

Media and culture-based public in the quadruple helix innovation model

Mediji i kultura bazirana na javnosti u četverostrukom heliks inovacionom modelu

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Abstract

Spiral innovation models challenge the technological and economic determinism inherent in linear "science and technology push" and "demand pull" frameworks that explain the primary drivers of innovation. These models posit that innovation is a multifaceted phenomenon, shaped by socio-economic contexts and cultural-historical legacies. The Quadruple Helix model extends the foundational Triple Helix by integrating civil society as a fourth dimension alongside academia, industry, and government. This expanded model emphasizes the interplay between these actors and civil society in shaping demands for innovative solutions in products and services. Civil society, as a multi-layered concept, encompasses media, culture, social values, lifestyles, art, and democratic principles. This paper critically examines the role of the culture- and media-based public and the inherently ambivalent nature of civil society within the Quadruple Helix model. By exploring their influence on the commercialization of knowledge into innovation, the analysis underscores the theoretical and practical implications of this extended framework.

Keywords: knowledge, innovation, quadruple helix model, civil society, media, cultural public, social capital

Sažetak

Spiralni modeli inovacija osporavaju tehnološki i ekonomski determinizam linearnih „science and technology push“ i „demand pull“ objašnjenja primarnih pokretača inovacija. Ovi modeli tvrde da je inovacija višeslojni fenomen, oblikovan socio-ekonomskim kontekstom i kulturno-istorijskim nasleđem. Model Četverostrukog heliksa proširuje osnovni Trostruki heliks uključivanjem civilnog društva kao četvrtog segmenta uz već prisutne elemente nauke, privrede i države u bazičnom heliks modelu. Model naglašava interakciju između ovih aktera i civilnog društva u oblikovanju zahteva za inovacijama proizvoda i usluga. Civilno društvo, kao višeslojni koncept, obuhvata medije, kulturu, društvene vrednosti, stilove života, umetnost i demokratske principe. Rad kritički ispituje ulogu javnosti zasnovane na kulturi i medijima i inherentno ambivalentnu prirodu civilnog društva u okviru modela Četverostrukog heliksa. Istražujući njihov uticaj na komercijalizaciju znanja u inovacije, analiza ukazuje na ključne teorijske i praktične aspekte primene ovog koncepta.

Ključne reči: znanje, inovacije, model četverostrukog heliksa, civilno društvo, mediji, kulturna javnost, društveni kapital

1. Introduction

Economic and social progress in most technologically and economically advanced countries is closely linked to the processes of creating, adopting, and capitalizing knowledge into innovations (Resimić et al, 2023). However, these processes do not inherently result in positive outcomes, such as the development of innovations. In many cases, substantial investments in research and development, as well as in other components

of the innovation process, fail to produce specific innovative solutions. This may occur due to misdirected research efforts and innovation activities or bottlenecks in certain phases of the innovation process that prevent inventions from transforming into practical innovations (Cvetanović & Nedić, 2019).

Moreover, the capitalization of knowledge into innovations does not take place solely within a framework of unimpeded market dynamics. On the contrary, from a

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theoretical standpoint, research, development, and innovation activities are often characterized by significant market failures and various externalities. That is why it is of great importance to recognize the degree of uncertainty and the magnitude of commercial risks that are inherent in every innovative venture without exception. Because of this fact, it is of particular importance to timely identify the magnitude of the uncertainty and risk that this process inevitably entails.

The original models of innovation were linear in nature and greatly simplified real-world relationships. In the innovation economy, they are widely known as "science and technology push" and "demand pull" models. The advent of non-linear innovation models, which provide a much more accurate explanation of the innovation process compared to linear models, is attributed to Schumpeter (1934). The essence of Schumpeter's approach lies in emphasizing the place of creativity and research and development activities in the realization of innovation processes. The methodological value of this perspective is its focus on the increasing non-linearity of innovation processes, where linearity is considered an exception rather than the rule.

A major breakthrough in the conceptualization of non-linear innovation processes was the introduction of so-called helix systems. These systems marked a fundamental shift in how knowledge is capitalized into innovations. The evolution of these models can be traced from the Triple Helix (TH) model, which emerged as a counterpoint to the linear "science push" and "demand pull" models of innovation generation (Etzkowitz & Leydesdorff, 2000), to the Quadruple Helix (QH) model (Carayannis & Campbell, 2009) and the Quintuple Helix (QtH) innovation model (Carayannis et al., 2012).

