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Adoption of Quadruple Helix Among Academics: A Conceptual Paper

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Keywords

Innovation, community-centric, quadruple helix, Malaysia

Adoption of Quadruple Helix Among Academics: A Conceptual Paper

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Abstract

The Ministry of Education in Malaysia has been appointed to be one of the leaders in the innovation landscape with the responsibility to facilitate the adoption of quadruple helix (QH) across institutions of higher learning in Malaysia (IHL) to accelerate the commercialization of IHL technology. However, it was reported that the adoption of QH in Malaysia still needs to be more extensive and widespread, especially in IHL. This paper aims to study the effects of psychological and external factors on adopting QH by applying the theory of reasoned action (TRA). This paper proposes a conceptual model and research hypothesis to understand further the role of psychological and external factors in influencing the adoption of QH. The conceptual model may help explain the phenomenon of low engagement in the adoption of QH among academics in Malaysia and may be used as a guideline to develop a strategic plan for promoting the adoption of QH among academics.

Keywords: quadruple helix, universities, TRA, innovation.

Introduction

Malaysia is a developing country that focuses on improving economic growth through innovation. Acknowledging the importance of innovation, the government has appointed leaders to transform Malaysia's innovation landscape with objectives to coordinate and present strategic planning to allow the country to embrace the innovation-driven economic growth goal fully. The leaders include the Ministry of Science, Technology, and Innovation, the Ministry of Finance, the Ministry of Energy, Science, Technology, Environment, and Climate Change, the Ministry of Education, the Global Science Innovation Advisory Council, the Prime Minister Department, the Economic Planning Unit, and Performance Management Delivery Unit. Each leader has different responsibilities to facilitate innovation within the ministry departments, agencies, and units under the mentioned ministry.

Not left behind, the Ministry of Education (MOE), as one of the leaders in transforming Malaysia's innovation landscape, has designed a Malaysia Education Blueprint (2015-2025) for Higher Education. This blueprint constructed ten development plans, and one of the core plans is innovation (Core 7) (MoE, 2015). The role of MOE is to facilitate the adoption of quadruple helix (QH) across higher learning institutions (IHL) across Malaysia. The ministry also has constructed strategic planning to encourage extensive adoption of QH, including increasing investment in research grants, prioritizing strategic, focused research areas, and providing support services (MoE, 2015). The effort from MOE is also supported by the Ministry of Science, Technology, and Innovation (MOSTI) via the National Policy of Science, Technology, and Innovation to promote collaboration between the university-industry-community in science, technology, and innovation (MOSTI, 2013).

Despite efforts and support designed by the government, it is also essential to highlight the challenges and difficulties in QH practice. Previous studies have suggested that academics need help coping with problems in collaborative research, including QH. Researchers suggested uncertainty, commitment, feedback from industry, power, funding, workload, and intellectual property rights as the factors that hinder the adoption of QH from the perspective of academics in IHL (Carlos et al., 2017; Hällgren & Maaninen-Olsson, 2005; Miller et al., 2016; Pavlak, 2004; Ragossnig & Vujić, 2015). A paper titled A Systematic Literature Review of University Technology Transfer from a Quadruple Helix Perspective: Toward a Research Agenda by Miller et al. (2018) reported that conflict of role and stress among academics is one of the significant drawbacks to applying QH because university evaluation imbalance and weighted more on teaching compared to research (Hughes & Kitson, 2012; Miller et al., 2016). Other factors influencing QH adoption among academics include motivation, social network, self-efficacy, and personality traits.

Problem Statement

Quadruple helix benefits many stakeholders, including academia, industry, government, and the public. It is one of the innovative approaches to conducting research and development that promotes long-term sustainability and accelerates the commercialization of research and development output (Hasche et al., 2020; MoE, 2015; Schütz et al., 2019). Malaysia's government has taken steps to foster widespread use of QH, particularly among IHL. However,

the Ministry of Education asserts that QH use within Malaysian universities is still not as widespread as it should be (MoE, 2015). However, little, if any, research has been conducted to investigate why QH is not extensively used in Malaysia, particularly among IHL.

