

COGNITIVE MODELING OF THE STARTUP LIFE CYCLE

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JEL Classification: M13**Labunska S. V., Prokopishyna O. V., Iermachenko Ie. V.**
Cognitive Modeling of the Startup Life Cycle

Under conditions of turbulent development of the world market, which takes place based on modern high-tech industries and introduction of IT technologies into all business processes development of the global socio-economic system is impossible without the spread and intensification of activities of startups. Startup enterprises, despite the short period of their existence, play an important role in the processes of generating new knowledge, creating innovative projects and commercializing innovative ideas. Startups, as business units, constitute a separate subset of innovative enterprises, grouped according to scaling, using breakthrough innovative ideas, specific sources of financing and increased risk. Since the typical features of a successful startup are the rapid expansion of operations and high risks of financial and economic activity, a conditional time point at which both the risks and rates of growth in transaction volumes are simultaneously reduced can be defined as the fluctuation point at which the startup ceases to exist. The results of applying mathematical methods to process statistical information on the dynamics of the market proved that the fluctuation point of the life cycle of startups in Ukraine takes place in the time interval of the first year of financial and economic activities of the enterprise. During this interval, startup enterprises are oriented towards one of two alternatives: scaling operations on the basis of attracting investments and a significant expansion of activities or gradual curtailment of an innovative project in which investors' financial resources could not be attracted. Both alternatives lead to the transmission of an enterprise from the class of startups to the class of large enterprises or the liquidation of the business. Startup enterprises in Ukraine have a high potential for innovation development and can become a driving force for the social and economic development of the country as a whole. In order to increase the positive effect of startup initiatives for the Ukrainian economy, it is necessary to solve a number of tasks, among which there are the expansion of information and financial support from the state, the formation of a favorable investment climate and infrastructure for the commercialization of innovative projects.

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В умовах турбулентного розвитку світового економічного середовища, що спирається на використання сучасних високотехнологічних виробництв і впровадження ІТ-технологій у всі бізнес-процеси, проблема управління ризикованими проектами набуває надзвичайної актуальності. Інноваційний розвиток глобального соціально-економічного середовища є неможливим без поширення та активізації стартап руху. Стартап-підприємства відіграють істотну роль у процесах генерації нових знань, створення інноваційних проектів і комерціалізації інноваційних ідей, незважаючи на короткий час свого існування. Стартапи як бізнес-одиниці складають окрему підмножину інноваційних підприємств, групуючись за ознаками масштабованої діяльності, використання проривних інноваційних ідей, специфічних джерел фінан-

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В условиях турбулентного развития мирового рынка, происходящего на основе современных высокотехнологических производств и внедрения ИТ-технологий во все бизнес-процессы, проблема управления рискованными проектами приобретает чрезвычайную актуальность. Инновационное развитие глобальной социально-экономической системы невозможно без распространения и активизации деятельности стартапов. Стартап-предприятия, несмотря на короткое время существования, играют важную роль в процессах генерации новых знаний, создания инновационных проектов и коммерциализации инновационных идей. Стартапы как бизнес-единицы составляют отдельное подмножество инновационных предприятий, группируясь по признакам масштабируемой деятельности, использования прорыв-

сування та підвищеної ризикованості. Оскільки визначними ознаками успішного стартапу є швидке розширення операцій та високі ризики фінансово-господарської діяльності, умовна часова точка, в якій одночасно відбувається зниження ризиків і темпів зростання обсягів операцій, може бути визначена як флуктуаційна точка припинення стартапу. Результатами застосування математичних методів обробки статистичної інформації щодо динаміки ринку доведено, що флуктуаційна точка життєвого циклу стартапів в Україні займає місце в часовому проміжку першого року фінансово-господарської діяльності підприємства. Протягом цього інтервалу відбувається орієнтація стартап-підприємства на одну з двох альтернатив: масштабування операцій на основі залучення інвестицій та суттєве розширення діяльності або поступове згорання інноваційного проекту, в який не вдалося залучити фінансові ресурси інвесторів; обидві альтернативи призводять до трансмісії підприємства з класу стартапів до класу великих підприємств або ліквідації бізнесу. Стартап-підприємства в Україні мають високий потенціал інноваційного розвитку і можуть стати рушійною силою соціально-економічного розвитку країни в цілому. З метою збільшення позитивного ефекту стартап-ініціатив для економіки України необхідним є вирішення ряду завдань, серед яких розширення інформаційної та фінансової підтримки з боку держави, формування сприятливого інвестиційного клімату й інфраструктури для комерціалізації інноваційних проектів.

