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# ENTREPRENEURIAL UNIVERSITIES AND INTERMEDIARY ORGANIZATIONS AS A SUCCESS FACTOR IN SMES: LITERATURE REVIEW

Preduzetnički univerziteti i posredničke organizacije kao faktor uspešnosti malih i srednjih preduzeća – pregled literature

## Abstract

The main goal of this article is to indicate the role of entrepreneurial universities and intermediary entities as a success factor of small and medium enterprises. Entrepreneurial universities represent institutions that undertake entrepreneurial activities with the objective of improving regional or national economic performance. On the other hand, intermediary entities advance the commercialization of science by providing a set of specialized services. The article points out the role and significance of three types of intermediary entities, such as university technology transfer and licensing offices, physical space intermediaries (incubators, accelerators and co-working) and specific financial providers' intermediaries (venture capital, angel finance and crowdfunding platforms). Moreover, the article underlines the role and the importance of the aforementioned intermediary entities in Serbia, with the aim of demonstrating their influence on forming new small and medium enterprises. We explore how these various intermediaries function and how they provide complementary and related services in support of scientific commercialization through entrepreneurship. The basic purpose of the aforementioned types of entities is to serve as factors of survival, growth and development of small and medium enterprises.

**Keywords:** *entrepreneurial university, intermediary organizations, technology transfer, incubators, accelerators, financial resources.*

## Sažetak

Osnovni cilj ovog rada jeste da ukaže na ulogu koju preduzetnički univerziteti i posredničke organizacije imaju kao faktori uspešnosti malih i srednjih preduzeća. Preduzetnički univerziteti predstavljaju institucije koje preduzimaju preduzetničke aktivnosti s ciljem unapređenja regionalnih i nacionalnih ekonomskih pokazatelja. S druge strane, uloga posredničkih organizacija jeste unapređenje mogućnosti komercijalizacije nauke pružajući skup specijalizovanih usluga. U radu je istaknuta uloga i značaj tri osnovna tipa posredničkih organizacija, kao što su univerzitetski transfer tehnologije i postojanje kancelarija za licenciranje, fizičke intermedijarne organizacije (inkubatori, akceleratori i *co-working* prostor) i specifični izvori finansiranja novih poslovnih poduhvata (rizični kapital, investicioni anđeli i masovno finansiranje). Takođe, u radu je istaknuta uloga i značaj pomenutih posredničkih organizacija u Srbiji, sa namerom da se ukaže na njihov uticaj na formiranje novih malih i srednjih preduzeća. U radu istražujemo kako funkcionišu ovi različiti oblici posrednika i kako pružaju komplementarne i srodne usluge kao podršku naučnoj komercijalizaciji kroz preduzetništvo. Osnovna svrha pomenutih tipova organizacija jeste da služe kao faktori opstanka, rasta i razvoja malih i srednjih preduzeća.

**Cljučne reči:** *preduzetnički univerzitet, posredničke organizacije, transfer tehnologije, inkubatori, akceleratori, izvori finansiranja.*

## Introduction

Education, research and innovation represent basic driving forces for development in a knowledge-based society. Innovations in a knowledge-based society are very important because knowledge creation and exchange are not goals per se but rather provide the basis for development and source of new innovations [41]. An advanced society is based on the existence of entrepreneurial members of society and business activities which are present on a global level and can be seen in developed and developing countries. Entrepreneurs, i.e., new, fast-growing and innovative SMEs, are the biggest contributors to changes in an economic system. This is due to the introduction of new products and services, new production, organizational and marketing models and methods which increase productivity and efficiency and strengthen the competitiveness of the economy [40]. Entrepreneurial thinking and raising awareness of entrepreneurship in general should be encouraged, primarily through the educational system. Entrepreneurship must be viewed as a constantly upgraded skillset in the process of continuous education. It is necessary to create a broad scheme that will include all levels of formal and informal education and all the relevant stakeholders in the educational process (pupils, students, teachers, professors, businesses, relevant institutions and organizations) [64]. In other words, education and research have long been regarded as the basis of economic growth, industrial restructuring, and as employment providers by a governing body of a nation. Due to this fact, there is a general trend of commercializing different aspects of science by adapting a research funding structure, providing incentives for new businesses and by reforming higher education, and introducing new legislation on intellectual property [50]. The traditional concept of wealth (land, labor and capital) is now being re-evaluated since science and entrepreneurship has emerged as a factor of economic growth.

### Entrepreneurial university: determinants and types

Interest in entrepreneurial activity at universities has never been greater than nowadays in the 21st century,

considering the opportunities that appear to result from developing new technologies, such as new materials, microprocessors, computers, telecommunication and robotics. Moreover, ten new technologies which are or will become the driving forces behind the fourth industrial revolution are: the concept of biometric payment, sale of solar energy, desalination, the application of artificial intelligence, the Internet of Things, mapping human DNA, smart self-driving vehicles, smart clothing, smart homes and biotechnology [29]. Universities now have a special status in relation to entrepreneurship education. In addition to their standard role in the development of science and education, their importance in the development of innovativeness, and indirectly competitiveness of the economy and economic development, are now being emphasized. Accordingly, we may at this point define the "entrepreneurial university" conceptually [63]. In the existing literature, there are many studies that use different approaches to defining the expression "entrepreneurial university" [10], [12], [18], [22], [33], [34], [35], [37], [38], [44], [45], [46], [47], [48], [49], [57], [59], [61], [62], [67], [77], [78], [79], [80], [89], [90], [99], [100], [101], [114], [115].

In Burton Clark's book from 1998 *Entrepreneurial Pathways of University Transformation* [18], entrepreneurial university is defined as university with modernized departments, research centers, faculties and schools. This necessity has been driven by new societal expectations and efforts to preserve its autonomy, including the matters of funding and outside interests, even those of the state [50]. As defined by Etzkowitz et al. [37], an entrepreneurial university is "any university that undertakes entrepreneurial activities with the objective of improving regional and national economic performance as well as the university's financial advantage and that of its faculty". Furthermore, universities are considered as important catalysts for international, national and regional economic and social development as those entities develop productive and creative links between education and research according to Kirby [62]. O'Shea et al. [77], [78], [79] consider the anatomy of an entrepreneurial university, with the most important elements being: human capital resources, financial resources, physical resources, commercial

resources, status and prestige, networks and alliances, and localization.