Researchers that have examined QH adoption in Malaysia have typically emphasized the industrial (Farida et al., 2021; Hamid et al., 2015), system development (Hamid et al., 2015), and economic perspectives (Iqbal, 2013). Among the exceptions is Bahron's (2018) conceptual study, which conceptualized and prioritized research topics for QH implementation at *Universiti Teknologi MARA* (UiTM).

Miller et al. (2016) performed a similar qualitative study. They identified human-centric, organizational, power relationship, network characteristics, and knowledge characteristics as critical variables facilitating knowledge transfer within the QH framework in Europe. As a result, this paper intends to re-examine and re-group the stated variables' influence into two main variables: psychological and external factors. These two main factors will be investigated to identify their influence on the adoption of QH among IHL.

Additionally, this research applies the Theory of Reasoned Action (TRA) to explain the variables affecting academic behavior, which is a QH adoption. This idea clarified the significance of attitude and subjective norms in determining an individual's proclivity to engage in specific behavior. Prior research has made significant advances in elucidating the impact of attitude and subjective standards on behavior across a variety of fields of study, including education, marketing, and psychology (Iqbal et al., 2011; Jolaee et al., 2014; Ramadani et al., 2014).

However, there are unresolved problems regarding research attitude and subjective norm adoption of QH from the viewpoint of an institution of higher learning (IHL) (Boruah, 2020). In any case, the theory of reasoned action has not been examined as a possible explanatory mechanism for adopting QH, and therefore, this research seeks to explain this occurrence.

Purpose of Study

This study aimed to ascertain the effect of psychological and external factors on adopting QH among academics from Malaysia's IHL. It also sought to analyze the effect of research attitude as a mediator between psychological factors and the adoption of QH. This paper aimed

to analyze the effect of subjective norms as a mediator between external factors and the adoption of QH among academics.

Literature Review

Understanding academic behavior is a process of evaluating factors that may be influential in explaining why academics behave in a particular way (Ajzen, 2005). The formation of behavior itself is contributed by how academics think before engaging in a specific behavior. Additionally, each academic has different interests and characteristics, which offer internal information when deciding to perform a behavior oppositely. In the context of this study, academics' decision to apply QH as a way to perform research, development, innovation, and commercialization is greatly affected by academics' research self-efficacy, research motivation, personality traits, level of job burnout, and social network (McAdam et al., 2018; Miller et al., 2016, 2018; Schütz et al., 2019).

Adoption of Quadruple helix

Quadruple helix is the improved version of Triple Helix (TH) that fosters collaboration in various forms of innovation, including technology or knowledge transfer (E Carayannis & Campbell, 2009; García-González & Ramírez-Montoya, 2019). Previously, TH has failed to promote the importance of customers or end-user feedback in the innovation process. Hence, the community/end-user was the fourth helix in QH (Elias Carayannis & Grigoroudis, 2016; Füzi, 2013; Schütz et al., 2019). Thus, it is believed that QH promotes synergies, including university, industry, government, and community, in innovation as well as to accelerate commercialization (E Carayannis & Campbell, 2009; García-González & Ramírez-Montoya, 2019).

QH is also known as a model that promotes the long-term sustainability of the innovation output as it creates spaces for product, process, and service improvement. This is because by adding community to the innovation process, businesses, governments, and universities will get access to current market trends, current societal requirements, and factual issues, which allows for the creation and provides an effective as well as appropriate solution (Elias Carayannis & Grigoroudis, 2016; Kolehmainen et al., 2016). Therefore, every helix involved will benefit from the innovation collaboration.

Unfortunately, it is essential to highlight that adding a helix also indicates welcoming additional problems to execute QH successfully. According to Schütz et al. (2019), the

motivation of the community to be involved in the innovation process can be questionable. The question of 'Why does the community like to be involved? 'What is the expected benefit the community desires?'. Hence, a conflict of interest will likely occur. Other than that, the credibility of communities' competencies and willingness to commit to being involved in uncertain and risky spheres could be challenging (Renn, 2014; Schütz et al., 2019).

