

University Startup Framework for Intellectual Property Rights (IPR) Commercialisation: A Qualitative Study

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Abstract

The aim of this paper is to propose a study on how to improve the commercialisation success rate of Intellectual Property Rights (IPR) while sustaining technology development during the Valley of Death by university startups in Malaysia. Even though the Malaysian government has put enormous efforts in accelerating commercialisation of IPR particularly those originated from the public universities, the commercialization success rate is only 8%. This study will use the combination of autoethnography and case study methodology to answer the research questions and confirm the proposed theoretical framework. This paper also discusses the critical success factors of university startups and presents a theoretical framework for university startup ecosystem, which integrates strategies to sustain technology development during Valley of Death and to increase the commercialisation success rate of university startup.

Keywords: University startup, Intellectual Property Rights, R&D Commercialisation, Malaysia

1.0 INTRODUCTION

1.1 Intellectual Property Rights (IPR) Commercialisation

As Malaysia is shifting from manufacturing and export-oriented economy towards knowledge-based economy, the commercialisation of Intellectual Property Rights (IPR) particularly from public universities has been one of the country's important agenda for sustainable economic growth. University startup has been one of the most effective commercialisation vehicles to support knowledge driven economy based on research and innovation (Boh et al., 2016; Bezanilla et al., 2020; Prencipe et al., 2020). As Malaysia is going towards becoming high income nation driven by innovation, one of the country's agenda is to build a productive commercialisation ecosystem (OECD Reviews of Innovation Policy: Malaysia, 2016). Since the last 10 years, some local universities have attempted to setting up university incubators to grow university spin offs or startups in order to commercialise Research and Development (R&D) products on their own (Othman & Mat Jalaluddin, 2018). However, in contrast to high number of Intellectual Property Rights (IPR) produced by the universities, the commercialisation success rate is still basically very low. It is reported that commercialization rate of publicly funded research projects was only 8% as reported in 9th Malaysia Plan (Malaysia STI Indicator Report, 2016; OECD Reviews of Innovation Policy: Malaysia, 2016). This issue has also been highlighted in local Malaysian newspapers. Zaidan & Sobry (2014) wrote an article in Berita Harian entitled "R&D Syok Sendiri" highlighting that less than two percent from 27,449 of research outputs from 15 public universities has been successfully commercialized in five to 10 years' period. Surprisingly, Malaysia is a net importer of IPR, with royalties paid amounted to USD 1.42 billion and received USD 101 million in return in 2013. Another indication that Malaysia acquired even more foreign technology was portrayed by the increasing gap between payments and receipts since 2009 (OECD Reviews of Innovation Policy: Malaysia, 2016). Therefore, there must be underlying reasons behind the phenomena of low commercialisation rate of IPR originated from the local universities. This study intends to explore this

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phenomenon in-depth and ultimately proposes a comprehensive solution to tackle this issue in the light of university startup creation.

University startup creation is vital to attract external venture capitalists to explore commercial viability of technologies produced by universities. Besides that, potential and commercial viability of technologies derived from university's R&D activities can be verified through university startup creation (Baycan & Stough, 2012). In the case of Malaysia, low commercialisation rate of IPR from the universities is highly associated with industry-academia gap (Ali et al, 2017; Ismail & Mohamed, 2016). This situation is also prominent in other developing countries, such as in Africa (Abereijo, 2015). Chandran et al. (2014) and Heng et al. (2012) highlighted the collaborative activities can benefit both if deliberate and effective efforts in reducing the R&D mismatch are made between the universities and industry. Based on finding by Chandran et al. (2014), poor collaboration rate between industry and universities caused the universities to produce R&D products that were not solving industrial problems, thus lead to low commercialization rate of the R&D innovation. As a results to low collaborative effort between the universities and industry, the universities try to remedy the situation by establishing their own startups within the university ecosystem to tackle the issue of low commercialisation rate.

Supported from four angles which are; i) issues and challenges in IPR commercialisation from academic researchers' perspectives (Kamaruddin & Samsuddin, 2013; Chandran et al, 2014; Ismail & Mohamed, 2016; Anuar et al, 2018; Ting et al., 2019), ii) issues and challenges in IPR commercialisation from the perspective of industry (Ali et al., 2017), iii) Business Model Canvas (BMC) and Lean Model Canvas (LMC) did not fully represent university startup ontology (Osterwalder, 2004; Maurya, 2012), and iv) the author's personal experience in co-founding and building a university startup, therefore, there is a need to increase the success rate of university startup as commercialisation vehicle to accelerate knowledge-driven economic development. By using qualitative approaches, this study intends to answer the main research question: How to increase the commercialisation success rate of Intellectual Property Rights (IPR) while sustaining technology development during the Valley of Death by university startup in Malaysia?

