

Effective Process of Commercialization at the Research Institutions in Malaysia

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ABSTRACT

The rapid change in science and technology has forced researcher and industry player to find new ways for commercialization of their technology and product. Proven and effective process of commercialization is crucial for the technology to further expand and succeed in the marketplace. Hence, the study was carried out to obtain the effective process of commercialization of technology and product at the selected research institutions in Malaysia. The interviews were conducted with six respondents from different research institutions in Malaysia with extensive experience and background in research, innovation and commercialization of technology and product. The data collected is analysed to obtain the effective process of commercialization as practice by the researchers for successful commercialization. The implementation of the effective process is presented for better understanding. The effective processes are expected to be used by other researchers for their research and innovation work. The effective processes of commercialization are presented and discussed in detail for better understanding and clearer picture.

Keywords: Commercialization framework, commercialization process, innovation process, lab to market, technology management, technology commercialization

1. Introduction

In recent years there is a change of technology around the world. People are competing to develop and adopt new technologies such as artificial intelligence, internet of things, big data, biotechnology and many more. Due to rapid development in these technologies, there is competition not only in industries but also in research institutions to transfer the technology successfully from lab to the market [1, 2]. As commercialization is one of the important aspects to bring technology or product into the marketplace, there is a need to obtain the effective process and its implementation throughout the journey. This has been proven as many establish companies have applied total commercialization process at all levels and treated as top priority [3, 4]. They set goals, develop skill, and get top management involved in the process to speed up the actions and decisions. These companies are willing to change their way of business just to get in-line with competitors [5].

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Engineers, researchers as well as policymaker should know the best process that the research institutions or companies practice for commercialization. Research department also plays vital role in terms of marketing, networking, financial, knowledge and insights of the current customers' needs and technology demand [6]. These aspects of commercialization should not be separated but should be implemented from the beginning of new product introduction until it goes to the market and should not wait until end of the product development [7]. Based on the observation and study, the commercialization of technology and product at the research institutions in Malaysia is still low. It is crucial to obtain the effective process of commercialization as practiced by the researchers in Malaysia. This study is conducted to identify the effective process of commercialization at selected research institutions in Malaysia. The implementation of the effective process also presented in the study for better understanding on when to apply the processes. The effective processes found in the study are expected to be disseminated to other researchers to successfully commercialized their technology and product.

2. Methodology

The study utilized a qualitative research method and using semi-structured interview method for data collection. The open-ended interview questions have been developed based on the research objectives. The interview was conducted with six respondents from the selected research institutions in Malaysia from various background. The selection of the research institutions was based on the research and innovation that covers on science and technology, microelectronics, and agriculture area. The study was used the same set of questions prepared for 6 respondents from Universiti Teknologi Malaysia Innovation and Commercialization Centre (UTM ICC), Universiti Teknologi Petronas (UTP) Technology Transfer & Commercialization Office (TTO), SHE Empire Sdn Bhd (Spin-off), Malaysian Institute of Microelectronic Systems (MIMOS), Malaysia Agriculture Research & Development Institute (MARDI and Standard and Industrial Research Institute of Malaysia (SIRIM).

