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ENGINEERING AND TECHNICAL SUPPORT FOR THE PRINTING PRODUCTION START-UP CREATION

The article is devoted to the development of the engineering and technical support for the printing production start-up creation using an innovative environment in the form of the HAB-infrastructure.

Keywords: printing production; innovative idea; HAB; start-up; life cycle; stakeholders; entrepreneurial ecosystems; mathematical model.

Introduction

One of the priorities of Ukraine's post-war reconstruction is the creation of innovative technologies for information exchange (IE). This area is based on such technologies as printing, telecommunications, information, etc.

The publishing and printing industry plays a significant role in the IE sector of Ukraine economy. Since 2009, there has been a trend towards increased competition in the printing market, but the development of innovation technologies and materials has been slow [1].

The history of innovation in Ukraine should be unique and successful. This can be achieved by implementing the following steps:

— development of a 'factory' of ideas and innovations, cultivation of start-up projects, creation of micro- and small high-tech enterprises, launch of their innovative products on the markets, interaction with international venture capital funds;

— scientific and technical problems solving for innovative products from state institutions and business;

— introducing foreign innovations into the Ukrainian economy (technology transfer; opening representative offices of foreign high-tech enterprises; establishing joint ventures in Ukraine, etc.).

The mismatch between educational, research and innovation activities and the real economy can be bridged through public-private partnerships in education and research, which should be carried out by universities [2].

Entrepreneurial education in Ukraine is gradually developing, but there is no systematic approach to education in educational institutions. At the level of higher education institutions, the Entrepreneurial University initiative has been laun-

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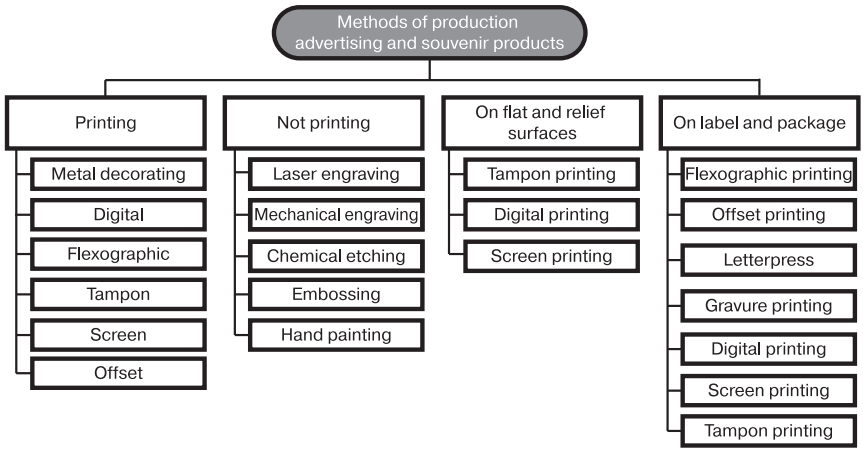

Fig. 1. Technologies aspects for printing products

ched, and several student incubators and accelerators have been set up [1]. For example, the 'Sikorsky Challenge Ukraine' (SCU) All-Ukrainian Innovation Ecosystem (innovation HUB) is an open innovation ecosystem that brings together the country's institutions interested in the development of the Ukrainian innovation economy: universities, research institutions, state and local governments, business companies, foundations and public organizations.

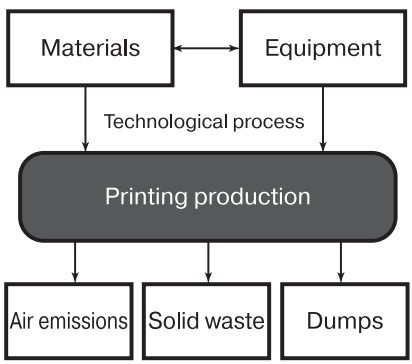

Fig. 2. Components of printing production as a source of environmental pollution

In the publishing and printing industry, it is possible to single out the main engineering and technical factors (ETF) that determine the features of the generation of innovative ideas [3–6]:

— improvement of technological processes of printing productions (fig. 1);

— expanding the range of printing products;

— development of modern consumables (paper, inks, adhesive polymer compositions, etc.);

— introduction of automation tools for managing, adjusting and controlling printing and operational parameters of printing production.

— using online Finishing processes in press;

— solving the problem of the disposal systems for printing products (fig. 2).