Ключові слова: когнітивне моделювання, життєвий цикл підприємства, інновація, стартап.

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ных инновационных идей, специфических источников финансирования и повышенной рискованности. Поскольку характерными признаками успешного стартапа является быстрое расширение операций и высокие риски финансово-хозяйственной деятельности, условная временная точка, в которой одновременно происходит снижение рисков и темпов роста объемов операций, может быть определена как флуктуационная точка прекращения стартапа. Результатами применения математических методов обработки статистической информации о динамике рынка доказано, что флуктуационная точка жизненного цикла стартапов в Украине занимает место во временном промежутке первого года финансово-хозяйственной деятельности предприятия. В течение этого интервала происходит ориентация стартап-компаний на одну из двух альтернатив: масштабирование операций на основе привлечения инвестиций и существенное расширение деятельности или постепенное свертывание инновационного проекта, в который не удалось привлечь финансовые ресурсы инвесторов; обе альтернативы приводят к трансмиссии предприятия из класса стартапов в класс крупных предприятий или ликвидации бизнеса. Стартап-предприятия в Украине имеют высокий потенциал инновационного развития и могут стать движущей силой социально-экономического развития страны в целом. С целью увеличения положительного эффекта стартап-инициатив для экономики Украины необходимо решение ряда задач, среди которых расширение информационной и финансовой поддержки со стороны государства, формирование благоприятного инвестиционного климата и инфраструктуры для коммерциализации инновационных проектов.

Ключевые слова: когнитивное моделирование, жизненный цикл предприятия, инновация, стартап.

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Introduction. Under conditions of accelerated turbulent changes in the world economic environment based on modern high-tech solutions and wide implementation of IT technologies in business processes, the problem of implementation of risk projects, which form proactive strategy for the development of separate industries and technological progress in general, becomes extremely important. Recent scientific studies [14] prove that development of institutions and infrastructure, human capital, innovations as well as technology transfer are

universal factors for ensuring stable economic growth, although each country uses its own competitive advantages and resources.

Nowadays the innovative development of global socio-economic environment is impossible without the spread and activation of startups. Mainly startup companies test and implement the latest technology and commercial solutions in all areas of business and then scale up breakthrough projects. As noted by leading scholars [2–4; 15], the startup flow is, in es-

sence, the process of developing and implementing innovative breakthrough technologies that shape the further development of mankind.

An American scientist-innovator Steve Blanc was the first in formulating new approach to determining peculiarities of business organization on the principle of startups and he defined startup company as a temporary venture aimed at search of iterative business model [1, p. 43]. The interpretation of the term "startup" in the context of limbic perception of its origin justifies its understanding as a new project that is elaborated under uncertainty and involves development of new products or services and is at the stage of searching for the best business ideas and funding [2].

O. Kulynych [6] persuades that a startup is a partnership of two or more people to create an innovative product or service that is at the early stage of business activity with limited resources and requires additional venture capital.

The concept of startup is often associated with limited resources for implementation of a new idea or a plan for market advancing. That is, a startup company is a venture that offers completely (revolutionary) new products (services), introduces new technologies or completely new channels for product promotion. Innovation activity is the main foundation and necessary (but insufficient) condition for creating of a startup.

In general, startup companies are innovative companies, whose activities in Ukraine are regulated by the Law "On Innovation Activity" [9, art. 16]. This document states that "an enterprise (or association of enterprises) of any form of ownership is recognized as an innovative enterprise if more than 70 % of the volume of its output (in monetary terms) for the referenced period are innovative products". In turn, innovative product is a product created in the result of an innovative project or produced in Ukraine for the first time, or has essentially new technical and economic features in comparison with other similar products [9].

