DEVELOPING ENTREPRENEURIAL ECOSYSTEMS IN EMERGING MARKETS: THE QUADRUPLE HELIX MODEL

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ABSTRACT

This book chapter explores the development of entrepreneurial ecosystems in emerging markets, with a specific focus on the Quadruple Helix Model. The Quadruple Helix Model emphasizes collaboration and interaction among four key actors: academia, government, industry, and civil society, to foster innovation and entrepreneurship. The chapter provides an overview of the concept of entrepreneurial ecosystems and their significance in driving economic growth and societal development in emerging markets. The chapter discusses the expected roles and contributions of academia, government, industry, and civil society in building and nurturing entrepreneurial ecosystems. The chapter concludes by highlighting the importance of a holistic and collaborative approach to creating vibrant entrepreneurial ecosystems that support innovation and growth and success of startups and entrepreneurs.

Keywords	entrepreneurial ecosystem, innovation, emerging markets, quadruple helix model, collaboration, economic growth
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INTRODUCTION

Entrepreneurship is becoming an increasingly important factor in economic development and innovation. Both Rodríguez et al. (2020) and Medeiros et al. (2020) refer to the emergence of entrepreneurship as a crucial component in future economic development and technological advancement. The authors believe that this trend will continue. The act of starting and growing a business on one's own is fraught with risk and challenges since it necessitates overcoming many challenges and obstacles along the way. Some of these obstacles include a lack of access to resources, talent, and markets; regulatory barriers; and cultural norms (Yasin et. al, 2021). Because of this, there must be an environment that is supportive and gives entrepreneurs the resources, networks, and knowledge they need to be successful in overcoming these obstacles. In addition, entrepreneurship is seen to be a process that is both complex and dynamic that calls for the participation of a variety of actors and the exchange of knowledge between them. There has been a change in attention among policymakers, academics, and business leaders toward building entrepreneurial ecosystems that assist in the growth of sustainable firms. An entrepreneurial ecosystem (EE), according to Stam (2015), is a set of interdependent actors and factors coordinated in such a way as to enable productive entrepreneurship. In addition, Mason and Brown (2013), posited that EEs are made up of connected entrepreneurial actors, organizations, processes, institutions, and personal characteristics that "formally and informally coalesce to connect, mediate, and govern performance within the entrepreneurial environment. As a result, this chapter adds to Stam's (2015) original definition of entrepreneurial ecosystems by defining EE as a group of interconnected actors and components that exist within a geographic area to promote entrepreneurial success.

Actor interaction within the entrepreneurial ecosystem began with the triple helix model (Universities, Industry, and the Government), and it has since been further developed

into the quadruple helix model (Universities, Industry, government, and donor community). In recent years, there has been a growing interest in a paradigm known as the quadruple helix model as a means of both understanding and developing entrepreneurial ecosystems. This model recognizes the distinct yet complementary responsibilities that the government, academic institutions, private businesses, and donor organizations may play in fostering the growth and development of entrepreneurship (Carayannis et al., 2018). This chapter aims to conceptualize how the quadruple helix model may be used to foster thriving entrepreneurial ecosystems for entrepreneurs in emerging markets.

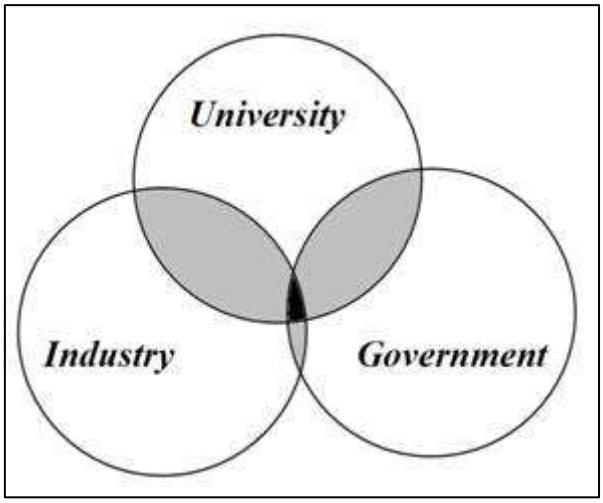
THE TRIPLE HELIX MODEL

While the Triple Helix model has been helpful in gaining a better understanding of the dynamics of innovation, it is not without its flaws. It fails to recognize the significance of society as a whole and the role that society plays in the process of innovation. In addition, in the interconnected world of today, the quick speed of technical breakthroughs, the emergence of new societal concerns, and the increase of public participation need an approach to innovation that is more inclusive and participatory.