2.0 PROPOSED THEORETICAL FRAMEWORK

2.1 Critical success factors of university startup

Establishment of university startups has shown to create positive impacts in term of economic, social, as well as innovation and knowledge transfer process. Malaysia has been trying to emulate success stories shown by university research parks such as Silicon Valley (Stanford University) and Harvard Innovation Lab (Harvard University). In term of economic impact, Silicon Valley and Harvard Innovation Lab were the classic examples of how technology based startups contributed to economic development through knowledge-driven economy (Smith & Ho, 2006; Wonglimpiyarat, 2009). Skute (2019) reported that the top 10 countries with the highest number of publications in academic entrepreneurship are developed and high income nations: USA, England, Italy, Spain, Germany, Belgium, Sweden, Norway, and Netherlands. In term of social impact, academic entrepreneurship also leads to job creation. Post-graduate and post-doctoral students were the potential founding teams of the startup since they were equipped with technical knowledge about the technology and eager to learn entrepreneurship and business skills (Boh et al., 2016). University startup creation has also stimulated innovation and knowledge transfer process. A study by Barbieri et al. (2018) showed that there was a positive possibility of academic researchers in Italy to collaborate, co-publish, and co-patenting with other firms once they created their own startup. In addition, Chandran et al. (2015) highlighted that academic researchers that have been exposed to commercialisation concepts and activities tend to do R&D in applied research which is more relevant towards industrial applications.

Most of the articles found on critical success factors of university startups are in the context of developed countries. By analysing 120 institutions in the US *via* Carnegie Classification System, Powers et al. (2005) investigated the effects of resource sets on two university commercialisation activities: the number of start-up companies formed and the number of initial public offering (IPO) firms to which a university had previously licensed a technology. Powers et al. (2005) concluded that university financial, human capital, and organizational resources were found to be significant factors for the formation of university start-ups and/or successful licensing to IPO firms. However, study by Powers et al. (2005) only focus on three aspects involving the university as stakeholders - which are in term of financial, human capital and organizational resources (Technology Transfer Office (TTO)) and not on other stakeholders which made up the whole ecosystem of university start-up framework.

In the context of Italy, Parmentola & Ferreti (2018) stated that the development of university spin-off has always been dynamics. Challenges and barriers faced by a university spin-off are varied based on different stages of spin-offs development. Critical success factors in university startups realization include the excellent scientific and entrepreneurial experience of founders, committed and dynamic founding teams, supportive university's incubation infrastructures, potential market demand, and existence of venture capitalists. This proposed study supports the finding by Parmentola & Ferreti (2018) and will take into account the success factors or determinants of university spin-off creations which are the excellent scientific and entrepreneurial experience of founders, committed and dynamic founding teams, supportive university's incubation infrastructures, potential market demand, and existence of venture capitalists. However, the study by Parmentola & Ferreti (2018) was based on university startups in Italy, which is a developed country. As this proposed study focuses on developing framework for developing country, some of the findings by Parmentola & Ferreti (2018) may applicable to be tested in different context. This proposed study will also examine the success factors or determinants of university startup creations outlined by Parmentola & Ferreti (2018), which are the excellent scientific and entrepreneurial experience of founders, committed and dynamic founding teams, supportive university's incubation infrastructures, potential market demand and existence of venture capitalists.

Muscio et al. (2016) studied the effects of university rules on startup creation based on case of academia in Italy and found out that monetary incentive has the most significant effect on encouraging academic startup activity. Based on the study, Muscio et al. (2016) concurred that there were three classes of institutionally-defined rules that can encourage the academic researchers to create a startup companies, which were general rules and procedures, rules regulating monetary incentives, and rules related to entrepreneurial risk. Berbegal-Mirabent et al. (2015) conducted a study to examine factors related to the creation of university startups and stated that lack of entrepreneurial culture could refrain attempts to encourage academic entrepreneurship and dilute any positive effects of startup investment and program. In the study, Berbegal-Mirabent et al. (2015) classified university startups into three categories: i) startups with support from the university's Technology Transfer Office (TTO), ii) startups that licensed IPR from the university, and iii) startups with TTO or university hold equity. The mechanisms include technology transfer activities that support university startups, normative framework, support infrastructures (business incubators & science parks), and TTO staff's specialist technical skills. Study by Berbegal-Mirabent et al. (2015) was nevertheless limited to Spanish universities context. In addition, a quantitative study in the context of Spanish universities by Bezanilla et al. (2020) highlighted influencing factors in determining entrepreneurial university, that were management team and organisational design were positively associated with training and research processes. The 13 influencing factors studied were: legal and administrative context, business and organisational context, entrepreneurship funding, training in entrepreneurship for faculty staff, inclusion of professionals, mission and strategy, policies and procedures, support from the management team, organisational design, training and research in entrepreneurship, extra-curricular training, active methodologies, and internationalisation.