Concentrating on the academic angle, universities are facing challenges and difficulties in shifting the innovation landscape from TH to QH. It is essential to recognize the role of academics in QH because they could offer comprehensive knowledge, talent, technical skills, and access to funding from the government. This explains why the government of Malaysia has appointed the MOE as one of the leaders in the national innovation landscape to facilitate QH among IHL (MoE, 2015). The government highlighted the potential of IHL to be the initiator of QH by providing excellent university-driven research and becoming a solution provider to the helixes (MoE, 2015).

However, the non-extensive adoption of QH across IHL, as claimed by the MOE, could be significantly influenced by a few factors suggested by prior research through systematic reviews. For instance, Miller et al. (2018) view academic skills as influential in academics' low engagement with QH (Miller et al., 2016). However, the authors suggested that an empirical study is needed to support the view. In addition, the author claimed job burnout is a factor that causes academics to show low commitment to QH (Miller et al., 2018). This is because universities maintain the weight of teaching performance compared to collaboration research involvement as the key indicator of performance (KPI).

Lack of motivation could be a drawback as this is aligned with the Expectancy Theory, which highlights the importance of values gained from performing a specific task (McAdam et al., 2018). Many other factors could be the prominent, influential factors determining the academic's decision to apply QH in research and innovation. A qualitative study executed by Miller et al. (2016) claimed that personality traits, skills, networking, incentives, skills, and university remit are significant to knowledge transfer within the QH framework in universities in the European context.

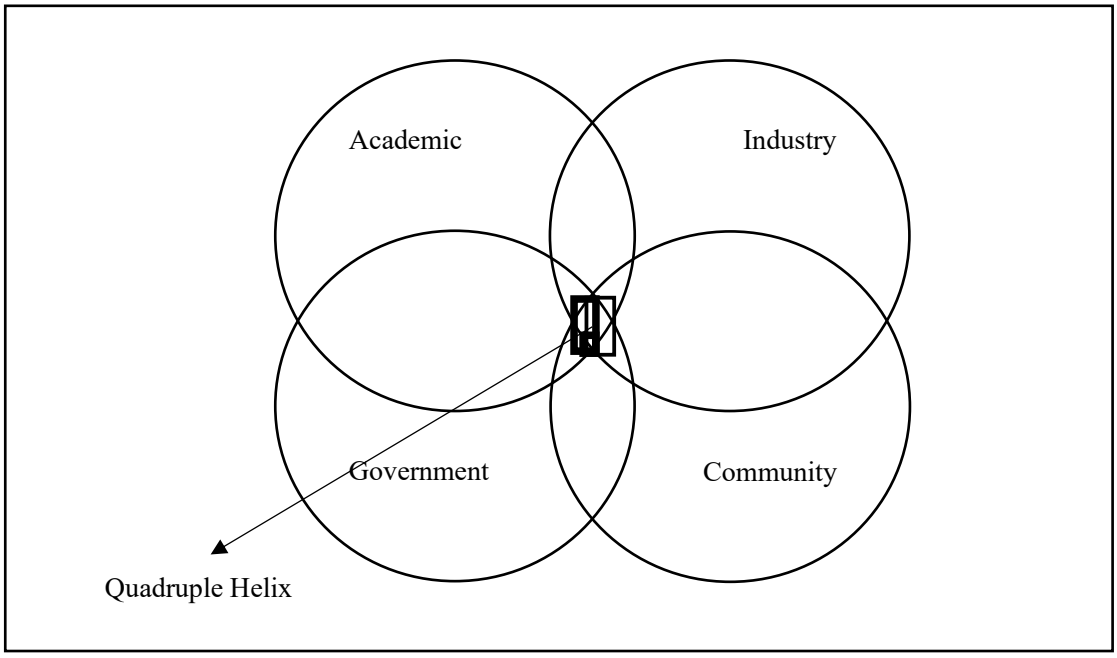

Figure 2.1 Quadruple Helix Framework Proposed by MOE.