The problem of increasing the efficiency of innovation activities is determined by the possibility of taking into account the maximum number of ETFs. This problem solution depends on the peculiarities of the research environment in which

the relevant innovation project is created and implemented. The concept of creating an entrepreneurial ecosystem allows for the research and innovation environments creation to 'germinate' innovative ideas and then 'grow' start-ups to the level of viable and productive business entities with a gradual increase in their revenues and staff. Education institutions in ecosystems attract talented young people, provide future and existing entrepreneurs with knowledge and competencies, create useful applications, and take measures to launch and support innovation units. The HAB principle is one of the promising forms of building an environment — an infrastructure for innovative projects [7]. This principle, in combination with the ecosystem concept, allows for an effective combination of research, production and business organisations of different levels with a set of competences that correspond to an innovative idea. Regulatory documents defining strategic directions for the development of innovation in Ukraine propose certain measures to overcome the crisis and increase the productivity of entrepreneurship [8, 9]. However, the concept of an entrepreneurial ecosystem, which is to some extent new to the country's professional community, is not used in these documents. In addition, for existing forms of HABs-infrastructures of various functional purposes — there are no scientifically sound methods for their design and construction. Thus, the creation of a theoretical basis for the scientific substantiation of the structure of HAB ecosystems (innovation, entrepreneurial, start-ups) in Ukraine is at an early stage. Therefore, in modern conditions, it is relevant to develop scientific and methodological foundations for creating rational designs of ecosystems of different problem orientation.

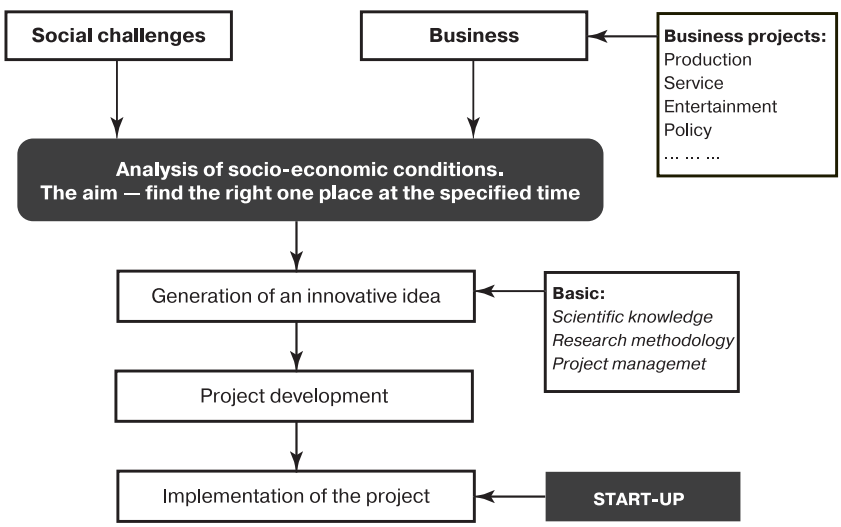

Fig. 3. The innovative activity basis

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Methods

The engineering and technical approach to the organization of printing innovation activities allows for the creation of relevant objects. Among them is the development of innovative ecosystems in the form of HAB infrastructure [10]. This can significantly improve the efficiency of innovative projects in the face of modern social challenges. At the same time, innovation activity is directly related to the characteristics of the welfare state (fig. 3). The successful implementation of innovative projects is determined by the perfection of the existing design environment for design work (fig. 4). Such a design environment is mainly focused on innovation, generating new business models, products and services, as well as creating more competitive and efficient markets and improving customer experience.

Results

The creation of start-ups related to manufacturing processes and the improvement of existing technologies can create a more dynamic economy by attracting ambitious and talented entrepreneurs, creating an environment for creative thinking and entrepreneurial activity.