It should be noted that education and research are the first and second mission of universities respectively, and indeed these two are a vital part of an entrepreneurial university. The new mission, called the third mission, requires from universities and academic institutions to be more entrepreneurial, and thus contribute to socio-economic development of a country and a region to a greater extent [34], [36]. Therefore, any prestigious university or academic institution should focus on the third mission to be able to compete with others and to handle the needs and challenges faced in their communities and societies. Salamzadeh et al. [92] elaborated on an input-process-output model to define the entrepreneurial universities. In their view “an entrepreneurial university is a dynamic system, which includes special inputs (resources, rules and regulations, structure, mission, entrepreneurial capabilities and expectations of the society, industry, government and market), processes (teaching, research, managerial processes, logistical processes, commercialization, selection, funding and financial processes, networking, multilateral interaction and innovation, research and development activities), outputs (entrepreneur human resources, effective research in line with the market needs, innovations and inventions, entrepreneurial networks and entrepreneurial centers), and aims to mobilize all of its resources, abilities and capabilities in order to fulfil its third mission.” The issues of the entrepreneurial university means that universities now have a mandate to produce new knowledge and reshape activities and values in order to facilitate the transfer of technology and knowledge spillover [8].

Similarly coined terms are “entrepreneurial science”, “entrepreneurial scientists” or “academic entrepreneurship”, which refer to workers and the type of work taking place in these institutions. Even though university professors have actively cooperated with the industrial sector, patented ideas and started companies since the late 19th century, the expression *academic entrepreneurship* is much more recent. Only in the last two or three decades has it been used systematically when university scientists take an important role in

providing successful commercialization of research-based knowledge and ideas. According to some scholars, such as Sooreh et al. [99], academic entrepreneurship and the philosophy of entrepreneurial universities go far beyond a mere engagement with industries [2], [13], [85]. Topics such as spin-off creation process [17], university technology transfer offices (UTTO) [28], new venture creation [92], commercialization of university research [103], academic status [46], start-up companies [91], [93], and many others have been included in the literature of academic entrepreneurship. As with the institutional terminology, these terms are most commonly used for activities such as patenting/licensing and forming start-up and spin-off companies (“science-directed commercialization”), rather than for “regular” contract work or expert advice for an established industry (“user-directed commercialization”), despite the fact that this may be the most frequent type of commercialization in a wider space [50]. This distinction is of central importance. Contract work and collaboration, consultancy and expert advice, private funding, graduate exchanges, all fall under the traditional mode of commercialization (user-directed), indicating the ways in which industry requirements and related activities play a dominant role in such processes. These activities have been part of university operations from the very beginning, and these activities are generally seen as straightforward or positive when discussing the effects on basic research and teaching [50]. However, when we talk about patenting or licensing and creating start-up and spin-off companies (science-directed), the driving force is often a scientist with marketable ideas and unique research results, with a different outcome for their academic institution. It has been argued, for example, that increased patenting may pave the way to reducing scientific exchange and communication, as the main employment of research results is directed to future research. The public role of universities that make exclusive or secretive licensing arrangements may be questioned as well. Another important dividing line between the two types of commercialization is that user-directed activities seem to thrive within the traditional academic departments, laboratories and units, while science-directed activities

may require a broader support structure in the form of intermediary organizations. At this point, it should be mentioned that intermediary organizations are entities that occupy a gap between scientific discovery and final realization of commercialization value, and their role is to provide specialized services and access to equipment and resources beyond the reach of many start-up firms [50].

Businesses and industry, on the one hand, and universities that engage in the science-directed commercialization, on the other, typically form a strong synergy, as the business side finds the university side to be a valuable collaborator in the development process of the product. This kind of arrangement regards the input in the form of research contracts with industry and the size of the revenues from such contracts, and the output as a co-authorship between academics and industrial researchers. This approach can also result in a fairly different output profile from other universities when we take into consideration the focus and co-authorship of scientific publications and the number of confidential reports. For some academic institutions, these associations also bring about the exchange of graduates and PhD students [50]. Universities that are part of a science-directed commercialization option are evidently patentees and beneficiaries of licensing, issuing licenses to third parties. Differently from other universities, the output of this option constitutes a series of patents rather than articles and books. Those universities may have made strategic decisions to focus their development in the fields where the outcome has a high demand for commercialization (e.g., biotechnology, nanotechnology, artificial intelligence, information technology, etc.). The resulting output of their research might be commercialized by using institution-owned (or staff-owned) spin-offs. Finally, a university that has chosen to engage in a science-directed commercialization will typically make administrative arrangements to position itself on the market. These may include the establishment of university technology transfer offices, consulting legal experts in intellectual property (IP) law, forming administrative departments with the purpose of supporting contract negotiations and monetary transfers, or creating rules and procedures for the internal redistribution of the revenues created by business activities.

## Intermediary organizations and entrepreneurial ecosystems

With the increasing frequency, the entrepreneurial universities represent a higher education institution that plays a dominant role in innovation and economic growth, which is also the definition adopted in this paper. Entrepreneurial universities are not only a source of general knowledge available to all who can read scholarly journals, hire a student and/or pay for different types of projects, but they are also a source of increasingly commodified knowledge, embedded in patents and start-up and spin-off companies. Examples of the world-renowned universities that have contributed to a regional industrial development are the Massachusetts Institutes of Technology (MIT) and Stanford [50]. Having taken into consideration the importance of the entrepreneurial university and education, the Centre for entrepreneurial teaching within the EU included a plan according to which at least 35% of the high school and university students in all member states until 2030 should have the possibility to participate in a program regarding the entrepreneurial university. In order to reach the established goal within the set timeframe, the education system of all member states at the national level should aim at implementing various programs for entrepreneurial education, while encouraging innovative partnerships between business systems and educational institutions [32].

