

PARADIGM SHIFT TO QUADRUPLE HELIX MODEL OF INNOVATION IN MALAYSIA

(Anjakan Paradigma kepada Model Inovasi Quadruple Helix di Malaysia).

THANALETCHUMY KRISHNAN*, NUR RIZA MOHD SURADI &
FARIDATULAZNA AHMAD SHAHABUDDIN

ABSTRACT

Innovation is crucial for sustainable economic growth, development, and national prosperity. A progressive and sustainable innovation ecosystem is required to achieve a high-income, developed, and high-technology nation status as well as to be a globally competitive nation. For this reason, the quadruple helix innovation model (QHIM) plays a significant role in economic growth and national development driven by science, technology, and innovation (STI). Collaboration and commitment among the four helices are essential for Malaysia to achieve National Transformation 2050 (TN50), Industrial Revolution 4.0 (IR4.0), Shared Property Vision (WKB 2030) and Agenda 2030. This paper reviews innovation collaboration in Malaysia focusing on QHIM. This paper concludes that Malaysia highly requires quadruple helix collaboration to be a developed and high-income nation. Malaysia's economic growth and national development depend on the implementation of the QHIM where the four helices integrate and collaborate to achieve sustainable wealth and prosperity through innovation.

Keywords: quadruple helix; triple helix; innovation collaboration

ABSTRAK

Inovasi adalah penting untuk pertumbuhan ekonomi, pembangunan dan kemakmuran negara yang mampan. Ekosistem inovasi yang progresif dan mampan diperlukan untuk mencapai status negara berpendapatan tinggi, maju dan berteknologi tinggi serta menjadi sebuah negara yang berdaya saing di peringkat global. Untuk tujuan ini, model inovasi lingkaran empat pihak (QHIM) memainkan peranan penting dalam pertumbuhan dan pembangunan ekonomi negara yang dipandu oleh sains, teknologi dan inovasi (STI). Justeru, kerjasama dan komitmen antara empat pihak adalah penting bagi Malaysia untuk mencapai Transformasi Nasional 2050 (TN50), Revolusi Perindustrian 4.0 (IR4.0), Wawasan Kemakmuran Bersama (WKB 2030) dan Agenda 2030. Kertas ini mengulas kerjasama inovasi di Malaysia yang memfokuskan QHIM. Kertas ini merumuskan bahawa kerjasama inovasi lingkaran empat pihak adalah penting dan diperlukan oleh Malaysia untuk menjadi sebuah negara maju dan berpendapatan tinggi. Pertumbuhan ekonomi dan pembangunan Malaysia bergantung pada pelaksanaan QHIM di mana empat heliks tersebut berintegrasi dan bekerjasama untuk mencapai kekayaan dan kemakmuran yang mampan melalui inovasi.

Kata kunci: lingkaran empat pihak (quadruple helix); triple helix; kerjasama inovasi

1. Introduction

Innovation is critical for sustainable economic growth, development, and global competitiveness. Accordingly, the Malaysian government has formulated the National Science, Technology, and Innovation Policy (NSTIP) 2021-2030 to enforce and empower the STI in national development and economic growth which is based on innovation (MOSTI 2021). It indicates that innovation becomes a key ingredient for a nation's development and advancement. To add to it, Malaysia has emphasised the importance of the innovation

ecosystem in the Tenth Malaysian Plan (MP10) and enforces the integration of various parties for sustainability in innovation (EPU 2016). Hence, all the parties of the ecosystem need to work together to engage in innovation contribute towards shared objectives and add value to it.

It follows that innovation today depends on diversity in ideas, knowledge, technology, experts, sources, and resources which leads to multiple parties' interaction in innovation for innovative solutions. Thus, the quadruple helix innovation model (QHIM) is the holistic approach that Malaysia highly needs as a developing country to be a high-income, high technology and sustainable nation by 2030 (EPU 2021b). Therefore, the government reconfigure the innovation ecosystem by introducing quadruple helix (QH) collaboration as a driving force in achieving the nation's vision and aims.