As stated earlier, the triple helix model has several inherent restrictions, which have led to the development of a new model called the quadruple helix. The quadruple helix model broadens the scope of the conventional triadic collaboration by adding a fourth helix, which may be thought of as the public or civil society. It acknowledges the significant role that individuals, communities, and non-governmental organizations play in the formation of innovation ecosystems. Carayannis and Campbell's (2009, 2021) focus on users who drive innovation in society and democracy-based knowledge production adds a fourth domain to the model. This domain is civil society. Carayannis and Campbell's work is an expansion of the original triple helix model that Etzkowitz and Leydesdorff (2000) developed. This addition has advanced the triple helix to a quadruple helix which is under consideration in this chapter. The goal of the quadruple helix model is to involve citizens as co-creators and active participants in the innovation process, as well as to engage and empower those individuals.

According to Carayannis (2008), it is conceivable to create a continuous knowledge production system because of the dynamic interaction that occurs across the four domains, which are characterized as "agglomerations of human, social, intellectual, and financial resources." The quadruple helix model presents an analysis of entrepreneurial ecosystems in an organizational context that is more comprehensive than the triple helix model (Cloitre et. al, 2022).

Figure 1: Triple Helix Model



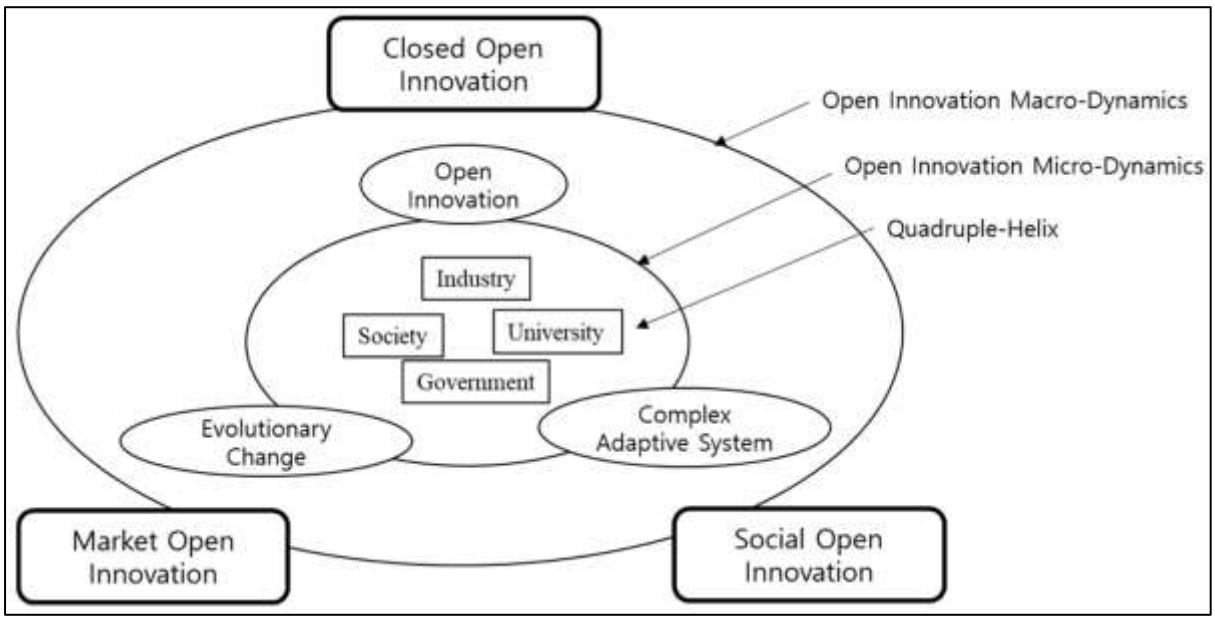
Source: Leydesdorff, 2012

THE QUADRUPLE HELIX MODEL

At its inception, the triple helix model of the knowledge production system was developed by Etzkowitz and Leydesdorff (2000) as a macro-level model of innovation. Its primary purpose was to symbolize the research and development process within three traditional domains. This domain includes participation from academia, industry, and the government. The formal and informal institutions that are present in each of these spheres are distinct from one another. 'Industry operates in the Triple helix as the locus of production; government is the source of contractual relations that guarantee stable interactions and exchange; and academia is a source of new knowledge and technology, which come together to form the fulcrum of knowledge-based economies' (Kolade et. al, 2022). The generative principle of knowledge-based economies' (Etzkowitz & Leydesdorff, 2000; Lew et al., 2018; Meyer et al., 2019) are some examples of institutions that traverse multiple sectors (Etzkowitz, 2003).