In Serbia, several segments of entrepreneurial university have been developed in Belgrade, Novi Sad, Kragujevac, Niš and Novi Pazar. At the University of Belgrade, there is the Center for Technology Transfer, which conducts identification, protection and commercialization of scientific research results and protection of intellectual property of the University, which will be covered later on in this paper. The Faculty of Technical Sciences of the University of Novi Sad (UNT) is particularly important as an entrepreneurial-minded institution which provides the biggest number of highly educated engineers. More than a hundred companies have been launched from this institution and most of them are recognized as global players in the IT industry. The city is also considered as the Serbian IT center, due to the fact that more than 50%

of software engineers are located in Novi Sad, and there is still an increasing demand for this profession. Of special significance to the strengthening of innovativeness is the Science and Technology Park of the UNT. With the support of the Faculty of Technical Sciences, around 140 start-up and spin-off companies have been founded, mainly in the IT sector, employing young engineers who graduated from the UNT. Some of these companies implement projects for large international corporations and have contributed to Novi Sad becoming recognized internationally as a "Software Valley". Project teams and prominent researchers from the UNT have been the recipients of numerous national and international awards for the best technical innovations [106]. At the University of Kragujevac, centers have been formed as a result of work on international projects, namely: Lifelong Learning Center, Knowledge Transfer Center, Collaborative Training Center, Creativity Center, Business Support Office. At the University of Niš, among others, there is the Innovation Center as an organizational unit of the University, which conducts in an organizational and systematic way the application of its own and external scientific results and modern technological processes aimed at creating innovations, development of prototypes, new products, processes and services. At the State University of Novi Pazar, the Creativity Center has been formed, with a vision to encourage creativity and entrepreneurial intentions in the academic population, to research innovative ways of studying that are facilitated by modern technologies. What is more, it is important to mention that students participating in entrepreneurship education are more likely to start their own business, and their companies tend to be more innovative and more successful than those led by persons without entrepreneurship education background [63].

Entrepreneurship is determined by several factors and trends, including social, legal and institutional. Therefore, in a society that encourages entrepreneurship, institutions are there to simplify entrepreneurial activity, which serves as an important aspect for improving economic growth and prosperity. Audretsch [8] further argues that universities have a wider scope than simply generating technology transfer (patents, spin-offs and

start-ups), as they contribute to and provide leadership for creating entrepreneurial thinking, actions, institutions and entrepreneurial capital.

Although functions and activities of new business start-ups are indisputably important – from perception of business opportunities, their evaluation, ensuring required resources, to the management of business operations – they are only part of the entire entrepreneurial process that defines assumptions for capitalizing on identified business opportunities. Consequently, comparing entrepreneurship with the process of a new business start-up represents a significant simplification in understanding the entrepreneurship phenomenon [83]. A more comprehensive approach to understanding the essence and economic function of entrepreneurship implies a wider consideration of the entrepreneurial ecosystems. By definition, entrepreneurial ecosystems are "a set of interconnected entrepreneurial actors, institutions, entrepreneurial organizations and entrepreneurial processes which formally and informally coalesce to connect, mediate and govern the performance within the entrepreneurial environment" [71]. In that system, universities have been providing intermediaries, which act as a bridge between the scientific discovery and the final creation of commercial value, provision of the specialized services and access to equipment and resources beyond the reach of many start-ups [19].

On the other hand, Savić, Pitić and Lazarević in their paper "Innovation-Driven Economy and Serbia" [95] defined the business and entrepreneurial ecosystem as an economic community supported by a foundation of interacting organizations and individuals – the organisms of the business world. The economic community produces goods and services of value to customers, themselves being ecosystem members. Member organisms also include suppliers, lead producers, competitors and other stakeholders. The determinants of efficiency in the innovation ecosystem matrix are as follows [95]: capital and resources, talents and champions, infrastructure and support programs, market and support networks, culture and communities, policy and regulations, visions and strategy. According to the International Telecommunication Union methodology [56], the participants in the innovation ecosystem are: 1) the state sector with a great number of

government institutions, 2) entrepreneurs, whose business model is based on the creation of innovative solutions, 3) educational and research and development institutions, which contribute to the development of human capital and research in the innovation ecosystem, 4) support measures, which provide specialized services and expert innovation support, including incubators, accelerators, business associations and mentors, 5) private sector, and 6) financial institutions, which include banks, seed funds, investors and others who finance innovations in the ecosystem. In addition, the ecosystem literature has created a basic division of intermediaries in the following way: 1) university intermediaries (technology transfer and licensing offices); 2) physical space (incubators, accelerators and co-working spaces); and 3) specific finance providers (venture capital, angel investors, crowdfunding platforms). Intermediary organizations provide support to innovation by engaging directly with individual establishments by providing services and access to resources that can improve business development or expedite technology commercialization [19]. Table 1 defines each intermediary organization and provides examples of their roles in scientific entrepreneurship.

### University intermediaries: intensified cooperation between university and industry

The beginning of commercialization of academic science usually starts with university technology transfer offices (UTTOs) or licensing offices, which interact with businesses to license a university-created technology. The key mechanisms for university technology transfer commercialization are licensing agreements between universities and the private sector, research joint ventures, and university-based start-ups. These activities can potentially result in financial gains for university, and other benefits to these institutions (e.g., additional sponsored research, hiring of graduate students and post-doctoral fellows), and job creation in the local region [87].

University technology transfer offices, participants of technology market, are defined as transactions for use, diffusion and creation of technology (or intellectual property). Technology licensing is conducted by companies of all sizes, but academic start-ups are the ones that are most commonly involved in scholarly work, given that they will deliver the greatest impact. In many countries, national governments have provided support for these initiatives via legislation to facilitate technological diffusion from

**Table 1: Different types of intermediary organizations**

Intermediary type	Definition	Roles in scientific entrepreneurship
<b>UNIVERSITY INTERMEDIARIES</b>		
University technology transfer /licensing offices	University offices with the role of managing IP for the technologies created at universities	<ul style="list-style-type: none"> <li>• Incentives to disclose inventions</li> <li>• Involvement of the faculty in the development process</li> <li>• Collaboration with businesses with the aim to license technology</li> </ul>
<b>PHYSICAL SPACE INTERMEDIARIES</b>		
Incubators	Locations used to create a starting point for enterprises and for the idea development	<ul style="list-style-type: none"> <li>• Provide affordable space</li> <li>• Provide support services</li> <li>• Generate revenue for firms</li> </ul>
Accelerators	Physical space, complemented with resources and financial investment	<ul style="list-style-type: none"> <li>• Offer intensive programming</li> <li>• Accelerate milestones</li> <li>• Invest in exchange for equity</li> </ul>
Co-working spaces	Physical spaces that promote proximity and interaction	<ul style="list-style-type: none"> <li>• Provide flexible, less structured programming</li> <li>• Offer space for social interaction</li> <li>• Facilitate networking and peer mentoring</li> </ul>
<b>SPECIFIC FINANCIAL PROVIDERS INTERMEDIARIES</b>		
Venture capital	Investment firms that raise funds from individuals and institutions to support new ventures with high growth potential	<ul style="list-style-type: none"> <li>• Provide multistage, benchmarked financing</li> <li>• Motivated to increase firm performance</li> </ul>
Angel investors	Individual investors or investment clubs that provide early-stage financing in support of new ventures	<ul style="list-style-type: none"> <li>• Provide early-stage funding</li> <li>• Act as a source of patient capital</li> <li>• Offer business advice and mentoring</li> </ul>
Crowdfunding platforms	Method of securing large numbers of small investments	<ul style="list-style-type: none"> <li>• Enable inventors to gain immediate product feedback</li> <li>• Support idea sharing</li> </ul>