According to [11], there are must be several key factors that contribute to the growth and potential of sustainable printing production. Let's highlight the most important ones:

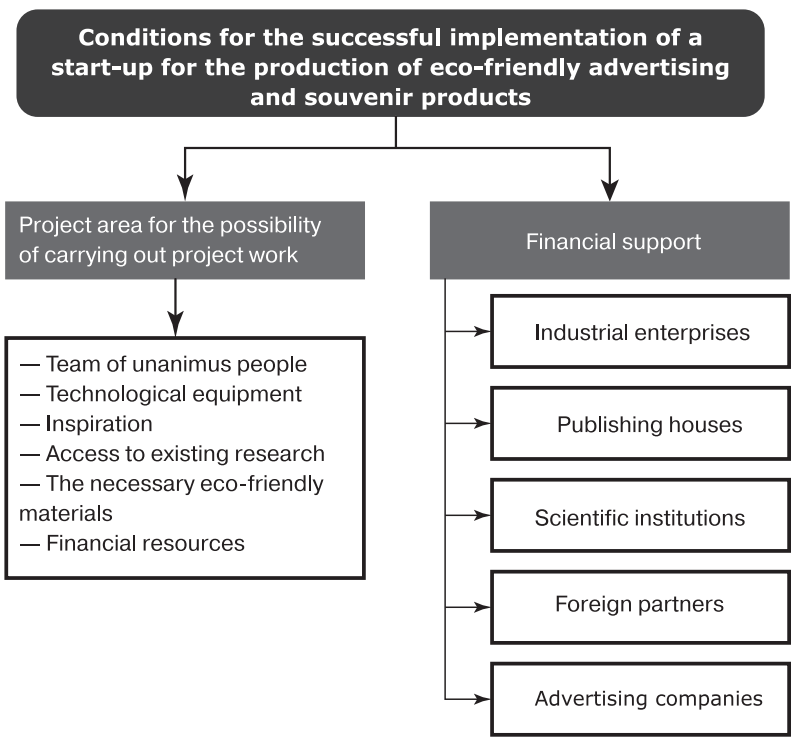

Fig. 4. The main elements of successful implementation of innovative projects

1. *Density*. When designing a printing production facility, accessibility and speed factors are taken into account. Such production should be located in places close to sources of raw materials and supplies. In addition, the area of land for transport and access roads should be taken into account. Ecosystems are usually concentrated around major industries, usually in large cities. It is important to understand that it is not about the number of people or companies operating in a country, but how close and interconnected they are. Density attracts talent, investment, aid and research.

2. *Availability of investment*. When developing a project, it is worth assessing the current state of printing production and providing a detailed action plan and project benefits. The start-up should attract the attention of potential investors and involve them in the project.

3. *Industry maturity.* Maturity refers to the stage of development of companies, as well as the experience of entrepreneurs and employees. Before setting up a production facility for different products types, it is important to assess market competition and the state of technological processes. This is necessary in order to create a unique project that will be understandable and at the same time completely new to the market.

4. *Specialized talent*. This is related to the formation of a team of participants who have been trained and are specialists in certain areas, not only employees, but also support staff (lawyers, managers, mentors, and consultants, among others).

5. *Education*. In the most mature companies, there is a culture of support for innovation and entrepreneurial values at all levels of society, as well as close links between universities and newly established companies.

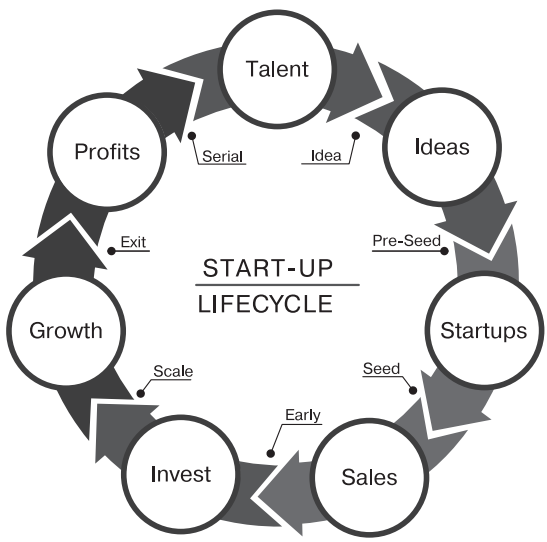

Fig. 5. Start-up lifecycle scheme

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6. *Enabling environment*. Understanding of business start-up opportunities, tax incentive policies, investment assistance, jobs, etc. The printing industry should strengthen the entrepreneurial attitude and culture of the population and institutions.

Discussion

So, for the best understanding the resources and elements that will ensure the creation of a successful promotional products business we may analyze the start-up lifecycle (fig. 5):

1. *Talent*: The first mission of the team members is to identify talent — people with specific skills, who are ready to implement viable ideas and turn them into a business plan.

