

УДК 330.341.1: 624.1

JEL Classification Code: O32, L70

**Shevchuk N.A.**

*Ph.D., Associate Professor, National Technical University of Ukraine  
«Kiev Polytechnic Institute. Igor Sikorsky «*

**Vapnichna V.V.**

*Ph.D., Associate Professor, National Technical University of Ukraine  
«Kiev Polytechnic Institute. Igor Sikorsky «*

## **DEVELOPMENT AND INTRODUCTION STARTUP PROJECT ON THE EXAMPLE OF THE GEOSYNTHETIC MODULE-FORMWORK**

*In the article reviewed theoretical and practical aspects of implementation of startup projects. Defined and described the main stages creation and implementation startup project on the example of the geosynthetic module- formwork.*

*The main objective of the project consists in the production and sale of geosynthetic formwork modules for geotechnical enterprises interested in the installing the foundation and fastening stank.*

*Module- formwork is necessary for solving the problems of improving the quality of the installation of the foundation pit with the method of «wall in the soil» with the help of a special geosynthetic material that isolates the influence of surrounding factors during the formation of the strength of the supporting structure by increasing the grafting of concrete with armature and reducing the cost of mounting the fixture.*

*The innovative product of the geosynthetic module-formwork is developed. Presented a detailed description of the idea and structure of the business model of the geosynthetic module-formwork, identified potential customers, analyzed factors of threats and opportunities, competitive environment, developed SWOT-analysis, target groups of potential consumers are considered, defining key benefits of the product concept, as well as a procedure for the implementation of the project.*

**Keywords:** startup project; «wall in the soil»; business model; innovative solutions; innovative product; geosynthetic formwork module; decking; foundation.

**Introduction.** Today, the development and implementation of innovative solutions becomes more urgent. For a master's thesis the section «Development of a startup project» is obligatory, therefore for expedient introduction of scientific researches of masters the expediency of development of startup projects is very actual. Innovative projects developed by masters students are an effective means of introducing new technology and new technologies, increasing the efficiency of production, manufacturing competitive products, overcoming the economic crisis and entering the world market.

**Analysis of recent research and publications.** The problem of researching the development and implementation of innovative solutions for startup projects is also the focus of economists and engineers. The study of the development and implementation of start-ups was dealt with by J. Mullins, N. Robemed, I. Per, I. Malyukova, O. Strutinsky, A.Yu.Kovlova, M.R. Barabash, VS Pikul, P. Til, V. Harnish, S. Ekland and others.

**Goal.** The purpose of the study is to develop an algorithm for creating a startup project on an example geosynthetic formwork module for the purpose of economic efficiency increase grafting of concrete with armature and a decrease in the cost of mounting the fixture.

**Presenting main material.** Startup is an entirely new project, based on which is an entirely new idea, which is the rapid development, implementation and profit making.

The origin of a project startup is a stage when there is an idea based on an innovative product, service or technology that improves, modifies, improves and improves the cost-effectiveness of implementation.

The success of the startup depends on the pioneering idea. Investors are always looking for innovation for which a clear plan is made, there is a need for consumers and the benefits that can be obtained, as well as the importance of turning an innovative idea into a working business model that takes into account the value of technology, segment and customer interaction, sales channels, monetization, identify key activities, resources and partners.

Startup is a recent project that develops under conditions of uncertainty and is engaged in the development of new products or services and is at the stage of finding the best business ideas under the condition of financing.

Development of the project start-up begins with the creation of a business model for commercialization of scientific and technical developments. Building a competitive business model, technology is an effective tool for solving problems, presents the structure of the most important elements of a business project, is the source of innovative ideas and approaches that can be applied in a unique combination of components [1].

The idea of the project is to manufacture and sell geosynthetic module formwork for geotechnical enterprises, who are interested in foundation foundations and foundation pits. Formwork module is necessary for solving problems and improving the quality of the installation of the foundation wall by means of a special geosynthetic material that isolates the influence of surrounding factors during the formation of the strength of the supporting structure, in particular, increases the grafting of concrete with reinforcement and reduces the cost of installation fastening [2].

To solve this problem, it was proposed to use a reinforcing frame made in a combined module, from a flexible non-removable formwork in the form of a bulkhead open from the waterproof geosynthetic material pencil. The arrangement is carried out by successive pumping of clay solution from the trench [3].