Source: Malaysia Education Blueprint 2015-2025 (Higher Education) (2015)

Research Self-efficacy

Self-efficacy refers to an individual's beliefs about their skills to effectively accomplish desired performance and task complexity, and it varies based on individual contextual variables such as gender, culture, values, and ability (Hendricks, 2016; Ross et al., 2016). In academic education, self-efficacy refers to an individual's assessment of his or her capacity to accomplish educational objectives (Elias & MacDonald, 2007). Considering the above, research self-efficacy is described as an individual's assessment of their capacity to conduct research activities, including scientific and technical skills.

Recent research has shown that academic self-efficacy is favorably associated with a behavior, which resulted in their decision to practice KS within the QH framework (Miller et al., 2016). However, some researchers contended that self-efficacy is irrelevant and has no connection with behavioral patterns. Additionally, some studies said that self-efficacy has a detrimental effect on behavior since it causes an individual to be overconfident and underestimate a behavior, which results in the individual failing to engage and get involved in a specific activity (Schunk et al., 2009; Tan & Md. Noor, 2013). The paradoxical nature of past

results prompted this study to re-examine the significance of self-efficacy in the context of QH adoption, which had yet to be explored.

Albert Bandura's theory of self-efficacy states that four major influences affect one's sense of self-efficacy: previous experiences, the experiences of others, verbal persuasions, and physiological feedback (Bandura, 1994), which this study attempts to investigate. Furthermore, the term' research self-efficacy' was chosen especially for this study owing to its relevance in determining the significance of QH adoption. This is because QH adoption is a method of doing research and innovation throughout IHL. Therefore, it is critical to emphasize research self-efficacy rather than academic self-efficacy.

Research Motivation

Many variables affect academics' behaviors, which in turn influence their choices to take on new responsibilities, and one of these aspects is the source of motivation (Lam, 2011; Tran et al., 2017). This study emphasizes the importance of research motivation in influencing the adoption of QH among academics from IHL. This is supported by Vroom's expectancy theory of motivation in 1964, which explained that the chain of effort, performance, output, and values should always be connected. To understand the source of motivation, this study referred to the work of Porter and Lawler in 1968, which suggested an intrinsic and extrinsic work motivation model that investigated the impact and significance of motivation on individual behavior (Porter & Lawler, 1968).

For instance, Khan et al. (2018) conducted in-depth assessments of the critical function of motivation in enhancing academics' research interest. Extrinsic motivations such as incentives, salary, promotion, and reputation have been shown to affect academics' desire to participate in research activities and their success. The authors asserted that intrinsic motivations such as self-satisfaction and experiences also had a role (Armijos Valdivieso et al., 2021; Guerin et al., 2015).

Personality Traits

Over the last decade, most research on personality traits has focused on their direct causal link with behavior (Steel et al., 2012). Scholars have examined the relationship between personality traits and research activities in the education sector worldwide. The Five-Factors Model (FFM), often known as the 'Big Five Model of Personality,' created by Robert McCrae and Paul Costa, has been adopted (Costa & McCrae, 1985; Ongore, 2014; Rizkiah & Kurniawati,

2019). The FFM or Big Five Model is believed to be the most stable and explains personality differences and offers the most comprehensive description and precise summarization of particular personality traits (Yesil & Sozbilir, 2013; Zaidi et al., 2013).

This model categorizes human personality traits into five traits: extraversion, openness to experience, agreeableness, conscientiousness, and neuroticism (Costa & McCrae, 1985). Neuroticism is a negative personality characteristic that has been shown to adversely impact work attitudes, behaviors, and performance (Ongore, 2014; Todorovic et al., 2011). Unlike extraversion, they are more social, emotional, confident, ready to interact physically and emotionally, energetic, happy, and chatty (Costa & McCrae, 1985). A person with agreeableness characteristics tends to be trusting of others, compliant, kind, thoughtful, and eager to assist those in need (Rizkiah & Kurniawati, 2019; Sutin et al., 2021). Next is consciousness, which represents a person who is intentional, focused, disciplined, and strongly desires to succeed (Costa & McCrae, 1985; McCrae & John, 1992). Lastly, openness to experience demonstrates curiosity about new adventures, inventiveness, risk-taking, adaptability, critical thinking, and a great imagination capacity (Steel et al., 2012; Stock et al., 2016).