Initially, the government implemented the triple helix innovation model (THIM) in the ecosystem to stimulate collaboration among academia, industry, and government (AIG). Whereas the QHIM is more comprehensive and open compared to THIM which emphasises the involvement of the public as the fourth helix in innovation to cultivate dynamic collaboration. The Malaysian government has implemented QHIM as a new approach in the ecosystem to address local needs, solve and resolve issues as well as face local and global challenges.

To clarify, Malaysia is the first nation that has initiated and adopted QHIM in ecosystem of the innovation as one of the new approaches for national growth and development (The Star Online 2012), which adds the public. Hence, new innovation policies and strategies were formulated to stimulate and uplift collaboration among various parties. In order to foster impactful interaction, the new innovation policies and strategies have been expanded to public involvement (The Star Online 2012; Nur 2015).

The objective of this paper is to highlight and explain the adoption of QHIM in Malaysia as a developing country for sustainable economic growth and national advancement.

2. THIM in Malaysia

The Triple Helix (TH) concept was developed and introduced by Etzkowitz and Leydesdorff in 1995 (Etkowitz & Leydesdorff 1995). The THIM of collaboration describes the interactions and relationships among AIG in the development of innovation (Figure 1). The concept of TH has been applied and practised in a number of countries with different approaches (Mulyaningsih 2015).

The Malaysian government introduced THIM in the Malaysia Eight Plan (MP8) to stimulate research, development, and innovation as well as partnership and collaboration among the AIG. Consequently, the government has formulated and implemented various STI policies and strategies to build and strengthen collaboration among the three parties (EPU 2000). These include public funds to stimulate collaboration between universities and industries as well as reinforce the role of business units of higher education institutions (HEIs) to promote collaboration with the industry for the application of new knowledge, technologies, and the commercialisation of innovation.

As can be seen, the involvement of the public (the *rakyat*) is missing in the THIM. The THIM will be more impactful with the involvement and interaction of the fourth helix (Heng *et al.* 2012). Even though THIM positively contributes to national development (Afzal *et al.* 2017), this model misses the fourth helix in the network. The missed fourth helix in the THIM can contribute to new possibilities and add value to innovation, which is considered vital for the nation's economic transformation.

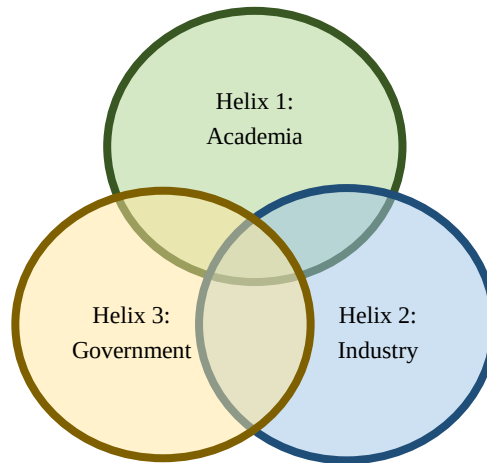


Figure 1: Triple helix innovation model (adapted from Leydesdorff 2012)

3. From THIM to QHIM

The key difference between the THIM and QHIM is the TH model focuses on institutional players whereas the QH model incorporates and emphasises public involvement in shaping innovation. The QH model focuses on societal needs, co-creation, and sustainable development.

