THE MODERATING EFFECTS OF PSYCHOLOGICAL EMPOWERMENT ON JUNIOR LECTURERS' TECHNOLOGY COMMERCIALISATION INTENTION.

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For my loved ones at home and all educators who taught me right from wrong**.**

Dr. Norhadilah Binti Abdul Hamid

My dear Dr. Norhadilah, without your early inspiration, coaching and enthusiasm, none of this would happen. As an expression of gratitude, I beg to dedicate it to your name.

Dr. Lee Te Chuan

As an expression of gratitude to your name.

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Hope that my beloved friends can enrich knowledge and skills to gain huge success in future

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ABSTRACT

Nowadays, Malaysia faced the landscape of university technology commercialisation still in development phase, which should put huge of efforts and attentions. Even though the importance of university technology commercialisation was acknowledged, the comprehension on factors that influencing technology commercialisation intention particularly of junior lecturers group remained limited. Hence, this study aimed at identifying the influential determinants of junior lecturers' technology commercialisation intention and determining moderating effects of psychological empowerment toward relationships among them. On the basic of literature review, Theory of Planned Behaviour (TPB) and psychological empowerment theory were adopted as theoretical foundations of this study. The data of this quantitative research were collected by mail survey questionnaire, which based on purposive sampling and minimum of 102 responses. As the data analysis using the Statistical Packages for the Social Sciences (SPSS) was conducted with prior, then proceeded to Partial Least Squares Structural Equation Modelling (PLS-SEM). The research findings revealed the positive effects of personal attitude and perceived behavioural control on technology commercialisation intention, except for subjective norm. Nevertheless, psychological empowerment was had significant moderating effect on relationship between subjective norm and technology commercialisation intention, but did not show on the other two relationships. In consequence, these research findings were important to clarify technology commercialisation intentions of junior lecturers, thereby could boost continuous improvements for technology transfer in public universities.

ABSTRAK

Hari ini, Malaysia berdepan dengan landskap pengkomersilan teknologi universiti yang masih di dalam fasa pembangunan dan memerlukan usaha dan perhatian yang banyak. Walaupun telah diakui pada kepentingan pengkomersilan teknologi universiti, namun pemahaman mengenai faktor-faktor mempengaruhi niat pengkomersialan teknologi terutamanya dalam kalangan kumpulan pensyarah muda masih dilihat terhad. Oleh itu, kajian ini bertujuan untuk mengenal pasti pengaruh niat pengkomersilan teknologi pensyarah muda dan mengenal pasti kesan moderasi penguasaan psikologi terhadap hubungan antara pemboleh ubah tersebut. Berdasarkan kajian literatur, *Theory of Planned Behaviour (TPB)* dan teori penguasaan psikologi telah diadaptasi sebagai teori asas bagi kajian ini. Di samping itu, data penyelidikan kuantitatif ini telah dikumpulkan melalui kaedah soal selidik mel yang berdasarkan persampelan purposif dan paling rendah pada 102 maklum balas. Oleh kerana analisis data melalui *Statistical Packages for the Social Sciences (SPSS)* adalah dijalankan dengan sebelumnya, maka teruskan kepada *Partial Least Squares Structural Equation Modelling (PLS-SEM)*. Hasil dapatan kajian ini mendapati terdapat kesan positif dari sikap peribadi dan kawalan sikap (*perceived behavioural control)* terhadap niat pengkomersialan teknologi, kecuali norma subjektif. Namun penguasaan psikologi juga mempunyai pengaruh moderasi yang signifikan terhadap hubungan antara norma subjektif dan niat pengkomersilan teknologi, sebaliknya tidak menunjukkan pada hubungan terhadap dua pemboleh ubah yang lain. Akhirnya, hasil kajian ini adalah penting untuk menjelaskan niat pengkomersialan teknologi pensyarah junior, supaya dapat meningkatkan penambahbaikan yang berterusan terhadap pemindahan teknologi di universiti awam.