Table 1 presents the content of the idea, the scope of application and possible basic potential markets, within which it is necessary to look for groups of potential clients.

**Table 1** – Description of the project startup idea

The content of the idea	Directions of application	User benefits
Creating a geosynthetic formwork module	Arrangement of fence fastening	Increasing the speed of work execution, and reducing the construction time
	Creation of anti-filter veils	Reducing material spending
	Formation of foundation structures	Improvement of the quality of the construction building erection

The nearest analogue is the erection of a monolithic reinforced concrete «wall in the ground», which includes a fort mine device, the trench is splitting into separate capture areas, and the construction of monolithic reinforced concrete sections in each of the capture areas. The erection of a monolithic reinforced concrete section in each of the capture areas includes the development of the soil under the protection of the pressurized thixotropic clay suspension, the manufacture of reinforcing frame and its lowering into captured area to the design depth, fixing the reinforcing frame to the fort mine device and concreting of the each section [2].

Another closest analogue for the construction of structures in the «wall in the ground» method is the use of metal rolling sheets in the form of formwork, which are immersed in a trench before filling its concrete directly into the clay solution. This allows for an approximate effect, but the disadvantage is the formation of formwork from individual sheets, which have insufficient density between joints, which can lead to a decrease in concrete strength and waterproofing of the object.

Creating a geosynthetic formwork module will improve the quality of the work done when setting the «wall in the ground.» Low cost, reliability and stability makes it possible to use this design by advanced construction companies.

The main stages of creating a geosynthetic module-formwork are as follow:

- Ordering of the necessary materials (armatures, geomembranes, auxiliary materials required for formwork construction);
- Formation of a reinforcing frame of a certain geometric shape;
- Creation of the primary formwork by means of geosynthetic membrane;
- Formation of the final modular formwork;
- Checking the quality of work and material.

It is proposed a new product implementation in the form of a module of formwork using a geosynthetic membrane, which serves as a formwork at the arrangement of supporting structures of a pit, which ensures the absence of filtration and improves the quality of the constructions erection by the method of «wall in the soil».

The market opportunities are identified that can be used during project implementation and market threats that may hinder its implementation. This allows us to evaluate the possibility of the geosynthetic module-formwork implementation into the construction market [3].

The developed business model of the geosynthetic module-formwork consists in the production and active sale of the complex, servicing and consulting (Tables 2, 3).

It can be concluded from this table that the construction market raises the question of choosing quality types of structures. There is a need for foundation installations, fencing and anti-filter veils and create requirements for the product presented in the consumer segment. When applying this design, there are certain threats (Table 4).

Formed threat factors can affect the possible reaction of the company receiving the product, but these threats are more dependent on external factors, so integrated account and timely response enable the product to develop stably. Along with the range of threats there are certain opportunities (table 5).

**Table 2** – The structure of the business model of a geosynthetic module-formwork

<b>Key partners</b> 1. Products Suppliers: DIAMET Ltd., Metal Holding, Imperative Ukraine, AJAX, Staleks Geosynthetics, DVS. 2. Products and services are provided to geotechnical construction companies, for underground construction, etc.	<b>Key activities</b> 1. Production and arrangement of the geosynthetic module-formworks. 2. Realization of the design. 3. Provision of consulting and technical support in the regions. 4. Certification once every 3 years	<b>Valuable Offer</b> 1. Narrow consumer segment 2. The value of the offer is to provide construction companies with a unique product, namely a geosynthetic module- formwork, which increases the quality characteristics during the formwork erection by the method of «wall in the ground». Ease of use, high reliability and resistance to external influences.	<b>Customers' Relationship</b> 1. Demonstration of possibilities of the geosynthetic module-formwork 2. Author's supervision	<b>Consumer Segments</b> 1. Special consumer segment: geotechnical enterprises, underground construction, construction organizations
	<b>Key Resources</b> 1. Material resources (rental of areas, equipment, construction materials, consumables, assembly workshop) 2. Intellectual resources (creation of patents and licenses for production and use) 3. Human resources (highly skilled workers) 4. Financial resources (Own funds and attracted investments)		<b>Sales Channels</b> 1. Direct sale of the product, advertising in magazines and newspapers of construction business, online advertising, receiving grants and writing promotional articles.	
<b>Cost structure</b> 1. One-time expenses (capital): equipment. 2. Constant expenses: rental of areas, payment for electricity, wages, communication systems. 3. Variables expenses: materials for the construction of the geosynthetic module- formwork frame.		<b>Ways of the Incomes</b> 1. Active sales 2. Passive sales 3. Author's supervision		

The growth of the ability to create supportive structures in the «wall in the soil» way is quite extensive, which allows us to explore new proposals in various applications and is a positive factor in shaping the needs of the product.