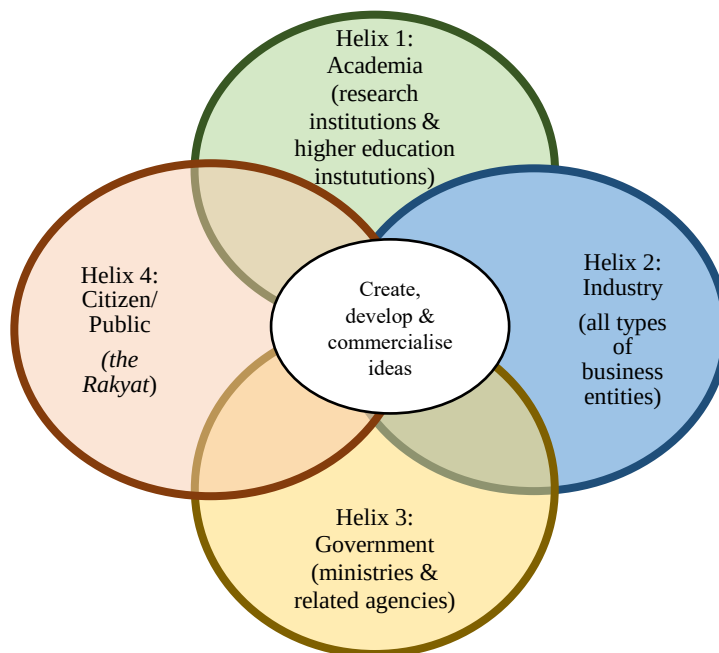


Figure 2: Quadruple helix innovation model (own illustration)

Both models are essential for Malaysia in driving innovation, yet QHIM is increasingly recognised for its comprehensive approach, inclusive innovation, and sustainable development. QHIM as an open innovation approach and inclusive innovation is highly needed by Malaysia

as a developing country (MOSTI 2015). QHIM is able to meet both economic and societal needs (Kolehmainen *et al.* 2015).

For developing countries like Malaysia, the transition from THIM to QHIM can significantly benefit the nation's aspiration to become a developed, high-income, and high-tech nation.

3.1 Helices of QHIM

The four components of QHIM are:

- (1) Helix 1: Academia
The helix 1 represents the academic institutions including institutions of higher learning, research institutes and other academic institutions which are involved in generating and disseminating knowledge and technology.
- (2) Helix 2: Industry
The industries include all types of business entities involved in the production and commercialisation of products (goods and services).
- (3) Helix 3: Government
The government refers to public authorities and other institutions or organisations responsible for promoting and creating a conducive environment for innovation.
- (4) Helix 4: Citizen/ public (the *Rakyat*)
The general public consists of individuals or groups of individuals such as non-governmental organisations, civil society organisations, community groups and civil society representing users/customers, who are involved in innovation.

4. Review of QHIM in Malaysia

In this innovation driven economy transition, innovation opens to external inputs to produce and commercialise ideas. In line with that, innovation evolves into multiple parties' interactions to create remarkable ideas and solutions through knowledge sharing and technology transfer. This can be done and achieved through a holistic approach where the four parties namely academia, industry, government and the '*rakyat*' (AIGR) interact with each other in innovation known as QHIM (Figure 2).

Given the above, QHIM adds and enlarges the involvement of the general public in the innovation. In other words, the QH model is the fourth helix-centred innovation, which provides space and creates opportunities for the public to engage in innovation (Rademaker 2019). To sum it up, QHIM is a strategic collaboration for optimum output from innovation which focuses on local needs.

The QHIM is capable of addressing complex societal issues. In Malaysia, this model has been applied in various sectors to promote innovation, sustainability, and socio-economic development. It can be seen in sustainable agriculture (Noor *et al.* 2021), biodiversity conservation (UNESCO Jakarta 2024), healthcare innovation, smart city initiatives (Dawood 2023) and as well as education and skills development. For education and skill development, QH is able to enhance the education system to better meet workforce demands by the industry as well as align educational programs with societal needs to ensure the graduate is equipped with relevant skills as explained in Service-Learning Malaysia- University for Society (SULAM) (Aris *et al.* 2024).

4.1 QH innovation collaboration in Malaysia

As a matter of fact, to be a globally competitive and developed nation, Malaysia needs to diverge and adopt an innovation culture where multiple parties collaborate in research, development, innovation, and commercialisation (RDCI). Collaboration among the multiple parties is able to make significant changes in innovation and contribute to sustainable national development and economic growth. In this situation, quadruple helix collaboration needs to be a focal point in an innovation-driven economy where it has the ability to stimulate the nation's economic competitiveness (Iqbal 2013).