Since it fosters innovation in the R&D process, the knowledge production system is, in fact, at the center of conceptual considerations in the helix models (Hülsbeck & Pickavé, 2014). The triple helix model describes two primary modes of the knowledge production system: "Mode 1, an academic-based knowledge production system, and "Mode 2," problem-solving for promoting innovation (Borgh et al., 2012). Mode 2 prioritizes the application of the created knowledge from a shorter-term viewpoint, whereas Mode 1 aims at an environment regulated by academia from a long-term perspective. Economic activity is fueled by Modes 1 and 2's knowledge production systems (Carayannis & Campbell, 2013).

Figure 2: Micro- and Macro- Dynamics of Open Innovation with a Quadruple-Helix Model



Source: Yun & Liu, 2019

QUADRUPLE HELIX MODEL: THE EXPECTED ROLE OF ACTORS

To provide a comprehensive understanding of the quadruple helix, it is important to consider the various roles that the actors may play within the ecosystem. Below are the expected roles:

ACADEMIA

Knowledge Generation and Research

It has been known for a long time that academia is the main engine for the production of new knowledge and research. Within the framework of the quadruple helix, the academic world is expected to play an essential role in the progression of scientific and technical understanding (Van Horne & Dutot, 2017). Universities and other types of research institutes are the center of cutting-edge research and are responsible for expanding the limits of knowledge in a variety of academic fields (Jacobs, 2014). This knowledge creation acts as a foundation for innovation, giving the essential skills and insights to meet the complex social issues that entrepreneurs face.

Collaboration and Knowledge Transfer

The capacity of academic institutions to work with and share their expertise with other stakeholders in the innovation ecosystem is one of the most important advantages that they possess. Within the context of the quadruple helix, academic institutions not only cooperate

with the private sector and public institutions but are expected to also actively engage with members of civil society. This collaboration makes it easier for academic institutions and other sectors to share ideas, areas of expertise, and resources, which ultimately results in research that is more relevant to real-world issues. In addition, academic institutions are expected to turn scientific information into practical applications that are of service to society.

Education and Human Capital Development

Education and the development of the next generation of innovators, entrepreneurs, and leaders are critical responsibilities expected of the academic community (Klofsten et. al, 2019). Students are equipped with the requisite skills, information, and critical thinking abilities to contribute to the innovation ecosystem by the academic community. The academic community does this by providing students with education and training at a high level. Within the framework of the quadruple helix model, educational institutions not only train students for conventional professional pathways, but they are also expected to instill an entrepreneurial attitude in students, a sense of social responsibility, and an in-depth comprehension of the requirements of society (Morawska-Jancelewicz, 2022). Graduates who have completed academic training will be better prepared to actively engage in the co-creation of innovations.

Social Impact and Responsiveness

In the context of the quadruple helix, academic institutions are expected to take on a role that is more socially engaged and responsive. Academics are becoming more engaged in solving societal issues, working with organizations that serve civil society, and interacting with local communities (Lerner et. al, 2000). This involvement guarantees that academic research is connected with the needs and goals of a larger community, which ultimately leads to outputs that have a greater effect and are more socially relevant. The inclusion of academic institutions in the quadruple helix contributes to the democratization of knowledge by making the findings of research more easily available and adaptable to a broader range of stakeholders (Carayannis & Campbell, 2011).

Policy and Governance

Within the context of the quadruple helix paradigm, academia is also expected to also make contributions to the processes of policy formulation and governance (Bellandi et. al, 2021). Academics are considered experts in their respective fields and offer recommendations and insights that are based on evidence in order to inform governmental policies. The academic community is expected to contribute to the formation of an environment that is amenable to innovation by actively engaging in policy debates and dialogues. This helps to ensure that laws and regulations support stakeholders. Because of this engagement, the

efficacy of policy choices is improved, which in turn promotes innovation that is both sustainable and inclusive.