2.2 The need for a university startup ecosystem

University startups in Malaysia has to be supported by a dynamic ecosystem of various stakeholders from both academia and entrepreneurial for further technology development during commercialisation process of the IPR. Transferring the technology is a sequential process involving steps of adaption and utilization that may change the technology into something that is more market-fit compared to the original technology invented. There is a huge gap between laboratory demonstration or lab prototype and commercial utilization (Goldhor & Lund, 1983), which is also termed as the Valley of Death (Fig. 1). Many inventions when they are licensed to startups, most of them are at the early stage of development, and were prone to fail particularly when crossing the Valley of Death phase. Nine out of ten startups failed in the first five years of creation (Blank, 2013; Cantamessa et al., 2018). Reason of the failure includes lack of product development during the Valley of Death (Osawa & Miyazaki, 2006). The difference between university startup and other technology startups launched outside of university is the complex interaction and bonds between university as parent organisation, directors and shareholders which highly consist of academic researchers and entrepreneurs. Inability to form balance and dynamic interactions between the stakeholders involved in university startup creation is one of the major reasons contributed to high failure rate of university startups (Shahidan et al., 2019).

2.3 Proposed university startup framework as an output of conceptual studies

Proposed framework for this study is based on interactive qualitative research design by Maxwell (2005). This model of research design consisted of five components which targeting different set of issues to ensure the coherence of the study. The five components are i) goals of the research, ii) conceptual framework, iii) research questions, iv) methods, and v) validity. Maxwell (2009) stated that conceptual framework for a study is the system

of concepts, assumptions, beliefs, expectation, and theories that supports the research. A conceptual framework “explains, either graphically or in narratively the main things to be studied – the key factors, concepts or variables – and the presumed relationship among them” (Miles and Huberman, 1994). Maxwell (2009) highlighted that labelling conceptual framework as “literature review” is dangerously misleading term as it will only lead the researcher to focus narrowly on “literature” and overlooking other conceptual resources including unpublished work, communication with other researchers, own experience and pilot study. Fig. 2 illustrates the contextual factors influencing a research design that will be adopted for this qualitative study.

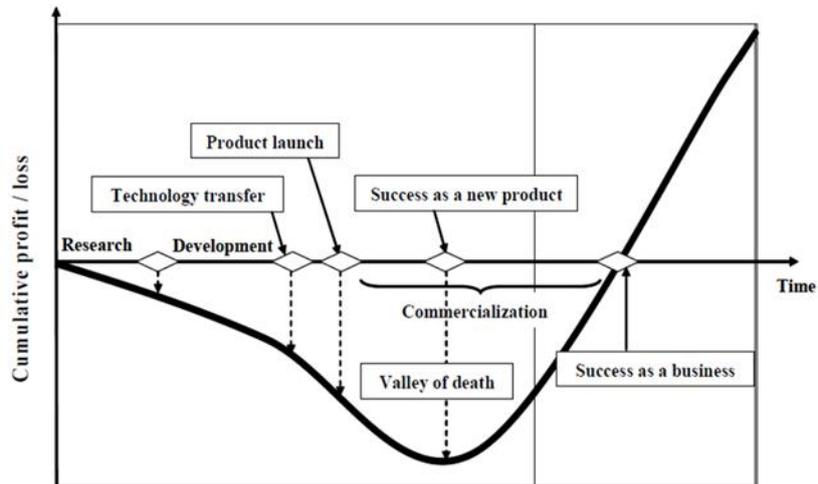


Fig. 1: Overall Process from Research to Commercialization
 (Source: Osawa & Miyazaki, 2006)