This suggests that Malaysia needs a well-planned innovation ecosystem where various parties collaborate to create, develop, and commercialise the innovation (MoE 2015). Realising the need for an innovation ecosystem that emphasises multiple parties' interactions, the government has made a significant effort to promote and introduce the QHIM into the innovation ecosystem.

It should be noted that the involvement of the fourth helix in innovation undoubtedly bridges the gap, together with the other three helices, where the needs of the public as the end users of the innovation will be identified. As a result, innovation based on user or customer needs can be offered to the public. Besides, the information and knowledge from the fourth helix transform into possible solutions. The fourth helix contributes to the creation of endless ideas which will enrich innovation.

The QH players in Malaysia are academia (research institutes and higher education institutions), government and related agencies such as the Ministry of Science, Technology & Innovation (MOSTI), Ministry of Education (MOE), Ministry of Agriculture & Agro-based Industry (MOA), Economic Planning Unit (EPU) and Malaysian Global Innovation & Creativity Centre (MAGIC), industry (venture capital, multi-national companies (MNCs), small medium enterprises (SMEs) and start-ups or spin-off: examples are SIRIM, Hewlett Packard (HP), and National ICT Association of Malaysia PIKOM) and the '*rakyat*' as a citizen/ public/ community/ civil society (as users, consumers, customers and clients) (MoE 2015).

To add to it, AIGR have roles and responsibilities in driving STI development. For instance, academia is responsible for producing high-tech experts (human capital), generating new knowledge and technology which are relevant to innovations that have the potential to be commercialised. The industry, as a second helix, utilises and develops academia's research and innovation (knowledge and technology) as well as is responsible for collecting information from the fourth helix. Next, the third helix, the government acts as a policy and strategy maker. The related ministries, agencies and other government organisations stimulate innovation and collaboration by funding, monitoring, coordinating, and planning public-funded RDCI projects. Finally, the fourth helix, the end-users of innovation, who are considered as one of the key sources of information and contribute to breakthrough ideas and solutions. For this purpose, the fourth helix is given relevant knowledge (from the grassroots level) to encourage the fourth helix to actively involved and contribute to innovation together with the other three helices. (MoE 2015).

Apart from this, initiatives and efforts taken by the Malaysian government to empower and promote the innovation ecosystem include established research, development and innovation agencies and institutes such as the National Science and Research Council (NSRC) and Innovation Foundation of Malaysia (YIM) (EPU 2015). The formation of such agencies indicates the Malaysian government's accountability in stimulating the nation's economic growth and development through innovation collaboration (Chandran *et al.* 2013).

YIM is responsible for promoting, educating, and creating a culture of creativity and innovation among all Malaysians, from the grassroots level up to industries while PlaTCom

Venture and Magic were created to strengthen, support and facilitate innovation activities including intellectual property rights procedures, commercialisation, and advisory services (EPU 2015).

The establishment of a technology transfer office (TTO), industry centre of excellence (ICoE), industry and community network, centre for collaborative innovation, university-industry collaboration centres, as well as research, innovation, and commercialisation (RIC) centres in most of the HIEs, are responsible for facilitating and stimulate existing innovation network among industry, government, and local communities. Innovation collaboration among AIGR is further encouraged through platforms such as SIRIM, Fraunhofer, Science Parks and incubators (Technology Park Malaysia which is currently known as MRANTI, Kulim Hi-Tech Park and universities). Some of the successful QH collaborations are Knowledge Transfer Centre Toray-USM, Kursi Perbankan dan Kewangan UUM-CIMB, Akademi Internet of Things (IoT) UTeM-Samsung and MyInnovationHub (KPM 2016).

In addition, the government has allocated numerous funds to support the innovation networks among the AIGR to overcome the financial constraint. Some of the ministries that contribute in funding and driving RDCI in Malaysia are the MoE, MOSTI, Ministry of Finance, Ministry of Human Resources, Ministry of International Trade and Industry as well as Natural Resources and Environment Ministry.

