Ministry of Education and Science of Ukraine
Ternopil Ivan Puluj National Technical University
Economics and management faculty
Management and Administration department

EXPLANATORY NOTE

to the Bachelor's paper

ON TOPIC
"Research on innovative technologies at the enterprise ("Budindustriya" plant of LLC "Ternopilbud" as a case study)"

Performed by: 4-th year student
Group: IBM-43
Speciality: 073 Management

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Ternopil – 2025

Ministry of Education and Science of Ukraine
Ternopil Ivan Puluj National Technical University

Faculty Economics and management
Department Management and administration
Educational Degree Bachelor's Degree
Specialty 073 Management

Approved by:
Department Head *Olena Sorokivska*

BACHELOR'S PAPER TASK

Kadziela Michal Jakub
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1. Bachelor's paper Topic:

Research on innovative technologies at the enterprise ("Budindustriya" plant of LLC "Ternopilbud" as a case study)

Supervisor PhD Ivanna Lutsykiv
(full name, scientific degree, academic rank)

Approved by the Order on « 29 » September 2024 № 4/7-950
2. Submission deadline « »
3. Input data Statistical information, legislative documents, company reports.

4. Brief Content of the Bachelor's paper:
Chapter 1. Theoretical fundamentals of the development of innovative technologies in the construction industry.
Chapter 2. Assessment of the innovative activity of the plant Budindustriya LLC Ternopilbud.
Chapter 3. Ways to improve innovative activity of the plant Budindustriya LLC Ternopilbud.
Chapter 4. Life safety, basics of labor protection.
5. List of tables and figures:
Narrow and broad concept of innovation. The organizational structure. Results of the study of technical and economic indicators of the "Budindustriya" Plant. The structure and dynamics of fixed assets during 2022- 2023 years. SWOT analysis of the prerequisites for enhancing innovation activity at the plant. Projected financial results of the project for 2025. Capital expenditures for project implementation. Sales volume of pinoizol insulation. Planned cost calculation for producing pinoizol insulation.

6. Consultants to Bachelor's paper Chapters

Chapter	Consultant's full name	Signature, date	
		given by	checked by
Occupational health and safety in emergencies	Ihor Okipnyi		

7. Date of assigning the task 5 September 2024

CALENDAR PLAN

№	Content	Chapters Deadline	Note
	Introduction	October	Done
1.	Theoretical fundamentals of the development of innovative technologies in the construction industry.	October	Done
1.1	Definition of innovative technologies and their role in the industry.	October	Done
1.2	The impact of innovation on the competitiveness of construction companies.	October	Done
2.	Assessment of the innovative activity of "Budindustriya" plant of LLC "Ternopilbud".	November	Done
2.1	Characteristics of "Budindustriya" plant of LLC "Ternopilbud".	November	Done
2.2	Analysis of implemented innovative technologies at "Budindustriya" plant of LLC "Ternopilbud".	November	Done
3.	Ways to improve innovative activity of "Budindustriya" plant of LLC "Ternopilbud".	November	Done
3.1	Organization of cinder block production as a method of increasing the profitability of the enterprise.	December	Done
3.2	Development of a project for the organization of a new production of pinoizol insulation.	December	Done
4.	Safety of activities, fundamentals of labor protection.	December	Done
4.1	Safety requirements at construction sites.	December	Done
4.2	Organization of first aid for injuries at a construction site.	December	Done
	Conclusions	December	Done
	References	December	Done

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ABSTRACT

Topic: Research on innovative technologies at the enterprise ("Budindustriya" plant of LLC "Ternopilbud" as a case study).

Bachelor Degree Paper consists of 58 pages, 3 figure, 11 tables, and 23 references.

The subject of research is an innovation activity of "Budindustriya" plant of LLC "Ternopilbud".

The object of research is the process of improving existing technologies and implementing innovative technologies at the "Budindustriya" plant of LLC "Ternopilbud".

The aim of the Bachelor's paper is to develop methodological approaches and practical recommendations for enhancing existing technologies and introducing innovative technologies at the enterprise.

The results are obtained with the following research methods: systematic and comprehensive approaches, methods of comparison, generalization, and exploration of cause-and-effect relationships.

The thesis substantiates a project for organizing new production lines for cinder blocks and pinoizol insulation to increase the profitability of the enterprise.

The results have been implemented in the operations of the "Budindustriya" plant of LLC "Ternopilbud."

The practical significance of the results lies in the development of proposals to of improving existing technologies and implementing innovative technologies at the "Budindustriya" plant of LLC "Ternopilbud".

Keywords: technology, innovative technologies, construction complex, payback period, net present value, profitability index, capital investment.

АНОТАЦІЯ

Тема: Дослідження інноваційних технологій на підприємстві, на прикладі комбінату “Будіндустрія” ТОВ “Тернопільбуд”.

Кваліфікаційна робота бакалавра: 58 сторінок, 3 рисунок, 11 таблиць, 23 літературних джерела.

Предмет дослідження – інноваційна дільність комбінату “Будіндустрія” ТОВ “Тернопільбуд”.

Об’єкт дослідження – процес вдосконалення існуючих та впровадження інноваційних технологій на комбінаті “Будіндустрія” ТОВ “Тернопільбуд”.

Метою роботи є розробка методичних підходів та практичних рекомендацій щодо вдосконалення існуючих та впровадження інноваційних технологій на підприємстві.

Методи дослідження – системний і комплексний підходи, методи порівняння, узагальнення, пошук причинно-наслідкових зв'язків.

В роботі обґрунтовано проект організації нового виробництва шлакоблоків та утеплювача “піноізол” з метою підвищення прибутковості підприємства.

Результати впровадженні в діяльність комбінату “Будіндустрія” ТОВ “Тернопільбуд”.

Практичне значення роботи полягає у розробці пропозицій щодо вдосконалення існуючих та впровадження інноваційних технологій на заводі «Будіндустрія» ТОВ «Тернопільбуд».

Ключові слова: технологія, інноваційні технології, будівельний комплекс, термін окупності, чиста теперішня вартість, індекс прибутковості, капітальні вкладення.

CONTENT

INTRODUCTION

Relevance of the topic. Innovation is one of the key concepts of the modern economy, which is fundamental to the development of enterprises and their ability to compete in a dynamically changing market. In particular, the construction sector, characterized by intensive use of resources and capital, requires constant implementation of new technologies and optimization of production processes. Construction not only affects the development of infrastructure and the national economy, but also sets the directions of technological and ecological changes, which are a response to the challenges related to environmental protection and sustainable development.

Trends in construction indicate a shift from traditional approaches to innovative and sustainable solutions, open up new opportunities for growth and development of the construction materials market, and contribute to the creation of an environmentally friendly and safe environment. Construction companies that follow trends and implement innovations and new technologies can remain competitive and successful in the dynamic environment of modern construction.

The purpose of this study is to develop methodological approaches and practical recommendations for improving existing and introducing innovative technologies at "Budindustriya" plant of LLC "Ternopilbud". The tasks include:

- to study the theoretical bases of intensification of innovation activity of enterprises, to define the conceptual bases of intensification of innovation activity of enterprises in building industry;

- to analyse the production and economic activity and peculiarities of implementation of innovative activity of the "Budindustriya" plant of LLC "Ternopilbud" ;

- to develop directions of intensification of innovation activity at the "Budindustriya" plant of LLC "Ternopilbud".

Object of study – the innovation activity of an enterprise.

Subject of study – the intensification of innovation activity of "Budindustriya" plant of LLC "Ternopilbud".

The practical significance of the results lies in the development of proposals to intensification of innovation activity of "Budindustriya" plant of LLC "Ternopilbud".

Research methods include structured and holistic approaches, techniques of comparison, synthesis, and exploration of causal relationships.

Information base of the study: data from the website "Budindustriya" plant of LLC "Ternopilbud", Ukrainian legal framework, statistical information, economic studies, and conference proceedings.

CHAPTER I
THEORETICAL FUNDAMENTALS OF THE DEVELOPMENT OF INNOVATIVE TECHNOLOGIES IN THE CONSTRUCTION INDUSTRY

1.1 Definition of innovative technologies and their role in the industry

Innovation is a concept with a very broad meaning, which is defined as changing the current way of doing things into a new, more effective one, or as a process, in which existing resources and possibilities are transformed into new ideas and then implemented in practice. This includes not only inventions or modern production technologies, but also innovations in areas such as trade, logistics or management. The term "innovation" comes from Latin, in which the words innovare mean creating something new, and innovatio - renewal. According to some authors, the origin of this term is also connected with the word novus, which means newness.

The concept of innovation was introduced to economics by JA Schumpeter at the beginning of the 20th century. He defined innovations broadly, indicating their role as an innovative combination of capital and means of production. In his approach, innovations included five key categories: introducing a new product or service that was not previously known to customers, implementing innovative production or distribution methods that had not been used before in a given industry, opening new markets, regardless of whether they existed before, obtaining new sources of raw materials or semi-finished products, both existing and newly discovered, and the creation of new organizational structures in the industry, such as changes in production systems [2]. The traditional approach to innovation treats it as a multi-faceted process leading to qualitative changes in the activities of enterprises.

Schumpeter also noticed that innovations can be the foundation for breakthrough changes and a key catalyst for economic development. The introduction of this concept by Schumpeter started a debate on the importance of innovation in the context of the economy.

As emphasized in the literature, the definitions of innovation have evolved along with economic development, which results from the diversity of theoretical approaches as well as and the relatively short history of innovation research [20].

There are two main approaches to defining innovation in the literature – narrow and broad. In a narrower sense, innovations refer only to the first use of an invention or a new product [4]. In turn, a broader view includes all research and development processes aimed at implementing improved solutions in technique, technology, organization and society.

An example of a narrow approach is the definition by Freeman and Soete, who define innovation as the first commercial use of a new technology or product. In turn, Porter understands innovation as a continuum of changes, from simple modifications of existing products to fundamentally new solutions, involving scientific, technological and organizational activities.