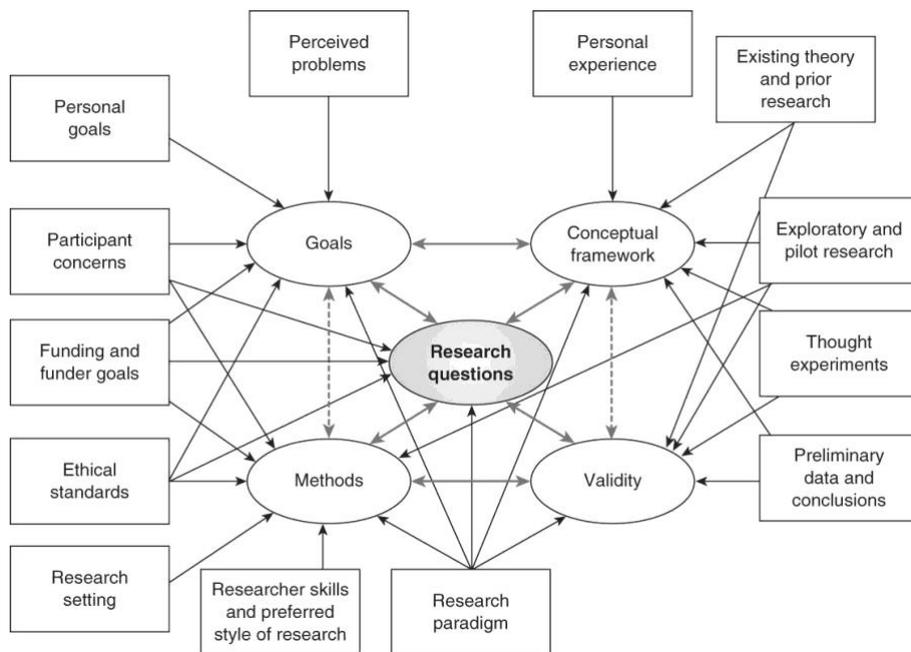


Fig. 2: Contextual factors influencing a research design
 (Source: From Qualitative Research Design: An Interactive Approach, by J.A. Maxwell, 2005. Copyright by SAGE)

Maxwell (2005) stated that the development of conceptual framework for qualitative study is influenced by the researcher's personal experience, existing theory and prior research (literature review), exploratory and pilot research, thought experiments and preliminary data and conclusion. For this proposal, the proposed framework for this study is only based on the author's personal experience, thought experiments, and literature review since the author is not yet collected any data and performed pilot study. Fig 3 shows the proposed framework of this study. This framework will be consistently strengthened as data collection and analysis take place as well as inputs from the literature.

The author's professional experience was important in shaping the topic of this research, therefore this connection will be briefly explained. The author "brackets herself out of the study by discussing personal experiences with the phenomenon" (Creswell & Poth, 2018). The author left her startup at the end of July 2019 of which she had been working on since August 2013. The author co-founded a biotech startup under one of local research university's incubation hub. The focus of her activity has always been on innovation and commercialization of Intellectual Property Rights (IPR) from the university while growing her startup into a sustainable business. While working on the startup, the author also involved with product R&D for the licensed patents, as the product development was continued concurrently with commercialisation effort. Based on her own entrepreneurial journey, she learnt that there are a lot of issues that hinder the success of university startups which include the researcher's mindset, attitude, and commitment as well as researcher's understanding in taking responsibility as a director and shareholder of a company.

Based on the author's experience, there is no prevailing policy, framework or even guidelines to balance the authority of an academician and to protect the legal rights of entrepreneurs in a university startup. Shahidan et al. (2019) reviews issues and challenges of IPR commercialization from the perspective of academic researchers and industry, issues related to university startup in the context of Malaysia, and the need for a university startup framework for commercialization of IPR. Even though the university startup may raise sufficient funding for the business, other factors such as lack of team work, poor corporate governance, ambiguous IPR technological feasibility and commercial viability, and inconsistency of university policy and enforcement were some factors observed by the author that contributed to university startup failure. The author has also observed other issues related to university technology transfer office (TTO) in term of IPR licensing, support from university's top administration, and incubator management. The insights from her entrepreneurial journey were complemented by continuous interactions and learning on developing startups by fellow entrepreneurs, venture capitalists, university technology transfer officers and business trainings outside of university for the past six years. However, due to the lack of Standard Operating Procedures (SOP), guidelines and policy to be followed by the universities and startup entrepreneurs, large numbers of university startups failed to sustain as a business before they manage to cross the Valley of Death. Due to author's experience in co-founding a university startup, particularly technology based startup, the author has decided to embark on this study with the focus to increase the commercialisation success rate of IPR while sustaining technology development during the Valley of Death by university startup in Malaysia.

