The Role of the Triple Helix Model in Sustaining the Regional Economic Development[1]

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Abstract: This paper highlights the contribution of the triple helix model in sustaining the processes of economic development at the regional level. The first part presents the triple helix system components intensively analysed in the international literature in this field, emphasizing the main conditions that must be met for the development of this model. The second part focuses on the regional strategies developed around the triple helix model based on a set of successful interactions among academia, industry and authorities, such as clusters and special economic zones. Considering the almost three decades of theoretical and practical experiences, there are highlighted a few successful examples implemented in a few countries with different economic potential. This is a way to demonstrate that all these actors have believed and supported this partnership and now they are able to reap the positive effects. A series of arguments are offered in favour of supporting the development of local collaborative structures, such as clusters and special economic zones, including them into the regional development strategies. The last part of the paper reveals a successful collaborative example from Romania, where the model was developed in an extended quadruple form. Besides, there are revealed the forward steps and initiatives prepared to be taken in order to improve the conditions for the implementation of this collaborative model into Romanian environment.

Keywords: university, innovation, economic development collaborative, cluster, special economic zone

JEL Classification: I23, I25, O32, R58

1. Introduction

The knowledge creation and innovation eco-systems, a vibrant industry and a well-functioning government are the key ingredients of sustainable development (Gatune et al., 2018). Understanding this reality, in the 1990s the ***triple helix model*** was conceived and later developed, bringing together the most important actors in any society: ***universities, industries and governmental authorities*** in a spiral model of innovation covering multiple interrelationships in the complex process of knowledge capitalization (Etzkowitz, 2002).

In the current economic and social context, for any country, the being competitive depends on how the three main actors are organized and, most importantly, work together. More than that, the triple helix model is not just about working together on an ad hoc or on project basis. Their cooperation is supposed to be more institutional, structured and strategic. And at a certain level, the success of this model could be related with the fact of ***taking the role of the other by adopting new roles***. More exactly, companies are implied in educational processes (internships, training sessions, implication in developing curriculum hosted by universities) and the university develops entrepreneurial activities (*entrepreneurial university*). In the triple helix model, knowledge does not only flow from university laboratories to the business structures as the traditional model of innovation, but there are multiple links, flows and backflows between multiple partners that make up a complex construction of public, private and knowledge actors (Winden & Carvalho, 2019).

The triple helix model of innovation refers to a set of interactions to foster economic and social development, as defined in concepts such as the knowledge economy and knowledge society (Leydesdorff, 2012). The university is vital in generating knowledge and know-how that underpins innovations while the industry is the key in valorising the knowledge and innovations on the market. Both these efforts require considerable mobilization of resources. There is also need for markets to allow for exchange of goods and services and also

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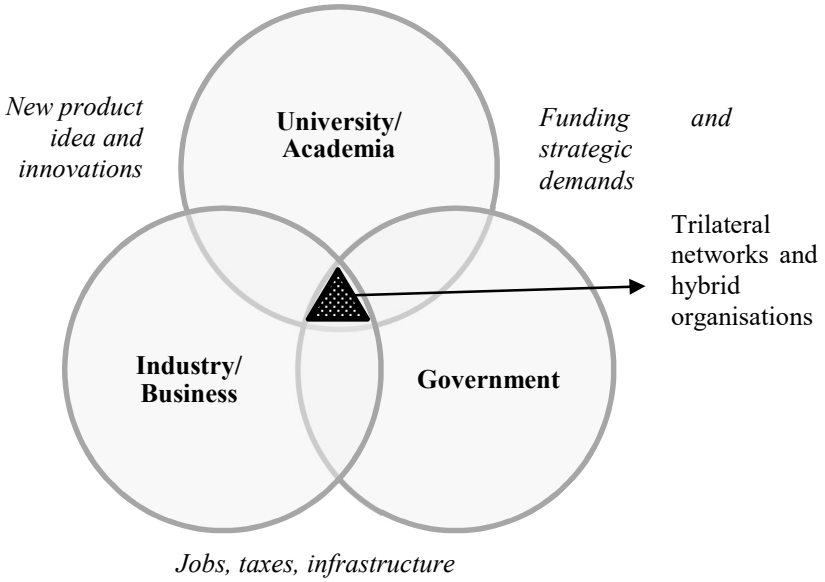
coordinate production activities through price signals. Governments play a crucial role in setting the regulation framework, facilitating the markets functioning and also incentivizing actors to participate in otherwise risky economic activities (Gatune et al., 2018).