The Oslo Manual, an international methodological manual, defines innovation both in the context of implementing new or significantly improved products and processes, as well as organizational and marketing methods [20]. However, a narrower approach focuses on technical innovations, such as new products or processes.

Table 1.1 presents a summary of the definition of innovation in two approaches: narrow and broad. In the narrow sense, it focuses on the first use of new technologies, products or inventions. In the broad sense, it includes the broader processes of research, development and implementation of improved solutions in various contexts, such as an organization or society.

Some researchers also distinguish innovation as a result and as a process. In the result approach, innovations are treated as changes in production leading to the creation of new products. In the process approach, innovations include creative thinking aimed at developing and implementing improved solutions in various areas of activity, from technology to society.

One of the common divisions of innovation is a classification that includes four basic types: product innovation, process (technological), organizational and marketing innovation.

Each of these types plays an important role in the functioning of modern enterprises, influencing various aspects of their activities.

Table1.1 – Narrow and broad concept of innovation – selected definitions

Author	Definition	Take
Carter, Williams (1958)	Innovation is the introduction of an invention that is a part of unused technological knowledge.	Narrow
Kuznets (1959)	Innovation is a new application of old or new knowledge to the production process initiating the application of the invention.	Narrow
Mansfield (1968)	Innovation is the first use of a novel product, process, system or device (machine).	Narrow
Whitfield (1979)	Innovation is any modification based on the assimilation of transferred knowledge. Innovation is a series of complex actions consisting of solving problems. As a result, a comprehensive and completely developed novelty is created.	Narrow
Freeman, Soete (1994)	Innovation is the first commercial application or production of a new technology or product.	Narrow
Kotler (1994)	Innovation is any good that is perceived by someone as new.	Narrow
Begg (1997)	Innovation is the application of new knowledge in the production process.	Narrow
Barnett (1953)	An innovation is any thought, behavior, or thing that is new, i.e. qualitatively different from existing forms.	Wide
Porter (1990)	Innovation is the economically successful exploitation of new ideas. It is a continuum of technical and organizational changes, encompassing on the one hand simple modifications of existing products, processes and practices to fundamentally new products and processes.	Wide
Lundval (1992)	Innovation is an interactive learning process that has a social and territorial reference and a cultural and institutional context.	Wide
Rothwell (1992)	Innovation is the process of accumulating know-how and learning internally and externally. It is the technical, financial, management, design, production, and marketing activities involved in the commercialization of a new or improved manufacturing process.	Wide
Haffer (1998)	Innovations are all changes that, in given spatial and temporal conditions, are perceived as carriers of novelty concerning both material and immaterial cultural products.	Wide
Rogers (2003)	An innovation is an idea, practice or object that is recognized as new by a person or other entity that adopts it.	Wide
Bogdanienko, Haffer, Poplawski (2004)	Innovation is the final stage in the creation of a new material reality; it is the first application of new ideas in practice.	Wide
Carter A.P. (2007)	Innovations are a heterogeneous phenomenon, and moreover, still undefined, and they are distinguished by one feature, which is novelty.	Wide

Product innovations refer to any changes aimed at improving the products manufactured by a company. These are changes in technical parameters, components, and the use of new materials resulting from the achievements of material engineering. Product

innovations may also consist in expanding the product range with new products. Importantly, such innovations may be based on completely new technologies, the use of existing technologies in new applications, or the implementation of knowledge from other fields. The introduction of a new product that meets the growing demands of consumers allows companies to strengthen their competitive position [8]. An example would be the introduction of modern smartphones with functions based on artificial intelligence that were not available before.

Process innovations, also known as technological innovations, include changes in the methods of production or service provision used, as well as in the methods of delivering products to customers. In this case, changes may concern both devices and and organization of production, and often result from the use of new technological knowledge. The aim of process innovations may be both the production of new or improved products that could not be created using conventional methods, as well as increasing the efficiency of production of existing products. An example is the automation of the production line, which allows for cost reduction, increased precision and improved quality of products.

Organizational innovations include changes in the way a company is managed, the way the workplace is organized, and in external relations. To be considered innovative, such changes must bring measurable benefits to the company, such as increased productivity, reduced costs, or increased sales [9]. Examples of organizational innovations include implementing advanced management techniques such as Total Quality Management (TQM), restructuring the organization to increase its flexibility, and introducing new operating strategies that allow for better adaptation to changing market conditions.

Marketing innovations mean the use of new methods in marketing that involve significant changes in the product's appearance, packaging, positioning, promotion, pricing policy or business model. The aim of these innovations is to stand out from the competition, attract new customers and increase the value of the offer for consumers. Examples include the introduction of a new brand symbol, modern packaging or innovative pricing strategies, such as dynamic price adjustments depending on demand.

In today's market, special attention is paid to technological innovations, which are the driving force behind generating economic value. They are a key factor in building competitive advantage, but not all important innovations have to be based solely on technology. Companies should therefore decide to what extent to focus on technological innovations and to what extent on business models. An example of routine innovation, i.e. developing existing technological competences within the current business model, is the successive introduction of increasingly efficient microprocessors by Intel [22].

Disruptive innovations, on the other hand, require a new business model, but do not necessarily involve a technological revolution. Google's introduction of the Android operating system, which is free, unlike Apple's or Microsoft's paid systems, is an example of a disruptive innovation that changes the rules of the game in the market.

Radical innovations, on the other hand, concern innovative technological solutions that do not require a change in the business model, but introduce completely new technologies, such as the use of genetic engineering in medicine. The last type is structural innovation, combining fundamental changes in technology and the business model. An example is the transformation of the photography industry in the digital era, where traditional companies such as Kodak had to master new technological competences and change their business approach.

The variety of types of innovations indicates the need for a strategic approach to their implementation, taking into account both internal and external sources, such as cooperation with universities or the purchase of technological licenses. The main sources of innovation, both technological and organizational, should be aimed at creating a sustainable competitive advantage of the enterprise [16].

Innovative technologies can be defined as advanced tools, processes, methods and materials that significantly change the traditional approach to production, management and functioning of enterprises. Their main goal is to increase efficiency, reduce costs, improve the quality of products or services and minimize negative impact on the environment.

According to the Oslo Manual, innovative technologies include the implementation of new or significantly improved products, processes, organizational and marketing methods

Examples of innovative technologies in industry are production automation systems that use artificial intelligence (AI) and robotics. These solutions enable companies to produce products with greater precision and less labor, which leads to increased competitiveness in the market. In the construction sector, innovative technologies such as 3D printing, the use of intelligent materials or building information modeling (BIM) allow for shorter project implementation times and optimization of resources.

Innovative technologies play a key role in the transformation of modern economic sectors. Their use is not limited only to improving the technical parameters of products, but also includes an impact on the business model and market structure [13]. Introduction of innovative technologies in the industry comes with several key benefits:

a) Increased production efficiency – innovative technologies enable optimization of production processes through automation, better resource management and reduction of material losses. For example, the use of Industry 4.0 technologies, including the Internet of Things (IoT), allows for real-time data collection, which improves operational decision-making.

b) Increased competitiveness of enterprises – by implementing innovative technological solutions, companies can deliver products of higher quality and lower costs, which allows them to stand out from the competition. An example are innovations in the automotive industry, such as electric and autonomous vehicles, which are redefining the transport market.

c) Sustainable development – in the face of growing ecological challenges, innovative technologies contribute to reducing the negative impact of industrial activity on the environment. Technologies such as renewable energy sources, material recycling or intelligent waste management support the achievement of sustainable development goals.

d) Creating new markets and employment opportunities – implementing innovative technologies leads to the creation of new economic sectors, such as the space industry,

blockchain technologies or biotechnology. The development of these fields generates new jobs and stimulates national economies.

e) Development of a knowledge-based society – industry driven by technological innovation contributes to increasing the importance of knowledge and education in society. Companies investing in research and development (R&D) play a key role in creating technological and social progress.

In summary, innovative technologies are not only a tool for modernizing industry, but also a foundation for the future of the global economy. Their role in creating competitive enterprises, building sustainable production models and developing new markets makes them a key element of the modern business world. Enterprises that properly use the potential of innovative technologies gain a competitive advantage and can respond more effectively to dynamic changes in the market environment.

1.2 The impact of innovation on the competitiveness of construction companies

The main driving force behind the country's long-term economic development is innovation, which requires investment. Today, in the period of Ukraine's transformation into a global market economy, the competitive position of the state will be determined by the availability of innovative potential and the effectiveness of mechanisms for financing its development. Legal regulation in the field of technology and innovation is governed by the following laws of Ukraine

Innovations play a key role in increasing the competitiveness of construction companies, enabling them to adapt to dynamically changing market conditions and growing customer expectations. Implementing modern technologies and processes allows construction companies to optimize costs, improve the quality of services and increase operational efficiency.

The level of development of the construction sector has a significant impact on the proportions and pace of development of various sectors of the country's economy, as well as

on the distribution and regional development of productive forces. As the construction industry develops, so does the production of building materials and equipment, engineering, metallurgy and metal processing, petrochemicals, glass production, wood processing, transport, energy and other industries.

Construction is one of the most capital-intensive sectors of the economy. The quality of life of both companies and the population as a whole depends on its scientific, technical, economic and competitive state [2]. The growth rate of housing construction requires the introduction of new architectural and construction systems and technologies, as well as the use of energy-saving technical equipment.

Modern housing makes new demands on building materials and products. These include a high level of factory readiness, minimal labour costs on the construction site, high quality, etc. Changes in ownership are leading to adjustments in the structure of housing - the proportion of low-rise buildings is increasing, the level of comfort in such housing is rising, and the requirements for the efficiency and quality of technical support systems are increasing.