The proposed initial framework incorporates findings by Karaveg et al. (2016) that determined R&D commercialization capability criteria and its implications for project selection in the context of Thailand. Like Malaysia, Thailand is also an Asian country and a founding member of ASEAN, sharing the same context with Malaysia in term of developing country and emerging economic region's perspective. Karaveg et al. (2016) stated that most research institutes in Thailand focus on basic research, therefore, the R&D outcomes did not fit the industrial demand, which resulted in low rate of R&D commercialisation. Due to this scenario, there was a need to establish R&D commercialization capability criteria for Thailand. Karaveg et al. (2016) also highlighted on IPR evaluation based on its commercial competency, that IPR with commercialisation potential needs to be assessed based on order of significance as follows: marketing, technologies, finances, intellectual property, resources, and impacts. This framework also integrates findings based on study by Gbadegeshin (2018) on the concept of lean commercialization. Since Finland is one of the highly technology advanced countries today, there are likely some limitation factors to be considered when testing lean commercialization framework in the context of developing country. In the context of this study, lean commercialization could be one of the potential strategies to minimize university startup failure during the Valley of Death. Therefore, this study will adopt the concept of lean commercialization to be incorporated into the newly developed framework. Moreover, in between Phase I and II, this framework also incorporates Lean Market Validation (LMV), which requires startup founders to go out to the market and meet with their potential customers to validate the existence of market demand of the new technology (Maurya, 2012).

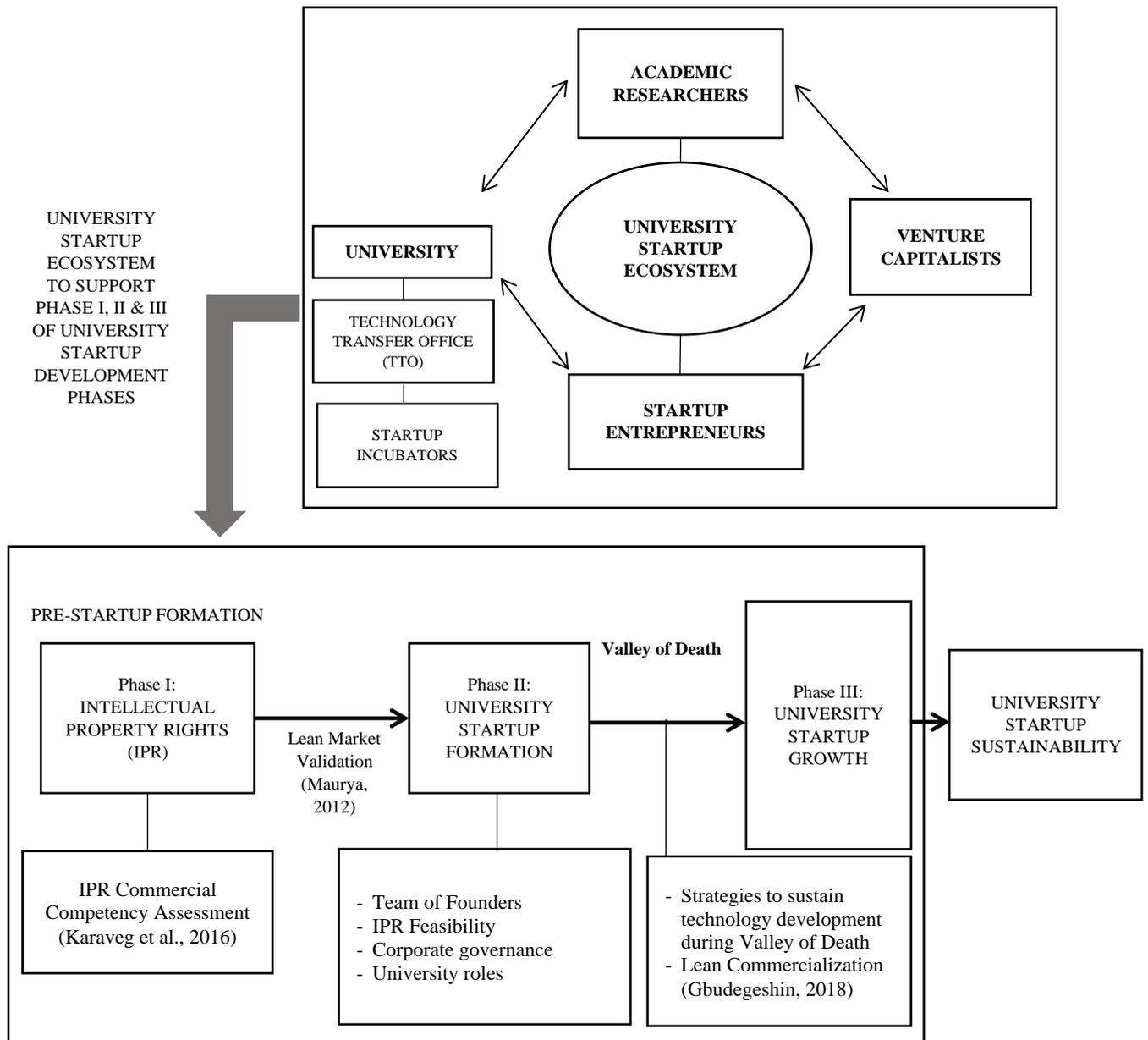


Fig. 3: Proposed Conceptual Framework (Source: Author's own elaboration)