Starting this model involves taking the initiative of one of the three actors. The driver of the triple helix can be any of the three main players. When *government* leads the process then this is a *top-down model,* where the policy drives the process, by formulating the overview and specifying the general objectives. When *industry or academia* drives, then a *bottom-up* process happens. But the two processes are not distinct as government can take the initiative of starting the process say through encouraging industry and then industry leaders can takeover. (Gatune et al., 2018).

2. The Triple Helix model: components and determinant conditions

The triple helix model is organized on the basis of a system consisting of: the three components (from three different areas: university, industry and government); the relationships among the components (through collaboration, technology transfer, conflict moderation, substitution and networking); the processes taking place into a common structure (related with generation, diffusion and application of knowledge and innovation) (Ranga & Etzkowitz, 2013). In order to illustrate the components of this model, the international specialized literature offers a specific graphical representation for the triple helix model, as the one presented in Figure 1.

Figure 1: The triple helix system: components and interactions



Source: Author, based on Ranga & Etzkowitz (2013).

Over time, the triple helix model, as a form of collaboration supporting the economic development, has shown that its processes of organization and operation require the provision of *three specific spaces*, built gradually, as follows:

- the *knowledge space* is about the concentration of related education, research and development activities in a certain geographical area, thus improving local conditions for innovation;

- the *consensus space* represents the environment in which individuals with different perspectives meet and interact representing businesses, organizations and institutions from the three institutional spheres and through mutual interaction are generating new ideas and innovative development strategies; the agreement is crucial in supporting the interaction among three powerful actors, as a key in generating trust and a shared vision, as well as in developing the regulation framework;

- the *innovation space* may result in the formation of hybrid organizations arising from the interaction of the three institutional structures and thus establishing of innovation clusters, business incubators, science and technological parks, research and development organizations (Ranga & Etzkowitz, 2013).

The relationship among the three main players here involved requires a strong communication, a mutual learning process to produce, diffuse, capitalize and regulate processes of generation and application of useful knowledge. The pragmatic relationship is an interactively concentrated effort embedded in shared values and consequently in productive projects.

Triple helix systems focus on the *open boundaries* among institutional components as a very valuable source of organizational creativity, encouraging individuals to move within and between spheres and to engage in recombining elements to create new types of creative structure. Networking in order to increase cohesion, destroying borders can be as important as the results of research and development (Etzkowitz, 2002)

Bringing the three dimensions together means the convergence and confluence of interests. Priorities have to be set not only on intellectual, rational and logical goals, but also on available resources, research agendas and an ex-ante assessment of the likelihood of success (Leydesdorff, 2012).

The development of the triple helix as an institutionalization process involves four phases, beginning with the recognition and understanding of needs, followed by internal transformation at the level of each participant in this model and the development of interactions between organizations, and ending with institutionalization. Going through these logical transformations requires the fulfilment of favourable tangible and intangible conditions (Cai et al., 2015). The *tangible conditions* that must be the basis for the development of the triple helix model are:

- competencies of universities in knowledge and technology generation and diffusion;
- absorptive capacity and demand of industry and innovator for knowledge and technology;
- supportive infrastructure;
- institutional entrepreneurs.