The innovative development stimulates the creation of new industries, leads to lower-cost production and increases the greening of production, so it is the main instrument for attracting foreign investment. The rapid and broad distribution of innovations ensures stable positions of leading countries on the global markets. The United States, as the world leader in the economy, according to the data of OECD [19] allocates the largest funds to research and development: more than USD460 billion a year (2.74 % of GDP). China takes the second position and invests to scientific research activities about USD338 billion a year (2.1 % of GDP). Japan's annual spending on R&D is USD160 billion (3.67 %). In Ukraine, the share of expenditures on R&D in the GDP in 2017 was 0.45 %, including the budget ones (0.16 %). Ukraine is the 76th in the world by total spending on innovations. At the same time, the total GDP growth due to the introduction of new technologies in Ukraine is 0.7 %, while in developed countries this rate reaches 60-90 % [19]. Thus, we may conclude that the national economy needs a radical upsurge in the level of innovation, and here startups can assist essentially.

Examples of the most successful startups are Google, PayPal, Wikipedia, Instagram, YouTube, Facebook, which eventually turned into powerful corporations. Nowadays, the scientific literature lacks a well-defined concept of startup.

Some researchers understand startup as any small newly created innovative business. Thus, the statistics regarding the number and dynamics of startups that are presented on various websites, both foreign [10; 11] and domestic [7; 13], vary significantly.

According to the Inn Mind Center, at the beginning of 2016 there were about 305 million of startups worldwide, nearly 472 million of entrepreneurs participated in startup companies or startup projects, and over the past years 100 million of new startups have been launched annually, including 1.35 million of technology ones [7].

The Startup Ranking, based on the analysis of the number of startups in 186 countries, demonstrates that in 2017 Ukraine ranked 42th, rising by 5 positions from the previous year and outperforming the Philippines, Romania and Greece. This position was obtained due to 216 startups operating in Ukraine. The first place in the rating was taken by the United States (45 251 startups), the second place – by India (5 318 startups) and the third one – by the UK (4 726 startups as of 1st June, 2018) [11]. The most internationally well-known Ukrainian startups are: DepositPhotos, IT-company Terrasoft, TemplateMonster, Petcube, Grammarly [5].

It should be noted that no startup companies were registered in Ukraine before 2005, but some startup projects were implemented on the principles of outsourcing with foreign startup companies [11]. The majority of Ukrainian startup companies are registered in Kyiv region (88 %) and the city of Kyiv (6 %). According to the information of the Startup Ranking, since 2014, the startup movement extends to different regions of Ukraine: startup companies were created in Lviv region (4 companies), Dnipropetrovsk and Ternopil region (2 companies in each), as well as in Kharkiv, Zaporizhzhya, and Zakarpattia region (1 company in each).

The purpose of this scientific research is to reveal the essence of the concept of "startup company", its differences from other types of business activity, as well as analyze the theoretical and methodological backgrounds for the development of startup companies.

A well-known American researcher Eric Ries believes that a startup is any business organization designed to create and promote a new innovation product under conditions of extreme uncertainty [17]. According to him, doing business under conditions of extreme uncertainty and, as a consequence, of an increased risk is a distinctive feature of these enterprises from others.

Paul Graham, the founder of Yahoo, highlights the feature of startup companies (projects) as assumption of rapid growth in a short period of time [18]. The short or limited time of the startup business existence is emphasized also in scientific works of N. Sytnik, D. Ponomarev, and others [8; 12].

Experts from the American financial and economic magazine Forbes determine the startup by the following distinctive features: it was founded not more than a year ago; it represents an innovative business that destroys traditional ideas about its sector; it is a business with a real business plan and projected sales that do not exceed average sales for startups; it is not a property of large corporations [16].

Thus, the main features of a startup as a newly created business are:

- novelty of the product offered by the startup;

- innovative ideas and / or absolutely new technologies of production created during the implementation of the startup;
- scalability of the business model – rapid growth of sales due to the introduction of a new product or a new idea, which revolutionary changes the existing product, and / or the application of new technologies, the formation of new consumer needs, which pre-determine further developments;
- short life cycle of a startup as a business entity, due to the introduction of innovations. Rapid diffusion of information and dissemination of innovations cause deprivation of leadership positions and preferences when using certain innovations.