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LIST OF ABBREVIATIONS

AVE	-Average Variance Extracted
CB	-Covariance Based
EPU	-Economic Planning Unit
GDP	-Gross Domestic Product
GERD	-Gross Expenditure of Research and Development
GRI	-Government research institutes
IHL	-Institute of Higher Learning
KBV	-Knowledge Based Entrepreneurship
MASTIC	-Malaysia Science and Technology Information Centre
MEE	-Model of Entrepreneurial Event
MITI	-Ministry of International Trade and Industry
MOSTI	-Ministry of Science, Technology and Innovation
NPSTI	-National Policy of Science, Technology and Innovation
PBC	-Perceived Behavioural Control
PE	-Psychological Empowerment
PLS	-Partial Least Squares
RBV	-Resource Based View
R&D	-Research and Development
RMK	-Malaysia Economic Plan
SEE	-Shapero's Entrepreneurial Event
SEM	-Structural Equation Modelling
SLR	-Systematic Literature Review
SMEs	-Small and Medium Enterprises
SPSS	-Statistical Packages for the Social Science
STIE	-Science, Technology, Innovation and Economic
TPB	-Theory of Planned Behaviour

TRA	-Theory of Reasoned Action
TPB	-Theory of Planned Behaviour
U&G	-Uses and Gratifications
UNEP	-United Nations Environment Programme
UPM	-University Putra Malaysia
USA	-United States of America
UTHM	-University Tun Hussein Onn Malaysia
UTM	-University Technology Malaysia
VIF	-Variance Inflation Factor
WIPO	-World Intellectual Property Organization

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CHAPTER 1

INTRODUCTION

1.1 Research background

Competitive growth had forced each country to place foresight on commercialisation, which aimed at gaining economic dominance (Kusumaputri & Isnasari, 2016; Min, Kim, & Vonortas, 2020). Based on Bandarian (2007), commercialisation is defined as a transition process from human ideas of innovative or technology concept to marketplace thereby fulfilling public demand as well. In other words, this transition process could be emphasised as 'from laboratories to company' (Balachandra & Friar, 1997) or 'from R&D sector to industry' (Ghazinoori, 2005). The meaning of commercialisation in this study refers to converting 'technology' into a position that led to financial profits (Siegel, Hansen, & Pellas, 1995). Obviously, technology was the core term and subset of commercialisation, which also engaged with innovation in order to create new product and service. Han (2017) also defined the technology commercialisation process as encompassing numerous original translation into market. As a consequence, it is not a simple linear process and required specific skills in product development, domain knowledge, market assessments, networking and patenting (Mom, Oshri, & Volberda, 2012).

Technology commercialisation allowed research and invention to turn into valuable market products; thus it was essential in the economic and social development process (Seif *et al*., 2019). Not only that, an effective commercialisation process enabled the survival of small ventures and firms in a dynamic business environment. This is because it was driven by market and revenue

motives so firms could seek commercial potential of investment on technology transfer that gained positive returns (Jefferson *et al.*, 2018). According to Datta, Mukherjee, and Jessup (2019), the major key of entrepreneurial success was technology commercialisation, which led several kinds of innovation activities in each field. For example, Korea had fully supported Research and Development (R&D) activities by accelerated fund and source investments (Kim *et al.*, 2019). Moreover, even some of the technologically advanced countries such as the USA, China and Australia had achieved 5G technology commercialisation, which built rapid growth for them (Hutajulu *et al*., 2020; Zemlickien & Turskis, 2020). Successful technology commercialisation created huge economic improvement and obtained global competences at the same time.

Due to the significant importance of university technology commercialisation so it had became a prominent of study issue in global stage (Peter *et al*., 2021; Mintardjo, 2022). For the achievement of successful commercialisation was under the high demand of further and depth investigation. Consequently, the existing study should be care about this research issue, which focus on drivers of technology commercialisation in Malaysia. Indeed, the low of commercialisation rate was one of major research issues in this study. As the crucial status faced by the Malaysian government is that there is still not much evidence on the remarkable improvement of university technology commercialisation. For instance, the commercialisation rate that targeted in Malaysia's Eleventh Economic Plan (2016-2020) is 5%, but the currently rate still dropped at 2.1% (Ragupathy, Baharin, & Turan, 2020). Not only that, the Malaysian Science, Technology & Innovation Indicators Report 2020 also recorded overall commercialisation rate of government funded R&D projects was 8% in 2015 whereas it was 9% in 2020, which noted as almost unchanged along five years of period (MOSTI, 2021a). Hence, a ideal solution of this research issue was followed by the necessity for empirical studies in order to provide specific and useful knowledge about strategies of increase technology commercialisation rate.