The *intangible conditions* are focused on general contextual factors and are as follows:

- *consensus on knowledge as the key to economic growth* (the model comes to create a framework of a regional collaboration of creating innovative technologies and products);
- *market orientated culture* (each player is concerned with pursuing their interests in the market);
- *process oriented knowledge management in knowledge production* (applying the specific principles and standards of quality management, creating the conditions for continuous improvement and efficiency);
- *intellectual property protection* (as one of the most sensitive issues in this collaborative project requiring specific means of guaranties);
- *civil society participation* (local initiatives and free mobility support the sources of innovation);
- *sense of competition* (this model based on an intensive partnership is performed in a way to support competitive market systems);
- *democracy in decision making* (needed at the level of each player).

Although these conditions are extremely challenging, there is a general acceptance that these favourable conditions are fruitful at the level of a regional innovation system, as we are going to highlight through several successful examples in the following chapters of this paper.

3. The triple helix model and its role in supporting the local economic development

The triple helix model is the most applicable and it generates effects at the level of local development, and in this particular case the clusters and special economic zones offer the best conditions.

Innovation takes place in an institutional, political and social context, where the innovation capacities should be approached as a geographical process and should be sustained through knowledge sharing regional communities. Innovation is easier when geographical concentration and proximity are present, and therefore the regional cluster and the special economic zone take on new dimensions in such processes (Gatune et al., 2018).

For the regional innovation system to be effective, the region needs not only scientific and technological institutions, but also tools to support innovation, such as institutions to promote concerted action and investment mechanisms, and therefore institutional support structures through regulations that favour innovation processes. It is also particularly important to have structures that link the regional to the national level. Bringing regional and national together is the key to exploiting national resources that can be substantial, and funding mechanisms often tend to be highly centralized at the national level. In designing concentrated spaces to ensure knowledge creation, innovation, consensus and cooperation, all these issues are essential (Rodrigues & Melo, 2013).

The decisive objective of a regional economic development policy is to create the conditions, infrastructure and resources that companies and communities rely on in order to be productive. Every successful company and every region begin with certain foundations — an educated population, concentration of skilled labour, dynamic networks of suppliers, strong infrastructure, basic research that can be capitalized on the market (Fuller et al., 2015).

The favourable conditions are crucial for common prosperity, which is at the heart of a successful economic development strategy. In our analysis, we highlight the ***clusters*** and ***special economic zones*** as two successful models that offer the best conditions for the application of this model and can generate remarkable results at the regional level, where they are implemented**.** What is noteworthy is that these structures have been implemented and have generated very remarkable results in developed and emerging countries. These have been noticed by the main actors in other countries, mainly in the developing countries that are looking for development solutions, and thus they have become role models. Projects in the same direction are currently under way in developing countries in Africa, which have seen this model as a solution to ensure that they use their valuable knowledge resources and to increase their chances of economic development.

3.1. Clusters – the suitable structure for implementing the triple helix model

Within the meaning of the classical definition, a ***cluster*** is a group of companies, as well as economic actors and related institutions that are located next to each other and that derive productive advantages from their proximity and mutual connections. Cluster analysis can help detect the region's strengths and economic challenges and identify realistic ways to shape the region's economic future (Cortright, 2006).

Therefore, the local or regional level is the best place to apply the triple helix model, as it offers the full potential for closer collaboration, which is the key to identifying innovative solutions that will later generate competitiveness. All this can be developed in innovative clusters or other collaborative structures that can lead the development of the region by increasing skills and creating industries. Industries can eventually generate companies that over time become world leaders and consequently the main drivers of economic development. Clusters increase the competitiveness of companies through accumulation economies. This is due to the presence of high competencies, providers of specialized services, improved market access and the flow of information (Gatune et al., 2018).

An inspirational successful triple helix project developed within a cluster structure in South Carolina

The triple helix innovation model is a point where industry, government and education come together in a common goal: to facilitate the generation of ideas and to use them in economic and social development.

There are many communities that recognize the importance of synergy among these key players, developing successful collaborations that can be inspirational models for actors involved in many locations around the world. Beyond the theoretical and idealistic dimension, these examples demonstrate that this model works and generates real effects for everyone implied and society.