The genesis of non-linear innovation models can be traced from the TH model, which appeared as a counterpoint to the linear "science push" model and the "demand pull" innovation generation model (Etzkowitz & Leidesdorff, 2000), via the QH model (Carayannis & Campbell, 2009) and the innovation model of the Quintuple helix (QtH), (Carayannis et al., 2012).

It is essential to acknowledge that reality often deviates from the assumptions underlying a conceptual model. This deviation is typically unfavorable, meaning that the assumptions upon which the observed model is built reflect a desired rather than an actual state. Nevertheless, models as conceptual representations of possible future scenarios are valuable when they reveal hidden or insufficiently visible relationships among involved entities and, frequently, when they point to solutions that may emerge from new ways of connecting these actors.

Empirical studies applying helix models often present varying interpretations, sometimes diverging from the original theoretical propositions of the models. Comparing the logic of different spiral models shows their essential complementarity when analyzing innovation processes in modern society, which can be marked as a

solid basis for building potential synergies between them (Cai & Lattu, 2021)

The analytical framework used in this study is qualitative in nature, which is in some ways a logical consequence of the very complicated and somewhat insufficiently convincing quantification of the element's characteristic of the fourth spiral of the QH model. It is worth noting that an additional limitation lies in the absence of unambiguous positions on the concept of civil society.

The composition of the paper consists of five sections. The first section of the paper is introductory. It explains the subject under investigation, the research instruments used in the paper, and presents the structure of the paper. The second section of the paper is dedicated to the development of the helix model. The third section of the paper attempts to explain the place of media and culture as well as civil society in the QH innovation model, while the fourth explores the complex structure of information and social capital in this model. Concluding remarks are presented in the fifth section of the paper.

2. The genesis of helix models for commercializing knowledge into innovations

The basic assumption of the TH model is that academia, industry, and government form the core of innovation systems, which develop through intensive transdisciplinary and cross-sectoral knowledge transfer (Cai & Etzkowitz, 2020). Although these entities are relatively independent and are largely driven by different motives, they manage to establish lasting institutional arrangements within national innovation systems (Etzkowitz & Leydesdorff, 2000; Ranga & Etzkowitz, 2013).

The TH model embodies a holistic approach to innovation, encouraging connections between different organizations and disciplines. As a networked system, it promotes rapid learning through collaboration and proximity among its key actors. Each actor is encouraged to examine the innovation process from his unique perspective, representing three interconnected spheres of equal importance within the national innovation network. In essence, the model encompasses the trilateral relationships between academia, industry and government in the processes of creation and commercialization of knowledge into innovation (Etzkowitz & Leidesdorff, 2001). Furthermore, the TH model encourages participants to work in an open environment where knowledge and innovation circulate freely.

The core innovation of the TH concept is based on two critical assumptions: system openness and a balance between differentiation and integration. System openness introduces the principle of equifinality, meaning that a desired outcome can be achieved regardless of initial conditions, provided innovative approaches are adopted to define problems and seek solutions. This principle offers hope, as it implies that success does not solely depend on starting conditions—enabling the possibility for poor regions to improve their prospects through innovation.

The balance between differentiation and integration assumes an open space for the circulation of intentions and knowledge, leading to the emergence of new ideas and their capitalization into innovations, where participants act based on principles of solidarity and collaboration (Cai & Amaral, 2022).

By integrating the sphere of civil society - comprising elements such as culture- and media-based public engagement - into the TH model, the QH model emerged (Carayannis & Campbell, 2009). This model is particularly instrumental in explaining how collective efforts, shaped by national cultural contexts and media-driven public discourse, can foster sustainable innovation and enhance competitiveness. This creates an environment conducive to generating creative solutions to multifaceted challenges.

The key drivers of knowledge creation and commercialization into innovations in the QH model are social capital and informational capital (Reis et al., 2022). By incorporating the fifth sector into the QH framework, the QtH model of innovation was developed (Carayannis et al., 2012). This model emphasizes how socio-ecological transformation can enhance the generation of knowledge and its commercialization into innovations. To achieve system sustainability and development, the model assumes that each of the five helices requires specific and indispensable resources necessary for their functioning and for the creation of socially and scientifically relevant knowledge.