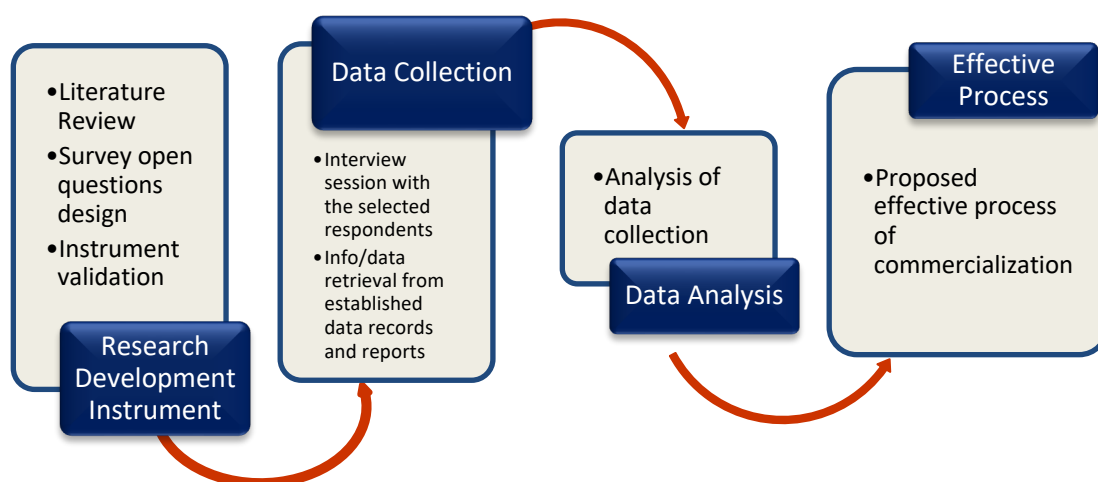


Fig. 1. Process flow of the research study

The interviews were conducted face to face with senior executives of MARDI, UTP TTO, UTM ICC and SHE Empire Sdn Bhd at their workplace; and the other two interviews which are SIRIM and MIMOS were done virtually using Google Meet due to Covid-19 pandemic restriction. Each interview

started with open questions on the common processes of commercialization practiced by the research institutions. This followed by sharing of experience, knowledge, success factor, issues and challenges and technology and product that they have successfully commercialized. Apart from questions prepared for the interview, the respondents were free to share their experience and ideas. The interview session lasted around two hours for each respondent. The data collected from the interviews were documented and analyzed after the meeting. Figure 1 shows the process flow of the research study.

3. Results

The study has found seven (7) effective processes of commercialization for technology and product based on the interview of the respondents from the selected research institutions in Malaysia. The effective processes, its implementation and justifications are presented in the next section.

3.1 The effective processes of commercialization based on the data collected

The effective processes obtained from the research study are grooming, initiate the real problem face by industries or stakeholder, personal branding, industrial partner, product branding, market validation and digital platform. Figure 2 shows the effective processes of commercialization as found in the study.



Fig. 2. Effective processes of commercialization

3.2 The implementation and justification of the effective processes

The implementation of the effective processes has been discussed in the study too. The implementation is crucial for the researchers to prepare themselves especially in the beginning of their research work as it will affect the entire path of the research and innovation journey. The researchers will know when to apply such processes during their research work. Besides, the justification of each process is discussed in more details. Table 1 shows the effective process commercialization, process implementation and justification of the processes for the successful commercialization of the technology and product at the research institutions.

Table 1
 Effective Processes, implementation and justification of the commercialization processes

Respondent	Effective Process of Commercialization	Implementation of the Process	Justification
UTM ICC	Grooming (mindset)	At the beginning of the research work / before the research starts	(a) To shape researchers to become creative, innovative, and extraordinary in research and innovation. (b) To motivate and help researchers or innovators to identify their research path from the very beginning of their research work.
UTP TTO	Initiate real problem faced by industries / stakeholders	Research and Development (R&D) stage	(a) To translate the real problem faced by industries for academics / researchers' solutions. (b) It reduces time as it skips a few research and innovation stages such as discovery of new technology, assessment of discovery and protection of discovery. (c) researchers can explore more about the opportunities and get to know the real issue happen in real world.
SHE Empire Sdn Bhd	Personal Branding	Product launched to market stage	(a) It brings the products from obscure to highly visible to the world. (b) To boost memorable impressions of consumers and stakeholders. (c) Non-stop process as it will develop and maintain the business and service in the marketplace. (d) To impress and influence the public on product or services offered through personal experience, expertise, and personality.
MARDI	Industrial partner	All stages of research and innovation from	(a) To create innovate solutions with real world impact.

		ideation until product go to market	(b) To understand the commercial application as well as market opportunities. (c) It is feasible for knowledge transfer between research institutions and industries.
MIMOS	Product Branding	Continuously and at all stages of research and innovation from ideation until product go to market	(a) To uplift the products built by research institutions or company (spin-off, start-up). (b) To build trust and relationship with audience which can turn them into loyal customers. (c) To compete with other brands from local and overseas.
SIRIM	Market validation	Product Development Stage	(a) To identify customers and stakeholders needs and demands before investing money and time. (b) To predict whether the business is profitable or not and determine if it is needed by the target market or not (c) It saves time, cost and reduce risks of the business.
	Digital platform	Market stage	(a) To promote technology and product, knowledge sharing, information center. (b) To interact with the potential client nationally and internationally.