4.2 Issues and challenges that have been discovered

Here are some of the issues and challenges that have been discussed in the literature:

(1) Policies and regulatory issues

STI policies and strategies for QH collaboration and partnership should be reviewed and expanded to foster innovation, collaboration, and sustainable development. Therefore, the government should formulate policies that promote innovation and collaboration among the multiple parties (Islam *et al.* 2021; Yatim *et al.* 2018).

(2) Fourth helix engagement

The fourth helix involvement in the QH model of innovation is challenging, need to ensure that the information, knowledge or even the feedback of the fourth helix is effectively integrated into the decision-making process. The involvement and participation of the fourth helix are limited and lacking in the decision-making process (Dawood 2023).

(3) Collaboration and partnership

Collaboration and partnership need to be further strengthened to promote effective collaboration and interaction among the helices of the QH model (Islam *et al.* 2021). Lack of collaboration may cause disconnection among the helices and hinder innovation. Effective collaboration and interaction among the helices is essential in driving innovation.

5. Conclusion

In conclusion, Malaysia aims to be a high-income and developed nation. As a developing country the Malaysian economy, growth and development depend on STI. Innovation nowadays has transformed and evolved to the interaction and involvement of multiple parties. Innovation is the output of a joint effort, in which multiple parties interact and contribute to impactful outcomes. Briefly, collaboration and partnership are essential in innovation to turn the input into new possibilities. Hence collaboration among the four helices (AIGR) is highly required to mobilise energy for 'Translating Innovation into Wealth' (EPU 2015), as well as commitment and collaboration of AIGR to achieve high technology nation status (MOSTI 2021) and for a 'Prosperous, Inclusive and Sustainable Malaysia' (EPU 2021b). QH

collaboration should be further strengthened and expanded for the benefit of the whole society and sustainability in socio-economic development by empowering and supporting the helices within the model.