Open Science and Collaboration Platforms

Further amplification of academia's position within the quadruple helix has occurred as a result of the growth of open science and collaborative platforms. Open-access publishing, data sharing, and open innovation approaches are all becoming increasingly popular in the academic world (Beck et. al, 2022). These programs promote openness, inclusion, and cooperation; as a result, they make it possible for a greater number of people from academia, business, the government, and civil society to participate and share their expertise. Open science platforms also make it easier for citizens to participate in scientific endeavors by enabling them to make contributions to ongoing research and to take an active role in the innovation process.

In conclusion, it could be said that, within the context of the quadruple helix model, academic institutions are expected to occupy a pivotal role thanks to the contributions they provide to the areas of knowledge production, cooperation, teaching, social impact, policy development, and open scientific efforts. Academic institutions, by actively engaging with various stakeholders, including members of civil society, improve both collective intelligence as well as the relevance of innovation.

INDUSTRY

The contributions that industry are expected to make in promoting economic expansion, bringing new ideas to market, and bolstering technical development cannot be overstated. In the following paragraphs, we will discuss the precise position that industry plays within the quadruple helix model, as well as the consequences this role has for innovation and the general advancement of society.

Innovation and Technology Commercialization

The business community is at the forefront of adapting scientific findings and technical advances into useful applications and products that can be sold. In the context of the quadruple helix, the private sector is expected to play a crucial role in the process of generating innovation by utilizing the findings of academic research and developing those findings into practical solutions (Bhattacharjya et. al, 2023). The industry is expected to make investments in research and development, which promotes the commercialization of new technology. This, in turn, stimulates economic growth and the creation of new job opportunities.

Market-driven Perspective

The quadruple helix approach benefits from industry's input because it offers a viewpoint that is market driven. Because of industry's focus on making a profit, companies have a deep awareness of the requirements of the market, the requirements of their customers, and the latest trends (Parida & Wincent, 2019). This point of view complements the academic institutions' research-oriented strategy and makes it possible to match innovation with market demands. The participation of industry guarantees that innovations are not only scientifically valid but also financially feasible, increasing the likelihood that they will be successfully implemented to influence society.

Industry-Academia Collaboration

Within the context of the quadruple helix model, one of the most important drivers of innovation is collaboration between industry and academic institutions. Industry and academia are expected to leverage their respective strengths to generate outcomes that are advantageous to both parties by cooperating to achieve their goals. In the process of scaling up inventions, the private sector contributes funding for research and development, while academia provides knowledge, research capabilities, and practical insights (Guindalini et. al, 2021). These types of partnerships lead to the exchange of technologies, the co-development of research initiatives, and the birth of spin-off businesses, all of which contribute to the growth of an innovative ecosystem.

Entrepreneurship and Job Creation

Industry, as an actor within the quadruple helix model, is expected to contribute to the development of new businesses and the production of new jobs. Companies have the capability to recognize business opportunities in the market and make use of resources in order to launch new initiatives. Innovation, the creation of new jobs, and overall economic growth are all significantly influenced by the activities of start-up companies as well as small and medium-sized businesses (SMEs) (Gherghina et. al, 2020). The business sector is able to promote the expansion of innovative companies and ease the translation of research findings into applications that can be used in the real world because it encourages an entrepreneurial culture.

Industry Engagement with Civil Society

Industry is expected to interact with civil society as part of the quadruple helix model, which acknowledges the significance of the requirements of society and the norms of the public. The expected engagement of industry with civil society guarantees that innovations that are produced do not have a detrimental impact on society and the environment (Roman

& Fellnhofer, 2022). The private sector is in a unique position to tackle societal issues, advance sustainable development, and bolster its commitment to social responsibility if it works in close partnership with non-governmental organizations, community organizations, and citizen stakeholders.

Industry-led Initiatives and Technological Solutions

Because of its knowledge base and access to resources, industry is frequently in the driver's seat when it comes to the creation and application of technological solutions to social problems. The private sector is expected to produce cutting-edge technology that may contribute to a variety of fields, including healthcare, energy, transportation, and communication when it makes investments in research and innovation (Noori et. al, 2020). Initiatives spearheaded by businesses are essential to the acceleration of technological progress, the enhancement of quality of life, and the resolution of urgent global challenges such as climate change and the depletion of natural resources.