One of the main areas where innovations affect the competitiveness of construction companies is process automation. The use of advanced technologies, such as building information modeling (BIM), enables precise planning and project management, which leads to a reduction in errors and a shorter investment implementation time. According to the report "Construction. Innovations [1]. Vision of industry leaders 2025", automation of construction processes is one of the key directions of development of the industry in Poland.

Another important aspect is the introduction of innovative building materials that are characterized by better technical parameters and greater durability. An example is the use of concrete with increased strength or composite materials that increase the energy efficiency of buildings. This approach not only improves the quality of implemented projects, but also contributes to sustainable development and environmental protection.

Innovations in the area of work organization and project management also have a significant impact on the competitiveness of construction companies. Implementation of

modern management methods, such as Lean Construction or Agile, allows for better use of resources, reduction of waste and increased flexibility in project implementation. Thanks to this, companies can react faster to changing market needs and customers.

It is also worth paying attention to innovations in marketing and customer relations. The use of modern communication tools, such as social media and digital platforms, allows construction companies to reach a wider audience and build lasting relationships with customers. In addition, the use of virtual reality (VR) technology allows for the presentation of projects in a more attractive and engaging way for potential investors.

The increasing emphasis on sustainability has created new opportunities for construction companies to differentiate themselves through green innovations [10]. By adopting environmentally friendly practices, companies can address global challenges such as climate change, resource depletion, and pollution while appealing to eco-conscious customers. Key innovations in sustainable construction include:

a) Net-Zero Energy Buildings (NZEBs) - these buildings generate as much energy as they consume through renewable energy sources, such as solar panels and wind turbines. Construction companies leveraging NZEB designs gain a competitive edge in markets with stringent environmental regulations.

b) Circular Construction Practices - recycling and repurposing materials from demolition projects reduce waste and decrase dependency on virgin resources. Companies that embrace circular construction not only lower costs but also enhance their reputation as sustainable industry leaders.

c) Green Certifications1 - Acquiring certifications such as LEED (Leadership in Energy and Environmental Design) or BREEAM (Building Research Establishment Environmental Assessment Method) demonstrates commitment to sustainability and attracts environmentally conscious clients.

Digital technologies are redefining how construction companies operate, providing tools to enhance efficiency, accuracy, and collaboration. Digital transformation fosters competitiveness in several ways:

a) Cloud-Based Collaboration Platforms - Tools such as Procore and Autodesk Construction Cloud enable seamless communication and document sharing among stakeholders, reducing delays and improving project outcomes.

b) Augmented Reality (AR) and Virtual Reality (VR) - These technologies enhance design visualization and decision-making by allowing clients and teams to explore 3D models of projects before construction begins. This leads to better client satisfaction and reduces costly design changes.

c) Digital Procurement Systems - Automating procurement processes ensures timely delivery of materials, minimizes human errors, and allows for cost optimization by comparing supplier options in real time.

In an industry that often faces labor shortages and high turnover rates, innovative approaches to workforce management can significantly improve competitiveness. Examples include:

a) Skill Development through E-Learning Platforms - By providing access to online training modules, companies can upskill their workforce in areas such as advanced machinery operation, project management, and sustainability practices.

b) Gamification of Training - using game-like elements to train workers enhances engagement and retention, making learning faster and more effective.

c) AI-Driven Workforce Analytics - Predictive analytics helps companies forecast labor needs, optimize schedules, and reduce downtime, ensuring timely project delivery.

Smart construction involves integrating IoT (Internet of Things) devices and data-driven technologies into building projects, leading to smarter infrastructure and better resource management.

a) IoT-Enabled Monitoring Systems - Sensors embedded in construction sites monitor variables such as equipment usage, material inventory, and environmental conditions in real time, ensuring efficiency and safety.

b) Smart Infrastructure - Incorporating smart features like automated lighting, HVAC systems, and self-maintenance capabilities into buildings adds long-term value for clients.

c) Predictive Maintenance - IoT and AI technologies predict potential equipment failures before they occur, reducing downtime and repair costs.

There is a steady trend towards an increase in the share of individual housing. This contributes to the growth of the share of brick houses, while the share of houses made of monolithic reinforced concrete, frame-panel and cellular concrete structures has increased more than 5 times. The volume of housing construction of wooden structures is growing. Accordingly, the share of large-panel construction has halved over the past ten years [15]. The use of local small-piece materials has virtually replaced precast concrete in building envelopes.

All of these factors should be taken into account when modernising and re-equipping existing facilities for the production of building materials, products and structures. New technologies should be focused on providing construction with both traditional products (such as floor slabs, etc.) and those that are in demand on the market today. These include, in particular, small-piece flooring elements, structural elements of hinged insulation systems, heat-efficient wall blocks made of foam concrete, perlite concrete, and others.

It is expected that gypsum-based materials will become widespread, as Ukraine has a sufficient raw material base. Gypsum products, being environmentally friendly, will be more widely used in residential construction to replace polymeric finishing materials.

Today's construction market offers a wide range of different engineering systems and equipment for buildings, autonomous boilers, appliances and fittings.

Gosstroy pays attention to the proposals of various leading companies and develops such systems through experimental implementation, followed by a review of the results. After the analysis, the existing state standards are adjusted and improved, and the possibilities of using new efficient appliances, equipment and systems are expanded.

When determining the priority areas for the development of industrial construction technologies, it should be assumed that the construction of new production facilities will be carried out in small volumes at present and in the near future. The main directions and

priorities of the structural reorganisation of industrial construction will be the expansion, reconstruction, re-profiling and technical re-equipment of existing industrial facilities.

It should be borne in mind that in Ukraine, industrial facilities in the basic industries alone use more than 35 million tonnes of load-bearing metal structures and about 250 million m3 of reinforced concrete structures, most of which are already worn out. Almost a third of all industrial facilities are potentially hazardous.

There is a gap in the degree of capital investment in the construction part and short-lived modern technologies. With a service life of 50-75 years for industrial buildings, the obsolescence of technological equipment currently occurs in 6-8 years. In this regard, there is a need for prompt re-equipment of industrial production, which is not always possible in the context of existing building design solutions.

In such circumstances, it is obvious that the giant companies will be replaced by small and medium-sized enterprises with an investment cycle of several years. In terms of urban planning, the emphasis is on densification and a more complete and rational use of industrial sites. There is a growing emphasis on increasing the capacity of companies, extending the life of buildings and structures, solving environmental problems and reducing operating costs [23].

Generalisation and analysis of the experience of modern industrial construction show that reinforced concrete retains a priority place in the overall structure of global construction production. The main areas of its development are as follows

- Development and application of high strength concrete structures with non-metallic reinforcement;

- Improvement of structures with pre-stressed reinforcement;

- Reuse of materials in the manufacture of reinforced concrete structures;

- Improvement of design methods and strengthening of reinforced concrete structures of buildings and structures in conditions of seismic impact;

- Improvement of structural solutions for buildings and structures of various functional purposes.

In the factory environment, flexible technologies focused on the production of small batches of various products with the use of automation and robotics systems in these technologies should be given priority for the production of precast concrete.

In general, the reuse of materials in construction, as one of the most material-intensive industries, is considered one of the promising areas for improving the construction complex of technically developed countries. Three main technologies are considered:

- reuse of building materials that have been properly prepared and used in similar or other structures;

- use of waste from various nonconstruction industries;

- re-use of specially adapted structures that have been dismantled many times.

For Ukraine, which has a powerful scientific, production and raw material potential capable of fully ensuring the practical implementation of modern world achievements in the field of concrete and reinforced concrete, the generalisation of network experience will allow us to develop proposals for the prospects and directions of reinforced concrete development.

The impact of innovation on the competitiveness of construction companies is undeniable, encompassing areas such as technology, sustainability, workforce development, and customer relations. Companies that prioritize innovation are better positioned to navigate challenges, meet evolving market demands, and establish themselves as leaders in the construction industry [19]. By leveraging innovative solutions, construction firms not only enhance operational efficiency but also build a robust foundation for long-term success and growth.

In summary, innovations are a key element in building a competitive advantage for construction companies. Implementing modern technologies, materials and management methods allows companies to increase operational efficiency, improve the quality of services and better adapt to market needs. As a result, these companies are able to not only maintain its position on the market, but also develop and acquire new customers.

CHAPTER 2
ASSESSMENT OF THE INNOVATIVE ACTIVITY OF "BUDINDUSTRIYA" PLANT OF LLC "TERNOPILBUD"

2.1 Characteristics of "Budindustriya" plant of LLC "Ternopilbud"

The "Budindustriya" plant of LLC "Ternopilbud" was established to perform a wide range of construction, installation, and design tasks, including construction work, production of building materials and structures, provision of design services for buildings and facilities of both industrial and non-industrial purposes, and promoting the economic development of Ukraine. The company's mission is to provide high-quality solutions in the construction sector, address social issues, and generate profit for its participants.

The "Budindustriya" plant operates in Ukraine in three main areas:

1. Execution of construction and installation works.
2. Production of building materials, structures, and products.
3. Provision of services in the construction sector and other activities outlined in the company's charter.

The primary goal of the plant's creation and operation is to achieve the maximum possible profit by selling its products (completed works and provided services), thereby meeting the social and economic needs of the workforce and the owners of production assets.

The main task of the of "Budindustriya" plant of LLC "Ternopilbud" is to maintain leadership in the construction materials market and attract new customers by offering its own products made from domestically sourced raw materials that meet ISO 9001 quality standards and provide professional service, utilizing its competitive advantages.

Key activities of the plant:

- Production of concrete products for construction.
- Manufacturing of other wooden construction structures and joinery products.
- Production of ready-mix concrete solutions.

- Production of building metal structures and structural components.
- Wholesale trade in timber, building materials, and sanitary equipment.
- Leasing and operation of owned or rented real estate.