2. *Idea*: Talented people need to find viable sources of ideas. This is important in businesses, where the entrepreneurs are young, with little experience in the labour market and little experience in identifying customer needs.

3. *Start-ups*: Talents with viable ideas create new companies. This stage involves the creation of working teams and the development of business strategies that the entrepreneur will face in the short and medium term.

4. *Sales*: Companies with robust and multidisciplinary teams begin to generate sales. At this stage, team members must support the company in making sales, ensure that high-quality promotional products are produced on time.

5. *Investments*: A promotional products company demonstrates, that the entrepreneurial team, product, and business model are well formed, and this attracts the interest of investors.

6. *Growth*: Companies that have investment generate expansion and growth. At this stage, the start-up's stakeholders should support the company's entry into new markets through internationalization.

7. *Profit*: The company makes sales and after a certain period of time reaches a stable profit. After a considerable journey and gaining relevant experience, new, more progressive and larger enterprises are created.

Each of the growth phases takes place in stages, which are broken down into the idea stage, pre-seed stage, seed stage, early stage, and scale-up from talent to profit.

From the 'idea' stage to the 'talent' stage, start-ups always have the same basic goals. These stages are crucial to the success of a start-up. Project stakeholders are the most intensive in offering the resources that a startup needs [11]: business knowledge, capital, market and business environment, resources, and regulations (fig. 6).

The 'Idea' stage involves validating the idea of minimizing risk using the concept of lean methodology through interviews with potential customers, analyzing how to enter a large market, developing a competitive product in the market, and creating a clear and attractive value proposition. Two key factors are also developed: the creation of a team of entrepreneurs and a personal financial plan.

In the 'Pre-seed' stage, the main goal is to validate business models by confirming the concept of the