3.0 METHODOLOGY

3.1 Justification for qualitative research approach

Based on the literature, most IPR commercialization related studies in Malaysia only discussed on commercialisation barriers and challenges either from the perspectives of academic researchers or the industry (Kamaruddin & Samsuddin, 2013; Ismail & Mohamed, 2016; Heng, 2012; Ali et al., 2017; Abdulrazak & Murray, 2017; Ismail et al, 2015). There were also studies on university-industry interactions which were conducted by Chandran et al. (2014) and Ting et al. (2019). So far, based on qualitative case study methodology, Ng et al. (2019) examined issues on university startup in Malaysia on the role of university incubators. Previously, Rahim et al. (2016) published a conceptual paper on role of university in providing support and infrastructure to support startups creation for university IPR commercialisation. By using keyword search “Commercialisation of R&D in Malaysia”, “University R&D Malaysia”, “University spin-off Malaysia”, and “University startup Malaysia” using Scopus, SAGE, ScienceDirect, SpringerLink, Emerald Insight, and Google Scholar, most of the publications found were conceptual papers and empirical studies that were done through qualitative approach. There is very

limited empirical data based on previous research conducted on university startup in Malaysia (Shahidan et al., 2019).

Qualitative methodology is underpinned by non-positivist ontology and interpretivist epistemology (Saunders et al., 2009). In the context of this study, the university startup phenomena in Malaysia is complex and far from being well-understood and studied. As the author has personal experience and practise in co-founding and building her own university startup for a period of six years, she understands that commercialisation culture is hugely affected by the local culture and norm. This phenomenon needs to be understood in depth and convert tacit knowledge of experiences, perceptions, and practise into explicit knowledge. In term of axiology, interpretivism allows the researcher to be a part of the research being studied, and being the key contributors to new knowledge contribution. In addition, as reported by Hossinger et al. (2019), geographical distribution of articles related to academic startups mainly originated from the European countries, followed by the US, and small number of articles were based in Middle Eastern and Asian contexts. In term of research method, most of the articles reviewed by Hossinger et al. (2019) adopted quantitative methods (74.61%), and only 41 articles (21.24%) used qualitative approach. In the early stage of academic entrepreneurship research, there is lack of statistics and reliable data, frameworks and theories for quantitative analyses. Hence, the use of qualitative method is more suitable to study the phenomena (Rothaermel et al., 2007). In the context of this study, since there is lack of empirical research on university startup in Malaysia, the use of qualitative approach is the most suitable approach to answer the research questions.

3.2 Research design

Emperical data will be collected through semi-structured interviews, content analysis, observations, and focus group discussion. Parmentola & Ferreti (2018) outlined the guidelines used for sample selections of their study. Samples selection for this proposed study, however, will be according to Malaysian context with some modifications: i) diverse representations of university startups from both Research Universities (RU) and Non-Research Universities in Malaysia, ii) focus on cases with enough track records/history from the pre-formation, formation, and other stages of university startup formation, and iii) ensure heterogeneity of the university startup from various technological backgrounds.

As the author is an active member of university startup community, she has the access for active engagement and interaction, and familiar with jargons and technical terms. By using purposive sampling, semi-structured interviews will be carried out with:

- i) selected university startups Chief Executive Officers (CEOs) and founders
- ii) selected academic researchers involved in university startup creations
- iii) selected venture capitalists that have given out supports (financial aids, mentoring, etc.) to university startups
- iv) selected staffs under university Technology Transfer Office (TTO) who have involved in IPR commercialisation

This study will be conducted by combining autoethnography and case study research methodology. Research design will be based on interactive research design by Maxwell (2005). Previously, when designing qualitative research, some scholars prefer to not adhere to any pre-determined structure and tend to start by exploring literatures and by observation. However, this is difficult as the context maybe too broad, and for a novice researcher, being “too loose” in term of research design is a huge disadvantage for those who just started doing research. Maxwell (2005) constructed interactive design for qualitative study with five components that are inter-related with each other, that was previously described in Fig 1. The proposed framework will be continuously amended to produce the finalized framework based on data obtained. The interactive research model design for this proposed study is illustrated in Fig 4, while Fig 5 shows the overview of methodology for this study.