The products of the "Budindustriya" plant of LLC "Ternopilbud" are competitive in terms of both quality and range. They meet the needs of the company's structural divisions as well as external consumers engaged in construction activities. The enterprise annually produces and sells approximately 75,000 m³ of concrete and reinforced concrete (10-15% of the total production volume in the Ternopil region). Product prices are average, but the company has reserves to reduce production costs.

The plant offers a wide and diverse assortment:

- Concrete floor panels.
- Stair flights and platforms.
- Road concrete tiles.
- Concrete curbs, rings, and lintels.
- Concrete slabs for fences.
- Concrete beams and channels.
- Driven piles.
- Foundation blocks.
- Cement solutions.
- Commercial concrete.
- Concrete mixer services.

Using customer-supplied materials, the plant provides services for producing wooden siding, flooring, baseboards, and parquet.

The production of these products is carried out using established technologies or new technologies introduced in compliance with the requirements of production processes and parameters.

Key stages of production:

- Implementation and improvement of technological processes.

- Reception of raw materials and their quantitative and qualitative assessment.
- Processing of raw materials.
- Execution of tasks to ensure the manufacturing and release of products.
- Quality and quantity assessment of the manufactured products.
- Sorting, transportation, and storage of finished products.

To meet the needs of consumers for high-quality construction materials and structures, the enterprise uses high-quality raw materials and components in its production processes. Additionally, a certified quality control laboratory equipped with modern tools operates at the plant to ensure product quality. The company implements an effective product and assortment policy, producing a variety of construction materials, products, and structures. The products are marketed independently, and a company website is utilized to promote goods in the market. The pricing strategy of the plant is based on the cost-oriented method of pricing.

The "Budindustriya" plant of LLC "Ternopilbud" was initially organized using a traditional linear-functional structure. Each basic function had its own department, which included smaller units. Each manager was responsible solely for their subdivision, while all decision-making authority across the organization resided with the General Director.

The organizational structure of the "Budindustriya" plant of LLC "Ternopilbud" is built according to the linear-functional type (as shown in aigure 2.1).

It should be noted that the organizational management structure of the plant is characterized by a high level of centralization, subordination, and control. The plant is directly managed by the Director, who is appointed by the Company's General Director, and heads of functional departments (financial, planning and economic, production, human resources, procurement and sales, chief mechanic and chief power engineer).

The main competitors of the plant are: Berezovytskyi Kombinat Budindustriya ALC, Ternopil Concrete Products Plant LLC Budmaterial, PrJSC Ternobuddetal, and Ternopil Concrete Plant.

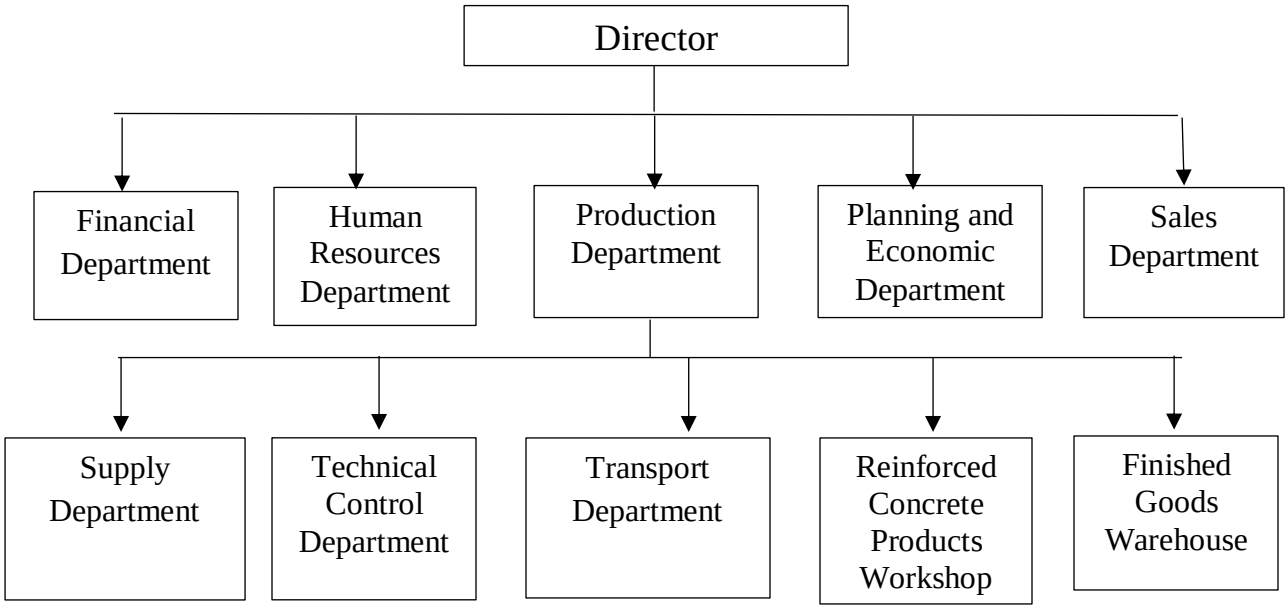

Figure 2.1 - The organizational structure of the "Budindustriya" plant of LLC "Ternopilbud"

As can be seen from the figure below, the plant has the following divisions:

- production department;
- supply department;
- technical control department;
- transport department;
- reinforced concrete products shop;
- supply and sales department;
- finished goods warehouse.

The management apparatus consists of the following departments:

- HR department
- planning and economic department;
- accounting department;
- financial department.

The key suppliers of cement for the production of concrete and reinforced concrete are Mykolaivcement PrJSC, crushed stone - Hnivansky Granite Quarry, and rolled metal - Metal PE.

The plant under study plans, organises and carries out financial and economic activities, guided by the plans developed by the company. The set of technical and economic indicators of the "Budindustriya" Plant of LLC "Ternopilbud" and the results of their analysis using absolute growth and growth rates are presented in Table 2.1.

Table 2.1 – Results of the study of technical and economic indicators of the "Budindustriya" Plant of LLC "Ternopilbud" for 2021-2023

Indicator	2021 r.	2022 r.	2023 r.	Deviation in 2022 compared to 2021		Deviation in 2023 compared to 2022	
				+/-	%	+/-	%
Net income from product sales, thousand UAH	20894,4	9646,9	10390,5	-11247,5	-53,8	743,6	7,7
Cost of goods sold (products, works, services), thousand UAH	24968,3	15713,4	24707,1	-9254,9	-37,1	8993,7	57,2
Administrative expenses, thousand UAH	1554,7	1142,2	1325,2	-412,5	-26,5	183	16,0
Selling expenses, thousand UAH	100,3	25,9	0,9	-74,4	-74,2	-25	-96,5
Other operating expenses, thousand UAH	1135,7	949,6	1194,5	-186,1	-16,4	244,9	25,8
Net financial result (loss), thousand UAH	6864,6	8184,2	16837,2	1319,6	19,2	8653	105,7
Average annual value of fixed assets, thousand UAH	28559,1	27136,2	28832,6	-1422,9	-5,0	1696,4	6,3
Accounts receivable, thousand UAH	2065,4	1654,8	3126,8	-410,6	-19,9	1472	88,9
Accounts payable, thousand UAH	6732,1	8045,5	9345,9	1313,4	19,5	1300,4	16,2

According to the comparative calculations, we can draw certain conclusions:

- the volume of net income from sales of the products of the studied plant in 2022 compared to 2021 decreased by UAH 11247,5 thousand or 53,8%; however, in 2023, compared to 2022, it increased by UAH 743,6 thousand or 7,7%;

- cost of sales for the analyzed period of 2021-2023 decreased by UAH 9254,9 thousand or 37,1%, and then increased by UAH 8993,7 thousand or 57,2%;

- administrative expenses in 2022 decreased by UAH 412,5 thousand or 26,5% compared to 2021, and increased by UAH 183 thousand or 16% in 2023;

- during 2021-2023, sales expenses decreased significantly, namely by 99%. The reduction in sales costs was due to a decrease in production and sales volumes and is a negative phenomenon, as it leads to a decrease in the plant's profit and the need to revise the sales strategy;

- other operating expenses for the period of 2021-2023 decreased by UAH 186,1 thousand or 16,4% and increased by UAH 244,9 thousand or 25,8%, respectively;

- a negative phenomenon at the studied plant was an increase in net loss by UAH 1319,6 thousand or 19,2% in 2022, and by UAH 8653 thousand or 105,7% in 2023;

- the average annual value of the plant's fixed assets decreased by 5% in 2022, but increased by 6,3% in 2023;

- the amount of accounts receivable in 2022 decreased by UAH 410,6 thousand, but increased by UAH 1472 thousand in 2023;

- the amount of accounts payable for the entire period under study increased by UAH 1313,4 thousand and UAH 1300,4 thousand, respectively, which is a negative phenomenon.

The effective functioning of any enterprise depends on adequate resource provision. Among production factors, human resources play a key role in determining an enterprise's strategic success and competitiveness. One of the critical indicators of an enterprise’s human resource potential is the stability of the workforce, assessed through the dynamics of personnel changes within the company.

From 2021 to 2023, there was a negative trend in the company's human resource potential. In 2022, compared to 2021, the total number of employees decreased by 8, and in 2023, compared to 2022, by 49. Throughout the analyzed period, the number of employees leaving significantly exceeded those hired, which is a negative trend for the plant. The turnover rate for new hires in 2022 decreased by 0.03 due to fewer hires and a reduction in the average number of personnel. Additionally, in 2022, there was an increase in turnover related to employee departures and a rise in staff attrition rates. In 2023, the trend of employee departures and a decline in the average number of personnel continued.

At the "Budindustriya" plant of LLC "Ternopilbud," administrative and management personnel receive fixed payments based on established rates, while workers are paid based on a tariff system. Additionally, the plant provides extra payments and bonuses based on productivity and work results.

Overall, during the analyzed period, the "Budindustriya" plant of LLC "Ternopilbud" operated under challenging conditions caused by the full-scale invasion, which negatively impacted the construction sector, leading to reduced production volumes of construction products, staff reductions, and negative financial performance dynamics.