Respondent 1 has proposed “Grooming” as an effective process of commercialization in Universiti Teknologi Malaysia (UTM). The “Grooming” was started after UTM realized that the common process must be revamped due to the middle innovation trapped occurred. In 1986, UTM was funded by the government of Malaysia with RM1 billion fund for their research and development. UTM was once equipped with the high-tech and sophisticated machines and facilities for their research study. In order to sustain the machines and the facilities, UTM must be independent in terms of grants secure and other source of funding. As the time pass by, these machines and facilities have been outdated due to the rapid change of the science and technology. In order to escape from the trapped, UTM has emphasized on the mindset of the researchers. They need to go out of the box. UTM has embark on the “Groom” process and it has provided a profound effect to the university. This can be seen by the creation of 44 spin-off and start-up companies under the UTM ICC after that. Grooming here means to change the mindset of the researchers as well as preparing themselves physically and mentally for their future work. Based on the respondent, grooming is implemented for researchers to become creative, innovative, and extraordinary. Young researchers or innovators are crucial to change the world thus it is necessary to nurture and cultivate their skills and thinking as early as possible [8]. Those researchers will be exposed with research and technology pitching for many events, exhibitions, and competitions around the world. They are urged to further study and find collaborator for their research. They need to brainstorm new idea, prepare research proposal, and publish scientific research papers nationally and internationally as many as possible. This has also can be found in the study by [9] on the grooming the top leaders. The study has shown that the important of the organizations to create systems and processes that enable managers to learn leadership from

experience. In their study, they have emphasized that the organizations must provide the managers with clear sense of what needs to be learned, surround them with people who support their efforts to develop themselves, and promote effective developmental practices such as reflection, dialogue, intentional goal setting and feedback. This is important to prepare managers for future leadership roles. The respondent has emphasized that grooming is the key process in the research and innovation work. He proposed that grooming process should start at the very beginning of the research work because it will determine the future path of the researchers in their research work. Figure 3 shows the implementation of grooming process at the beginning of the innovation work as provided by Respondent 1.

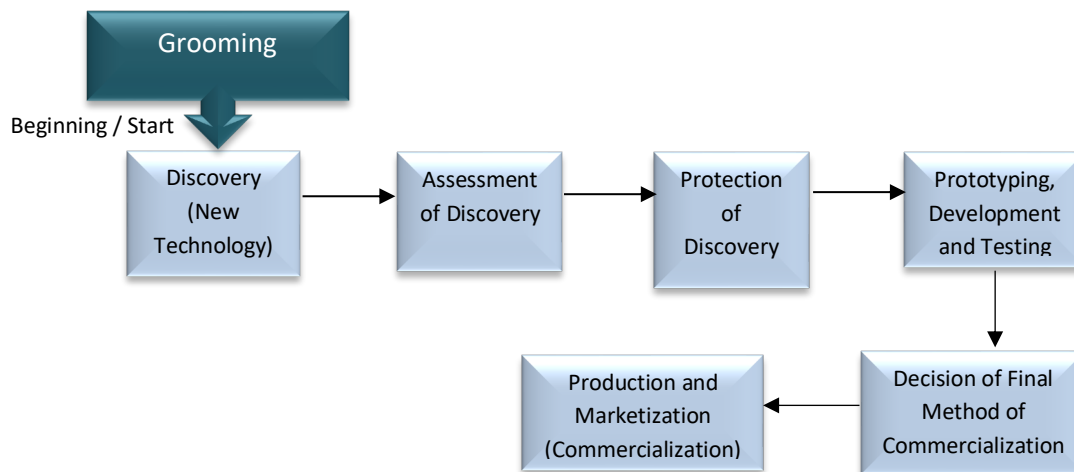


Fig. 3. Effective process of grooming

Respondent 2 is from the Technology Transfer Office (TTO), Universiti Teknologi Petronas (UTP). The respondent has vast experience in commercialization of research and innovation at the university. Based on the respondent, researchers have changed their approach on the research and innovation work. Initiate the real problem faced by industries or stakeholders is an effective process for commercialization as proposed by the respondent. Previously, most researchers are doing research based on the research gaps found in literature review [10] but now they have turned to initiate the real problem faced by industries or stakeholders as for the research and innovation work at the university. The implementation of this process has shortened the actual process of research and innovation where ideation and proof of concept is no more applicable. The process is implemented at the Technology Readiness Level (TRL) 4 stage under the development stage. The researchers will pick up the problem from industries and provide the proposal for further collaborative work. Technology Transfer Office (TTO) will assist on the collaboration by formal engagement such as agreement with the selected industry. This approach has helped the industries to share their real problem at site. At the same time the researchers can explore more about the opportunities and get to know the real issue happen in real world. The companies usually seek for other opportunities to extend their expertise and develop innovative technologies due to many challenges they face like competitors, recession and climate change [11]. Hence, both university and industry not only collaborate for product innovation but also able to transfer and share knowledge for integrating new technologies. Consequently, the knowledge transfer between university and industry will drive the economic growth through the innovation work [12]. Figure 4 shows the process of initiate the real problem faced by industries or stakeholders as proposed by the respondent.