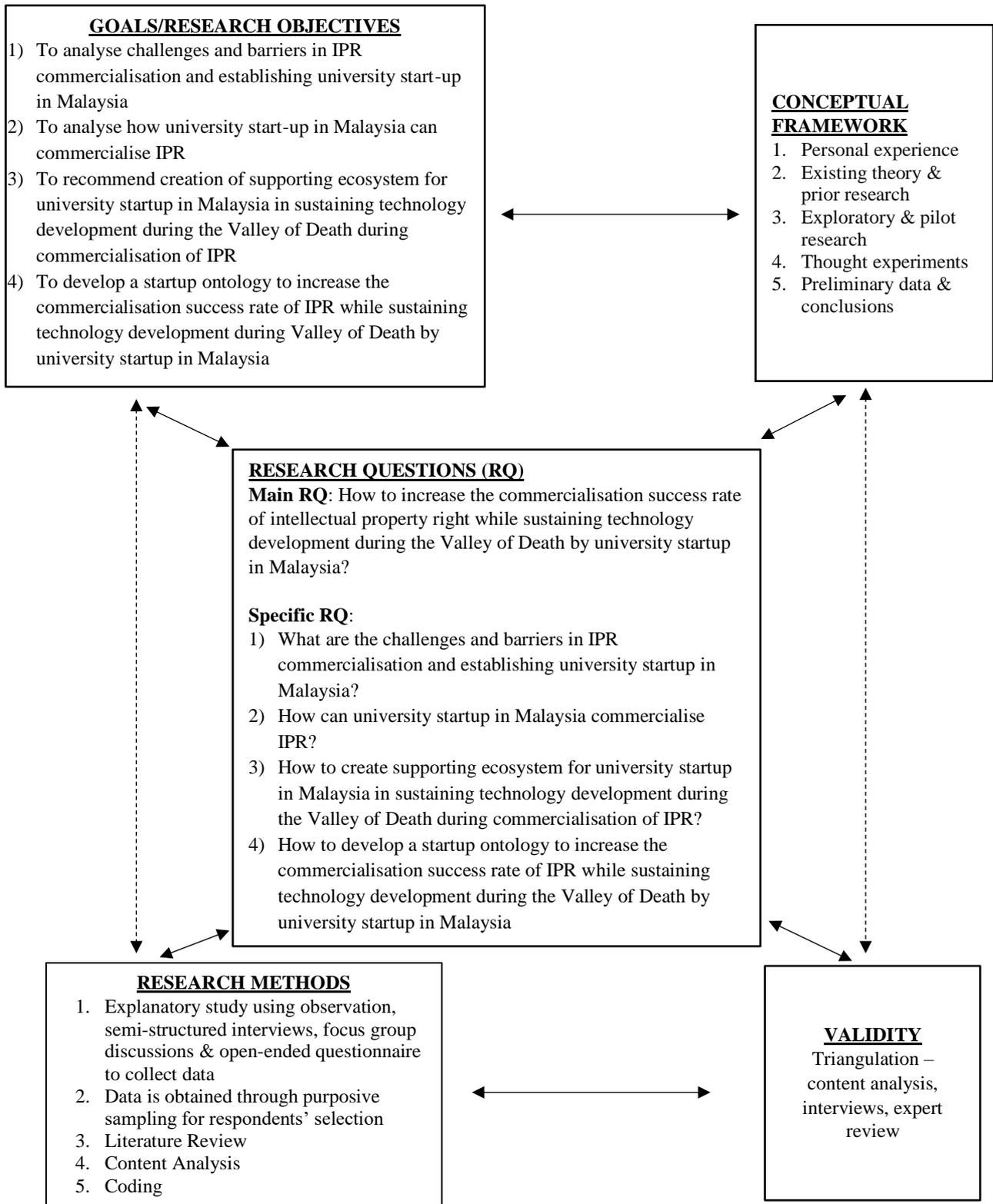


Fig. 4. An interactive model of research design for this study
 (Source: Author's own elaboration based on Maxwell, 2005)