2.2 Analysis of implemented innovative technologies at "Budindustriya" plant of LLC "Ternopilbud"

The strategic development of any enterprise, including in the construction materials industry, depends on its competitiveness and ability to adapt to market changes. To achieve competitive advantages, three primary approaches are available: becoming an industry leader, reducing competitors' influence, or influencing the market environment. Implementing each of these approaches requires innovative activities, which must include a significant innovation component.

Key resources driving innovation:

1. Infrastructure for Research and Development: Fixed assets such as buildings, equipment, and other resources can support research, development, and innovation projects.

2. Technological Modernization: Fixed assets can facilitate the implementation of new technologies, fostering innovation in production processes.

3. Creativity and Development Stimulation: Access to resources for research and innovative ideas enhances creativity and increases an enterprise's innovation potential.

4. Competitiveness: Studies show that investments in fixed assets often lead to improved competitiveness through increased productivity and product quality.

5. Investor Appeal: Possession of modern, efficient, and technologically equipped assets makes enterprises more attractive to investors.

The structure and dynamics of fixed assets during 2022-2023 are presented in figures 2.2, and 2.3.

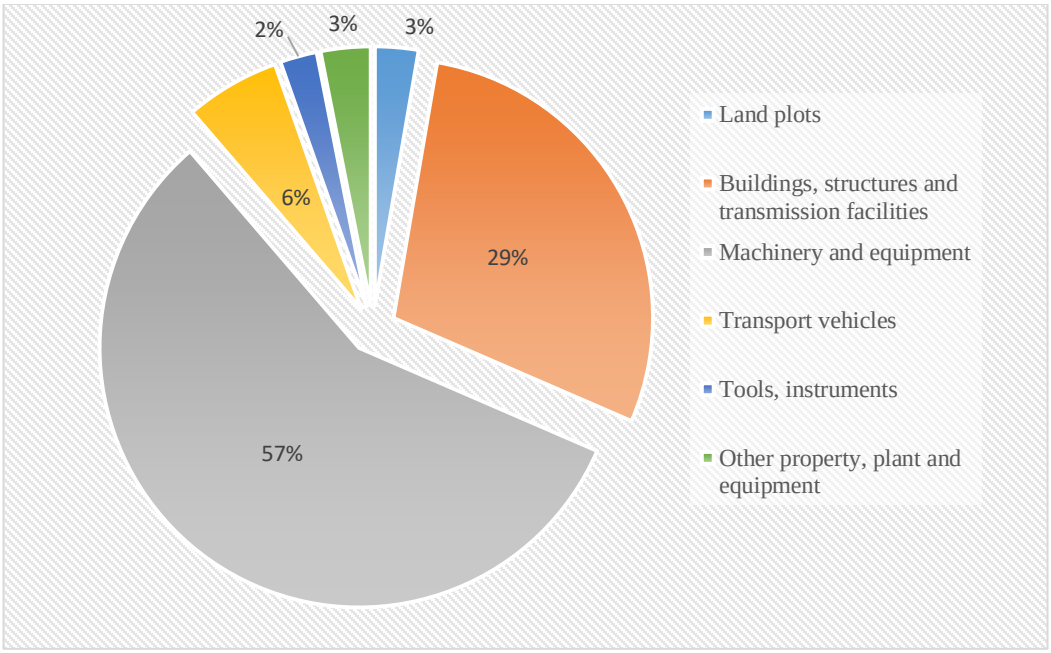

Figure 2.1 - The structure and dynamics of fixed assets during 2022 at "Budindustriya" plant of LLC "Ternopilbud"

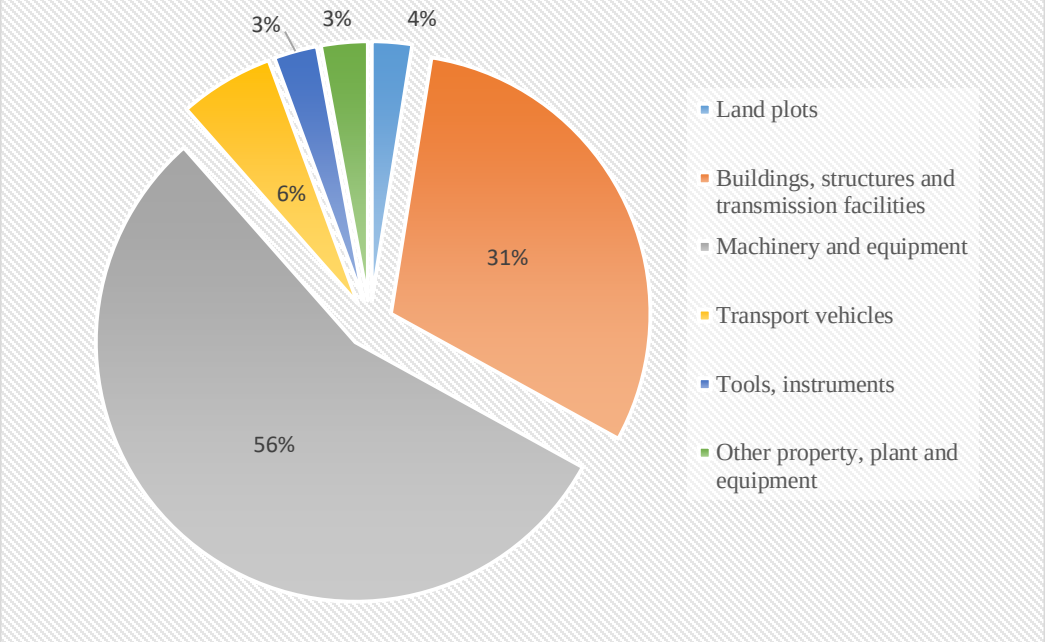

Figure 2.1 - The structure and dynamics of fixed assets during 2023 at "Budindustriya" plant of LLC "Ternopilbud"

The average annual value of fixed production assets increased by UAH 1,696.4 thousand in 2023 compared to 2022. The monetary value of buildings, structures, and transmission equipment grew by UAH 978,7 thousand. The active part of the enterprise's fixed assets—machinery and equipment—rose by UAH 468.3 thousand. Additionally, transportation assets increased by UAH 100,1 thousand, and tools and instruments grew by UAH 154,4 thousand. The value of other fixed assets decreased by UAH 5,1 thousand, while the value of land remained unchanged.

The "Budindustriya" plant is a major producer of construction materials, including concrete and reinforced concrete products such as panels, floor slabs, foundation blocks, and road curbs. Production adheres to a stable technological process, meeting strict technical and production requirements. The plant has modernized lines for producing ready-mix solutions, construction concrete, structural concrete, commercial and structural reinforcement, precast concrete, and paving tiles.

The plant has built a strong reputation for high-quality products and an ethical business culture. Constructing a concrete batching plant enabled technical development and improved production efficiency. The facility's mechanized and modern transport systems support the production of quality concrete and solutions. Maintenance of fixed assets, equipment adjustment, and repair are managed by the chief mechanical and electrical engineers' departments.

In recent years, the plant introduced a computer-based system for material cost calculations and payroll management, increasing efficiency. It also expanded its product range to include new items such as hollow panels, blocks, and basement walls. However, aging equipment remains an issue, with some machinery's wear rate exceeding 65%. This outdated equipment is bulky, inefficient, and energy-intensive.

Significant Modernization Efforts:

– 2016: The plant introduced drying chambers for wooden blanks and advanced heating devices, eliminating the need for steam-based processes. This innovation significantly reduced energy costs.

– 2017: To address high raw material waste in the woodworking department, a wood splicing line was introduced for producing wooden doors, resulting in a 9.01% cost savings and a 39% reduction in waste.

– 2007: A new line for producing wooden windows with double-glazing units was introduced, adhering to the DSTU B V.2.6-23-2001 standard.

– 2018: The plant implemented a new garage construction system.

The current state of innovative activity at the "Budindustriya" plant is influenced by numerous factors that either promote or hinder innovation. Addressing these factors will enable the plant to develop strategies for enhancing innovation. To analyse the innovation activity of the selected business entity, we will use the method of strategic analysis - SWOT analysis (see table 2.2).

Table 2.2 – SWOT analysis of the prerequisites for enhancing innovation activity at the "Budindustriya" plant of LLC "Ternopilbud"

Weaknesses of the enterprise	**Threats from the external environment of the enterprise**
Increased production costs due to rising prices for electricity, gas, metal, and other resources. Insufficient working capital. Slow renewal of the active portion of fixed assets. Inconsistent market research for construction materials. Lack of innovative management at the enterprise and low levels of innovation activity among personnel.	Reduction in the production volumes of construction materials due to the war. Rising prices for all types of resources. Emergence of new competitors. Decrease in consumer purchasing power and demand for products. Introduction of new types of construction materials. Lack of effective government investment policies and programs.
Strengths of the enterprise	**Opportunities in the external environment of the enterprise**
Production of high-quality, competitive products. Leading positions in domestic markets, with an implemented quality system. Customer-oriented approach in operations. Silled workforce. Modern production technologies and equipment, with a sufficient technical base. Compliance with environmental safety standards. Significant experience in manufacturing construction materials and an effective sales policy. Positive reputation and organizational culture. Availability of free private capital. Presence of a system for continuously generating new ideas regarding the company's products and services. Periodic implementation of modern management tools. High-quality software. Advanced automation technologies.	Implementation of modern digital technologies. Increasing market share. Diversification of raw material and supply sources. Compensating for fluctuations in demand for construction materials through individual developers. Development of information technologies. Accumulation of knowledge from global business technologies.

The SWOT analysis of the prerequisites for stimulating innovative activities at the "Budindustriya" plant of LLC "Ternopilbud" demonstrates that the company's strengths outweigh its weaknesses, and the market provides more opportunities than threats for the innovative development of the enterprise. Thus, to stimulate innovation at the plant, it is necessary to create favorable conditions not only at the external level (e.g., providing incentives, subsidies, etc.) but also within the organization itself.