Source: Adapted from [19].

universities to firms and collaborative research (e.g., the Law on Innovation Activity in Republic of Serbia), they subsidize for research joint ventures involving universities and firms (e.g., the European Union's Framework Programs and the US Commerce Department's Advanced Technology Program (ATP)), and share expertise and laboratory facilities. Along these lines, national, state, and regional government authorities have also provided support for science parks and incubators.

O'Shea, Allen, Chevalier, and Roche [77] compiled a list of factors that influence the number of start-ups that a university is able to generate, such as: past UTTO success, university's quality, the size and source of research funding, and the amount of resources devoted to UTTO staff. Moreover, Siegel and Wright argued that three main determinants of UTTOs are: 1) they provide university's incentives to disclose inventions and engage in the commercialization process, 2) they maintain researchers' involvement in the development process, and 3) they provide information about the value of technology [98]. Aceytuno [1] has investigated the major European models of technology transfer such as the Anglo-Saxon, Nordic and Central European. Wright and associates [112] determined in a study of UTTOs in Belgium, Germany, Sweden and UK that UTTOs are better at intermediating the transfer of explicit rather than tacit knowledge. Based on interviews with 128 UTTOs directors, Markman, Phan, Balkin and Gianiodis [75] show that whereas for-profit UTTO structures are positively related to new venture formation, traditional university and nonprofit UTTO structures are more likely to correlate with the presence of university-based business incubators. What is more, while discussing the case based on Belgium's KU Leuven UTTO, as research and educational institution with international appeal whose programs are based on the innovative research of its scientists, Debackere and Veugelers [26] argued that UTTOs reduce information asymmetries between industry and university, while fostering industry-university linkages, which are lacking in the European context and cause the "European paradox" – high levels of scientific expertise with low contributions to industry. This awareness is underlined by Huyghe and colleagues [55] in their research, where

they discovered that more than a half of the surveyed pre and postdoctoral research fellows at twenty-four European universities were completely unaware of their university's technology transfer operations. To improve the commercialization of academic achievements, UTTOs use various mechanisms, such as equity and uniform start-up licenses, educational support programs, and incubators. Universities have begun to adopt equity instead of licensing fees, to encourage new start-up formation. Di Gregorio and Shane [27] found that UTTO policies, more than capital market constraints, affect the number of new ventures created: when UTTOs make equity investments, more start-ups are formed. Many types of licensing agreements are used by UTTOs, with new express licenses recently becoming popular.

In 2018, the Joint Research Centre of the European Commission (EC) launched a Competence Centre on Technology Transfer (CC TT) intended to become a recognized reference point for expertise on technology transfer for the EC and the institutions of the Union. The CC TT provides technology transfer policy related expertise and services to the EC and other institutions of the Union and operational support services to a broader range of stakeholders including: member states and individual institutions facing technology transfer related challenges and issues. The CC TT takes a holistic approach to the technology transfer process and provides services in three interconnected domains capturing a complex value chain. These are: technology transfer capacity building, technology transfer financing, innovation ecosystems design [39].

In spite of a number of new institutions that have been founded in Belgrade, Novi Sad, Niš and Kragujevac in the last five years (eight business and technology incubators, four science and technology parks and four centers for the technology transfer) in Serbia, there is still lack of infrastructural support for innovations. However, these organizations for providing infrastructural support to an innovation activity often lack sufficient capacity or human or financial resources necessary to accomplish its mission. A great number of business and technology incubators were formed with the aim of providing support to the spin-off and start-up companies; however, those

are frequently donation initiatives for which a long term financing has not been secured.

In order to develop the level of economic innovativeness, which is a prerequisite for the development of entrepreneurship, it is necessary, as set out in the Strategy of Scientific and Technological Development for the 2016 –2020 period, to change the system of science and innovation management in Serbia, increase the level of investment in this sector, improve the relevance of scientific research for the development of the economy, develop stimulating financial mechanisms and an institutional framework for linking science and economy. A significant innovation support program initiated by the state is the Innovation Fund. It encourages the formation of new companies and development of the existing ones, promotes the transfer of technology from the academic to the commercial sector, and provides financial support to innovative projects, which are jointly developed by scientific research institutions and SMEs. In addition to the Innovation Fund, transfer of knowledge, development of new technologies and innovation commercialization in the partnership between the Government, University of Belgrade and City of Belgrade, there is also the Science Technology Park (STP) Belgrade, as well as the Center for Technology Transfer of the University of Belgrade (CTT UB) [95].

The Science Technology Park Belgrade is intended for start-ups and growing high-tech development companies (SMEs and development centers of international companies), helping them develop and commercialize innovative products and services. The STP Belgrade has been established as a partnership between the Government of the Republic of Serbia (represented by the Ministry of Education, Science and Technological Development), the City of Belgrade and the University of Belgrade, based on international experiences and best practices, thus becoming a place where institutions meet science and industry. The STP Belgrade has become a new business core of the city that brings together dozens of high-tech development companies/teams by providing different programs and activities, and plays an essential role in developing an innovation ecosystem in Serbia [97]. On the other hand, the Center for Technology Transfer of the University of Belgrade's goal is to help scientists and

researchers to realize new, life-improving products. The CTT UB's mission: to help protect intellectual property (IP) produced at the UB and facilitate the transfer of IP rights to industry, resulting in new, life-improving products; to improve and increase collaboration between the UB and industry; to support researchers and students in implementing their ideas/projects [16].