South Carolina is the location of the world's largest BMW production facility, and some will say, the catalyst to making the region an automotive cluster of excellence. Besides, more than 250 other automotive companies, from suppliers to software providers, including American, French, German and Japanese auto giants, operate here being parts of this ever-growing industrial powerhouse.

In this very specialised and concentrated area there is an extraordinary need of a knowledge, specialised skills and talents channel to nurture the workforce. This need is extraordinary supported by Clemson University

that since 2007 has developed the ***Clemson University International Center for Automotive Research*** (CU-ICAR) with a very well targeted vision to be the premier automotive research, innovation and educational enterprise in the world.

Their strong and fruitful interaction is financially supported by the private and public sector. Since its inception, CU-ICAR has secured investments totalling USD 300 million, including more than USD 95 million from governmental agencies, allowing industry and university to focus on programmes, research and advancements within the industry.

Corporate decision-makers are seeking that level of collaboration, especially when setting up a new business structure in a new geographic region where the company doesn't have its own research, development and talent infrastructure. *Deep Orange*, a dedicated master programme developed by CU-ICAR, offers all the necessary educational and practical infrastructure from concept designing a vehicle to a market-ready prototype.

This master innovative program, through its strong education, research and industry collaboration, allows students to understand a wide range of automotive industry issues, provided in partnership with the main international manufacturers and industry partners, offering the latest perspective on vehicle design in terms of new technology (Caldwell, 2022).

This successful particular example demonstrates the way all three facets of the triple helix model work together being able to generate remarkable outcomes for every part implied, local community (university), industry and national development. This joint project was developed at the ***initiative of an industrial region to modernize itself with the impulse of a university***. Many other collaborative projects have been developed as a *university initiative to attract industry*, as were the cases with the development of the Stanford's science park around the university or the Research Triangle in North Carolina (the largest research park in the USA including: North Carolina State University, Duke University and University of North Carolina) (Leslie & Kargon, 1996).

3.2. Special economic zones – the proper location for developing the triple helix model

In Asian countries, the collaboration among the key actors is crucial for attracting foreign direct investment, creating innovation-driven industries and offering high value-added jobs. Understanding all these positive effects, the central authorities relaxed the control to local administrative institutions. At this level, the best conditions are offered by the ***special economic zones***.

The tech hub of Shenzhen in China

The ***tech hub of Shenzhen*** in China is an outstanding example of how world-leading companies can emerge from these ecosystems. The city is home to the headquarters of leading electric vehicle battery maker BYD and software giant Tencent, which has grown into a global behemoth since being founded by Pony Ma and four other Shenzhen University classmates in 1998.

Analysing the Shenzhen favourable environment for such a success, besides the special economic zone conditions, it is more the obvious the role of the ***Shenzhen University***, declaring itself as dedicated to serving the Shenzhen special economic zone (Yeo, 2022).

Weakening control of the central government by transferring to the local government authorities a number of economic prerogatives, especially in the areas of infrastructure construction, has allowed companies in the area to increase their production efficiency.

In this context, key players were encouraged to develop interactive links with each other. The Shenzhen government has created a favourable institutional environment to attract infrastructure construction, manufacturing and high-tech industries. The industry conducts research and development activities, enabling modernization and innovation. The university is involved in technology transfer, setting up new research spin-offs and other reform measures, including the promotion of university-industry links, the development of university-run enterprises, the construction of science parks and the management of multi-campus systems.

This is a successful model in the application of the triple helix model in Asia. Of course, this demonstrates and encourages central authorities to continue to give more freedom to local authorities to engage in models such as the one in Shenzhen. The industrial sector massively focused on innovation needs a stronger involvement of the authorities, the universities being also open to collaboration, so as to achieve the effectiveness of the model.

These transformations would allow greater freedom and power to coordinate local industrial development. Thus, the local authorities are interested to attract new FDI for stimulating economic growth, and consequently the full achievement of the conditions for the triple helix model to generate its effects on economic development (Yeo, 2022).