The term "personality" refers to a pattern of thoughts, feelings, and behavior that reflects an individual's interaction with and response to his or her physical and social environment (Üstüner, 2017). Personality is often referred to as the enduring features that distinguish one person from another via behavior (Steel et al., 2012; Zaidi et al., 2013). Numerous empirical investigations have shown a substantial and significant effect, as well as a connection, between personality traits and job involvement at the university level; nevertheless, most of these studies concentrated on teaching, publishing, research, and administrative work (Forrester & Tashchian, 2010; Rizkiah & Kurniawati, 2019).

Level of Job Burnout

In the last few decades, most research on academic behavior has emphasized the significance, impact, and effect of job burnout in educational institutions (Adenike, 2011; Ahsan et al., 2009). Job burnout exemplifies the degree of flexibility, resources, and workload constraints that can affect an individual's job performance (Teresa et al., 1996; Tracey et al., 1995). As a result, negative job burnout may influence an individual's reaction to behavior and their ability to work.

This study shows that the work environment influences academics' job burnout, which reflects the academic desire to apply QH as a new research and innovation landscape at IHL. However, this statement is yet to be proven because many prior studies on job burnout have concentrated exclusively on its relationship to job satisfaction among academics (Jain & Kaur, 2014; Jung & Shin, 2015).

Maslach and Jackson (1981) coined the term "job burnout" to describe the emotional fatigue, depersonalization, and loss of feeling of personal success that occurs as a result of professional stress and continual pressure (Allen et al., 2021; Hegel et al., 2021). The definition is thus highly relevant in the current community, industry, and government expectations of educators at IHL, as this refers to current government-driven policy, funding directives, and the reshaping of academic work, as well as the emergence of multiple roles among academics, particularly in the context of IHL (Mohd Beta & Ali, 2017).

Social Network

A social network within an educational institution is essential because it enables educators to engage within the academic realm, facilitating information and opinion sharing (T. C. Andrews et al., 2016; McConnell et al., 2020b). Because the connection occurs inside the same domain, the information received by each party is likely to be highly impactful. Academic engagement channels enable academics to share ideas, raise awareness of innovation, and offer encouragement and disapproval of newly proposed innovations (Tessa C. Andrews & Lemons, 2015; Dancy et al., 2016).

Apart from that, social networks facilitated by mass communication can continuously enhance an individual's knowledge, emotions, and perceptions in the direction of innovation (McConnell et al., 2020a). In addition, peers' experience is essential since it may develop an academic's confidence level in engaging and executing a behavior, particularly if the model or peers and observer have comparable characteristics, talents, workload, and work environment (van Blankenstein et al., 2019).

By emphasizing the importance of social networks as a known influential factor in determining behavior through interaction and relationship, it also demonstrated consistency with previous research in the field of QH that advises the importance of a positive environment, colleagues, and support within an organization in order to foster adoption of QH in IHL context

(McAdam et al., 2018; Miller et al., 2016, 2018). Unfortunately, this area has never been empirically explored. Hence, more empirical evidence needs to be provided to prove the link between social networks and the adoption of QH in the context of IHL.

Research Attitude

Studies have been undertaken to examine the influence and link between attitudes and innovative behavior in a variety of fields of study, including information technology, finance, marketing, agriculture, sustainability, innovation, healthcare, and education (Ahmad et al., 2020; Chan et al., 2020; Nijeboer, 2020). In psychology, attitude is a set of beliefs, feelings, ideas, experiences, knowledge, and expressions towards an object that leads to a given action or behavior (Ajzen, 2005; Bakanauskas et al., 2020). It is also described as an individual's reaction to a value, which can be positive, negative, or neutral, and this will impact how the value is expressed in behavior (Hepler & Albarracin, 2013; Ramadani et al., 2014).

According to Bakanauskas et al. (2020), a person's attitude is influenced by their ideas, beliefs, perceptions, emotions, experiences, knowledge, and information. These elements are vital to an individual's appraisal process before reacting to the assessed action or behavior (Gaiseanu, 2020; Van Kleef et al., 2015). The mentioned ideas above have become one of the fundamental supports of this study to employ 'research attitude' to mediate the effect of research self-efficacy, research motivation, personality traits, and level of job burn, which have been investigated in research behavior in the higher education context, however, suggested inconsistency results.