### **Physical space intermediaries: incubators, accelerators and co-working**

The commercialization of science requires physical workspace, laboratory space and advanced equipment in order to be carried out. Incubators, accelerators, and co-working spaces are the most important physical space intermediaries between university and industry. The concept of a business incubator is considered as a systematic effort directed at new venture creation through the provision of physical facilities, technical and administrative support, services to guide firm growth and mitigate failure. Business incubators are defined as an organized way of formation of small and medium-sized enterprises, from the idea to its ability to function independently. A large number of different entities participate in the development of incubators, such as local and regional governments, universities, chambers of commerce, science parks, private real-estate developers, and non-profit organizations, some of which are involved in sponsoring, establishing, or running incubation programs [3]. Honig and Karlsson [53] define business incubators as "organizations whose purpose is to support the creation and growth of new businesses, by supplying a shared office environment and agglomeration of new and small businesses". Furthermore, Bruneel et al. [13] define incubators as "tools to accelerate the creation of successful entrepreneurial companies".

The most crucial importance of an incubator, through which its efficiency is evaluated, is the number of successful businesses that mature and continue their business outside the incubator premises. This further influences the creation of a positive image of entrepreneurship and the creation of a new entrepreneurial culture that directs individuals to accept responsibility for their own material status. It also motivates them to accept new forms of work engagement,



as well as to self-employment, abandoning the philosophy of “getting a job” and adopting the philosophy of “creating a job for oneself”, fostering and promoting entrepreneurial qualities and acceptance of change as a way of life.

Al-Mubarak and [5] Busler identified several strengths of incubators, which include the following: (a) supporting economic development by creating new jobs; (b) accelerating the modernization and diversification of the region’s economy; (c) fostering and supporting enterprises that create the best environment for businesses to start up; (d) investing long-term time and effort to strengthen the relationships between academia and industry; (e) providing networking opportunities between academia and industry to collaborate for mutual benefit; and (f) commercializing knowledge and building relationships that add value to the economy.

There is considerable diversity in the types of incubators, their modes of operation and the objectives they pursue. This observation was underlined by Peters, Rice and Sundararajan [86, p. 83], who considered incubators as “an evolving innovative organizational form that is a vehicle for enterprise development.” However, most incubators tend to be either physical incubators (PI) providing work space for clients, virtual incubators (VI), which utilize computer technology to deliver services, or a hybrid approach incorporating elements of the two main types. Bruneel, Ratinho, Clarysse and Green [14] presented a summary of the evolution of business incubation’s value proposition. The first-generation incubators focused only on office space and shared resources. Second-generation incubators added coaching and training support, while third-generation incubators focused on access to technological, professional, and financial networks. The earliest incubators obtained their financing from state sponsorship, but afterwards for-profit and corporate incubator emerged, with incumbent companies offering incubation and in return collecting the proceeds of their success as new sources of revenues [52]. Furthermore, incubators can be classified in one of the following ways: mixed-type incubators, which serve all technologies and types of firms; economic-development incubators, which aim to leverage local activities to create employment opportunities; technology incubators, which typically

focus on specific sectors and offer access to specialized resources (e.g., testing facilities), which are particularly important for the commercialization of science.

In the United States, the most common form of incubator model found is university-based incubators. The strategic focus of a university-based business incubator is technology transfer and commercialization of research primarily, which originates from university, as well as local high technology businesses. The European Union encourages the development and networking of business incubators, which have begun to develop over the last 30 years in the most developed EU countries. Their primary goal was to create jobs and products of greater added value. EU member states and EU candidate countries have all adopted the incubator model in different areas. We have also adopted this model. In Serbia, for example, the Business Incubator Novi Sad provides significant infrastructural support. Its overall goal is to help entrepreneurs to transfer their business ideas into a successful business concept. Apart from the office, conference and common rooms, their tenants also receive consultancy services, administrative support and a bookkeeper at their disposal. If potential entrepreneur has a brilliant business idea or already a finished product set for the market, an application for the entry is always open. Evaluation is happening four times a year and with that being done you are one step closer to join them. The effectiveness of incubator participation on the commercialization results of individual organizations also differs. Schwartz [96] found statistically significant higher survival probabilities for firms located in incubators compared to firms located outside those incubator organizations [96]. Key findings of the study, realized by Molnar and associates [69], [75], include that business incubation programs help companies create many new jobs; incubation programs provide a substantial return on investment and create new jobs for a low subsidy cost; incubator companies experience very healthy growth; business incubation programs produce graduate firms with high survival rates; most incubator graduates remain in their communities; most incubator firms provide employee benefits. Also, a study was conducted to analyze the role of business incubators in emerging markets by Dutt

and associates [30], and their research design involves examining business incubators in emerging markets as a form of open system intermediary. They examine the relative emphasis that business incubators in emerging-market countries place on developing markets versus developing specific businesses. This study examines how private, government, academic, and nongovernmental organizations' sponsorship of incubators influences the mix of services that incubators provide.

In the study of Rothaermel and Thursby [90], the authors explore the effect of university linkages on incubator firm failure and graduation, with linkages being licenses or professors in the firms' senior management team. They find support for their hypotheses that a university link reduces probability of new venture failure, but prevents the firm's graduation from the incubator. Lasrado et al. [66] investigate whether firms graduating from university incubators attain higher levels of post-incubation performance than firms participating in non-university affiliated incubators do. Results show that university-incubated firms do indeed benefit from their relationship with university incubators. After firms graduate from a university incubator, the number of jobs and sales grow over time, showing that their performance improves continually. Moreover, the authors find that university-incubated firms generate greater employment and sales than non-incubated firms, which indicates superior performance.

While it is acknowledged that incubators provide a wide range of services, the actual utilization of such services was not clear. Mattare et al. [72] surveyed 77 incubator tenants in Maryland, US, and ranked the top ten desired services in rounded figures as: networking (44%); marketing plan assistance (39%); social media marketing (30%); training/workshops (30%); counselling/consulting (29%); financial planning (29%); website development (27%); business plan development (26%); peer network (26%); and meeting space (25%). The performance of business incubators is often measured by the number of graduates who launch successful businesses and move onto a path of economic growth, thus contributing to the achievement of the main incubator objectives of economic development, the establishment of entrepreneurial ventures, and meaningful job creation.