The analysis of the competitive environment of the geosynthetic module-formwork is presented in Table 6.

After analyzing the peculiarities of the competitive environment for the implementation of the product of the geosynthetic formwork module, a SWOT

analysis can be made, in which the strengths and weaknesses will be expressed for its implementation (Table 7).

**Table 3** – Characteristics of the potential clients of the startup project

Item	The need for the market	Target Audience (Target Market Segments)	Consumer requirements for goods
1	Arrangement of anti-filter veils	Construction organizations	Provision of high quality insulation from groundwater
2	Formation of fence fastening	Construction organizations	High quality of works and provision of construction stability
3	Arrangement of bases and foundations	Construction organizations	High quality of works and provision of construction stability

**Table 4** – Threat factors

№ Item	Factor	Threat Description	Possible reaction of the company
1.	Cost increase	Increase in the price of a construction in accordance with the increasing demand for materials and services	Negative
2.	Political situation in the country	Possible seals in the company	Negative
3.	Negative feedback	Distribution of information, reviews with negative content	Negative
4.	Decrease in quality	Absence of skilled personnel	Negative

**Table 5** – Opportunity Factors

№ Item	Factor	Opportunity description	Possible reaction of the company
1.	Extensions of functions	Prospects for expanding the scope of the product	Positive
2.	Improving quality	Improvement of this model in order to improve its quality indicators	Positive
3.	Expansion of the company	Providing goods and services related to them in all regions of the country	Positive

**Table 6** – Step-by-step analysis of competition in the market

Features of the competitive environment	What is this characteristic	Influence on enterprise activity
Competitive environment of technical development	Use of the geosynthetic formwork module and optimization of work in the arrangement of supporting structures	At the expense of increasing productivity and reducing the cost of working time
Competitive product environment	Providing high quality and durability of the design, and high waterproofing properties	Use of materials and raw materials of high quality

**Table 7** – SWOT-analysis of the startup project

<b>Strengths:</b>	<b>Weak sides:</b>
<b>Opportunities:</b> 1. Increased sales of the product due to the improvement of the design. 2. Receipt of state orders for manufacturing and installation of construction. 3. Reduction of tax expenses and receipt of tenders. 4. Expansion of the market at the expense of foreign customers.	<b>Threats:</b> 1. Price competition in connection with the emergence of new products of this nature. 2. Changing prices by increasing the cost of materials materials, can lead to a decrease in demand, especially from small firms. 3. Political and economic situation in the country. 4. Loss of potential clients due to crisis situations. 5. Reducing the percentage of sales due to late execution of orders.

The uniqueness of this product and the availability of a wide range of features contribute to the rapid development of this market segment, and opens the door to new partners. In the future, this will allow to compete with larger companies at a high level, increase the level of trust and attract additional investments [4].

The development of a market strategy involves identifying a market coverage strategy: a description of the target groups of potential customers (Table 8).

**Table 8** – Selection of target groups of potential consumers

<b>№ Item</b>	<b>Description of the profile of the target group of potential clients</b>	<b>Readiness of consumers to accept the product</b>	<b>Tentative demand within the target group (segment)</b>	<b>Intensity of competition in the segment</b>	<b>Simplicity the entrance to segment</b>
1	Metrostroy	High	High	High	Free
2	Interbudtunnel	High	High	Average	Free
3	Interbudmontazh	High	High	Average	Free
4	Megapolisbud	Average	High	Average	Free
5	Ukrgolovspetsstroy	Average	High	Average	Free

According to the results of the analysis of potential groups of consumers, it can be concluded that this service has a high demand in this environment, certain groups of consumers are ready to accept the new product and its effective indicators, despite the rather high competition in this segment.

To work in the chosen segment of the market, the strategy of market coverage and the basic strategy of its development according to our product were used. Differentiated marketing involves the development of a marketing complex for a relevant market segment, which corresponds to its special differences and needs, which are the basis of the market segment. The basic development strategy of the project is to meet the needs of a particular market segment in comparison with competitors [5].