The QtH approach integrates the TH and QH models, demonstrating that knowledge possesses the qualities and functions of both input and output for each subsystem when analyzed individually. Knowledge, entering as an input into one subsystem, exits as an output into another subsystem, which in turn serves as input for the next subsystem, creating a continuous cycle of knowledge circulation and innovation generation. With this, the circulation of existing knowledge continuously generates the process of creating new knowledge and its transformation into innovations.

The model highlights that investments in knowledge and the promotion of knowledge creation generate critical impulses for innovation. By initiating small yet continuous steps, the synergistic potential of the QtH model fosters the development of a long-term and sustainable knowledge-based society that coexists harmoniously with nature.

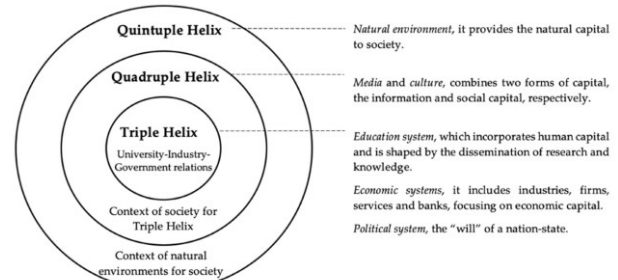
It appears that the QtH model, which introduces the dimension of the environment into the QH framework, has garnered significantly more attention from researchers in recent years. This heightened interest may be attributed to the growing relevance of sustainable development concepts, such as the imperative of green transformation, which have become particularly prominent in recent decades.

It should be noted that the inclusion of civil society as the fourth element in the TH model does not reduce the

relevance of the initial model. Similarly, QtH development does not automatically render the older QH model obsolete by introducing the natural environment as an additional building block. Instead, the logic of the QtH model apostrophizes the need for socio-ecological social and economic systems in the 21st century. In other words, including new segments, the TH model expands the theoretical framework and clarifies its application, but does not completely replace the original theory (Amaral & Cai, 2022).

The TH model encompasses and serves as a basis for a knowledge-based economy, while the QH model acts as an indicator of the broader context of a knowledge-based society. Furthermore, the QtH model emphasizes the need to consider the natural environment in a social and economic context. Essentially, this indicates the necessity of integrating society and the natural environment into a holistic perspective of innovative architecture (Carayannis & Campbell, 2012).

Figure 1. Illustrates the components of the previously mentioned spiral innovation models



Source: Reis et al., 2022

3. Quadruple helix model of innovation

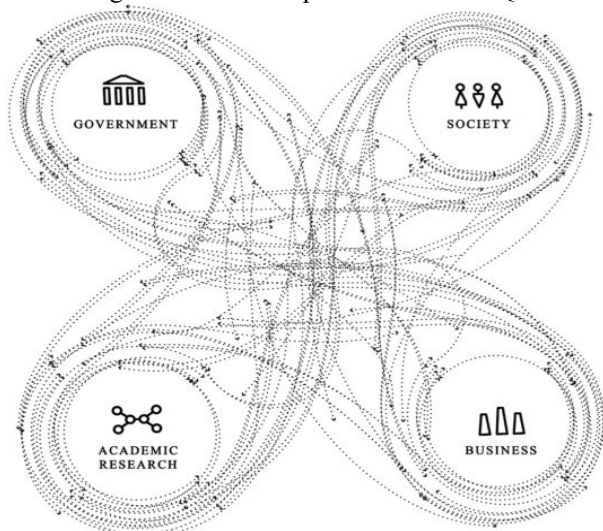
The QH model of innovation is based on the premise that universities, industries, governments, and civil society operate on principles of open knowledge circulation, learning processes, communication, and mutual cooperation. These spiral linkages result in multi-dimensional relationships that facilitate the capitalization of knowledge into innovations.

By contextualizing the TH model and introducing the fourth helix—comprising informed and cultural publics and civil society - the QH model offers a deeper understanding of the evolution of helix logic. his approach supports the research into the role of civil society in the construction of a national innovation system, the basis of which is the logic of the spiral connection of economic actors from the previously mentioned four institutional sectors of modern society.

The TH model traditionally emphasizes a top-down approach, driven by state, university, and industry policies and practices (Carayannis et al., 2018; Halibas et al., 2017). In contrast, the QH model fully embraces top-down, bottom-up, and mid-level influences. Civil society plays a crucial role as a catalyst for initiatives and actions that enhance the design, fine-tuning, and performance of government institutions, universities, and businesses,

alongside their strategies, policies, and practices (see Figure 2).