Special economic zones benefiting from the presence of universities

Looking at the top special economic zones in the world, it is quite obvious that they all either host universities within or near them, which leads to the conclusion that universities are a key factor in their success,

and the triple helix model is perfectly applied. The following paragraphs provide some effective examples of how three very different special economic zones can all benefit from the presence of a university (Serlet, 2022).

Dubai Internet City is one of the best appreciated special economic zone in the world, located adjacent to the industrial clusters such as Dubai Media City and Dubai Knowledge Park, with an extraordinary expansion, famous for being the Middle East headquarters of the world's largest tech companies.

The home to 1,600 tenants, including some of the world's most well-known blue-chip IT companies, is located across the street from American University in Dubai, opened four years before the zone, providing companies located there with an endless supply of tech-savvy students from around the world.

This area is extremely open to this kind of partnership. In 2018, the British University of Dubai, the Triple Helix Association, and other four universities jointly organized the first Triple Helix international summit in the region, highlighting once again the role of government-university-industry in building cities and nations based on innovation.

Cayman Enterprise City is also home to the University College of the Cayman Islands. The area is completely full, with over 250 companies setting up a physical office presence there, including the law firm Dentons, the web-browser company Brave and the crypto-exchange Binance. The University has a strong role to play in providing specialists and organizing innovation-focused events.

Kigali Free Zone is home to the famously selective Carnegie Mellon University Africa. The zone has just over 100 tenants, including Volkswagen's self-driving car factory, Africa's first native smartphone company, Mara Phones, and Apex Biotechnology, a manufacturer of HIV and cancer medications.

Universities ensure the presence of energetic and creative young people, who during their studies and even later guarantee that the area remains in contact with current technological trends. In most areas with barren industrial parks or office buildings, universities have brought an extremely valuable addition, including the living spaces improvement, making them livelier and more oriented towards new smart technologies.

Universities act as magnets for entrepreneurs, almost all of them have entrepreneurship programs and organize start-up events. In all the examples mentioned here, universities have frequently held conferences that have attracted key figures in the global technology scene. Many national and local authorities around the world now understand this and are preparing projects based on future development within the structure created around the triple helix model (Serlet, 2022).

More recently, inspired by emerging economies such as the UAE, China and Singapore, and due to the fourth industrial revolution, the idea of bringing together government, business and academia together for development has been revived. ***Africa's Agenda 2063***, for example, has an IT–university flagship project that builds on the experience of the Pan African University which has existed since 2008 and operates alongside the African continental free trade area. The triple helix summits organized in the African and Arab ICT hubs hosted by African Leadership University aim to develop three million ethical leaders and entrepreneurs by 2035.

4. The helix model in its quadruple form applied in the Romanian business environment

The general framework for applying the triple helix model in the Romanian economy is very generous, given the large number of internationally recognized universities and research institutions, the innovative national companies and the international investors operating here, along with the authorities' policies focus on sustainable development, all of these enhanced by the Romania's status as an EU member state. However, considering the high potential of Romania, the key partners of the triple helix model are at the beginning of their collaboration with modest interactions so far in creating a consistent cooperation structure.

However, it can be seen that a triple helix model works successfully, within the ***Cluj IT Innovation Cluster.*** Since 2012, this cluster has brought together all the entities needed in meeting the extended model conditions, where *a fourth part is involved in facilitating the interaction among the main players*, as follows:

- *enterprises* from the ICT sector located in the metropolitan area of Cluj-Napoca:
- *universities with research activities*: the Technical University Cluj-Napoca and the Babeş-Bolyai University Cluj-Napoca;
- *public administration authorities*: the Cluj County Council and the Mayor of Cluj-Napoca;
- *catalyst organizations*: North-West Regional Development Agency, the Cluj Territorial Office for SMEs and Cooperation, the Transylvania branch of the Romanian Association for Electronic and

Software Industry, Transylvania Advanced Equipments and Technologies produced in Romania (Lazăr, 2013).