Specifically, this includes:

- Implementing new technologies and technological processes into production.
- Manufacturing new products or improving the properties of existing products.
- Enhancing the material and technical base.
- Improving the organization of management at the plant.
- Expanding into new sales markets.

Additionally, the readiness of the staff for innovative activities, their awareness of the need for innovations, and the support from the enterprise's management and employees are critical conditions for stimulating innovation.

CHAPTER 3
WAYS TO IMPROVE INNOVATIVE ACTIVITY OF "BUDINDUSTRIYA" PLANT OF LLC "TERNOPILBUD"

3.1 Organization of cinder block production as a method of increasing the profitability of the enterprise

With the increase in cottage construction, the requirements for suburban real estate are changing. The rise in energy costs compels domestic developers to pay special attention to energy efficiency. Consequently, they are adopting modern materials with high insulation properties. Moreover, many developers consider factors such as the cost and speed of construction, as well as the potential for energy savings during house operation.

To improve the financial performance of the "Budindustriya" plant of LLC "Ternopilbud", we propose acquiring new technologies for the production of cinder blocks.

Cinder blocks are construction blocks (wall material) manufactured by vibro-pressing concrete mortar into a mold. They have been and remain a popular material for wall construction across all sectors of building. They are easy to use for constructing low-rise buildings (cottages, garages, workshops) without requiring the services of a mason (1 block equals 3–4 bricks). They are strong, possess good thermal and sound insulation properties, and are cheaper than bricks, foam blocks, and other building materials. The speed of wall construction with cinder blocks is relatively high. The range of cinder block consumers is vast, ranging from private individuals to large construction companies working in industrial construction.

Thus, we can conclude that the proposed project is feasible and promising for Budindustriya LLC Ternopilbud.

To establish cinder block production, the following are required: a vibropress machine, raw materials, technology, and a relatively level production site.

Vibropress Machine. There are various types of vibropress machines available, ranging from industrial models to those suitable for household use.

There are various types of vibropress machines available, ranging from industrial models to those suitable for household use.

We will choose between the "Drakon" vibropress and the "Sprut" vibropress machine. Table 3.1 outlines the specifications of these two machines.

Table 3.1 – Specifications of "Drakon" and "Sprut" vibropress machines

Parameter	Unit of Measurement	Unit of Measurement	
		“"Drakon"”	“Sprut”
Nominal Power	kW	0,3	0,6
Operating Voltage	V	380	
Production Capacity (blocks/shift)	Blocks	600-1200	600-1500
Machine Weight	Kg	220	270
Block Dimensions	Mm	390/190/190	
Machine Cost	UAH	58000	59500

As we can see, the "Sprut" vibropress machine has superior specifications, even though its cost is 1500 UAH higher than that of the "Drakon." Therefore, for the implementation of this project, we choose the "Sprut" vibropress machine.

The following components are required for the production of building blocks:

- cement;
- filler;
- plasticizer;
- water.

Cement of grade 400 is preferred, though other grades are acceptable if proportions are adjusted. For example, when using grade 300 cement, its consumption should be increased by 10–15%.

Concrete fillers can include various materials such as sand, gravel, slag, granulated slag, shavings, screenings, expanded clay, gypsum, brick fragments, and other natural and industrial materials. Depending on local conditions, block requirements, and cost, the appropriate filler can be chosen. Below are several popular concrete compositions and their main groups:

1. Slag from metallurgical plants (gray or dark gray with a high cement content, sieved fine fraction) – 9 parts.

– Cement – 1 part.

– Water – 0.5 of the cement volume.

2. Granulated slag from metallurgical plants (yellow-greenish with a high cement content, sieved fine fraction) – 4 parts.

– Fine screenings – 4 parts

– Cement – 1 part.

– Water – 0.5 of the cement volume.

3. Other slag concretes.
4. Concrete with sand and gravel.
5. Concrete from brick waste.
6. Expanded clay concrete.
7. Ash concrete.
8. Sawdust concrete and other combinations of the listed materials.

Plasticiser is not a mandatory component of concrete. The plasticizer is an optional component of concrete but offers significant advantages:

– Increases the early strength of the blocks, which is crucial for limited production areas.

– Improves block quality by reducing wear, increasing water resistance, and enhancing frost resistance of the concrete.

Technology for producing building blocks:

1. Concrete preparation: The preparation of a solid concrete mix is achieved using cement, slag (screenings), and water. In our region, depending on the moisture content of the fillers, a solid mixture is obtained by mixing 0.4 to 1 part of water with 1 part (by weight) of cement M-400 and 4 to 9 (usually 5-7) parts of screenings (gravel, slag, expanded clay). Mixing is best done in a concrete mixer.

2. Block production:

– Load the concrete mix into molds (dimensions: 390 mm x 190 mm x 190 mm with two rectangular voids).

– Compact the mixture using vibration and pressing.

– Remove the blocks from the mold and place them on pallets.

3. Drying and stacking:

– The blocks achieve the required strength for stacking within 36–96 hours at natural temperatures. Full curing occurs within a month under conditions of 20°C and high humidity.

– Blocks are stacked in pyramid-shaped piles with spacing for even drying of the edges. Each pyramid contains 100 blocks, marked with the production date and time. Blocks can be shipped on the fourth or fifth day.

This structured approach ensures efficient and high-quality cinder block production.

The Budindustriya plant, LLC Ternopilbud, has a facility of sufficient size with a flat concrete floor, which allows for year-round production of cinder blocks. The facility is equipped with excellent ventilation and heating systems.

The retail price of a cinder block measuring 20x30x60 cm in the Ternopil region ranges from 50 UAH to 70 UAH. We plan to sell our product at a price of 60 UAH. Implementing this project will enable the company to achieve significant profitability.

The Budindustriya Plant, LLC Ternopilbud will be able to establish efficient and economically beneficial production of cinder blocks.

Productivity of the Vibropress “Sprut”:

Per Day: 616 blocks.

PerMonth: 616 × 20 working days = 12,320 blocks.

PerYear: 12,320 ×12 months = 147,840 blocks.

Table 3.2 shows the planned costing of a unit of production, namely a foam block of 200/300/600 mm in size.

Table 3.2 – Planned cost calculation for producing a cinder block (200/300/600 mm) in 2025

Expense items	Expenses, UAH
1. Raw materials and basic supplies	15,1
2. Auxiliary materials	2,1
3. Packaging materials	1,1
4. Electricity and fuel (for technological purposes)	2,9
5. Base wages for production workers	2,5
6. Additional wages for production workers	0,5
7. Payroll charges	0,5
8. General production expenses	5,9
Total Production Cost	30,6
9. Administrative expenses	1,8
10. Non-production expenses	3,6
Total Cost	36

Projected financial results of the implemented project for 2025.

Table 3.3 – Projected financial results of the project for 2025

Item	Amount (thousand UAH)
Revenue (sales proceeds)	8870,4
Value-added tax	(1774,1)
Net revenue (sales proceeds)	7096,3
Cost of goods sold	(5322,2)
Gross profit	1774,1
Administrative expenses	(202,2)
Selling expenses	(218,2)
Other operating expenses	(39)
Profit from ordinary activities before tax	1314,7
Income tax	236,6
Net profit	1078,1

By implementing the cinder block production project, the Budindustriya Plant, LLC Ternopilbud, is projected to achieve a net profit of 1,078.1 thousand UAH in 2025.

Capital expenditures for the project are detailed in Table 3.4.

Table 3.4 – Capital expenditures for project implementation

Type of expenditure	Amount (thousand UAH)
1. Cost of equipment (including VAT)	770
2. Commissioning expenses	7,7
3. Transportation costs	33,1
4. Installation and testing costs	51,1
Total Expenditures	861,9

The total capital expenditures required to implement the project amount to 861.9 thousand UAH.

To determine the efficiency and feasibility of implementing this project, we will calculate its payback period, net present value (NPV), and profitability index.

To determine the efficiency and feasibility of implementing this project, we will calculate its payback period, net present value (NPV), and profitability index. The payback period of the project is calculated using the formula (3.1):

$$T_{ок} = \frac{CEx}{Np} \qquad (3.1)$$

Where:

CEx– capital expenditures;

NP – net profit.

Substituting the relevant values, we get:

Tок = 861900/1078100 = 0,9

Thus, the payback period of this project is 0.9 years, or 10 months.

Now, we calculate the net present value (NPV), which represents the discounted value of the project (the current value of revenues or benefits from the investments made). The condition for project acceptance is NPV>0NPV>0.

In practice, NPV is calculated using the following formula:

$$NPV = -CF_0 + \frac{CF_1}{(1+E)^t} + \frac{CF_2}{(1+E)^2} + ... + \frac{CF_n}{(1+E)^n} = \sum_{t=1}^{n} \frac{CF_n}{(1+E)^t} \qquad (3.2)$$

Where:

– CF_o – capital investment (initial investment);
– CFn – expected net cash flows in period t (CFn = profit + amortization);
– t – time period;
– r – discount rate (20%).

Substituting the relevant data, we get:

$$NPV = -861900 + \frac{1078100+215620}{(1+0,2)^1} + \frac{1078100+215620}{(1+0,2)^2} + \frac{1078100+215620}{(1+0,2)^3} + \frac{1078100+215620}{(1+0,2)^4} + \frac{1078100+215620}{(1+0,2)^5} = 3006 \text{ thousand UAH}$$

The profitability index (PI) is defined as the ratio of the total discounted effects (the difference between benefits and current costs) to the amount of investment. If PI>1, the project is effective; if PI<1, the project is ineffective.