Figure 2. Approaches to initiative and action in knowledge creation and capitalization in the QH model



Source: Hadiyanto et al., 2020

The analytical approach of the QH model differs fundamentally from the theory of the national innovation system (Lundvall, 1988, 1992; Nelson, 1993), which assigns a leading role to enterprises in driving innovation. Additionally, the QH model is distinct from the statist TH model, where the state assumes a more dominant role. The QH model centers on the network of overlapping communications among its primary elements and the identification of key characteristics of institutional arrangements between academia, business entities, government institutions, and civil society.

The QH model of the quadruple helix has had a pronounced impact on the organization of research and development at the regional level. The model's foundational premise is that the market should function in the interest of society, while society, in turn, should serve its people. Within this framework, the role of individuals is of central importance. Carayannis and Campbell (2009) argue that the coexistence of plural knowledge paradigms in advanced democracies represents distinct knowledge clusters, which form homogeneous configurations of knowledge unbounded by geographic or sectoral limitations, particularly in the context of social media.

Despite its strengths, the QH model is not without limitations. One critical weakness lies in its methodological foundation, particularly the lack of quantitative measurement. Critics of the QH model have pointed out that adding a specific helix without rigorous explanations of what constitutes civil society is inherently problematic (Cai & Lattu, 2022).

The literature identifies diverse components of the fourth helix: Carayannis and Campbell (2009) list media, creative industries, culture, value systems, and lifestyles as core elements. Taratori et al. (2021) highlight media-based and cultural public spheres, civil society,

democracy, urban sustainability, and similar factors. Reis et al. (2022) emphasize national culture, media, and civil society, whose interwoven activities contribute to the development of social and innovation capital.

The following section provides a brief analysis of the content comprehensiveness of national culture, media public spheres, and civil society as indisputable attributes of the QH innovation system.

3.1. National culture

National culture refers to societal patterns of behavior, ranging from family interactions to conduct in organizations or public spaces, which shape perceptions of other nations and cultures. In a broader sense, national culture encompasses a constellation of shared values, norms, and practices characteristic of a specific country, thereby influencing behavioral patterns and attitudinal orientations among its population. One conceptualization of culture emphasizes its relationship to innovation as a critical form of change (Inglehart & Welzel, 2010).

The term "national culture" is sometimes equated with the concept of "cultural pattern," which in turn has increasingly been described in this century as "mental programming" (Hofstede, 2001). Each individual develops unique thinking patterns, sensitivities, and response mechanisms acquired throughout life. In summary, individual behavior is partly shaped by one's mental framework and partly determined by the natural and social environment—namely, the societal characteristics where an individual is born, raised, and functions. This includes influences from family, neighborhood, educational institutions, peer groups, and the organization in which one works (Hofstede & Hofstede, 2005). National culture plays a critical role in studying innovation because cultural conditions determine whether, when, and in what form innovation will be adopted (Cahyadi et al., 2024). Societies characterized by higher levels of individualism, willingness to take risks, and openness to change demonstrate greater innovativeness (Escandon-Barbosa, 2022).

The category of culture encompasses numerous concepts, such as value systems, attitudes toward various life issues, and the understanding of dominant assumptions shared by individuals within a given society (Harrison & Huntington, 2000). Notably, culture is a collective rather than an individual phenomenon. However, it is not universal but shared by the majority within a specific society. Culture is learned through socialization and manifests in people's behaviors. At the core of the culture concept lies a system of societal values (Hofstede, 2007). Within the defined objectives and scope of this study, the phenomenon of innovation culture is of particular importance. An organization's innovation culture is closely linked to its environment, including its sociocultural context and societal values (Bonetto et al., 2022). Innovation culture in any society must primarily stem from the logic of reproducing its foundational economic units—enterprises—which ensure their survival

and prosperity only if they can offer new products, techniques, technologies, work organization, business models, and management methods suited to contemporary times.

The core challenge in fostering innovation lies in generating new knowledge that leads to something genuinely novel. Here, "new" does not merely signify chronological succession to previous developments but represents a fundamental departure from the prior, embodying true originality. This novelty may manifest as an entirely groundbreaking idea or as a unique adaptation for a specific local environment. Innovation culture is synonymous with a knowledge-driven culture within an organization, one that supports the creation and transfer of knowledge, emphasizes creativity, fosters innovation, encourages learning, and promotes the sharing of knowledge across organizational boundaries. This culture reflects a sustained practice of innovative behavior, embodying the fundamental values and assumptions of creating, sharing, and utilizing knowledge in an innovative organization.