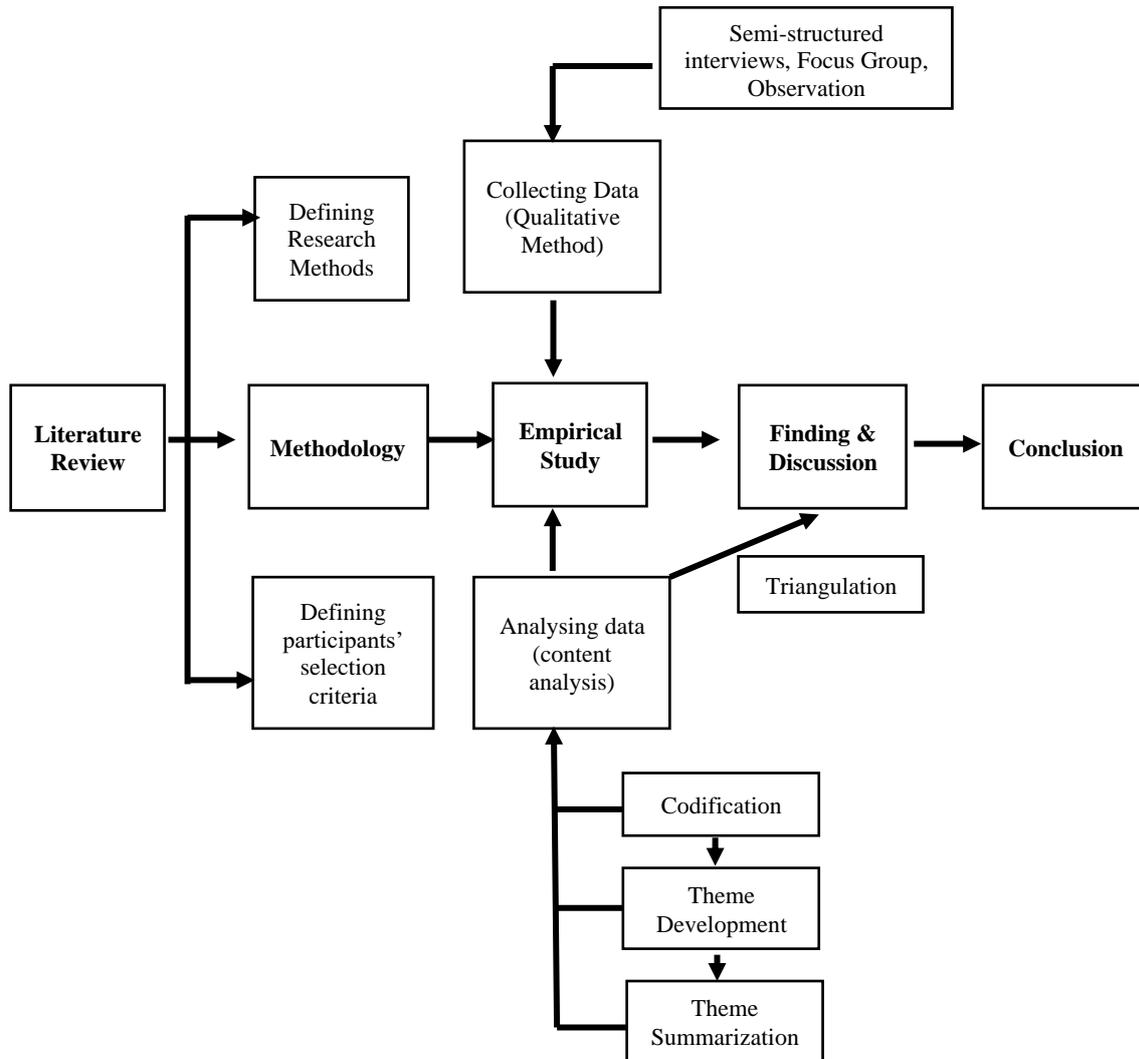


Fig.5: Overview of methodology for this study (Source: Own elaboration)

4.0 STRATEGIC MANAGERIAL IMPLICATIONS AND CONCLUSION

The findings of this study will be essential to enhance R&D Commercialization Policy (2009) developed by Ministry of Science, Technology & Innovation (MOSTI) of Malaysia and will be useful to provide guidance for the types of funding given by MOSTI to assist technology startups in crossing the Valley of Death and further developed their prototypes to be commercially viable. This research is conducted with the highlight to tackle issues related to United Nation's Sustainable Development Goals (SDG) especially fall under Goal 8: Decent Work and Economic Growth, and Goal 9: Industry, Innovation and Infrastructure, as creation and application of new knowledge through science and technology mainly has become one of the most crucial ingredients that drives the national and economic developments in recent years especially for ASEAN countries and developing countries in general.

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