

THE DEVELOPMENT OF ACADEMIC ENTREPRENEURSHIP AND THE EVOLUTION OF MODELS OF INNOVATION

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Annotation

This article presents the main models for the development of academic entrepreneurship. It provides understanding of the academic entrepreneurship concept, its forms and mechanisms. It provided main characteristics of knowledge production and transfer models, from Mode 1 to Mode 3. Article shows peculiarities of Triple helix concept of university engagement into innovation processes.

Key words: *academic entrepreneur, innovation, small innovative enterprises.*

Academic entrepreneurship

Academic entrepreneurship is relatively new concept for economic theory. From a traditional point of view “Academic entrepreneurship” means “university spin-off” or institutional transfer of research, development or technology to initiate innovation or venture. Wherein university spin-offs are defined as new ventures that are dependent upon licensing or assignment of an institution’s IP for starting their activity (Wright, 2007).

The term “academic entrepreneurship” is correlated with university employees and students. Academic entrepreneur is a university scientist, most often a professor, a post-doc researcher or PhD student who sets up a business company in order to commercialize the results of the research (Barcik et al, 2017). Academic entrepreneurship as a process includes the efforts and activities that universities and their industry partners undertake in hopes of commercializing the outcomes of faculty research (Wood, 2011).

An academic entrepreneur independently determines the profile of the studies, conducts research and at the same time works as an entrepreneur. Combining academic education, research activities and, an entrepreneurial

mindset, the academic entrepreneur acts to create income, profit and self-employment. In a society, the academic entrepreneur is the link between the scientific sphere (knowledge-driven) and the commercial (innovation-driven) world. The essential qualities for an academic entrepreneur are creativity, a wealth of ideas, and connections both within a scientific discipline and in related disciplines (or know-how). (Bartels & Bencherki, 2020).

In most cases, academic entrepreneurship takes place as a spin-off or start-up by commercializing innovative ideas, developments that have already been created in universities or are still being created. Thus, university spin-offs or start-ups in advanced economies have significantly influenced changes in the field of scientific research over the past 30-40 years. Academic entrepreneurship in the form of a start-up or spin-off has the main goal is to establish the necessary connection between the scientific world and private enterprises and thereby satisfy the demand of society for new products, services and ideas (Evers et al, 2020).

In advanced economies spin-offs' are driven mainly by the growing demand from private enterprises, nongovernmental organizations or the public sector for new knowledge and know-how from the academic sector. The commercialization of knowledge in the form of spin-off provides some potential benefits for the regional ecosystem (Benneworth & Charles, 2005), namely:

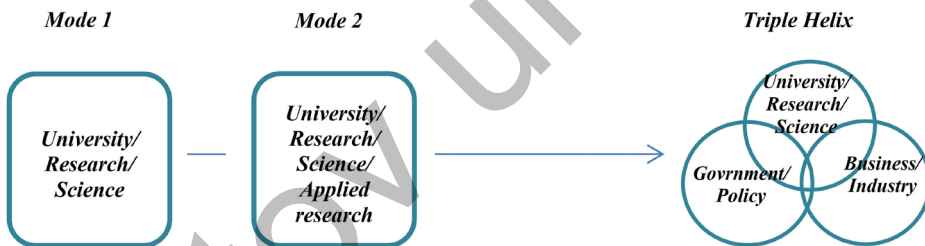
1. Spin-offs attract employers, paying good wages and promoting entrepreneurship (Etzkowitz, 2001).
2. Spin-offs create new networks to access project financing.
3. Spin-offs help universities with their third mission and make strong linkages with "parent" institution.
4. Spin-offs' activity can impact on the development of regional ecosystem;
5. Spin-offs stimulate creation of an infrastructure which is useful for other new companies in the region.

The study of academic entrepreneurship in the United States (Link et al, 2015) showed that in most cases, academic spin-offs are founded by professors, with subsequent involvement of research scientists, academic directors and executives. This way of formation of scientific entrepreneurship is associated with changes in innovation models (Figure 1). Figure 1 shows changes occurring in the production of knowledge and innovation, as well as in new fields of activity created by academic entrepreneurs, which lead to an increase in the demand for new knowledge and know-how.

Modern government and enterprise strategies foster direct collaboration with universities, mostly in the form of the creation of university spin-offs. As a consequence, universities are developing towards a new "mode" of knowl-

edge production. Before, the functions of the teaching staff were limited to conducting scientific research with limited opportunities of its practical implementation. The “old” system (Mode 1) was characterized by the predominance of theoretical science (Novotny, 2003). The main outcomes of scientific research were publications in scientific and technical journals and reports at conferences, which are evaluated by colleagues.

The “new” model (Mode 2) begins to take into account the commercialization of the results of scientific research. The outcomes of scientific and technological progress are becoming demanded by society (Sitenko, 2018). This evolution is forcing research laboratories to build partnerships with industry, prioritizing applied research as a way to finance their activities along with their core research costs. In “Mode 2” enterprises have to pay to use the research results that were available free of charge under the old “Mode 1” model. On the other hand, firms also have the ability to direct the research and development work of public laboratories according to their own development strategy, provided that they are able to pay the costs of technology development.