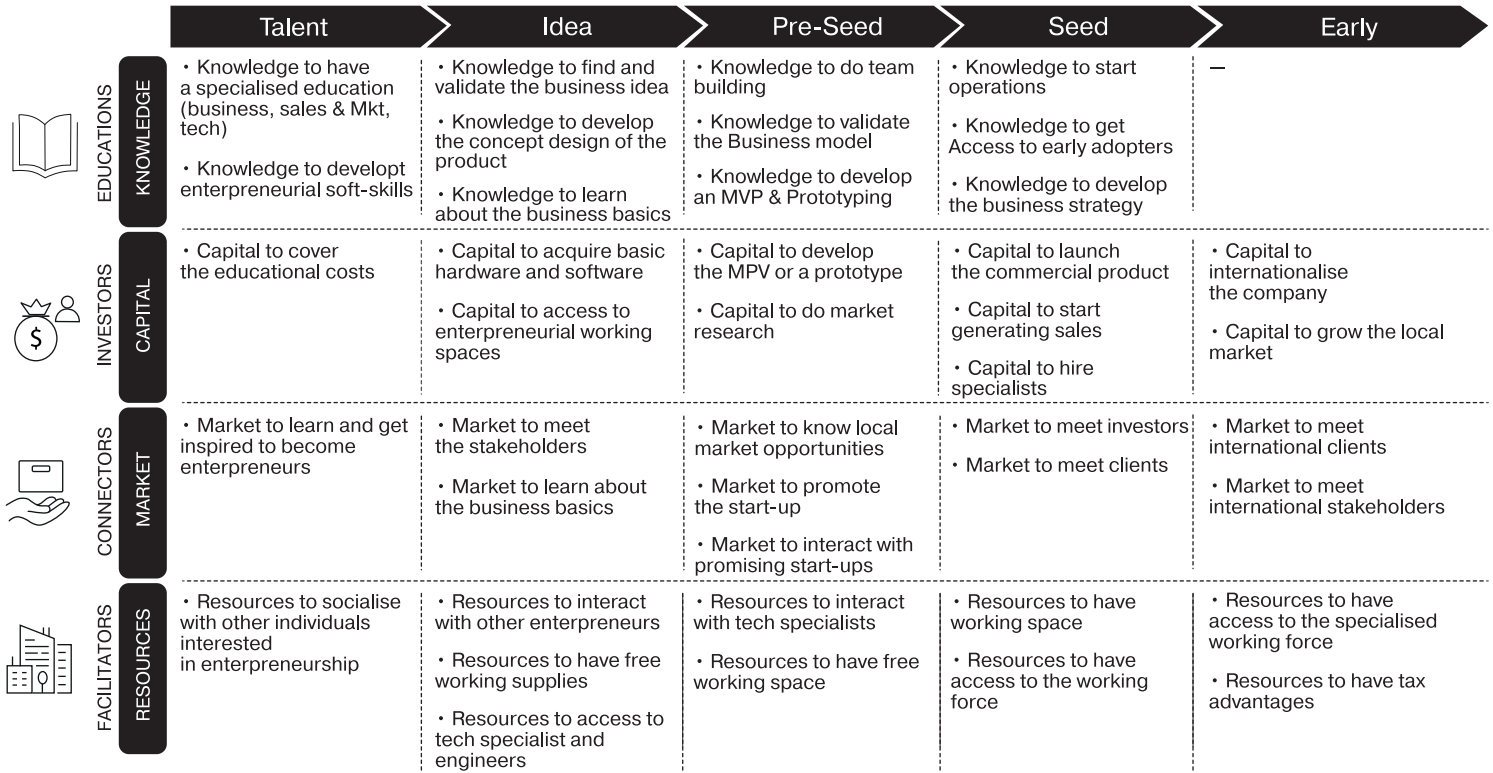

Fig. 6. Primary objectives per start-up growth stage

enterprise and evaluating viable products with future customers.

At the 'Seed' stage, a commercial product is created and the first customers are acquired. At this stage, the customer acquisition strategy, acquisition costs, average revenue, etc. allow entrepreneurs to create an effective business plan, that helps them outline a growth strategy.

At the 'Early' stage, the company reaches the break-even point and consolidates its sales and expenses, mainly in local markets.

At the 'Talent' stage, the main mission is to increase revenues and generate profits. Key objectives are developed, such as growing in existing markets with new products or services, creating alliances with international partners and entering new markets.

In order to create the methodology for assessing the maturity of the enterprise and the effectiveness of their stakeholders we offer specific recommendations for creating and promoting a start-up:

1. The primary goal of entrepreneurial activity is the ability to generate highly profitable start-ups. These highly profitable start-ups should reinvest their profits and human potential in new start-ups.

2. The life cycle of a start-up goes from idea to profit through different stages of growth: idea stage, pre-seed stage, seed stage, early stage and scale-up (fig. 5).

3. Start-up conversion rates are considered a common standard internationally for evaluating a start-up.

4. The essence of a start-up is to bring a start-up from a business idea to profit by supporting its growth, offering access to business knowledge, capital, market and resources at different stages of startup development.

5. Different stakeholders shape and influence the development of entrepreneurial activity:

— Educators: Offer start-ups access to knowledge.

— Investors: Offer start-ups access to capital.

— Connectors: Offer start-ups access to the market.

— Facilitators: Provide start-ups with access to resources.

The methodology consists of a combination of steps, that experts perform in the process of evaluating a start-up. The logical progression of the methodology is shown in fig. 7.

At the final stage, some recommendations may be generated and prioritized based on the level of stakeholder performance [11].

The main goal of the recommendations is to accelerate the growth of a startup by empowering its stakeholders, for which purpose the recommendations are grouped into three categories:

1. *'Creating the stakeholders'*: When the evaluation level is 'Non-existent', the category of the recommendation is 'Creating'. The recommendations of 'Creating' type propose specific activities to create and make sustainable non-existent actors in the ecosystem.

2. *'Empowering the stakeholders'*: When the evaluation levels are 'On performance' and 'Acceptable performance', the category of the recommendation is 'Empowering'. The recommendations of the 'Empowering' type propose specific activities to support the sustainability of the ecosystem's stakeholders.

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3. *'Boosting the stakeholders'*: When the evaluation levels are 'Optimal performance' and 'Excellent performance', the category of the recommendation is 'Boosting'. The recommendations of the 'Boosting' type propose specific activities to support the growth of the ecosystem stakeholders.

So, a start-up can be defined as a company, that builds its activities on the basis of innovation and research. Ae start-up can be interpreted as a search for the best solution to a particular task or problem in more modern and innovative ways.