References

- Afzal M.N.I., Dutta S., Mansur K.B.H. & Lawrey R. 2017. Practice of triple helix (TH) model in Malaysian research
Aris S.R.S., Wahi R., Mohamed A.M.D., Zulkipli Z.A., Hashim R.A. & Babiera R.I.M. 2024. Exploring the
nexus of service-learning initiatives and quadruple helix stakeholders in Malaysia. *Environment-Behaviour
Proceedings Journal* **9**(29): 21-27.
- Chandran V.G.R., Sundram V.P.K. & Santhidran S. 2013. Innovation systems in Malaysia: A perspective of
university-industry R&D collaboration. *AI & Society* **29**: 435-444.
- Dawood S.R.S. 2023. The use of quadruple helix model in smart cities development: Evidence from Bandar Cassia
township in Penang, Malaysia. *Theoretical and Empirical Researches in Urban Management* **18**(2): 78-100.
- Economic Planning Unit (EPU). 2000. Policy objectives and framework. In *Eighth Malaysia Plan 2001-2005*.
Putrajaya: Unit Perancang Ekonomi, Jabatan Perdana Menteri.
- Economic Planning Unit (EPU). 2015. *Rancangan Malaysia Kesebelas : 2016-2020*. Putrajaya: Unit Perancang
Ekonomi, Jabatan Perdana Menteri.
- Economic Planning Unit (EPU). 2016. *Inovasi Penjana Kekayaan 2016-2020*. Putrajaya: Unit Perancang Ekonomi,
Jabatan Perdana Menteri.
- Economic Planning Unit (EPU). 2021b. *Executive Summary of The Twelfth Malaysia Plan 2021-2025*. Putrajaya:
Unit Perancang Ekonomi, Jabatan Perdana Menteri.
- Etzkowitz H. & Leydesdorff L. 1995. The triple helix---university-industry-government relations: A laboratory for
knowledge based economic development. *EASST Review* **14**(1): 14-19.
- Heng L.H., Othman N.F.M., Rasli A.M. & Iqbal M.J. 2012. Fourth pillar in the transformation of the production
economy to knowledge economy. *Procedia-Social and Behavioral Sciences* **40**: 530-536.
- Iqbal M.J. 2013. Transforming Malaysian economy from production base to knowledge base using quadruple helix
research collaborations. PhD Thesis. Universiti Teknologi Malaysia.
- Islam A., Jerin, I., Hafiz, N., Nimfa, T.D. & Wahab S.A. 2021. Configuring a blueprint for Malaysian SMEs to
survive through the COVID-19 crisis: The reinforcement of quadruple helix innovation model. *Journal of
Entrepreneurship, Business and Economics* **9**(1): 32-81.
- Kementerian Pendidikan Malaysia (KPM). 2016. Amanat Tahun Baharu 2016 - YB Menteri KPT 15.
<https://www.mohe.gov.my/muat-turun/awam/teks-ucapan-dan-slide/2016/amanat-tahun-baharu-2016/8-amanat-tahun-baharu-2016-yb-menteri-kpt> (15 June 2024).
- Kolehmainen J., Irvine J., Stewart L., Karacsonyi Z., Szabó T., Alarinta J. & Norberg A. 2015. Quadruple helix,
innovation and the knowledge-based development: Lessons from remote, rural and less-favoured regions.
Journal of the Knowledge Economy **7**: 23-42.
- Leydesdorff L. 2012. The triple helix, quadruple helix, ..., and an N-tuple of helices: Explanatory models for
analyzing the knowledge-based economy?. *Journal of the Knowledge Economy* **3**(1): 25-35.
- Ministry of Education (MoE). 2015. *Malaysia Education Blueprint 2015-2025*. Putrajaya: Kementerian Pendidikan
Malaysia.
- Ministry of Science, Technology & Innovation (MOSTI). 2015. MOSTI sedia platform bagi melonjakkan aktiviti
pengkomersialan pada tahun 2016. [https://www.mosti.gov.my/en/berita/19-november-2015-mosti-sedia-
platform-bagi-melonjakkan-aktiviti-pengkomersialan-pada-tahun-2016/](https://www.mosti.gov.my/en/berita/19-november-2015-mosti-sedia-platform-bagi-melonjakkan-aktiviti-pengkomersialan-pada-tahun-2016/) (30 June 2024).
- Ministry of Science, Technology & Innovation (MOSTI). 2021. *Dasar Sains, Teknologi dan Inovasi Negara (2021-
2030)*. Putrajaya: Kementerian Sains, Teknologi & Inovasi.
- Mulyaningsih H.D. 2015. Enhancing innovation in quadruple helix perspective: The case of the business incubators
in Indonesia. *International Business Management* **9**(4): 367-371.
- Noor N.H.M., Ng B.K. & Hamid M.J.A. 2021. Tapping the potential of rice research for sustainable agricultural
development: Lessons from Malaysia's Public Research Institutions. *International Journal of Interdisciplinary
& Strategic Studies* **2**(2): 104-114.
- Nur N.A.M. 2015. Open innovation in public service reform. *Commonwealth Innovations Review* **21**(1): 20-25.
- Rademaker L.J. 2019. The possible role of users in the innovation ecosystem and innovation process. Master Thesis.
University of Twente.
- The Star Online. Quadruple helix way to innovation. 2012. [https://www.thestar.com.my/news/nation/2012/03/01/
quadruple-helix-way-to-innovation](https://www.thestar.com.my/news/nation/2012/03/01/quadruple-helix-way-to-innovation) (12 May 2024).
- UNESCO Jakarta. 2024. *Report of the 14th Southeast Asian Biosphere Reserves Network (SeaBRnet) Meeting:
Envisioning People in Biosphere Reserves Living in Harmony with Nature*. Jakarta: UNESCO Jakarta
- Yatim N.H.M., Rusuli M.S.C. & Ismail M. 2018. A quadruple helix approach in an organizational performance

framework of Malaysian SMEs from the lens of information management. *Advanced Science Letters* **24**(1): 530–533.

*Department of Mathematical Sciences
Faculty of Science and Technology
Universiti Kebangsaan Malaysia
43600 UKM Bangi
Selangor, MALAYSIA
E-mail: p84073@siswa.ukm.edu.my*, nrms@ukm.edu.my, azna@ukm.edu.my*

Received: 9 September 2024
Accepted: 11 November 2024

*Corresponding author