In general, the primary sources of technology commercialisation were institutions of higher education such as colleges, university colleges and universities, which merged fundamental technology commercialisation with individual knowledge (Yahaya & Bakar, 2017). At the same time, Chatterjee and Sankaran (2015) also proved that one of the issues in technological innovation was commercialisation of university academic research. Therefore, the concerns of exploiting university

research outputs in either production or consumption activities deserve public attention (Sutopo, Astuti, & Suryandari, 2019). Technology innovation and commercialisation in university were categorised in various fields such as health sciences, engineering technology, information technology, social sciences, agricultural sciences and so on. Furthermore, the behaviour of academicians played a critical role in attaining successful university technology commercialisation. Berggren (2017) had claimed they were key individuals who conducted and participated in commercialisation activities of research and development (R&D), innovation and invention. At the same time, numerous studies such as Seif *et al.* (2019); Gur (2017); Neves and Brito (2020) and Zhao, Broström, and Cai (2020) also highlighted that behavioural intention of academicians was able to influence technology commercialisation rate in universities. The study on technology commercialisation intention among academicians dealt with individual psychological characteristics and personality traits such as motivation (Backs et al., 2019), risk propensity and self-discipline (Fini *et al.*, 2018). This was confirmed by Hmieleski and Powell (2018), which indicated the most important criterion of emerged appropriate value on university technology commercialisation was personal psychological foundation among academicians. For instance, the psychological empowerment of academicians was one of the measures that predicted technology commercialisation intention.

Past studies by Backs et al. (2019) and Wahab et al. (2020) proved that individual age was also a noteworthy factor affecting orientation of academicians. For instance, the younger academicians were more easily motivated by research rewards than older academicians, because they aimed to strive for high income (Backs *et al*., 2019). The Malaysian government, however, faced critical issues such as low of research productivity from young researchers. Based on annual report by Malaysian Science and Technology Information Centre (MASTIC) it was realised that the intake number of work force was inconsistent with research outputs among university academicians. To interpret, the number of researchers per 10,000 labour force was 59, but the country's commercialisation rate was placed between 5 to 10 per cent in 2018 (MASTIC, 2019). It contributed to fault on sustainable technology transfer and development in a country. Therefore, the primary task of present study is to identify the factors influencing technology commercialisation intention among junior lecturers in Malaysian public universities. Moreover, this research adopted the

Theory of Planned Behaviour (TPB) and psychological empowerment theory as the foundation of conceptual framework to examine the key factors influencing junior lecturers' technology commercialisation intention and moderating relationships among them. Both theories included many significant variables that will be detailed in the literature review. In a nutshell, the changing attitude of junior lecturers toward technology commercialisation depended on their behavioural intention.

A recent study by Zemlickien and Turskis (2020) had claimed that innovation played the basic role toward sustainable knowledge and contemporary economy in any country. Therefore, the author suggested that universities could make efforts in emphasising creative and innovative ideas, then provide facilities and bridge novel outcomes to market accordingly. Overall, raising technology commercialisation intention among junior lecturers was essential for assisting economic growth, creating job opportunities and building high quality of social life.

1.2 Problem statement

In Malaysia, most universities had not been active in technology commercialisation activities if compared to other Asian countries such as South Korea, Japan and Singapore (Ali & Leman, 2017; Sharif & Ramli, 2019). One of the main reasons was that these Malaysian universities faced lack of capital sources to enhance technology commercialisation activities. For instance, Sharif and Ramli (2019) had noted low funding of pre-seed on university technology commercialisation caused failure in boosting academicians' intention at the prior stage. Hence, this problem may have significant influence on university lecturers especially among young academicians as they would not be interested in technology commercialisation from the beginning of work.

The next research problem was high dependence on foreign technology imported from other industrialised countries. It also concerned technology commercialisation intention of academicians because of this reduced the requirement to engage in commercialisation of own research outputs. Moreover, Bloom, Draca, and Reenen (2020) had proven that there was no significant effect of import competition on human innovation intention. Therefore, the main objective of the National Policy on Science Technoogy and Innovation (NPSTI) was generating national technology independently through commercialisation of R&D outcomes

from universities (MOSTI, 2021b). Indeed this prospect was consistent with the objectives of present study, which determined factors influencing technology commercialisation intention among junior lecturers in Malaysian public universities.

Previous scholars had claimed that current trends, whereby universities were struggling to connect with industry and market need, so caused the loss of commercial value on innovation products and paved the way for cultivating intention (Seif *et al*., 2019). For example, the Ali and Leman (2017) study illustrated university R&D put major attention on education of specialised knowledge rather than invention of new products in engineering based industries. In addition, the rising numbers of patents were misaligned with the number of technology outputs commercialised by lecturers and academic staff (Wahab, Suffian, *et al.*, 2020). This problem was believed to affect progress of Malaysian university R&D outcomes, also less encouraged it when it came to the commercialisation stage.