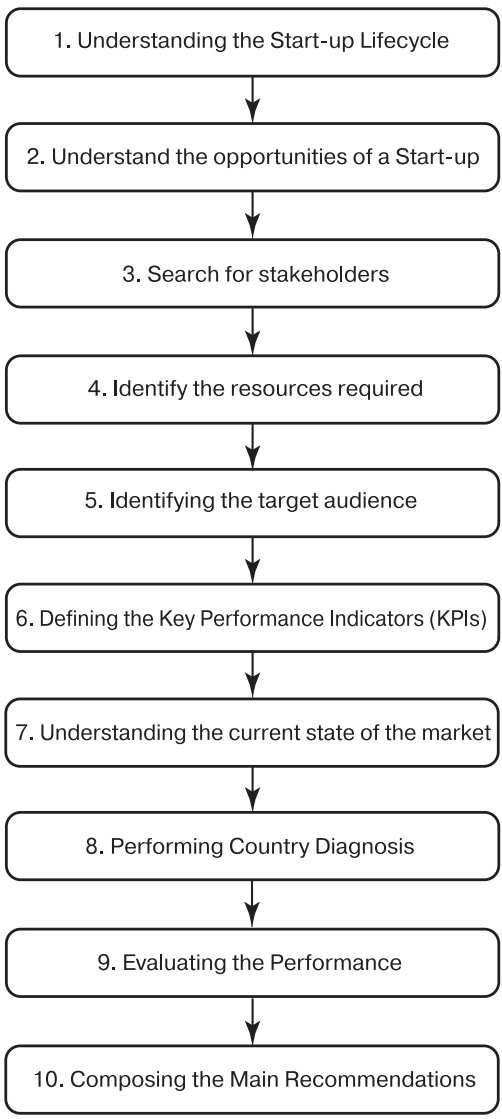

Fig. 7. Algorithm of the start-up valuation methodology

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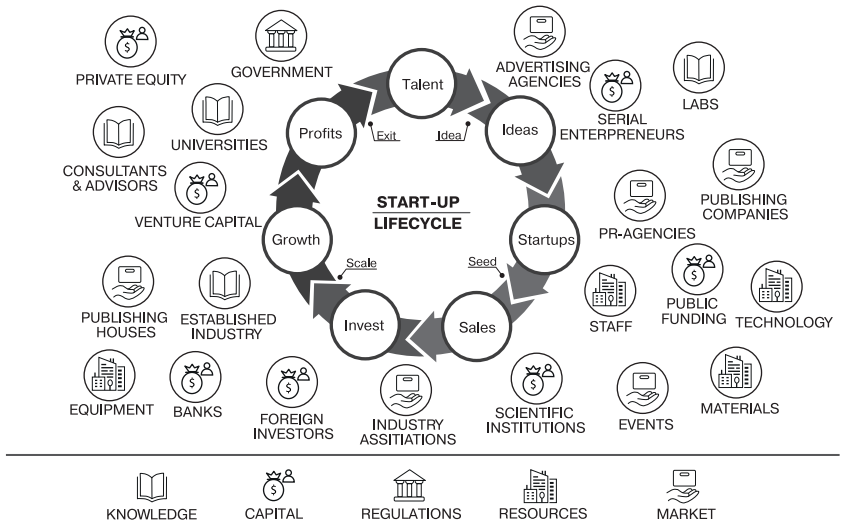

Fig. 8. Information exchange entrepreneurial ecosystems stakeholders

In this case, creating a start-up is a search for opportunities, research of technologies and materials for creating eco-friendly printing products. When creating a start-up, one searches for capital, market, knowledge and resources in order to invest the profits in the creation of new startups, stimulating the country's printing industry and strengthening the country's economy (fig. 8).

The systematic combination of start-up elements is carried out through the matchmaking procedure (fig. 9).

For the effective functioning of a competitive entrepreneurial ecosystem, it is necessary to use rational tools in the form of space-time structures (project areas). The basis of the proposed methods of creating a research area is the idea of its structural organiza-