PI = 3868883,5/861900 = 4,5

Thus, after conducting several calculations, we determined that the project for the production of cinder blocks is efficient and feasible to implement is both efficient and feasible for implementation. It is forecasted that the "Budindustriya" plant of LLC "Ternopilbud" will annually increase its production volumes of cinder blocks by 10-15% through the release of high-quality products at an affordable price. As a result, the company's profits are expected to grow.

3.2 Development of a project for the organization of a new production of pinoizol insulation

The "Budindustriya" plant of LLC "Ternopilbud" has demonstrated profitability over the past three years. However, a decline in efficiency indicators was observed in the past year. To enhance its range of services and improve production, operational, and financial-economic performance, we propose a project for organizing a new production line for pinoizol insulation.

Pinoizol insulation is a lightweight, porous material of pure white color, simple to use, and highly versatile. It:

– Does not support combustion, does not melt, and does not release toxic substances when exposed to fire.

– Is resistant to aggressive environments, organic solvents, microorganisms, rodents, and insects.

– Is a "breathable" (vapor-permeable) material that prevents increased humidity in rooms and condensation on internal walls (even in the presence of cracks or pores in the external walls), promotes self-regulation of humidity, and is resistant to mold and fungi.

– Has excellent soundproofing qualities, with a 50 mm thick panel absorbing up to 95% of sound vibrations.

Using pinoizol insulation in buildings significantly reduces heating costs and is easy to cut with any cutting tool (knife, wire, etc.). It operates efficiently within a temperature range of -60°C to +150°C, withstanding an unlimited number of freeze-thaw cycles.

A 50 mm thick pinoizol panel provides thermal protection equivalent to: 75 mm of polystyrene foam, 125 mm of mineral wool, 340 mm of wood, 900 mm of brick, and 2132 mm of concrete.

The softness of pinoizol is a crucial characteristic that enhances its technological utility in construction. Its flexibility allows it to adhere fully to brickwork surfaces without leaving gaps. This softness is essential for achieving the desired thermal and acoustic insulation properties. Experimental data confirm that the lifespan of pinoizol exceeds 50 years, which is superior to many other thermal and sound insulation materials.

A distinctive feature of pinoizol is its versatility of application, including:

– thermal and sound insulation of walls;

– production of sandwich panels;

– insulation of floors, roofs, pipelines, industrial refrigerators, and drying chambers;

– direct on-site pouring into wall voids, underfloor spaces (between joists or under concrete screeds), attics, mansards, and technical floors.

The use of pinoizol in residential, agricultural, and industrial structures is permitted by: The Ministry of Health, the Main Directorate of the State Fire Service, and the State Construction Committee of Ukraine.

The implementation of the new production project will not result in changes to permitted emission parameters of harmful substances into the atmosphere. Since the project is planned as part of a restructuring process, the sanitary and hygienic conditions of the workplace will remain unaffected.

Pinoizol insulation can be produced in the following forms: sheets measuring 0.6 m x 0.5 m with a thickness of 50 mm or 100 mm, granules packed in bags or mats, liquid form

for direct pouring on construction sites.To implement this project, it is necessary to establish the production of pinoizol insulation by introducing the required equipment into the manufacturing process.

Thus, considering the versatility of applications for pinoizol insulation, we can confidently assert that there is demand for this type of product. The equipment required for the production of pinoizol insulation consists of two components: one of the machines ("IZOL Standard" or "IZOL Profi") and a compressor. Since the necessary compressor is already available at the enterprise, only the machine is required. Table 3.5 presents the specifications of the "IZOL Standard" and "IZOL Profi" units.

Table 3.5 – Specifications of "IZOL Standard" and "IZOL Profi"

Parameter	Unit	Value	
		"IZOL Standard"	"IZOL Profi"
Production capacity of Pinoizol insulation	m³/hour	4-10	
Density adjustment range for Pinoizol insulation	kg/m³	5-35	
Dimensions	mm	360/360/360	420/420/420
Weight	kg	29,5	34,5
Nominal power	kW	1,0	1,3
Operating voltage	V	380	
Maximum height of external foam mixer lift/drop	m	Up to 25	Up to 50
Operating radius	m	Up to 30	Up to 60
Compressor air output	l/min	150-300	
Remote control system	set	Yes	
Operating personnel	person.	1	
Unit cost	UAH.	57100	59460

As we can see, the "IZOL Profi" unit offers superior characteristics, despite its cost being 2,360 UAH higher than that of the "IZOL Standard" unit. Therefore, we choose the "IZOL Profi" unit for the implementation of this project.

The "IZOL Profi" Unit Includes:

- a dosing and component supply block;
- an external foam mixer;
- a remote control block;
- hoses for the external foam mixer (3 pieces, 50 m each);
- a pouring hose (7 m);
- hoses from the component tanks to the unit (2 pieces, 2 m each);
- shut-off valves for the component tanks (3 sets).

Additionally, purchasing this unit includes technical documentation officially permitting the production of both liquid and sheet pinoizol insulation.

Advantages of the "IZOL Profi" Unit:

- djustable production capacity: A wide range of 4 to 9 m^3/hour.
- Density adjustment capability: Allows setting the required density of pinoizol insulation within the range of 5 to 35 kg/m^3.
- External foam mixer: The length of hoses connecting the dosing block to the external mixer can be adjusted from 0.5 to 50 meters.
- Lightweight equipment: The mobile components weigh only 5 kg, making them easy to move on construction sites.
- Centralized operation: Solution preparation and pouring into technological tanks are performed in one location, typically on the truck bed used to deliver the equipment and components.
- High operating range: Capable of lifting or lowering liquid pinoizol insulation up to 60 meters (operating radius).
- Component flow regulation: Adjustable for precise component usage.

- Air preparation system: Air from the compressor is not fed directly to the foam generation block but passes through a system that allows pressure adjustment using a throttle on the unit.
- Remote control system: Allows a single operator to manage the unit, enabling more efficient use of components for the production of Pinoizol insulation.
- No clogging: The foam generator is designed to prevent blockages, overpressure of one component by another, or air forcing components through the system.
- Two-stage foam generator: Ensures maximum foaming efficiency.
- Separate mixing of components: Mixing occurs in an external foam mixer, where the resin, solution, and air are delivered separately. The mixer is designed so that the flow vectors of all components align upon merging, preventing foam suppression by resin and enabling greater material output.
- Comprehensive cleaning system: The unit allows for cleaning of individual channels. The resin pump and solution pump can be cleaned separately, which significantly extends their service life by eliminating the corrosive effects of phosphoric acid. The pouring hose can be cleaned independently or simultaneously with one or both channels of the unit.
- Foam generator for technical foam: The unit can also be used to generate technical foam for the production of foam concrete.
- Compact and ergonomic design: The unit features a convenient layout and compact dimensions.

The unit operates on a compressed air source (working pressure of 3 to 7 atmospheres) and a 380 V power source. The CO-7B compressor (already available at the facility) is suitable for this purpose, although newer models, such as the K-24, are also available. Alternatively, any compressor with the specified working pressure and a capacity of at least 500 liters/min can be used.

Using a compressor with lower productivity may result in insufficient foaming, leading to excessive consumption of the foam-forming solution and increased moisture content in the final product.

For the production of pinoizol foam plastic, four primary components are used: polymeric urea-formaldehyde resin, foaming agent, hardening catalyst, and water. To improve the physical and mechanical properties of the insulation, the addition of modifiers is recommended.

1. Polymeric urea-formaldehyde resin.

This is the main component of pinoizol production and is manufactured by many enterprises in Ukraine and the CIS countries. There are various brands of this resin, but KFMT and KFZh are recommended for production.

2. Foaming agent.

This component is a surface-active substance. Many types of foaming agents are available. For production, ABSK(LG, Korea) will be used.

3. Hardening catalyst.

Orthophosphoric acid is used as the hardening catalyst, available in different concentrations as technical or purified food-grade acid. The recommended choice is 85% purified food-grade acid (Belgium).

4. Water.

Regular tap water free of mechanical impurities is used.

The technological principle of pinoizol production involves increasing the initial volume of the foam-forming solution by foaming it with compressed air, followed by the curing of pinoizol after it is poured into molds or directly into the internal cavities of protective structures.

The production of pinoizol does not require large areas, typically 100–150 m².

The unit operates using compressed air (working pressure of 3 to 7 atmospheres) and a 220 V power supply. The CO-7B compressor will be used, though newer models such as K-24 are also suitable. Any other compressor with the specified working pressure and a capacity of at least 500 liters per minute can be used.

Using a compressor with lower productivity will not achieve the required foaming ratio, leading to overuse of the foam-forming solution and an increased moisture content in the final product.

Foaming issues can lead to excessive use of the foam-forming solution, resulting in higher moisture content in the final product.

The organizer of this project is the chief engineer, who reports directly to the company director.

To implement this project, two workers are required. The monthly salary for these two production workers will amount to 22,800 UAH, resulting in annual labor costs of 273,600 UAH for the enterprise.

Production Capacity of the Unit

Per day: 6 м^3 × 8 hours = 48 м^3

Per month: 48 м^3 × 20 working days = 960 м^3

Per year: 960 м^3 ×12 months = 11520 м^3

The production will be sold on the domestic market at the following prices: pinoizol sheets (dimensions: 0.6 m × 0.5 m, thickness: 100 mm): 270 UAH per m³, on-site pouring: 250 UAH per m³.

Table 3.6 – Sales volume of pinoizol insulation

Product Name	Unit of Measurement	Physical Sales Volume, units	Sales Price, UAH per m³	Revenue from Sales (including VAT), thousand UAH
Pinoizol insulation	thousand m³	11,52	270	3110,40

We will present the planned cost calculation for a unit of production per cubic meter (table 3.7).