Prior research to identify the significance of attitudes on academic behavior was conducted by Tiwari (2020), who discovered that attitudes are positively associated with students' acceptance of online classes during the COVID-19 pandemic. Similarly, in the innovation context, Ju and Lee (2020) emphasized the need to consider people's attitudes toward innovation as determining elements that impact their behavior toward embracing innovation. Miller et al. (2016) conducted a qualitative investigation that revealed the effect of academics' attitudes toward knowledge sharing under the QH framework at European institutions. In sum, this study would like to re-investigate this matter in the context of IHL in Malaysia.

Subjective Norm

The effect of subjective norms in mediating the influence of social networks on the adoption of QH among academics in IHL is also investigated in this study. While past research has shown modest empirical support for the significance of social networks in adopting QH, there is contradictory evidence for the critical influence of social networks on academics' research behavior in IHL (T. C. Andrews et al., 2016; Korir, 2014). Prior study findings may have been more intriguing if they incorporated subjective norms to moderate the influence of social networks on academics' research behavior.

A thorough examination of the literature revealed that subjective norms are essential in influencing behavior (Andersen et al., 2019; Kilic et al., 2011). In a similar vein, Altawallbeh et al. (2015), who investigated the mediating role of subjective norms to influence behavior among lecturers at Jordanian University, discovered that subjective norms had a significant impact on lecturers' behavior, particularly their willingness to adopt new technology in teaching and learning environments.

Even though Sheeran et al. (1999) suggested that subjective norms are a less powerful predictor of behavior than attitude, a significant number of empirical investigations have indicated that the effect of subjective norms on behavior should be noticed. A previous study by Khan et al. (2018) on attitudes toward research among research teachers established the importance of subjective norms in influencing research behavior among teachers.

Research Questions

Using the arguments advanced in the preceding literature review section, this study will address the following research questions:

Research question 1: Do factors such as research self-efficacy, research motivation, personality traits, level of job burnout, and social network affect the adoption of QH among academics in Malaysia's institutions of higher learning?

Research question 2: What is the effect of research attitude as a mediator between research self-efficacy, research motivation, personality traits, and level of job burnout and adoption of QH among MRU academicians?

Research question 3: What is the effect of subjective norms as a mediator between social networks and the adoption of QH among MRU academicians?

Research Hypotheses and Framework

Several parameters (independent variables) will be explored to determine their impact on adopting QH (dependent variable). The independent factors to be examined in this study include research self-efficacy, research motivation, personality traits, level of job burnout, and social network. The dependent variable is the adoption of QH. The following are the study's hypotheses:

H1: Research self-efficacy has a significant and positive effect on adopting QH.

H2: Research motivation has a significant and positive effect on adopting QH.

H3: Personality traits have a significant and positive effect on adopting QH.

H4: Job burnout has a significant and positive effect on adopting QH.

H5: Social network has a significant and positive effect on adopting QH.

H6: Research attitude has a significant and positive effect on adopting QH.

H6(a): Research attitude mediates research self-efficacy's influence on QH adoption.

H6(b): Research attitudes mediate research motivation's influence on QH adoption.

H6(c): Research attitudes mediate the influence of personality traits on adopting QH.

H6(d): Research attitudes mediate the influence of job burnout on adoption of QH

H7: Subjective norms have a significant and positive effect on adopting QH.

H7(a): Subjective norms mediate social network's influence on QH adoption.