Developing an innovative organizational culture necessitates fostering key elements such as a creative climate and the quality of innovative leadership. An innovative culture provides an environment that motivates creative and innovative employees to experiment with new ideas. Crucially, this culture eliminates the fear of punitive consequences for potential failures, enabling employees to take healthy risks in testing novel concepts. In this context, innovation culture serves as an essential environment for achieving business success and sustaining long-term competitive advantage. As Lawson and Samson (2001) highlight, innovation culture acts as a strategic tool for shaping modern innovative organizations. It is a hallmark of all highly successful organizations, offering an exceptionally conducive environment for developing comprehensive creative and innovative potentials. By fostering such an environment, organizations not only enhance their ability to innovate but also position themselves to navigate the complexities of the future with agility and resilience. Innovation culture, therefore, is not merely an operational attribute but a strategic necessity, integral to achieving and maintaining organizational excellence.

3.2. Media and their influence on public discourses on knowledge and innovation

The concept of the media-driven public refers to an audience shaped and influenced by media communication, which forms public discourses on knowledge and innovation (Carayannis & Campbell, 2009). The role of media-based public is multiple; the media recognize and justify social innovations (Roman et al., 2020), articulate emerging needs in society (Carayannis et al., 2019), and not infrequently directly initiate and transform media content (Schutz et al., 2019). Within the QH model, the media represent the aggregate of all institutions with a communication and information impact on society.

Media serve not only as tools for accessing information but also as determinants of its distribution, character, meaning, and orientation. They embody the fundamental attributes of the socioeconomic system in which they operate, significantly influencing the formation of societal relationships. Increasingly, media are not merely intermediaries portraying social reality but active creators of that reality. Events unreported by media often lack broader social relevance or visibility.

The media landscape has undergone significant transformation compared to the era of mass communication dominance. Innovation theory offers enhanced tools for media researchers, enabling a deeper understanding of these changes. These tools not only uncover new aspects of media phenomena but also shed light on facets of new media that might otherwise remain unexplored (Krumsvik et al., 2013).

In the contemporary media and communication environment, traditional one-to-one direct communication has evolved into forms such as one-to-many and many-to-many communication. This transformation has been enabled by the internet's networking capabilities across diverse media platforms (Jensen & Helles, 2011). Media exert considerable influence in designing social reality and shaping culture in its broadest sense. Their mediated communication plays a pivotal role in constructing societal perceptions. The complex and often contradictory processes of social and cultural change are substantially driven by the phenomenon of media logic—a concept linked to the media's impact on various social subsystems.

3.3. Civil society

Knowledge-based innovation systems are constructed and interconnected through social infrastructures that promote an increasing influence of civil society on developmental processes. In the QH model, civil society is conceptualized as a knowledge society composed of wirelessly connected, free, yet sufficiently informed and self-aware cultural individuals.

By incorporating civil society as an equal actor in the creation and capitalization of knowledge into innovations, the QH model highlights the transformation from a knowledge economy to a knowledge society and, ultimately, a knowledge democracy (Carayannis et al., 2012). For example, the European Commission has integrated the QH model into its framework through the principle of responsible research interactive role for civil society in publicly funded research (Leydesdorff & Smith, 2022). In this context, it should be noted that citizens are no longer merely users but also active participants who promote and contribute to the development, dissemination, and application of innovations.

The creation of knowledge and its capitalization into innovations represent a transdisciplinary process that has become increasingly nonlinear, complex, and hybridized. The inclusion of the QH model has become critical, as scientific knowledge is increasingly valued for its societal impact. Consequently, the fourth helix emphasizes

discoveries and innovations that enhance societal well-being, fostering connections between science, the economy, government, and society.

In knowledge-based societies, the role of a well-founded but sufficiently flexible system for utilizing knowledge and innovations is becoming increasingly significant. Such a system must be fully oriented toward meeting the needs of the human community, ensuring that scientific progress and innovation are effectively aligned with societal priorities.

4. Social and informational capital as drivers of knowledge and innovation

The QH model operates within the framework of the knowledge society, representing a higher level of development and maturity compared to the industrial and informational societies of the 20th century. Toward the end of the 20th century, the global economy transitioned from an industrial society to an information society and, ultimately, to a knowledge society. In industrial society, the primary production factors - capital and labor - yielded their dominant role to advanced information and communication technologies (ICT) and systems, which emerged in the late 1970s. In a further wave of transformation at the dawn of the third millennium, ICT and systems became essential infrastructure for knowledge transfer and skill development. These elements now serve as the key drivers of growth and development across economies at various levels.