Based on the requirements of consumers from the selected segment to the supplier and the product, as well as depending on the strategy of development and strategy of competitive behavior, a strategy of positioning, determined in the formation of a market suggestions, has been developed. Positioning strategy is based on the strategy of development and product improvement, taking into

account the wishes of potential customers, the high reliability of the product, quality, cost and the possibility of feedback from the manufacturer.

When developing a marketing program, the first step is to develop a marketing concept for the product that the consumer will receive. In table 9 we summarize the results of the analysis of the competitiveness of the goods.

**Table 9** – Defining the key benefits of the product concept

№ Item	Need	Benefit offered by the product	Key Benefits to Competitors
1	Need in the quality of work	High quality end product	Improvement of quality by reducing the influence of soil particles, ground water, preventing the formation of film on the reinforcing frame, all that increases the strength of the structure by about 20%
2	The need for waterproofing underground structures	Savings on waterproofing costs during operation	Provides waterproofing properties of the design in the initial period of its use
3	The need for optimization of construction	Significant level of optimization	Due to the integration of technological processes, there is no need for additional work

The next step is to determine the price limits that should be guided when setting the price for a potential product, this involves an analysis of the prices of competitors' products and consumer income of the product.

The cost of a geosynthetic formwork module using a 3 mm geomembrane consists of the price of the product without taking into account the reinforcing frame, the installation of the reinforcement frame and the cost of the work.

The price from 2000 UAH to 5000 UAH per 1 m<sup>3</sup> may vary depending on the class and diameter of the reinforcement and the thickness of the geosynthetic material from which the module has been made.

The formation of the sales system is aimed at building organizations, using a zero-level channel with direct sales to the customer. The supplier must also carry out delivery and assembly and installation of the design. The sales channels of the geosynthetic module-formwork correspond to a rather narrow market segment, but the absence of such products allows for free entry into the market.

**Conclusions.** Summarizing the analysis of a new product of the geosynthetic formwork module, a startup project was developed. Effective design of the formwork module for the construction of supporting walls and foundation foundations, should provide waterproofing properties, durability and strength of consolidated structures.

The qualitative characteristics of this product are presented in the process of research analysis mutually complement each other and have a high probability of expected results of the design work.

Applying approaches for the development of the geosynthetic module-formwork, combine such important technological processes as the construction of supporting structures, enclosing foundation pits, anti-drainage curtains, bases and foundations allow to improve the construction process due to high optimization, reduction of material volume and improvement of construction quality.

The advantages of using the geosynthetic-modular formwork are that concreting sections in the middle of flexible formwork from the geosynthetic membrane eliminates the deposition of clay solution on the frame reinforcement, which improves the adhesion of concrete to the frame and increases the strength of the wall, eliminates the mixing of concrete with an argillaceous suspension and increases the strength and water resistance of the wall, waterproof formwork provides effective protection of the wall itself from the influence of groundwater and acts as a reliable waterproofing of underground and deepened structures, which dispute jeni way «monolithic wall in the soil».

The use of the geosynthetic formwork module provides increased strength of structures constructed in a way of «wall in the soil», reducing its cost, as well as reducing labor costs for its construction.

### References

1. Гавриш О.А., Солнцев С.О., Дергачова В.В. та ін. *Методичні рекомендації до виконання розділу магістерських дисертацій для студентів інженерних спеціальностей*. Київ : НТУУ «КПІ», 2016. – 28 с.
2. ДБН В.2.1–10–2009. *Основи та фундаменти.*; Введ. 19.01.2009.
3. Шевчук Н.А. Зайченко С.В., Кривда О.В. 2018. Впровадження та реалізація стартап проекту геомехатронного комплексу. *Сучасні проблеми економіки і підприємництва*. № 21. – С. 4.
4. S. Zaichenko, N. Shevchuk, V. Vapnichna. 2017. The determination of the choice of technologies and equipment for the construction of tunnels. *International research and practice conference «Modern methods, innovations and experience of practical application in the field of technical sciences»: Conference proceedings, December 27-28*, p.130-134.
5. Шевчук Н.А. 2018. Впровадження та реалізація стартапів в гірництві. *Міжнародна науково-технічна конференція, присвячена 120 –річчю КПІ «Проблеми геоінженерії та підземної урбаністики», м. Київ, 17-18 травня С. 89-90.*