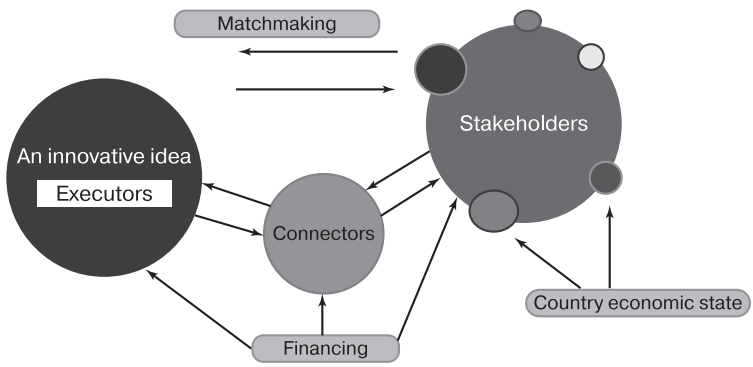

Fig. 9. Matchmaking procedure for entrepreneurial ecosystems creation

tion in the form of HUB. Each element of the future research area (start-ups, researchers, scientific and industrial institutions, ministries and departments, consortia, stakeholders, etc.) is presented in the form of conventional circles with the appropriate set of competencies (•), which focused on solving the innovative problem (fig. 10, a). On the basis of the principle of analogies, a structural diagram and a mathematical model of the creating process and functioning of a suitable innovative HUB were developed in the form of a 'coaxial mechanism' with elements conditionally rotating with the corresponding angular velocities Ω and (t) around a single center — an innovative idea (start-up or innovative idea) (fig. 10, b). The successful functioning of the such type HUB is based on the coordination of the angular velocities of rotation of the constituent elements Ω_i (t) (which conventionally determine the generalized indicators of economic efficiency) taking into account the corresponding radii of rotation R_i (conditional indicators of the of the HUB participant size), the number of competencies K_i for each HUB participant and interaction forces between the HUB elements (conditional indicators of financial flows).

A mathematical model of the entrepreneurial ecosystems creation process for the proposed form of the HUB has been developed. In a generalized form, the mathematical model is represented by a system of functional dependencies: $N_i = f(\Omega_i, R_i, P_i, K_i, t, \Delta t)$ — the number of competencies in the synchronization mode at all levels (elements) of the HUB, where Δt is the time interval for the synchronization of competencies of all levels (determined from the project success conditions: $N_i \geq N_k$, where N_k — normative indicator), t — project execution time.

Conclusions

1. A theoretical approach to creating a rational form of project environment for the successful imple-

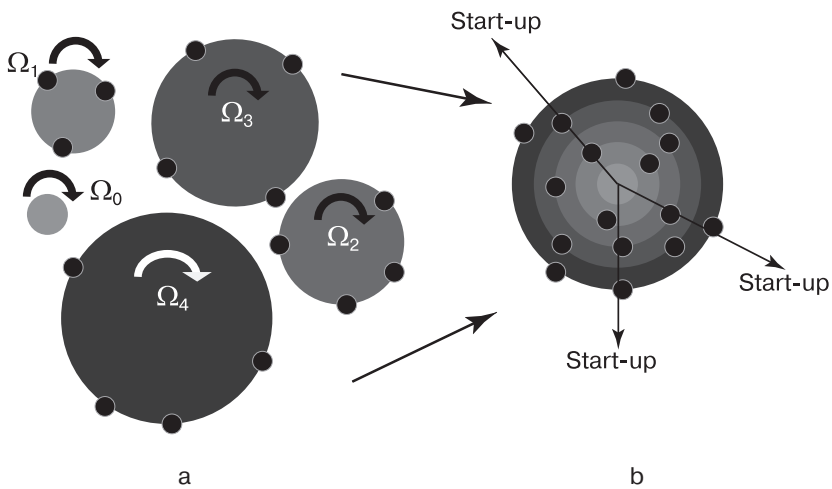

Fig. 10. The scheme of HAB project area creation

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mentation of innovative projects is proposed. The proposed methods are based on the principle of its structural organization in the form of a HAB.

2. The technologies and materials for the printing production are considered.

3. The methodology of start-up creating for the printing products manufacturing is presented.

4. On the basis of the principle of analogies, a structural scheme and a mathematical model of the process of creation and functioning of the relevant innovation HUB in the form of coaxial elements around the centre — the innovative idea — have been developed.

5. Innovation HUBs can be considered as engineering and technical support for the start-up creation.

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Стаття присвячена розробці інженерно-технічного забезпечення для створення стартапу поліграфічного виробництва з використанням інноваційного середовища у виді ХАБ-інфраструктури.

Ключові слова: поліграфічне виробництво; інноваційна ідея; ХАБ-інфраструктура; стартап; життєвий цикл; працедавці; підприємницькі екосистеми; математична модель.

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