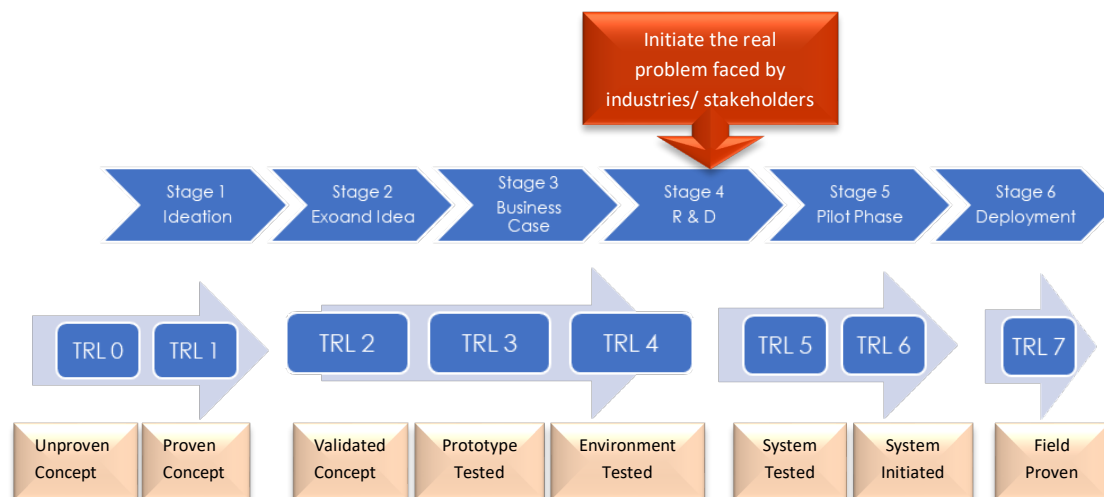


Fig. 4. Effective process of initiated the real problem faced by industries or stakeholders under the Technology Readiness Level (TRL) 4

Respondent 3 is one of UTM’s researcher for product named Naturel Kiss under the spin-off company, SHE Empire Beauty Sdn Bhd. Based on the respondent’s experience in commercialization, personal branding is the effective process of commercialization. Personal branding is considered as one of the marketing strategy to convince public image [13] to create brand awareness and brand loyalty. According to the respondent, personal branding should be done continuously as it is a non-stop process for business sustainability and advancement. A good and proactive promotion will boost the audience trust and improve potential buyer. Normally, promotion through advertisement requires a huge amount of money but personal branding is the cheaper way and more effective. It can be done personally through social media such as Facebook, Instagram, TikTok and Tweeter. These social media are accessed by millions of people around the world thus it become a perfect platform for student, entrepreneurs, companies, and many other entities to share and promote [14]. It is also used to predict the future of marketing [15]. Hence, personal branding is crucial not just a promotion tool but also to collect all the informative data required for businesses. Figure 5 shows the implementation of personal branding in the research and innovation process of cosmetic product at SHE Empire Sdn Bhd. The personal branding is performed continuously from its first launched to the market.