Wiggins and Gibson [111] identified five tasks that business incubators must accomplish in order to succeed: (1) establish clear metrics for success, (2) provide entrepreneurial leadership, (3) develop and deliver value-added services to member companies, (4) develop a rational new-company selection process and (5) ensure that member companies gain access to necessary human and financial resources to succeed. Pals [81] discusses several factors related to incubator success. First, a clear mission statement is significant for knowing incubator long-term goals. Second, collaboration between university and a business incubator allows the business incubator to gain access to potential new tenant companies. Third, clear selection criteria of tenants to enter a business incubator will be helpful to the committee that chooses appropriate tenant companies. Fourth, networking with funding organizations is an important key to the success of business incubators. Fifth, monitoring and keeping records are important for finances and contracts. Incubators need to track results, such as the number of tenant companies receiving admission and those exiting them, so that incubator management can have adequate feedback. Sixth, incubators should focus on services as keys to success, including the infrastructure for tenant companies to receive tools and advice in order for them to succeed. Seventh, a strong manager should have several characteristics including business experience, background in operations procedure, computer skills, financial management skills, marketing skills, interpersonal skills, motivation skills and problem-solving skills, and should be a hard worker.

Over the past decade, a special type of incubator called an "accelerator" or "seed accelerator" proliferated rapidly and emerged as an integrated part of the entrepreneurship ecosystem. Cohen and Hochberg have provided a general definition of accelerators as "a fixed-term, cohort-based program, including mentorship and educational components that culminates in a public pitch event or demo-day." Accelerators are a rapidly growing phenomenon. The first accelerator, Y Combinator, was founded by Paul Graham in 2005 in Cambridge, Massachusetts, and soon moved and established itself in Silicon Valley. In 2007, David Cohen and Brad Feld, two start-up investors, set up TechStars in Boulder, Colorado, hoping to transform its start-up

ecosystem through the accelerator model. Nowadays, estimates of the number of accelerators range from 300+ to over 2000, spanning on six continents. The number is growing rapidly [21].

The only accelerator and actually the first one that started operating in Serbia is StartLabs. This is a US-based seed fund, investing in start-ups from Southeast Europe. StartLabs provides up to €50,000 seed investment for innovative entrepreneurs [95]. Opportunities are blooming just across the national border within the Bulgarian LAUNCHub, Eleven, and the global ones like Seedcamp. These accelerators recognized the potential of Serbian start-ups and already invested in many of them, as well as in the ones mentioned above. Table 2 below provides a summary of the differences between incubators and accelerators.

While the accelerators are described sometimes as a ‘new generation incubator model’ [84], they differ from incubators on eight important dimensions, among others duration, cohorts, business model, selection, venture stage, education offered, venture location and mentorship [20]. For example, accelerator programs are limited-duration programs – lasting approximately three months. Research on incubators suggests that firms graduate from incubators anywhere from one to five years after they begin [6]. Another by-product of the structured, limited-duration programs of accelerators is that ventures enter and exit the programs in groups, known as cohorts or batches. While venture founders in an incubator may also develop relationships with other founders at the incubator, the experience of starting a program simultaneously strengthens uncommonly strong bonds and communal identity between founders in the

same accelerator cohort. The batching selection process also focuses the accelerator’s marketing and outreach around the key dates. Moreover, open application process attracts ventures from a wide, even global, pool. Top accelerator programs accept as few as one percent of applicants [21]. Many accelerators are privately owned, and take an equity stake in the ventures participating in the programs. On the other hand, incubators are mostly publicly owned, managed by managers, and generally without their own investment funds [4], [51]. Intense mentorship and education are cornerstones of accelerator programs and often a primary reason why ventures participate. Research on incubators [51] suggests that incubators offer fee-based professional services, such as accountants and lawyers. Education at accelerators, however, appears to be extensive, and often includes seminars on a wide range of entrepreneurship topics, including unit economics, search engine optimization, and term sheet negotiation. Such seminars are usually delivered by either the directors of the programs or by guest speakers who often provide one-on-one guidance after their talks.

Most accelerators offer co-working space and other services in addition to mentorship, educational and networking opportunities. Co-working spaces represent a low-rent alternative to workspaces and offer a more informal setting. They are different from the shared offices in a sense that they offer greater social involvement, pleasing ambiance and management dynamic by cashed-out entrepreneurs and potential investors [109]. Co-working spaces are present both in singular hotspots (such as WeWorks) and in large organizations (such as Microsoft and Google). Although incubators and accelerators have begun offering co-working spaces, Moriset [76] expressed

**Table 2: Summary of the differences between incubators and accelerators**

	Incubators	Accelerators
<b>Duration</b>	1-5 years	3 months
<b>Cohorts</b>	Yes	No
<b>Business model</b>	Investment; non-profit	Rent; non-profit
<b>Selection frequency</b>	Competitive, cyclical	Non competitive
<b>Venture stage</b>	Early	Early, or late
<b>Education offered</b>	Seminars	Ad hoc, HR/legal
<b>Venture location</b>	Usually on-site	On-site
<b>Mentorship</b>	Intense, by self and others	Minimal, tactical

Source: [20].

doubts about their long-term impact, as they do not generate much profit for operators nor add much value to the occupants.

There are three types of co-working space users: freelancers, microbusinesses, and people working for themselves or for companies external to the space [82]. In order to have results from collaboration, it is necessary for a co-working organization to act as a facilitator and mediator of the process, as it was discovered that placing people together will not necessarily create meaningful collaborative relationships. Research on the contribution of co-working spaces to science entrepreneurship is limited thus far. A case analysis in South Wales found that co-working spaces support entrepreneurs and entrepreneurial activities through networking, peer mentoring, and easier access to forms of capital, among other things, but this study has limited generalizability [43]. Waters-Lynch and associates [109] argued that Schumpeterian economic theory is a useful theoretical lens through which co-working may be studied to understand how it contributes to innovation.

### **Finance providers: venture capital and angel investors**

The common problem that entrepreneurs face is raising money that will ensure the greatest success in business compared to the costs that these sources require. In developed countries, micro, small and middle-sized companies focus on numerous funding sources, such as bank loans, leasing, factoring, mezzanine financing, stock exchange [25]. In addition, science-based start-ups are subject to greater expenses due to the costs of laboratories and clean workspaces, highly skilled employees, insurance, consulting services, and the need to protect intellectual property. In order to compensate for these expenses, various funding sources have emerged, with varying costs to the entrepreneur and greater package options for additional services. There are financial intermediaries who are in charge of screening potential start-ups, preparing legal documents, and following up the progress on behalf of the investors.