The most significant elements of social capital are social networks. Networks are built on reciprocity in transactions and include both independent relations among participants and firms. Networks can be formal, explicitly tied to decisions about the strategic goals of individuals and organizations, or informal, encompassing spontaneous or implicit interactions. Formal networks include relationships with organizations like banks or service firms, while informal networks involve interactions with family members, friends, and colleagues. Networks between firms often pertain to commercial transactions, such as the exchange of goods and services, facilitated through supplier and client relationships.

Participation in networks increases the likelihood of achieving specific goals. Informal networks include interactions with family, neighbors, colleagues, and friends, who may belong to the same or different generational, status, national, or religious groups. Formal networks, on the other hand, consist of engagement and activities within political organizations and civil society entities. Generally, simultaneous involvement in multiple organizations strengthens connectivity networks and enhances social capital.

Different societies exhibit diverse social norms. While some norms operate on a societal level, specific groups often maintain their own set of rules, which may exert greater influence than universally accepted norms. Social norms are widely accepted informal rules and conventions that dictate, prohibit, or adjust individual behavior in

various societal contexts. Although unwritten, they are often expressed or reinforced through religious beliefs, songs, proverbs, music, or similar cultural elements. In some instances, they are embedded within legal frameworks and regulations. From a societal perspective, social norms enhance allocative efficiency: the overall benefits society derives from cooperative behavior far outweigh the individual costs imposed by adhering to these norms. To the extent that social norms effectively limit opportunistic behavior, the costs associated with enforcing contracts are reduced, leading to higher returns on investments and other economic transactions.

Social capital is primarily a form of cooperation-based capital, shaped by mutual activities, trust, and reciprocal assistance that arise during individuals' economic interactions. It is possible to distinguish between bonding and bridging social capital. Bonding social capital unites people with similar characteristics, such as ethnicity, religion, or social benefits, while bridging social capital connects individuals with dissimilar characteristics (Putnam, 2000). In addition to these distinctions, formal and informal social capital can also be differentiated, based on the level of formalization of network connectivity (Putnam & Goss, 2002).

The QH innovation model is closely associated with informed public participation and the growing significance of broad digitalization, as well as the creation and expansion of informational, or in today's context, digital capital. At its most fundamental level, the concept of digital capital refers to the conditions that determine the forms and possibilities of using digital technologies (Park, 2017). The pervasive nature of digital technology applications has enabled profound transformations in human behavior. Advances in digital technology have introduced a qualitatively new mode of communication and collaboration among all economic and social actors, thereby driving the continuous transformation of human society as a whole (Mora et al., 2021).

This transformation is so fundamental that it is often equated with the technological revolutions of the 19th and 20th centuries (Ochoa Pacheco & Coello-Montecel, 2023). Thanks to the nearly explosive technological development of information and communication technologies, informational capital enables complex interactions among actors from all segments of society. This makes it possible to supplement existing knowledge about digital technologies and skills with new insights. In a certain sense, digital capital represents a predetermined set of dispositions influencing how people interact with digital technology. Some perspectives even suggest that digital capital refers to the accumulation of digital competencies (Ragnedda, 2018). The commercialization of knowledge into innovation does not occur in isolation. It happens within an existing ecosystem built upon prior innovations. Consequently, experience is a vital resource that users draw upon when encountering new forms of technology (Park, 2017).

4. Conclusion

The transition from the TH to the QH model can be attributed to the acceleration of social and technological progress and the need to enhance the innovativeness of enterprises and countries. As the effectiveness of innovation systems based on the TH model began to decline under rapidly changing modern economic conditions, the demand for a more effective modification of innovation systems emerged - one that aligns with the further development of helix logic theory.

According to the QH model, the knowledge society serves both as an environment and a goal in itself for generating and realizing innovations tailored to the needs of smart and sustainable production. In knowledge-based societies, an established yet sufficiently flexible system for the utilization of knowledge and innovation plays an increasingly significant role, fully oriented toward meeting the needs of contemporary human communities.

Civil society, within the QH model, should be understood as a knowledge society composed of interconnected, free, informed, and culturally aware individuals. From this perspective, the QH innovation model advocates for an approach in which knowledge is created and commercially valorized within a broader, transdisciplinary context where innovation users play a significant role.

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