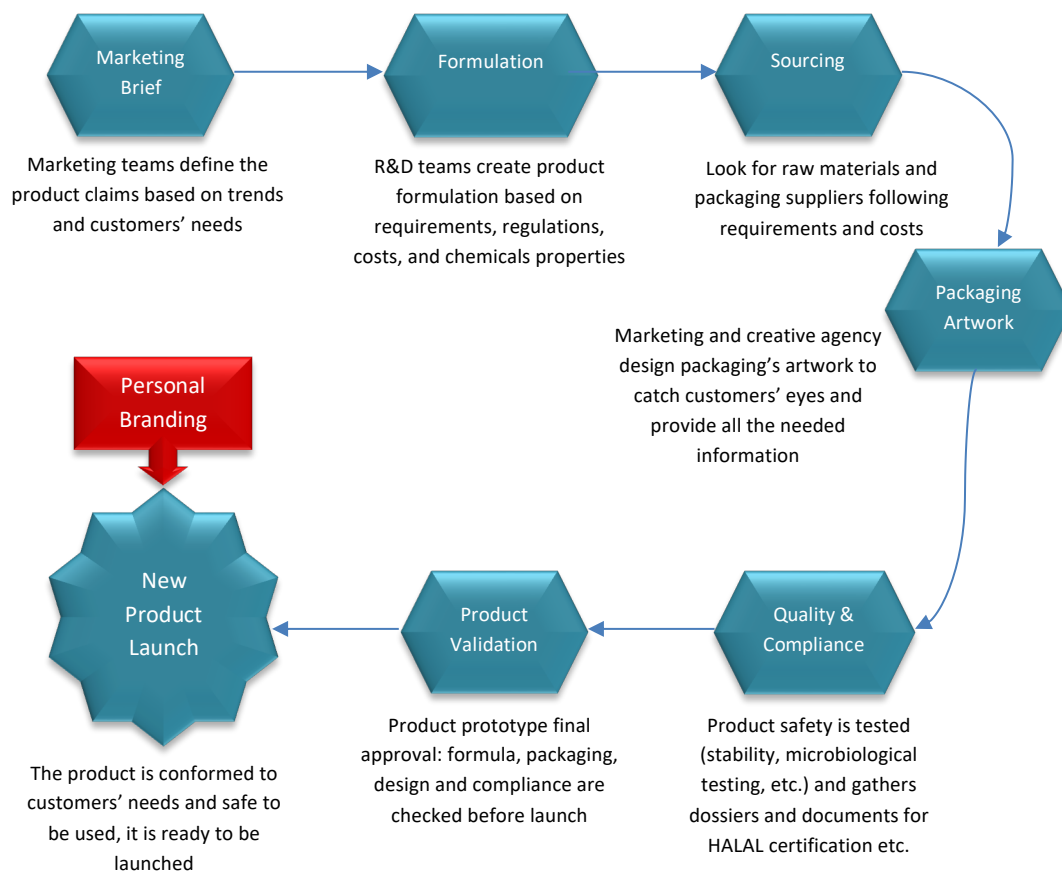


Fig. 5. Effective process of personal branding

Industrial partner is another effective process of commercialization as proposed by respondent 4 from Malaysian Agricultural Research and Development Institute (MARDI). MARDI commercialize their technology through (a) extension agencies to farmers, breeders and entrepreneurs of food processing industries, (b) licensing its property right to private firms and (c) technical training and seminars. MARDI is not transferred its technology directly to stakeholders or users but through the extension agencies from public agencies or private sector [16]. After this stage, then the technology is transferred to the stakeholders or users such as farmers, farmers association, entrepreneurs and public agencies. Figure 6 shows the process flow of technology transfer at MARDI.