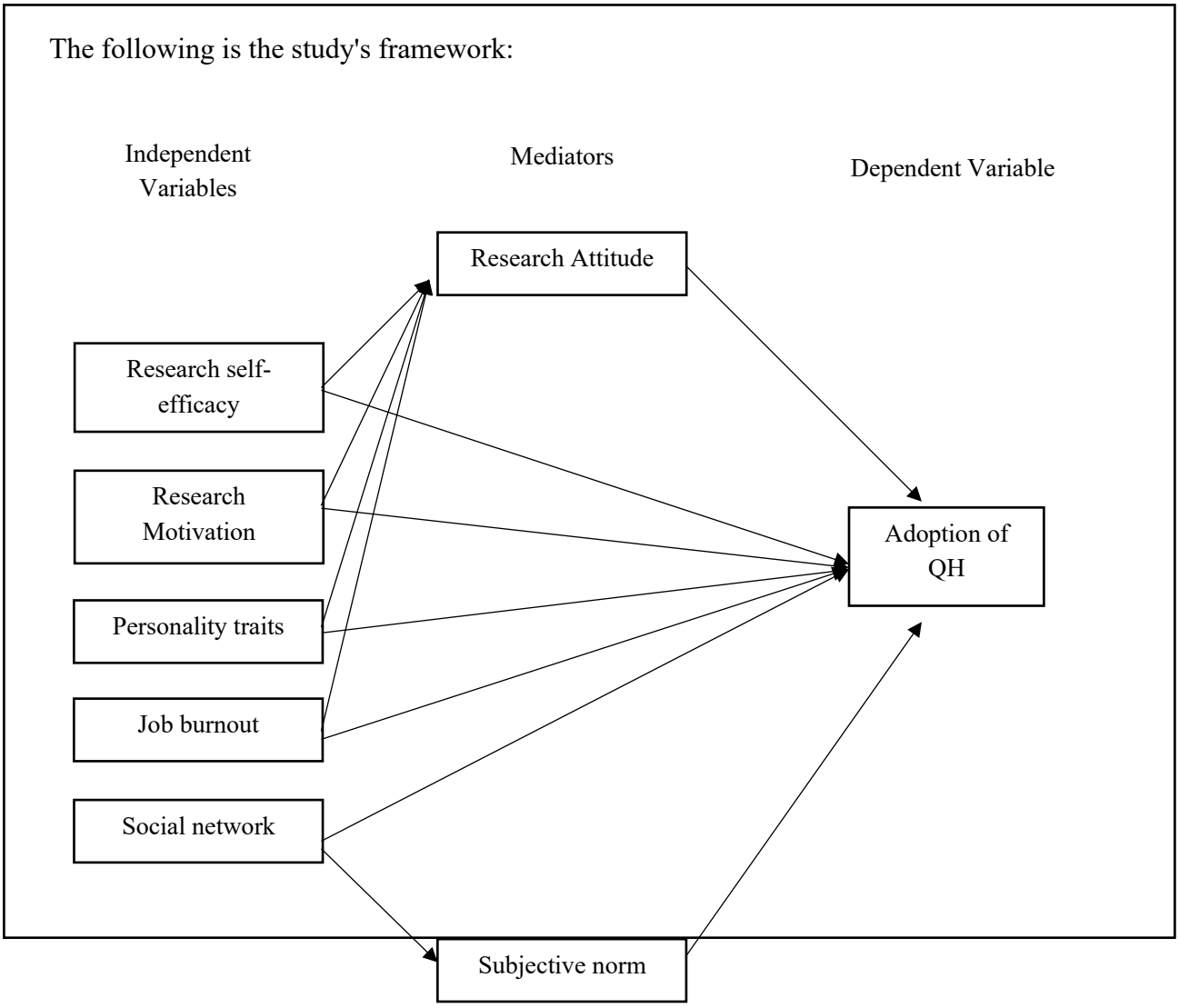

Figure 1 Conceptual framework

Conclusion and Future Research

This academic behavior study examined the variables influencing academics in Malaysia IHL to promote and widely adopt QH as a new research and innovation ecosystem (MOE). This conceptual paper is the first part of the research. It summarizes the research problem, defines the research questions and hypotheses to test, and reviews the literature relevant to the significant

areas of behavior as suggested by theories such as self-efficacy theory, expectancy theory of motivation, big five personality theory, and Maslach job burnout theory.

Additionally, the quadruple helix notion is examined. Subsequent papers developed from this research will further detail the methodology employed, the survey instruments and execution, the findings, and the management implications of this research. The findings of this study will assist the local IHL and government in further developing their innovation landscape strategy to address the issue of low QH engagement among academics from IHL, as this is one of the efforts to support the country's economic growth through an innovation-driven strategy.

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