Identification of certain specific features of startup companies (projects) and generalization of theoretical studies [2; 5; 6; 12; 13; 15; 21; 22] allowed to make a comparative characteristic of startup companies presented in Table 1. So it is possible to conclude that a startup company has common features with innovative small enterprises (it is included into their totality), such as small size, unstable market situation, attracting external financing, high risk, innovation activity.

It should be noted that startups, as business units, constitute a separate subset of innovative companies, grouped on the basis of scalability, use of breakthrough innovative ideas, specific sources of funding, and increased riskiness.

Based on characteristics given in Table 1, it can be proposed to consider a startup company in general as a small innovative company that is at the startup phase of its devel-

opment. While the startup phase may be defined as a period in the life cycle of an innovative business during which the company operates in high risk environment, introduces crucial innovations, grows fast and attracts external funding for success.

Since the highlights of a startup are fast scalability of operations and high riskiness of business, the conditional time point, at which risks decrease and transactions grow simultaneously, can be defined as the fluctuation point of the end of the startup phase and transition of a startup business to the phase of the mature business, as shown in Figure 1.

Autio and Rannikko [15] suggest that the stand-up, start-up and scaleup phases of business development can be divided into two sub-phases.

Thus, the stand-up phase includes:

- ideating – a period of the life cycle of a business when one person or a vague team reveals a problem in consumption or market and expresses entrepreneurial ambition to create a scalable product or service;
- concepting – a period of the life cycle of a business when two or three entrepreneurial core co-founders with complementary skills and ownership plan define business mission and vision aimed at fast growing performance based on radical innovations.

The startup phase includes:

- committing – a period of the life cycle of a business when co-founding team with shared vision, values and attitude dedicate financial and material resources to develop and launch a new product or service;

Table 1

Comparative characteristic of startup companies and small & medium-sized innovative enterprises

Feature	Startup business	Innovative small and medium business
The degree of innovation	An absolutely new “breakthrough” idea for production and sale of a product that does not exist on the market; enrichment of the existing product with completely new features; application of unique new technologies; development of unique channels for sales and product promotion	Implementation of new or existing in other areas ideas for a particular company, industry or product market; use of improved technologies; application of production technologies or methods for promoting goods (products, works, or services) implemented in other industries, companies or markets
The rate of growth and return on investments	High (within 1-3 years) rate of growth and return on investments	Comparatively low (over 3 years) rate of growth and return on investments
Scalability and impact on the development of certain industries or technologies	High scalability, due to breakthrough technologies	Low scalability, because the impact of innovative products is limited by the company, industry or region.
Ability to predict performance	Hardly forecasted results due to wide fluctuation of changes of environmental factors, uncertainty of market response	Relatively high degree of predictability, since already known introductions are made
The degree of risk	Very high risk	Middle risk
Organizational forms and infrastructure centers	Startup companies (private companies, limited liability companies), startup projects, business incubators, business accelerators, techno parks, etc.	Small and medium companies (private companies, limited liability companies), business centers, business incubators, business accelerators, technology parks, investment and innovation funds, etc.
Sources of funding	Business angels, innovative funds, venture funds, crowdfunding, lending institutions	Own funds, lending institutions, innovation funds, venture funds, public associations of business entities
Influence on the market	Considerable	Minor

Source: developed by the authors based on [2; 5; 6; 12; 13; 15; 21; 22]

- validating – a period of the life cycle of a business when the management team of a new business entity tests assumptions for validated solution to achieve initial growth of revenue and in majority cases tries to attract additional resources via investments or loans for equity to increase business transactions and sales.

The scaleup phase includes:

- scaling – a period of the life cycle of a business when a professional management team improves the quality of the launched product or service and achieves measurable growth in a big or fast growing market based on significant funding attracted;
- establishing – a period of the life cycle of a business when a professional management team expects the achieved great business growth to continue, easily attracts resources, expands the market to the international level and often tries to culturally continue “like a startup; initial founders or investors make exit(s) or continue with the company.

Figure 1 demonstrates the life cycle of a successful startup company, however the carried out statistical analysis

of startups confirms that their implicit nature of a highly risky business in most cases leads to discontinuation of their functioning, as shown in Figure 2.