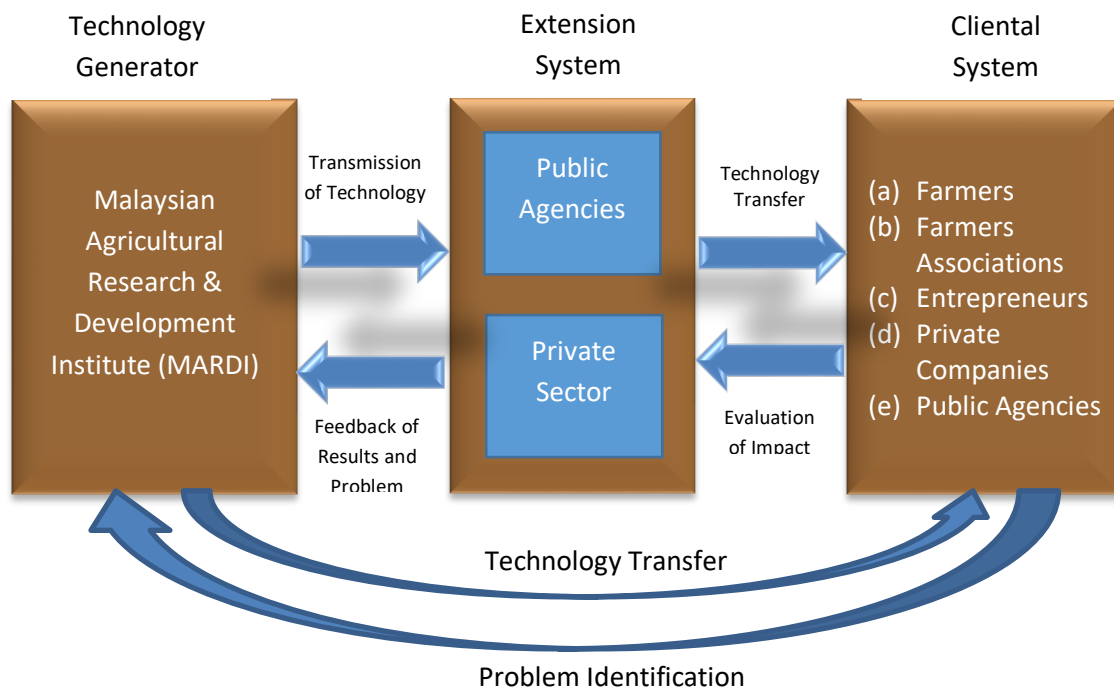


Fig. 6. Process flow of technology transfer at MARDI

Based on respondent's experience in research and commercialization, MARDI as a technology generator require the involvement of industrial partner for successful commercialization. The technology transfer of MARDI is divided into five phases (i) development of new technology (ii) technology evaluation and approval for commercialization (iii) pre-commercialization (iv) commercialization and (v) post commercialization. The main processes in these phases are ideation, proof of concept, research and development (R&D), prototyping, technology piloting and innovation. Industrial partners are selected to assist and monitor all the activities by providing ideas, feedback, opinions, and resources to researchers; and involved in meetings and site visits. As for researchers, building the network with industrial partner makes them understand the commercial application as well as the market opportunities. It is proven to be the key success of their commercialization as MARDI has successfully commercialized 94 technologies and contribute the income of RM8 million in the form of licensing pay-outs, royalties, management fees and consultation services. Besides, industrial partner helps researchers to understand and integrate the knowledge as well as reduce the ambiguity [17]. Therefore, by engaging industrial partner in the research and innovation work would produce a successful product to market. Industrial partner can be highly effective if close interaction exist, focus on problems and utilizes the strengths effectively [18]. The implementation of industrial partner as proposed by respondent is illustrated as in Figure 7.

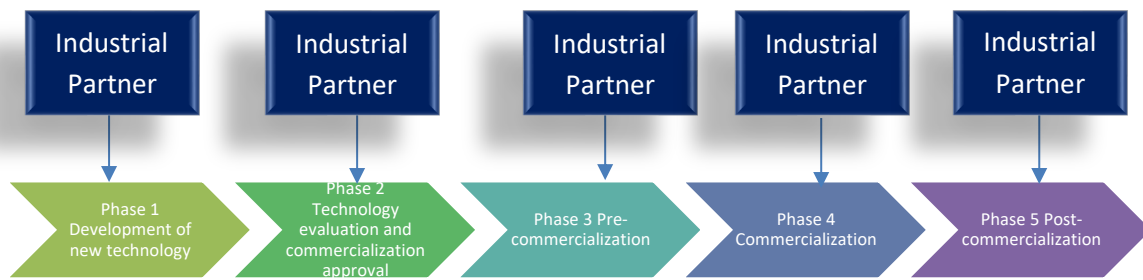


Fig. 7. Effective process of industrial partner

Product branding is another effective process as proposed by Respondent 5. Based on the respondent’s experience in the research, development, and commercialization in Malaysian Institute of Microelectronic Systems (MIMOS), product branding is crucial for the product to be relevant and reliable in the marketplace. The respondent has emphasized that branding come first before products. The respondent has given one example of the importance of branding. It is between MIMOS and HITACHI, a company which have the same focus on the Technology Solutions, Power Systems, Industrial Systems, Electronic Systems and some other things. There was one potential project and MIMOS have the technology and expertise but due to the trust and favourable, MIMOS could not secured the project. This has proven that branding plays an important role for the business to survive. Product branding needs to be implemented continuously during the research and innovation work. Although branding requires huge amount of money for promotion, but the acknowledgement and trust of the product brand by the stakeholders or users is more crucial. The study has proven that customers responded more favourably to the establish brands to reduce the uncertainty in product purchases [19]. The effective process of product branding as proposed by the respondent is illustrated as in Figure 8.