In conclusion, industry is expected to play a vital role within the quadruple helix model, driving innovation, commercializing technologies, and contributing to economic growth. Through collaboration with academia, industry can leverage research outcomes and transform them into marketable products and services. Moreover, industry engagement with civil society ensures that innovations are developed with societal needs in mind. The active participation of industry in the quadruple helix model fosters a dynamic ecosystem of innovation where research, entrepreneurship, and societal impact are intricately intertwined.

CIVIL SOCIETY

By acknowledging the significance of civil society as an active player in the innovation process, the quadruple helix model signals a departure from the more typical triple helix model. The diverse viewpoints, local knowledge, and social values that civil society is expected to contribute benefit the innovation ecosystem (Carayannis & Morawska-Jancelewicz, 2022). Civil society comprises people, communities, and non-governmental organizations. In the following paragraphs, we will discuss the unique function that civil society is expected to play within the quadruple helix model, as well as its implications for the promotion of inclusive and environmentally responsible innovation.

Citizen Engagement and Co-Creation

The participation of civil society in the context of the quadruple helix places an emphasis on the active engagement and empowerment of people in the role of co-creators of innovation. Citizens have unique perspectives, experiences, and requirements that may serve as the impetus for the innovation process. Problem-solving, idea generation, and the identification of social concerns are all areas in which civil society is expected to make

contributions through the use of participatory methodologies such as citizen science, crowdsourcing, and co-creation projects (Panori et. al, 2021). Because of this participation, innovations will be more responsive, relevant, and aligned with the objectives of the larger community.

Social Needs and Value Alignment

Within the context of the quadruple helix concept, civil society is responsible for bringing attention to social needs, values, and ethical issues. Civil society may more effectively advocate for solutions to urgent social challenges, including inequality, environmental sustainability, and social justice if it is actively involved in the process of innovation and participates on a regular basis (Fox & Macleod, 2023). Civil society organizations serve as intermediaries, reflecting the interests and concerns of underrepresented groups, to guarantee that new ideas are accessible to all people and are distributed fairly. Their participation contributes to the development of a more holistic knowledge of the effects that innovation have on society.

Democratizing Knowledge and Access

The function that civil society plays within the quadruple helix is about contributing to the democratization of information as well as access to innovation. Civil society may support the free flow of information and empower individuals to interact with scientific research and technological breakthroughs through the promotion of open science, open data, and knowledge-sharing programs (Trojan et. al, 2019). This access to knowledge enables individuals to engage in discussions, make informed decisions, and offer their skills, which helps bridge the gap between academic institutions, private enterprises, and the government.

Accountability and Governance

Within the framework of the quadruple helix concept, the role that civil society plays in maintaining accountability and good governance is of utmost importance. Civil society groups are expected to keep various stakeholders accountable for their activities, encourage openness, and advocate for ethical standards through the checks and balances that they provide (Zaman, 2023). Their participation contributes to reducing the risk of innovation being misapplied or leading to unintended effects, protecting the public interest, and fostering responsible innovation.

Social Innovation and Grassroot Initiatives

Within the framework of the quadruple helix concept, civil society is expected to serve as an incubator for social innovation and grassroot initiatives (Calzada, 2020). Projects led by the community, social enterprises, and non-profit organizations frequently originate from civil

society with the goals of tackling the problems facing society and fostering social transformation. These projects, which are driven by the knowledge and requirements of the community, lead to innovation that is both inclusive and sustainable. Organizations that are part of civil society can serve as catalysts for bottom-up innovation, community empowerment, and the creation of beneficial social effects (Pandey, 2023).

Collaboration and Partnerships

The inclusion of civil society in the quadruple helix model is conducive to the formation of partnerships and collaborations among the many stakeholders. Civil society groups are able to use their local expertise and networks to facilitate multi-stakeholder cooperation through partnerships with academic institutions, private enterprises, and public sector organizations (Petrevska Nechkoska et. al, 2023). These relationships increase the collective intellect and the diversity of ideas, which ultimately results in solutions that are more comprehensive and successful. Within the context of the innovation ecosystem, the participation of civil society also helps to cultivate trust, legitimacy, and social cohesion.