---

**Шевчук Н.А.**

кандидат технічних наук, доцент кафедри економіки і підприємництва,  
Національний технічний університет України  
«Київський політехнічний інститут імені Ігоря Сікорського»

**Вапнічна В.В.**

кандидат технічних наук,  
доцент кафедри геоінженерії,  
Національний технічний університет України  
«Київський політехнічний інститут імені Ігоря Сікорського»

### РОЗРОБКА ТА ВПРОВАДЖЕННЯ СТАРТАП ПРОЕКТУ НА ПРИКЛАДІ ГЕОСИНТЕТИЧНОГО МОДУЛЯ-ОПАЛУБКИ

В статті розглянуто теоретичні та практичні аспекти реалізації стартап проектів. Визначено та описано основні етапи створення та впровадження стартап проекту на прикладі геосинтетичного модуля опалубки.

Визначено головну мету проекту, яка полягає у виробництві та продажу геосинтетичного модуля-опалубки для геотехнічних підприємств зацікавлених у влаштуванні фундаментів та кріпленні котловану. Модуль-опалубка необхідна для вирішення проблем підвищення якості при влаштуванні кріплення котловану способом «стіна в ґрунті» за допомогою спеціального геосинтетичного матеріалу, який ізолює



дію навколишніх факторів під час формування міцності підтримуючої споруди за рахунок підвищення щеплення бетону з арматурою та зменшення витрат на влаштування кріплення.

Розроблено інноваційний продукт геосинтетичний модуль-опалубка. Представлено детальний опис ідеї, структуру бізнес-моделі геосинтетичного модуля-опалубки, визначено потенційних клієнтів, детально проаналізовані фактори загроз та можливостей, конкурентне середовище, розроблений SWOT-аналіз, розглянуті цільові групи потенційних споживачів, визначенні ключові переваги концепції товару, а також визначено процедуру реалізації проекту.

**Ключові слова:** стартап; бізнес-модель; інноваційні рішення; інноваційний продукт; геосинтетичний модуль опалубки; опалубка; «стіна в ґрунті»; фундамент.

**Шевчук Н.А.**

кандидат технических наук, доцент кафедры экономики и предпринимательства,  
Национальный технический университет Украины  
«Киевский политехнический институт имени Игоря Сикорского»

**Вапничная В.В.**

кандидат технических наук, доцент кафедры геотехники,  
Национальный технический университет Украины  
«Киевский политехнический институт имени Игоря Сикорского»

#### **РАЗРАБОТКА И ВНЕДРЕНИЕ СТАРТАП ПРОЕКТА НА ПРИМЕРЕ ГЕОСИНТЕТИЧЕСКОГО МОДУЛЯ-ОПАЛУБКИ**

*В статье рассмотрены теоретические и практические аспекты реализации стартап проекта. Определены и описаны основные этапы создания и внедрения стартап проекта на примере геосинтетического модуля опалубки.*

*Определена главная цель проекта, которая заключается в производстве и продаже геосинтетического модуля-опалубки для геотехнических предприятий, которые заинтересованы в устройстве фундаментов и креплении котлованов. Модуль-опалубка необходима для решения проблем повышения прочности при установке крепления котлована способом «стена в грунте», с помощью специального геосинтетического материала, который предотвращает воздействие внешних факторов при формировании прочности поддерживающих сооружения, за счет повышения сцепления бетона с арматурой и уменьшения затрат на устройство крепления.*

*Разработан инновационный продукт геосинтетический модуль-опалубка. Детально описана идея, структура бизнес-модели геосинтетического модуля-опалубки, определены потенциальные клиенты, детально проанализированы факторы угроз и возможностей, конкурентная среда, проведен SWOT-анализ, рассмотрены целевые группы потенциальных клиентов, определены ключевые преимущества концепции товара, а также определена процедура реализации проекта.*

**Ключевые слова:** стартап; бизнес-модель; инновационные решения; инновационный продукт; геосинтетический модуль опалубка; опалубка; «Стена в ґрунті»; фундамент.

---

**Шевчук Н.А.**

**nata520522@gmail.com**

**Вапнічна В.В.**

**v.vapnichna@kpi.ua**