The international advanced study of entrepreneurship The Global Entrepreneurship Monitor [17] defines nascent entrepreneurs and a new business as early-stage entrepreneurial activity that lasts less than 3.5 years, but this quantitative limit undoubtedly needs to be justified.

Petersburg Business Incubator in research of startups in the Russian Federation estimated the share of startups closed during the first year at 40 %, and 30 % more cease to exist within another two years [13].

Observation results of CB Insights on the development of startups in the US [11] show that more than a third of the startup companies exit the market during their first year in business, and almost the same quantity – in the next year, so about 75 % of the startups discontinue their business in 2 years from the moment of their launching. The average lifetime of a startup in the US is about 20 months [7] (Fig. 3).

Demographic analysis of startup companies in Ukraine, as well as in other countries, is complicated by the limited sta-

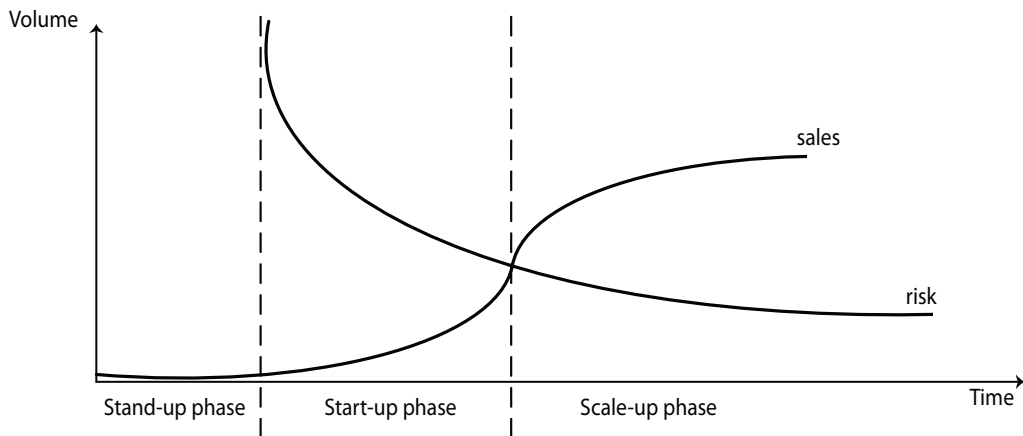


Fig. 1. Evolution curve of the life cycle of a successful startup

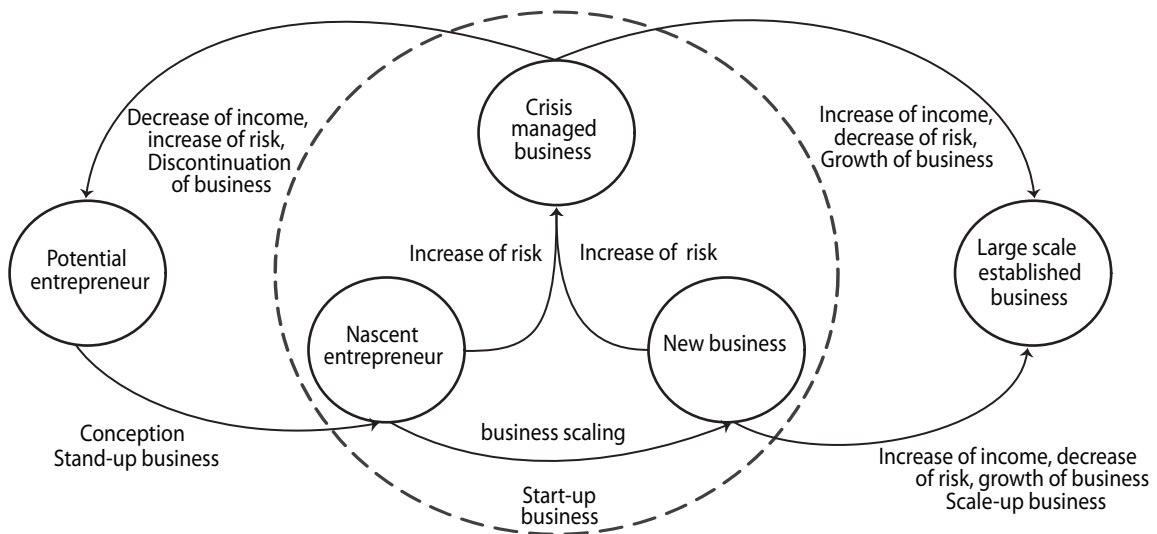


Fig. 2. A cognitive map representing the life cycle of a startup

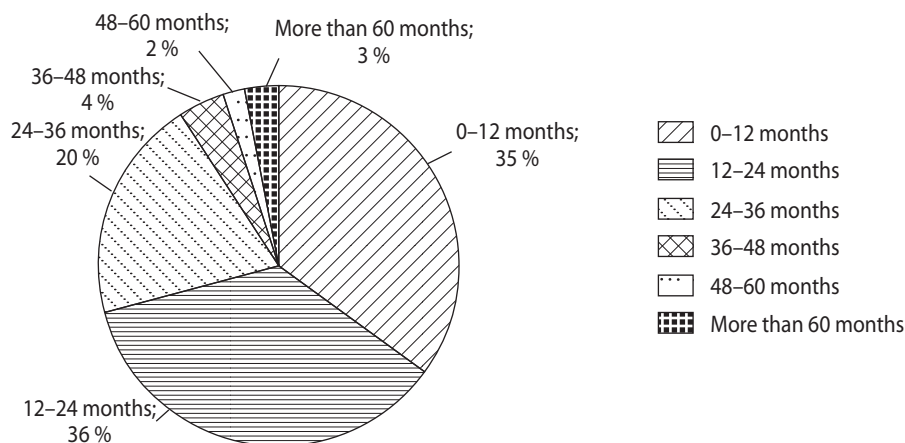


Fig. 3. Time characteristic of the existence of startups [7]

tistical information on their creation and liquidation, but indirectly, the life cycle of startup companies can be determined based on the information about their financing, which is publicly available.

Thus, using the information of the international rating agency Startup Ranking [11], it is possible to estimate that 45 startups from 180 Ukrainian companies (i.e. 25 %), which are represented in the ranking, received funding during the first year of their activity. On the other hand, statistics on the financing of startups confirm the logical conclusion about the choice of investors for the most promising companies: each second company among the 20 best ones received domestic or foreign investments in the total amount of USD13.1 million, the share of companies that received investments among the 40 best companies fell to 37.5 %, among the 60 best companies was 30 %, among the 80 best companies was only 27.5 %. Thus, it is possible to conclude that startup companies that failed to attract investments did not have the capacity to scale up their operations and expand their activities and thus were forced to discontinue their business. This conclusion is also confirmed by the results of numerous studies of reasons for liquidation of startups [11], which determine the inaccessibility of funding as the biggest problem for the development of small innovative businesses.