In conclusion, the expected role of civil society in the context of the quadruple helix is crucial because it ensures citizen participation, attends to social needs, democratizes information, encourages accountability, fosters social innovation, and promotes cooperation. The quadruple helix model welcomes inclusion, diversity, and social responsibility in the realm of the innovation process. This is accomplished by acknowledging the significance of civil society as an active participant in the innovation ecosystem. The participation of members of civil society groups contributes to the formation of an innovative ecosystem that is more sustainable, ethical, and responsive, which ultimately results in a positive influence on society.

GOVERNMENT

Within the confines of the quadruple helix structure, the government is expected to play a significant role in the formulation of policies, the provision of resources, and the promotion of an environment that is conducive to innovation. In the following paragraphs, we will discuss the expected function that governments play within the quadruple helix model, as well as the consequences of this role in fostering innovation that is both inclusive and sustainable (Masuda et. al, 2022).

Policy Formulation and Regulation

In the context of the paradigm of the quadruple helix, the function of the government is expected to include the creation of policy and the control of business activities. Governments have the ability to foster innovation, safeguard intellectual property, and ensure ethical business practices through the implementation of various policies and regulations (Fatima et. al, 2020). The government is able to promote an atmosphere that encourages collaboration

and innovation by providing clear policies and frameworks. This environment may be beneficial for academics, industry, and civil society. In addition, the policies of the government may be used to solve problems that confront society, encourage sustainable practices, and promote research and development in important fields.

Funding and Resource Allocation

The provision of financing and the distribution of resources for research, development, and innovation are all critical roles that the government is expected to perform. The government is expected to provide support for projects in academia, business, and civil society by making investments in research infrastructure as well as providing grants and financing schemes (Mazzucato, 2019). These investments contribute to the development of new technologies, the promotion of entrepreneurial endeavors, and the stimulation of economic growth. The government's financing is also a factor in the development of significant infrastructure (Kholiavko, 2021). This includes research facilities and information communication technology (ICT) infrastructure that spurs digitalization, which are all necessary for the innovation process.

Collaboration and Partnerships

Within the framework of the quadruple helix concept, the expected role of government as a facilitator of collaboration and partnership is essential. Creating forums for sharing information, establishing collaborative research endeavors, and providing funding for innovation clusters or hubs are all ways that governments may encourage collaboration between academic institutions, the private sector, and civil society (Surana et. al, 2020). By bringing together many stakeholders, the government supports multidisciplinary collaboration, which may be used to address complex social concerns by utilizing varied knowledge and resources.

Public Procurement and Demand Stimulation

The role that the government plays in public procurement has the potential to accelerate innovation by increasing the demand for novel approaches (Uyarra et. al, 2020). The government is able to incentivize firms and research institutes to produce new goods and services by creating rules and criteria that promote sustainability, efficiency, and social effect. In addition to supporting innovation and entrepreneurship, the establishment of a market for new ventures and smaller companies can result from public procurement.