This collaborative project in the IT&C industry develops, connects, engages and promotes inspiring people and creative ideas in a continuous flow of innovative development.

Considering the *important role of communication among the players in this model, in many cases a new partner is needed and consequently added in a quadruple helix model, this last one acting as a catalyst* to facilitate interaction between the partner entities and even to generate future projects.

Seeing the high potential of Romanian economy, the ***Triple Helix Association of Romania*** (THAR) could be considered as a partner with an important role of facilitator able to offer a solid knowledge base on this collaborative model, helping the Romanian actors to develop effective triple helix interactions. THAR could help with promotion, peer learning and partnership development. Creating linkages by organising many events in order to bring together all these actors, THAR could be very important in promoting this model, facilitating an increasing interaction among them.

The THAR's activities range from the development and debate around top class scientific studies, by means of conferences, summits, and awards, following with the networking among both leading education and research institutions and stakeholders to foster a wide dissemination and uptake of the scientific findings by means of publications, and co-operation projects. There is also included here the support in translating academic models into practical achievements by enhancing international exchange of scholars and the education and training of students, researchers and practitioners.

The vision of THAR covers many communicational areas, such as:

- facilitation of (digital) competence building of industries, government, innovators and the third sector;
- joining the innovation networks to facilitate EduTech, LegalTech and FinTech;
- boosting Romania's capacity to attract research and innovation funds (e.g., EU);
- connecting the local innovation networks with global pools of investors
- producing an impactful research and technology transfer to the market;
- facilitating scale-up support;
- engaging society (including youth) in participatory governance to boost inclusion and representation (THR, 2022).

THAR could be one of the best facilitators to connect the three components of the model in the Romanian economy. From this point of view, the participation of foreign companies operating in the Romanian business environment can be a way to develop this model, given that these, through their international experience, can contribute to the application of this model.

A good contribution in this direction comes from the university level supported by the new *educational reforms* adopted at national level towards redefining the curricula and proactivity or interactivity. In this regard, the real support is provided by the creation of very strong university consortia and their internationalization strategies where the collaboration and exchanges of students, professors and researchers are very important in getting the experience and expertise for moving forward (Miron & Gherasim, 2018). All these transformational processes are vital in proceeding through the phases of this model previously mentioned in the paper. Therefore, in the Romanian situation, the *bottom-up model* seems to be more practical, where the universities and the representatives of domestic or international businesses identify themselves as the locomotive for the implementation of the triple or quadruple helix model.

5. Conclusions

The aim of the paper is to reveal that beyond the educational dimension, universities around the world are playing an increasingly active role in supporting economic projects, facilitating investment and business with a strong economic and social impact. In addition, this model is strongly supported by the development and use of technology, to increase business efficiency, but also to identify solutions in the context of current risks in the world economy. The elements presented in the paper advocate the inclusion of this model in the strategy of local development and further of attracting foreign direct investment, oriented mainly to the fields of high value-added services.

The future strategic plans of all the partners have to be creative, flexible, ambitious, forward thinking and agile, in order to take advantage of the current disruptive changes in higher education and industries.

To create unique opportunities for entrepreneurship and innovation, all the three players in the triple-helix model must work together for innovation to truly thrive for the benefit of society's progress. The elements of analysis presented in the paper advocate the application of the triple helix model at local or regional level, given the examples of real projects implemented in countries with different levels of development, resources and conditions.

All of these successful examples come to support further efforts in exploring the triple helix model which proves to be extremely versatile and can be adjusted to current needs and realities. In view of the latest global challenge, the COVID pandemic crisis, the Triple Helix Association has launched several calls since 2020 to create quadruple helix structures, implying also the society and citizens, in order to identify not only medical solutions, but also multiple response patterns to the Covid-19 pandemic for understanding weaknesses, strengths, and challenges, for national governance and innovation systems, drawing on political, social and economic dimensions (*A Study on Triple Helix Innovation to Address the COVID-19 Pandemic – A Skill and a Necessary Stage*) (THA, 2020).

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