Contemporary forms of financing such as private equity, venture capital, business angels and crowdfunding

can all serve as a good alternative to traditional banking products, especially for highly innovative firms [105]. It should be emphasized that private equity is a broader term than venture capital (risk capital). It is important to distinguish between these two terms. As a rule, venture capital refers to financing an enterprise in an early phase of development and in the phase of expansion [114]. Venture capital can invest in the seed phase (research, assessment and development of initial concept, i.e., R&D phase), start-up phase (product development and marketing) and expansion phase (growth and expansion for achieving profitability). On the other hand, private equity can be informally and formally organized. If informally organized, private equity can take the form of business angels, who are wealthy individuals with corporate experience. These individuals are ready to invest their money, contacts and experience in a particular industry in order to profit from increase in the company's value. When formally organized, private equity takes the form of private equity funds, a limited partnership where investors are limited partners and the fund manager serves as the general partner. Once established, private equity funds are institutional investors who are willing to invest funds in companies which do not have a long history of business. Their goal is to recognize a growth potential of a company, to invest money in it, and to help company develop financially and in terms of marketing and technology. As this type of investor is included in the daily activities of the company, there is the presence of a stable economic and institutional environment [31]. What is more, when talking about the funding-role of universities, universities take equity instead of licensing fees, which has the effect of legitimizing the start-up on the one hand and acquiring the potential financial benefits on the other.

VC firms are partnerships whose primary task is to raise money from investors of any origin (corporate, bank-owned, or private or government-sponsored) and to channel those investments into worthwhile projects that have the potential to generate a substantial return on investment. They have been defined as investors, or wealthy individuals, whose main objective is to invest in new ventures with a high growth rate [24]. Venture capitalists rely on a system that uses tranches to finance

a project. Hence, if a project falls short of its estimated performance or expectations, the funding can be interrupted. Having both public research funding and VC will result in innovative activity, from the point of view of patents and start-ups [94]; however, the ability of VC investment to stimulate innovation also depends on characteristics of the VC firm [65]. According to Hsu [54], VC-funded firms are more likely to engage in cooperative commercialization strategies (such as strategic alliances), and to have more initial public offering than other non-VC funded firms. The reputation of VC firms also plays part in successful funding, which is why start-ups will agree to pay more in terms of equity for investments from VC firms with higher reputations.

Some important aspects of VC networks that are taken into consideration are the presence of social capital [113] and geographic proximity to a VC firm, although many VCs have an extensive network of geographic coverage. There is more local bias when VC is specialized in a technology industry and when investments are made in a greater number of rounds. Results show that local investments are more likely to have successful exits, which also has implications for the ways in which VCs add value to portfolio firms, although social capital is differentiated from a geographical point of view. Pinch and Sunley [87], for example, found that VCs in the Southampton, UK, clusters are less effective as knowledge transfer agents than VCs in leading high-tech clusters (such as Silicon Valley).

The venture capital investors possess four different attributes. The first one is investment, primarily in start-up, technologically-oriented enterprises that cannot obtain a conventional loan – facility. The second one represents funds that are made available without a time limit, where the capital investment is not aimed at dividends or interest, but at the profit generated when the equity stake or shares in a company are sold. The third one is participation in the form of capital investment, which carries a very high risk that may result in losing the investment principle, although at the same time high investment profitability is possible. Finally, the fourth one is the fact that inexperienced entrepreneurs as well as small and medium-sized companies are also offered the optimal management of know-how as a way of assistance in making the investments as successful

as possible, where the investor plays an active role in the entrepreneurial activities.

Venture capital involves a five-step process: (1) obtaining funds from limited partners; (2) identifying, analyzing, and selecting appropriate investment entities; (3) structuring the terms of investment; (4) implementing a deal and monitoring portfolio companies; and (5) achieving returns and ultimately exiting from the investment [25].

According to Wright and associates [112, p. 1209], “venture capitalists and angels with specialist technological skills may act as intermediaries that provide access to customers and suppliers.” Technology-based firms may be the ones interested in this kind of intermediation. When conducting research, Vanacker, Collewaert, and Paeleman [108] matched a sample of VC and angel-backed firms to similar non-backed firms and used OLS regression to assess the impact on performance measured by gross profits, and found that both funding sources moderate the relationship between slack resources and firm performance in comparison to non-backed companies. Their conclusion was that angel investors make better use of human resources, while VC investment was found better at managing and using financial and human resources. These outcomes point out that the efficiency of start-ups in commercialization operations may benefit more from VC than angel investment, as well as that greater VC ownership increases performance.

The choice of investment by the VCs is also more inclined towards experimental and radical innovations, as underscored by Kerr and Nanda [60], but a high level of trust between projects and VCs is also more likely to create a legally binding relationship. Cumming and Dai [23] discovered that fund size has a diminishing marginal return on start-ups. In a novel exploitation of exogenous variation in new airline routes, Bernstein, Giroud, and Townsend [9] found that greater on-site involvement, particularly of the lead VC, increased innovation in firms along a number of dimensions; they interpreted these findings as indicating that monitoring by a VC is in fact a valuable asset for funded firms.

In the USA, venture capital and private equity have been a significant source of financing for small and medium sized enterprises. At the European Union level, European

Union is carrying out a program aimed at encouraging the investment of VC and PE. The program is conceived by analogy with the program of the American Congress. The joint program of the European Commission and the European Investment Fund was named JEREMIE (Joint European Resources for Micro to Medium Enterprises). The program was established with the aim to facilitate access to venture capital loans, guarantees and funds for EU members. On the other side, the percentage of venture capital and private equity in the Republic of Serbia are at a very low level. Economic trends impose necessity of the development and increasing of VC and PE activity in order to achieve a sustainable development of the economic system [73]. With regard to the current position of the venture capital industry in Serbia, it is important to note that there are no officially registered venture capital funds in Serbia. However, several regional VC funds have Serbia on their investment horizon. It is essential to mention that these VC funds are usually registered in jurisdictions with preferential tax status, although they have offices in Serbia to support capacity development of portfolio companies. The most important VC fund that is present in Serbia is definitely Enterprise Innovation Fund (ENIF), managed by SC Ventures. This fund has been active since 2016, focusing on an investment portfolio that consists of innovative SMEs at various stages of business development, from the seed to expansion phase, in the Western Balkans. ENIF aims at reinforcing the financial structure of innovative SMEs, resulting in a strong and bankable balance sheet. Target fund size is 40 million EUR that will be invested through equity and quasi-equity financing, where SMEs can obtain investments from EUR 100 000 up to EUR 1.5 million. Based on available data, total invested amount in Serbia during the last two years from the ENIF has been estimated at 2.5 million EUR. Additionally, the amount of annual equity financing available to Serbian SMEs is estimated at up to 2 million EUR [107].