Table 3.7 – Planned cost calculation for producing pinoizol insulation

Expense Item	Cost, UAH
1. Raw materials and primary supplies	90,2
2. Auxiliary materials	6,5
3. Packaging materials	0,7
4. Electricity and fuel	7,5
5. Base wages for production workers	1,1
6. Additional wages for production workers	0,3
7. Payroll charges	0,1
8. General production expenses	6,8
Total Production Cost	113,2
9. Administrative expenses	2,7
10. Non-production expenses	4,5
Total Cost	120,4

We will calculate the costs for the annual production volume:

11,520×120.4=1,387.0 thousand UAH.

We will also determine the projected financial result of the implemented project for the year 2025.

Table 3.8 – Projected financial results of the project for 2025

Item	Amount (thousand UAH)
1	2
Revenue (sales proceeds)	3110,4
Value-added tax (VAT)	(528,8)
Net revenue (sales proceeds)	2581,6
Cost of goods sold (COGS)	(1387,0)
Gross profit	1194,6
Administrative expenses	(31,1)

Continuation of the table 3.8

1	2
Selling expenses	(38,5)
Other operating expenses	(17,9)
Profit from ordinary activities before tax	1107,1
Corporate income tax	332,1
Net profit	775,0

Thus, by implementing this project, we will achieve a net profit of 775 thousand UAH.

After conducting the necessary calculations, we determined that the payback period for this project is 0.03 years, or 0.4 months (11 days).

Now, we will calculate the net present value (NPV) of the project using formula (3.2).

Substituting the relevant data:

$$\text{NPV} = -22300 + \frac{775000 + 4670,4}{(1 + 0,18)^1} = 638,4 \text{ thousand UAH.}$$

We will calculate the profitability index (PI) for this project. By substituting the relevant data, we obtain:

$$\text{PI} = \frac{660737,6}{22300} = 29,6 \text{ UAH.}$$

Thus, after conducting the necessary calculations, we have determined that the project is effective and feasible for implementation.

CHAPTER 4

SAFETY OF ACTIVITIES, FUNDAMENTALS OF LABOR PROTECTION

4.1 Safety requirements at construction sites

Today, the work of construction workers is approaching the work of highly mechanised manufacturing enterprises, which has its own specific features that require a certain approach to solving safety problems. These features include, first and foremost, working in the open air, as it is difficult to create normal meteorological conditions at workplaces. Constant movement of workplaces and tools, which again requires addressing occupational safety issues. Significant physical exertion, which must be accompanied by increased attention to the constantly changing production situation. There is also work at height, often without lighting and in poor climatic conditions, etc.

An accident is always preceded by a deviation from the norms of the production process. Therefore, analysing and studying injuries makes it possible to develop preventive measures that will eliminate hazardous working conditions at construction sites.

First of all, all employees must receive training at the enterprise in the form of briefings on occupational safety and health, first aid, rules of conduct and actions in case of emergencies. Employees who combine professions (including employees of integrated teams) are instructed in both their main and part-time professions.

For example, at a construction site, a foreman is obliged to ensure high labour discipline among team members and require workers to comply with internal regulations and labour safety rules. After all, the responsibility for violation of occupational health and safety rules at work is primarily borne by officials, i.e. those persons who are entrusted with the performance of occupational health and safety duties.

The task of managers and employees is to eliminate the conditions that will contribute to accidents or reduce them as much as possible. However, these preventive measures cannot be implemented in a timely manner if they are not technically and organisationally prepared in advance. This preparation is possible when the project documentation contains a list of the existing hazards, the nature of these hazards, the severity of accidents and accident prevention measures.

The issue of ensuring healthy and safe working conditions is also addressed in the design of the construction master plan. Detailed occupational safety issues are developed in the technological maps for all construction and installation works: earthworks, brickwork, reinforced concrete, installation, electrical, sanitary, finishing, loading and unloading, and transport. All decisions on the execution of work that ensure safety and completely eliminate the element of risk during the work operation are reflected in the components of the technological map.

Proper organisation of the construction site and creation of safe working conditions is a primary stage in the construction of any facility and one of the prerequisites for reducing occupational injuries and occupational diseases among workers.

It should not be forgotten that one of the factors in reducing occupational injuries is proper lighting of construction sites and even distribution of light across workplaces, aisles, passages, storage areas, near sanitary facilities, in buildings, and during earthworks.

The main causes of injuries during loading and unloading operations include falling loads during their movement, improper fastening of loads on vehicles, violation of the rules for operating construction machinery, lack or non-use of personal protective equipment, insufficient lighting at workplaces and storage areas at night, rigging by untrained workers, etc.

The safety of loading and unloading operations is ensured through the correct placement of workers, briefing and training in safe working methods, and the appropriate selection of lifting mechanisms, auxiliary and rigging devices. Responsibility for the safe conduct of work rests with the ITPs appointed by the organisation's order. Those responsible for the safe conduct of loading and unloading operations, when appointed to work, must be tested for knowledge of the specifics of the technological process, labour safety requirements, the arrangement and safe operation of lifting and handling equipment, fire safety and industrial sanitation in accordance with their job responsibilities.

The safety of loading and unloading operations also depends on the turning radii, positioning and free passage of vehicles. When loading and unloading on railway tracks, special platforms and overpasses are equipped, and auxiliary equipment is used: ladders, bridges, slags, etc.

Timely provision of first aid in the event of accidents is of great importance in preserving human life and health. It must be provided quickly and efficiently. Therefore, first aid rules must be included in the training programme for workers and engineering and technical staff.

4.2 Organization of first aid for injuries at a construction site

The timely provision of first aid in case of accidents is crucial for preserving life and health. It must be administered promptly and competently. Therefore, the rules for providing first aid must be included in the training programs for workers and technical staff.

Order of first aid in case of accidents:

1. Free the injured person from the harmful factor causing the injury (e.g., remove heavy loads, disconnect electric current, remove chemical agents or water), bring them into fresh air, and loosen belts or buttons.

2. Perform artificial respiration, stop bleeding, and apply bandages or splints as needed.

3. Call an ambulance and transport the injured person to the nearest medical facility using any available means while adhering to safety measures.

Shock in Injuries:

One of the most frequent and severe complications in fractures, burns, and severe wounds is shock, which results from serious disruption of the central nervous system regulating blood circulation, metabolism, and respiration. Symptoms include initial agitation followed by depression, pale skin, low body temperature, rapid weak pulse, and low blood pressure. The injured person should be placed in a comfortable position to minimize pain, warmed with heating pads, and given stimulating drinks such as hot tea, coffee, alcohol, or wine. Painkillers may also be administered. Immediate medical attention is critical.

Bruises and Sprains:

These injuries are characterized by swelling, bleeding, pain, and limited limb movement. First aid involves keeping the injured person calm and applying cold (ice, snow, or a towel soaked in cold water) to the affected area.

Dislocations:

Dislocations cause changes in joint shape and limb length. First aid focuses on immobilizing the affected joint.

Wounds:

Wounds are dangerous due to potential blood loss, contamination, and infection. Vital organs (muscles, vessels, nerves, bones) can sometimes be damaged. For penetrating wounds in the skull, chest, abdomen, or joints, immediate medical attention is crucial. First aid involves cleaning hands with soap, applying iodine to fingers, and using sterile materials to bandage the wound without attempting to clean or wash it, as this should only be done by a doctor.

Fractures:

Fractures can be open or closed. First aid aims to prevent further soft tissue damage from bone fragments and serious complications such as shock or bleeding. Immobilization of the fractured area using splints or available materials (boards, sticks, etc.) is essential. For

open fractures, the skin around the wound should be treated with iodine, and a sterile bandage applied.

Burns:

For burns caused by fire, hot liquids, or steam, remove clothing carefully and bandage the area with sterile material. Do not attempt to remove clothing pieces stuck to the burn or apply ointments. Burns from acids or quicklime require immediate rinsing with water for 10-15 minutes, followed by specific treatments (e.g., soda solution for acid burns).

CONCLUSIONS

The construction industry is one of the key sectors of the economy, as it influences the development of infrastructure, housing and utilities and the transport network. The effectiveness of its economic and social functions depends on how successfully the industry's enterprises operate and develop, including the construction materials industry, which is the main supplier of resources for construction. The main means of achieving this goal is innovation aimed at ensuring the competitiveness of products in domestic and foreign markets, as well as addressing the problems associated with outdated technologies, low efficiency, aging equipment and inefficient structure.

The main purpose of the creation and operation of the "Budindustriya" plant of LLC "Ternopilbud" is to obtain the maximum possible profit by selling to consumers the products manufactured (works performed, services rendered), on the basis of which the social and economic needs of the labour collective and owners of the means of production are satisfied.

The SWOT-analysis of the prerequisites for intensifying the innovative activity of "Budindustriya" plant of LLC "Ternopilbud" shows that the company's strengths prevail over its weaknesses, and the market provides more opportunities than threats for the innovative development of the business entity. Thus, to stimulate innovation at the plant, it is necessary to create not only appropriate conditions at the level of the external environment, but also within the organisation itself.

The current state of innovation activity at Budindustriya LLC Ternopilbud is a consequence of the influence of many factors that facilitate and inhibit the speed of innovative transformations at the plant. Taking into account these factors, as well as the problems of innovative development related to them, allowed us to develop directions for intensifying innovation activity.

To expand the range of services and improve the production, operational, and financial-economic performance of Budindustriya LLC Ternopilbud, we proposed projects for the organization of new production lines for cinder blocks and pinoizol insulation.

By implementing these projects, the company will achieve net profits of 1,078.1 thousand UAH and 775 thousand UAH, respectively. The payback period for the cinder block production project is 10 months, while the Pinoizol insulation production project has a payback period of 0.4 months. The net present value (NPV) and profitability index (PI) for the cinder block production project are 3,006 thousand UAH and 4.5, respectively, while for the Pinoizol insulation project, they are 638.4 thousand UAH and 29.6, respectively.

Thus, all the proposed projects are profitable, effective, and feasible. Their implementation will not only improve the financial position of Budindustriya LLC Ternopilbud but also ensure stable financial development, entry into new markets, and a high reputation in the external market overall.

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