Not only that, unclear orientation on young researchers among university technology commercialisation was also considered as another problem in this study. It was attributed to poor commercialisation culture and improper training given to young researchers in universities (Xuyen, Huong, & Huong, 2020). Two of past studies by Ramli, Majid, and Badyalina (2021) and Beyadar et al. (2021) mentioned that universities should determine orientation of young researchers on technology commercialisation through work culture such as the need to prepare for market collaboration instead of traditional roles. Furthermore, some universities took more consideration on lecture performances of young academicians (Ismail & Sidek, 2019). As a result, junior lecturers would lose technology commercialisation intention gradually; this enhanced the importance of carrying out this study.

Even though the importance of university technology commerrcialisation had been emphasised by scholars, it still appeared that few studies investigated academicians' attitudes and perceptions. So far, there was little discussion on the relationship between determinants and junior lecturers' technology commercialisation behavioural intention. Based on results of systematic literature review, only 35 articles among a total of 178 articles (20%) discussed academicians' intention on university technology commercialisation. The deficiency of information from past studies may cause passive attitude toward conducting technology commercialisation among junior lecturers. Additionally, the author was realised another research gap through literature review on Malaysian past studies, which

identified research respondent as university's academicians who considered to large community. For instance, Rashid, Al-kake, and Othman (2019) was determined all academic staff as research respondent, whereas Wahab et al. (2020) was determined all categories and fields of lecturer as research respondents. Due to the general or wide range of research respondents will cause research bias such as time consuming, high cost and inaccuracy of outcomes (Pilot & Hunger, 1999, p. 37). In consequence, the author attempted to specific research respondent on junior lecturer who less than five year of working experiences. This research context will desire to resolve gap and obtain efficient outcomes on technology commercialisation intention of junior lecturer in Malaysian public universities.

Nevertheless, former studies that investigated the relationship between determinants and academicians' commercialisation intention have produced mix and conflict of results. Hence, it was reflected a critical of research gap that doubt on actual force of academicians' commercialisation intention. According to results of meta analysis had found that eight articles among total of twelve articles (67%) exposed significant results, but the strength level of majority determines that based on the correlation coefficient, R were considered as very weak, weak and moderate (see in table 2.4) Furthermore, the overall mean of R^2 on relationship between determinants and academicians' technology commercialisation intention was 0.23, which is also categorized in weak level (see in table 2.5). For example, both of past studies by Passaro et al. (2018) and Farrukh et al. (2019) indicated that attitude influenced academicians' technology commercialisation intention, but the strength level of those relationships were low. This situation may due to the exclusion of mediators or moderators in research design (Baron & Kenny, 1986). In order to address this research gap, the author included psychological empowerment (PE) theory as the basis of framework and moderating variable in current study for more comprehensive review. Last but not least, psychological empowerment that encompassed four cognitions (competency, meaning, impact and self-determination) were desired to boost the strength of relationship between attitude, subjective norm, perceived behavioural control and junior lecturers' technology commercialisation intention.

To sum up, the present study was developed in response to those gaps in studies which examined the relationship between determinants and junior lecturers' technology commercialisation intention.

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VITA

The author was born on 7th November, 1996 in Batu Pahat, Johor, Malaysia. She attended SMK Dato Syed Esa for her secondary school and SMK Tinggi Batu Pahat for one and half years of pre-university study. She had sat four (4) national examinations examined by the Malaysian Examination Syndicate. They are the Primary School Evaluation Test that known as *Ujian Pencapaian Sekolah Rendah* (UPSR) in 2008, Lower Secondary Assessment (commonly abbreviated as PMR) in 2011, Malaysian Certificate of Education (also known as SPM) in 2013 and Malaysian Higher School Certificate (commonly abbreviated as STPM) in 2014 subsequently. Beside, she participated actively in curriculum activities thereby she had joined the St. John Ambulance while in primary and secondary school. In order to apply for admissions in public university, she also took the Malaysian University English Test (MUET). In 2020, she received her Bachelor Degree of Technology Management (Production and Operation) with First Class Honours in University Tun Hussein Onn Malaysia (UTHM) After that, she continued her study and pursued to Master Degree of Science in Technology Management, also in UTHM. During this time, she was a research assistance with project entitiled 'Determinants of Junior Lecturers' Technology Commercialization Intention', which also supported by the UTHM under Post-Graduate Research Grant (GPPS) of Vot H720. Not only that, she was attended a few of statistical software of workshops such as Statistical Package for Social Sciences (SPSS) and SmartPLS, so desire to enhance skill of data analysis for research works. Last but not least, she had first-authored two papers in areas of social science and technology management respectively. Hence, she have board interest in science and technology, which particularly of technology transfer and commercialisation within next five years of future studies.