Education and Skills Development

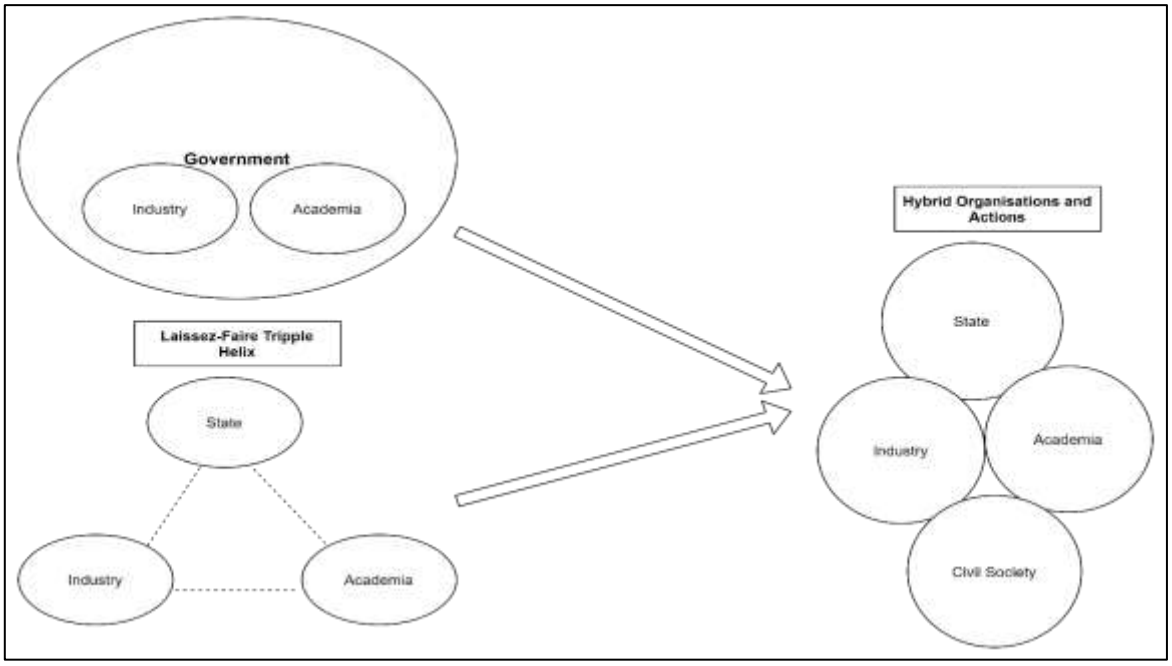
Within the context of the quadruple helix concept, the government is expected to play an essential role in advancing educational opportunities and professional growth. The government is able to guarantee a competent labor force that is able to drive innovation by investing in educational institutions and programs that provide vocational training. Education in the STEM fields (science, technology, engineering, and mathematics), digital literacy, and possibilities for lifelong learning can all benefit from policies enacted by the government (Barakabitze et. al, 2019). Education and the development of skills are given primary importance by the government in order to better equip its population for active participation in the innovation ecosystem.

Public-Private Partnerships for Societal Impact

Through its participation in the quadruple helix model, the government places an emphasis on public-private collaborations for the purpose of improving society. The government is in a better position to handle social issues such as healthcare, energy, climate change, and the alleviation of poverty if it works in conjunction with the private sector and civil society. Public-private partnerships may make it easier to share information, resources, and expertise, which can then result in the creation of fresh solutions that are advantageous to society as a whole (Saruna et. al, 2020). The engagement of government helps to create fair development and guarantees that innovations are in line with the interests of the general public.

In conclusion within the context of the quadruple helix, the involvement of the government in formulating legislation, supplying financing and resources, supporting education and skill development, and fostering collaboration is very important. The engagement of the government creates an atmosphere that is conducive for collaboration among academics, industry, and civil society, which in turn drives innovation that is both inclusive and sustainable. The government has the ability to drive social advancement, handle complicated issues, and guarantee that innovation benefits the larger society by utilizing its regulatory authority and financial capabilities.

Figure 3: From Tripple Helix Model to Quadruple Helix Model



Source: Author's own conceptualization, 2023

CONCLUSION

When it comes to fostering innovation and advancing societal and economic development, the "quadruple helix" model places a strong emphasis on the necessity of collaboration between many sectors, including business, civil society, and government. Through interdisciplinary collaboration and an environment that encourages entrepreneurial thought, the first helix, which consists of academic institutions, is responsible for driving innovation and technological advances. Investing in research and development (R&D), the transfer of technology, and the commercialization of newly developed technologies are the three pillars that comprise the second helix, which is industry. Businesses are able to make their ideas a reality and make profit because of the industry's extensive market knowledge, resources, and specialized skill sets. The third helix is composed of civil society, and its primary concerns are social inclusion, environmental sustainability, and ethical problems.

It fosters public engagement as well as creativity, and the government plays an important role in the process of establishing an environment that is favorable to innovation. On the other side, the quadruple helix approach places an emphasis on inclusive involvement, honest communication, and collaborative accountability in order to resolve difficult issues and create sustainable futures. Nevertheless, implementation and maintenance are difficult tasks because of issues such as the need to strike a balance between competing interests,

guarantee equitable participation, and find a solution to power dynamics. The quadruple helix approach provides a solid framework for innovative problem-solving, attending to social problems, and making progress toward sustainable development. Through ongoing acceptance and development of the quadruple helix concept, it may be possible to construct future civilizations with a greater capacity for inclusiveness, resilienc, and creative potential.

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