Angel investors can be defined as individual investors who are involved at an earlier stage of development, and provide financing in smaller individual amounts. This process allows for projects to provide a proof of concept for scientific discoveries. As regards the total amount of financing by angels, a project receives higher financing

than by VCs [110]. Angels usually have experience with technological projects, and they are able to advise project participants [20]. Beneficial for commercializing science, angels also have much longer time horizons than VCs, as they do not have to exit at some point on behalf of other investors; however, like VCs, they prefer to be located close to start-ups in which they invest. Although in the past angel investors were not particularly interested in the media and empirical research, this trend has recently reversed, even when obtaining data from them is challenging. Kerr and associates [60] used the data obtained directly from organized angel groups in a regression discontinuity design to study the effect of angels on firm outcomes. They defined a discontinuity threshold as the level of critical interest shown in a company by angels, and their results indicated that start-ups funded by two successful angel groups had a higher probability of survival or successful exit, and better employment outcomes than those rejected by the same groups. Bernstein, Korteweg, and Laws [9] investigated how angel investors make investment decisions based on start-up characteristics. Email notifications, served to attract the attention of the potential investors, but angel investors were more influenced by the composition of the funding team than the firm sales and the identities of other investors, reinforcing their importance for the commercialization of science.

Serbian Business Angels Network is the first organization of this type in Serbia, formed with the intention to connect domestic entrepreneurs with angel investors. Serbian Business Angels Network (established as early as 2009) is one of the first organizations of this type; it was modelled after such organizations in the Silicon Valley; this network consists of exceptional individuals who invest their capital and knowledge in firms with high development potential [25].

### Crowdfunding platforms

Crowdfunding is the most recent form of financing a project, defined as "the efforts by entrepreneurial individuals and groups – cultural, social, and for-profit to fund their ventures by drawing on relatively small contributions from a relatively large number of individuals using the Internet, without

standard financial intermediaries” [58]. The emergence of crowdfunding can be traced to the aftermath of the 2008 recession. Financing through traditional channels, such as banks, was much less available and it became more regulated over time, while equity crowdfunding standards are slow to develop in many countries [15]. Crowdfunding is an alternative method of raising capital in place of traditional methods of gaining capital from banks, commonly called crowdfunding campaigns. By virtue of web-based platforms, combined with advertising and word-of-mouth marketing, projects are able to reach a much broader range of potential investors than the angel-funding model. There are three key participants in the crowdfunding process. The campaign/project organizer, raising the funds to implement their idea, the platform that plays the role of a mediator for an agreed-upon percentage of the funds collected, and project backers, i.e., persons investing their money in projects.

There are several forms of compensations that crowdfunding campaigns offer. Donation models, delivered mostly by charities and nonprofits, do not provide financial compensation. Reward models give gifts in return for investment. Pre-purchase models allow investors to pre-order at a more advantageous price the product in return for their investment. Lending models offer return with interest to the investors. Finally, equity models offer shares in profit, or ownership [58]. Lehner, Grabmann and Ennsgraber [68] gained an insight into crowdfunding, noticing its ability to serve as an alternative distribution channel, whereby funders test products before they are presented to the market. According to Frydrych, Bock, Kinder, and Koeck [42], the composition of the funding team and the time necessary to achieve funding goals affect the outcomes of the campaign. Stanko and Henard [102] found that apart from generating funding, the campaigns help the creators with product feedback and idea sharing, which in turn allows campaigners to monitor how their ideas are perceived and in what way they can be improved. Openness of a campaign to external feedback and starting the campaign early in the development process attracts attention of the backers, who feel involved and valued, not just in a financial sense but also at the developmental stage. Although using an on-line platform enables geographic

freedom of extending interest in a project, most campaigns are concentrated in geographic regions, typically more economically and entrepreneurially fertile [74], which reinforces the idea that crowdfunding projects could be considered as part of the regional innovation ecosystem.

World Bank forecasts indicate that by 2020 the crowdfunding market will be valued at 96 billion dollars. The Council for Innovative Entrepreneurship and Information Technologies of the Government of the Republic of Serbia recognized crowdfunding in 2018 as important for the development of this area. The German-Serbian Initiative for Sustainable Growth and Employment also recognized the potential that crowdfunding could have in Serbia, and has been supporting this innovative concept since 2017 [7]. After a study on challenges for youth entrepreneurship, noting that the greatest challenge is precisely access to capital, the German-Serbian Initiative for Sustainable Growth and Employment, in cooperation with the Brodoto social enterprise, started popularizing the concept of crowdfunding in Serbia.

## Conclusions

Entrepreneurial thinking and raising awareness of entrepreneurship in general should be encouraged, primarily through the educational system. Universities now have a special status in relation to entrepreneurship education. This research was conducted in order to present the entrepreneurial universities and intermediary organizations. Entrepreneurial university is realized through focusing on the third mission of universities which ensures the success of universities in becoming more entrepreneurial. On one side, entrepreneurial university is any university that undertakes entrepreneurial activities with the objective of improving regional and national economic performance. On the other, intermediary organizations are entities that occupy a gap between scientific discovery and final realization of commercialization value, and their role is to provide specialized services and access to equipment and resources beyond the reach of many start-up firms.

The ecosystem literature has created a basic division of intermediaries in the following way: 1) university intermediaries (technology transfer and licensing offices);

2) physical space (incubators, accelerators and co-working spaces); and 3) specific finance providers (venture capital, angel investors, crowdfunding platforms). Intermediary organizations provide support to innovation by engaging directly with individual establishments by providing services and access to resources that can improve business development or expedite technology commercialization. This paper presents systematic literature review of intermediary organizations, their determinants, types, a question of effectiveness, most cited and most useful research in the field of technology transfer, business incubators, venture capital, crowdfunding etc. Also, the article underlines the role and the importance of the aforementioned intermediary entities in Serbia, with the aim of demonstrating their influence on forming new small and medium enterprises.

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