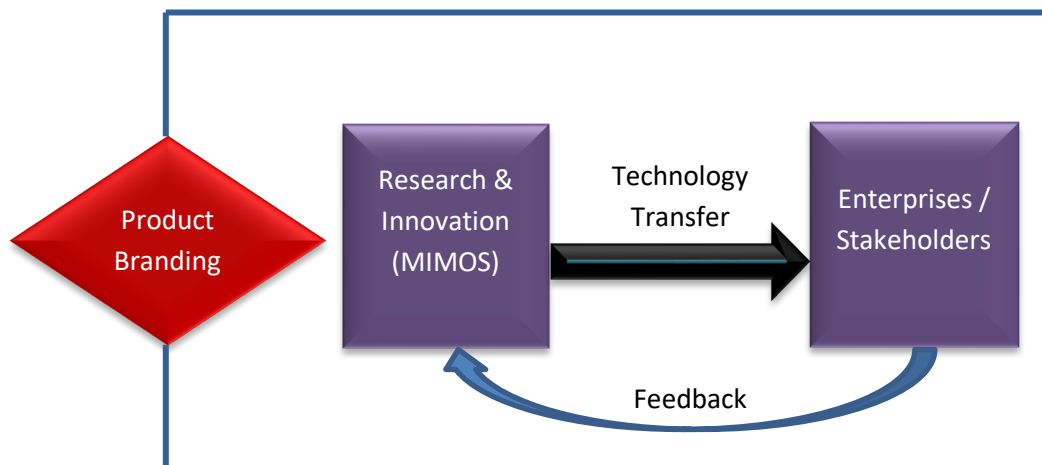


Fig. 8. Effective process of product branding

Respondent 6 from Standard and Industrial Research Institute of Malaysia (SIRIM) has proposed market validation as an effective process for commercialization. The respondent has emphasized that market validation is a key factor for commercialization of technology and product as it gains confident and helps researchers to understand the technology market route. Market validation is done during the assessment of the potential technology received from the customer or client. If the validation shows credible results to proceed, then SIRIM will proceed for investment in the project. Market validation helps researchers and stakeholders to predict whether the business is

profitable or not and determine if it is needed by the target market or not. Market validation will determine the market acceptance, demand, refine product or service attributes and access product's value to customers and businesses by engaging with prospective customers or stakeholders [20]. Before research institutions or companies investing huge amount of money in technology development, it is useful to probe, test and validate the market opportunity [21]. Figure 9 illustrates the effective process of market validation as proposed by Respondent 6. The market validation is implemented when the technology or product is at the Technology Readiness Level (TRL) 6, during the technology development process.