Source: based on: Etzkowitz, H. and Leydesdorff, L. “The dynamics of innovation: from National Systems and “Mode 2” to a Triple Helix of university–industry–government relations.” Research policy 29.2 (2000): 109-123.

So, Mode 2 gave a new basis for the relations between main agents of innovation process – the Triple Helix concept by G. Etzkowitz with L. Leydesdorff (1997). According to the concept, successful innovation development is based on the interaction of main groups of actors of innovation systems: university, business and government. University is involved in the development of innovation, organizes the cooperation with industry, business, largely by taking the functions of their research units. Classical university turns into an entrepreneurial (innovation) university, developing the business principles in students and academic staff with focus on final implementation of generated inventions and ideas (Sitenko, 2019).

Useful insights can be found in the further developments of the Triple Helix concept, which were named as Quadruple and Quintuple Helix (Carayannis & Campbell, 2009). They add civil society and environment respectively, forming new understanding of university as “organization capable of higher order learning” as well as knowledge as “highly complex and non-linear” (Mode 3) (Carayannis, et al, 2018).

So, within the framework of the innovation model “Mode 2” non-university institutions have taken on a new role for knowledge creation and production. Table 1 summarizes the differences between Mode 1 and Mode 2.

Table 1. Main differences between innovation models Mode 1 and Mode 2

Mode 1	Mode 2
Industrial economy	Knowledge economy
Plans are formed in the academic environment	Plans are formed in a wider context
Problems are solved in the academic sector	Knowledge is produced in the context of its further application
Organizational structures hierarchical	Horizontal, flexible organizational structures
The system is based on constantly operating institutions	The basis of the system is temporary networks
Knowledge production is carried out in special institutes	Knowledge production takes place in different sectors of the economy
Low level of responsibility knowledge producers	High level of responsibility and reflection
The peer review system will include only representatives of the academic community	The peer review system includes a variety of clients
Source: based on: GIBBONS, M. et al. The new production of knowledge: the dynamics of science and research in contemporary societies. London: Sage Publications Ltd, 1994	

Mode 2 includes a larger number of agents whose collaborate temporary which other. In this situation there are no pure “science” of university and “technology” of industry (Jimenez, 2008). The production of knowledge became more a “socially distributed” process.

New Mode 3 has main characteristics of Mode 2, but it closely linked to current societal needs. According to the Carayannis & Campbell (2009), Mode 3 is some kind of innovation ecosystem which combines people, culture and

technology. In this ecosystem people may do creativity and inventions within top-down (policy-driven) as well as bottom-up (entrepreneurship-driven) linkages. Mode 3 pays more attention not on agents of innovation system but on the networks that may connect them on different levels.

Developing of academic entrepreneurship concept

In practice, universities that adopted technology transfer strategies receive different outcomes that are sometimes disappointing, because university innovation infrastructure functioned as a facilitator for existing entrepreneurial activity, not as a trigger for it (Fisher et al, 2019). This demands a further research of the academic entrepreneurship concept. From the one side, more stakeholders have become involved in academic entrepreneurship (Siegel and Wright, 2015). From the other side, the process of commercialization of academic knowledge may differ because of level of economic development of the country. Siegel and Wright (2015) provide a new context for the concept with traditional and emerging point of view (Table 2).

Table 2. Traditional and emerging perspectives on academic entrepreneurship

	Traditional perspective	Emerging perspective
Purpose	To generate direct financial returns	To provide a wider social and economic benefit to the university ecosystem
Forms	Academic spin-offs; licensing; patents	Student and alumni start-ups; entrepreneurially equipped students; job creation in the local region or state
Participants	Academic faculty and post-docs	Students; alumni; on-campus industry collaborations; surrogate entrepreneurs
Support mechanisms	TTOs; science parks	Accelerators; Entrepreneurship garages; student business plan competitions; collaborative networks with industry and alumni; employee mobility; public-private 'incubators'

Source: based on: Siegel, Donald S., and Mike Wright. «Academic entrepreneurship: time for a rethink?.» *British journal of management* 26.4 (2015): 582-595.

Traditional views on the academic entrepreneurship focused on such metrics as the establishment of TTOs, use of patents and licensees and promoting university start-ups/spin-offs. Despite that universities were highly effective,

some studies concluded that many TTOs were inefficient, and had low capabilities to be successful in this arena (Siegel and Wright, 2015). Emerging perspective shows that universities may impact socioeconomic environment in many other ways by creating new infrastructure and on-campus support mechanisms which should be studied.

There is rising interest in academic entrepreneurship in developing countries (Gamata & Urban, 2020), but the empirical evidence (Fisher et al, 2019) reveals that countries concentrate more on the identification and protection of IP than on creating start-ups. Low levels of academic entrepreneurship at universities are explained by a weak set of institutional and organisational factors which inhibit the commercialisation and technology innovation process (Boshoff et al. 2018; Chantson and Urban 2018).

Conclusions

Academic entrepreneurship concept is still in uprising interest of researchers and economists. Most HEIs try to develop entrepreneurship to increase their competitiveness and expand financial flows. Emerging perspective for the development of academic entrepreneurship assumes expanding the participants, forms and support mechanisms.

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