деятельности на предприятии			✓
4	На предприятии происходит формирование самообучающейся организации		✓	
5	На предприятии существует программа развития творческих способностей сотрудников в области решения проблем		✓	
6	Ведется учет как реализованных идей, так и общего количества кайдзен-предложений		✓	
7	Операционные процессы на предприятии регулярно улучшаются посредством специально запущенных программ по их совершенствованию		✓	
8	Осуществляется выравнивание объема работ			✓
9	Создание процесса в виде непрерывного потока создания ценности		✓	
10	В организации проводится учет результатов работы с потребителем		✓	
11	Встроенный контроль качества			✓
12	Большинство сотрудников организации могут своими словами сформулировать миссию организации и согласны с ней		✓	
13	Формирование и работа команд, исповедующих философию бережливого производства		✓	
14	Существует система контроля за достижением целевых показателей эффективности		✓	
15	Руководство личным примером демонстрирует приверженность к философии бережливого производства	✓		
16	Персонал предприятия регулярно проходит обучение по методике «Бережливое производство»	✓		
17	На предприятии высокая доля реализованных предложений от зарегистрированных и одобренных руководством		✓	
18	На предприятии высока доля подразделений, в которых внедрены инструменты бережливого производства (5С)	✓		
19	На предприятии определены основные потоки создания ценности		✓	
20	На предприятии построены карты потоков создания ценности		✓	
21	В организации проводится оценка уровня удовлетворенности потребителей		✓	
22	Идет работа по выявлению источников возможных улучшений			✓
23	Стратегические цели время от времени пересматриваются в зависимости от требований времени		✓	
24	Философия бережливого производства нашла отражение не только в декларациях и принципах, но и в практической деятельности каждого сотрудника	✓		
25	Каждый сотрудник имеет четкое представление о текущих целях своего подразделения		✓	
26	В нашей организации высокая степень доверия между сотрудниками и руководством		✓	
27	На предприятии существуют рабочие межфункциональные группы			✓
28	На предприятии высока доля персонала, участвующего в подаче и реализации предложений		✓	
29	Происходит ли попытка на предприятии перейти от 5С к 6С	✓		
30	Происходит регулярная работа по выявлению и ликвидации потерь	✓		
31	Произошел переход от системы выталкивания к системе вытягивания		✓	
32	Организация постоянно изучает рынок и потребителей на предмет новых возможностей и новых требований		✓	
33	Потребности, предложения и жалобы покупателей регулярно изучаются		✓	

1 балл- работа вводится на крайне низком уровне, отсутствие результата

2 балла- работа вводится, результат есть, но присутствуют резервы по активизации деятельности

3 балла- активная работа, постоянное совершенствование деятельности в данном направлении