The analysis of investments revealed that 50 % of financed startup companies (of the 20 most successful in Ukraine) attracted investments in the amount of USD1 million and over. Since fast recoupment is the essence of startups, it can be forecast that the income of such companies on average exceeded USD10 million. According to the current national legislation, small companies are legal entities with a staff of no more than 50 people and an annual income of EUR10 million. Thus, such successful innovative companies can no longer be classified as small companies and do not meet the theoretical criteria for recognizing them as startups.

Conclusions. The fluctuation point of the life cycle of startups in Ukraine takes place in the time period of the first year of the financial and economic activity of a company. During this interval, the startup company is guided by one of two alternatives: 1) scaling up its operations based on attracting investment and significant expansion or 2) gradual curtailment of

the innovative project that failed to attract financial resources of investors. Both alternatives lead to the transmission of the business from the class of startups to the class of large companies or to the liquidation of the business. Thus, a short life cycle is a characteristic feature of startup companies, which is proved by monographic analysis and by the results of application of mathematical methods for processing statistical information on market dynamics. Despite the short time of existence, startup companies play an important role in processes of generating new knowledge, creating innovative projects and commercializing innovative ideas. A startup company is a forerunner of innovation development and a driving force of socio-economic development of a country.

In order to increase the positive effect of startup initiatives for the Ukrainian economy, it is necessary to solve a number of tasks, including the expansion of information and financial support from the state, formation of favorable investment climate and infrastructure for the commercialization of innovation projects, i.e., the theoretical justification of which is a promising area for further research.

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