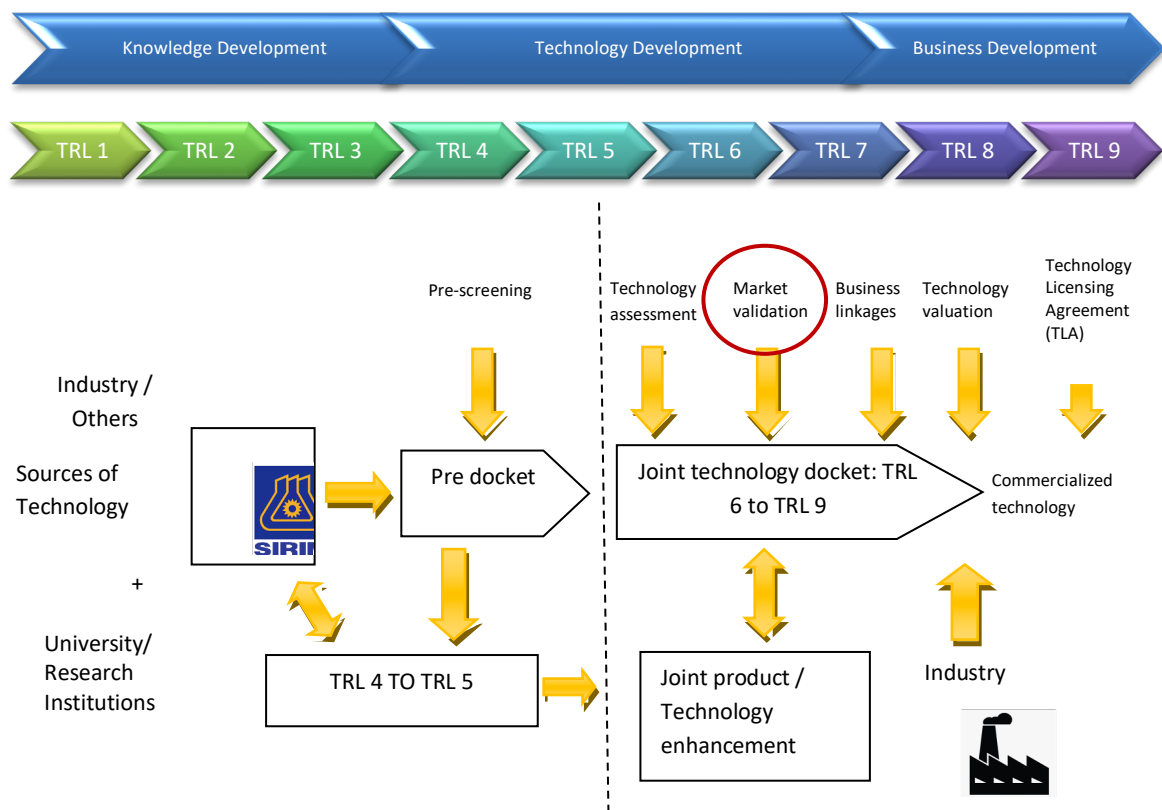


Fig. 9. Effective process of market validation

Respondent 6 has proposed another effective process of commercialization. It is digital platform. According to respondent, digital platform is crucial and compulsory for research institution and company as the platform is used to interact with the potential client nationally and internationally. It is the medium used to sell, promote and share information about the company, products and services. Digital platform is crucial if the product or technology is already in the market. iVenture is an example of digital platform developed by SIRIM which can be downloaded from Playstore or Applestore to facilitate the user to acquire information about the product or service offered. The study has found that digital platform is crucial to commercialize the technology and product as it helps to enhance performance, time efficiency, and save costs [22-24]. One of the competitive advantages of digital platform in comparison with traditional businesses is its special architecture where multilevel and modular of digital platforms gives flexibility in scaling and connecting various resources and participants [25]. Figure 10 shows the implementation of digital platform in the commercialization process of technology and product at SIRIM.

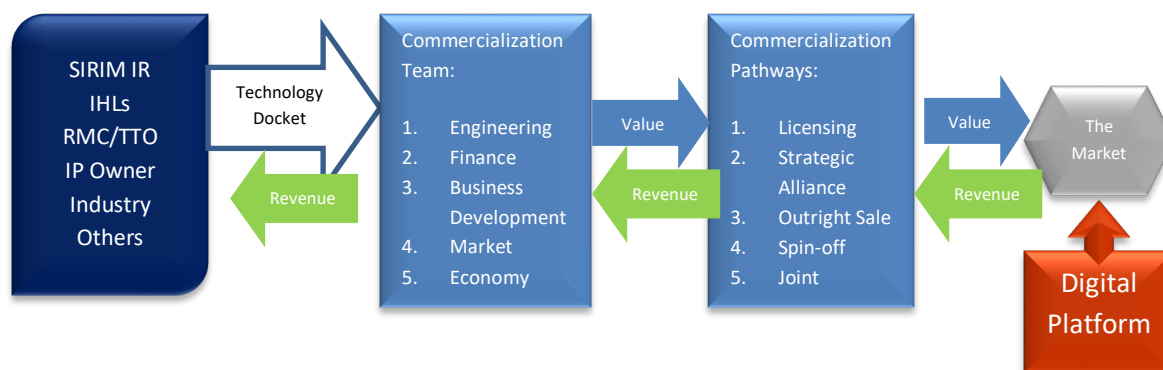


Fig. 10. Effective process of digital platform

4. Conclusions

The effective process of commercialization is very crucial to the research institutions to successfully transferring their technology and product from lab to market. The data collected in this study are very informative and beneficial to all researchers in Malaysia. Grooming, initiate the real problem faced by industries or stakeholders, personal branding, industrial partner, product branding, market validation and digital platform are those effective processes found in this study. The implementation of the study also presented for the researchers to understand of when to apply such processes. The study has proven that the effective process of commercialization will spur the growth of science and technology as well as the economics of the country if the right process implemented by the researcher of the respected area at the research institutions in Malaysia.

Since the study is focusing on the commercialization at the research institutions only, the recipient may require more data from companies and industries too. Future researchers may focus on the data on the commercialization process from companies and industries. They may combine the data from the companies with the results found in this study to enhance the commercialization of technology and product at the research institution in Malaysia.

As a conclusion, the study has successfully obtained the effective processes of commercialization for technology and product at the selected research institutions in Malaysia. The effective process and its implementation will help to guide other researchers to commercialize their research and innovation of technology and product effectively.

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