Focus Group Evaluation on IPTComKit™ Commercialization Model

NORSHUHADA SHIRATUDDIN [1]
SHAHIZAN HASSAN [2]
NOR LAILY HASHIM [3]
SITI MAHFUZAH SARIF [1]
MUHAMMAD SHAHBANI ABU BAKAR [3]
[1] School of Multimedia Technology and Communication
[2] Othman Yeop Abdullah Graduate Business School
[3] School of Computing
Universiti Utara Malaysia
06010 UUM, Sintok, Kedah
MALAYSIA
[1]{shuhada; ctmahfuzah}@uum.edu.my; [2]shahizan@uum.edu.my; [3]{laily; shahbani}@uum.edu.my

Abstract: - Although many efforts have been made by the government to commercialize R&D products, very few is successful. Accordingly, the aim of this study is to propose a commercialization model to help researchers obtain information on the commercialization phases, processes and procedures. In the pursuit of the study, 3 main phases are implemented. This involves the construction of a model named IPTComKit™, development of tools and evaluation of perception. The model consists of 3 phases: concept and feasibility, development, and commercialization and growth. It proposes 6 processes that should be undertaken by researchers; investigation, feasibility, planning, pre-production, production and business maturity. Each step in the process is viewed from a technical, market, business and socio-economic perspective. The model also suggests 19 steps to be followed to ensure a high possibility of commercialization. A total of 25 respondents from 12 institutions evaluated the model using an eight-dimensional measurement of visibility, complexity, compatibility, flexibility, clarity, effectiveness, manageability and evolution. It can be concluded that this model generally has a moderate strength and is seen as a practical guide for researchers.

Key-Words: - Commercialization model, model evaluation, web services, information and knowledge

1 Introduction

Commercialization refers to the process by which the results of a research are translated into marketable products and commercially produced. The Malaysian government has made significant investments in research activities and development (R&D) in an effort to strengthen the capacity and capability of the nation. For example, in the 8th Malaysia Plan (8MP) of RM100 million has been channeled through the Development Division, Ministry of Higher Education (MOHE) and of the total, RM79.12 million was given to 17 universities from 2001 to 2005. While under the 9th Malaysia Plan (9MP), a total of RM200 million has been allocated for the purpose of R&D and commercialization [13].

In connection with the above issues and in line with the 9MP, Malaysian Technology Development Corporation (MTDC) through the Commercialization of Research & Development Fund (CRDF) has been redesigned to provide financial assistance to universities/research institutes and companies qualified for the funds. In addition, it is also reported as part of the efforts to accelerate the commercialization of R&D, fiscal incentives such as pioneer status for a period of 10 years and a tax deduction equivalent to actual investment were offered. Furthermore, the management and commercialization of research unit in universities and research institutions are strengthened to increase the commercialization of R&D.

Of late, in the Malaysia 2013 budget, the government has further allocated a total of RM19 million for training local intellectual property development. In addition, the government allocates RM600 million to five research universities to conduct high-impact researches, which are aimed to be commercialized.

This paper describes a study where a commercialization model is developed to assist

researchers in understanding the requirements to commercialize. The first section details the formulation of problem, followed by a proposed solution, descriptions of the study and finally, the findings.

2 Problem Formulation

Although many efforts have been made by the government through the various Ministries, only 3.4% of the projects were successfully commercialized in the 8MP. Then, in 2007, it was reported that only 3% of research findings from six Higher Education Institutions (HEIs) in Malaysia were successfully commercialized.

More disturbing, although much efforts and programs are implemented by the government, if researchers at HEIs are clueless of the process and are not keen on commercialization, then the government's mission would not be successful. This view is supported by Kennedy [9] and Richard and Thursby [15]. Three causes are seen as contributing to low percentage of commercialization of research findings:

- Lack of commercialization culture - particularly public HEIs that are not classified as research universities are not aware or are not interested in the issue of commercialization.
- Reference materials and tools to commercialize research, whether in print or electronic form, are limited when compared to countries such as Canada, USA and in Europe.

2.1 Proposed Solution

Accordingly, in an effort to ensure more researchers are aware of commercialization process, this study proposes a commercialization model to help HEI researchers understand the phases, processes and procedures of commercialization.

The specific objectives are:

- Build a commercialization model with toolkits (named IPTComKit^{TM}) for use by researchers at HEIs
- Measure the perception of a sample of the researchers on the IPTComKit^{TM} model

3 Methodology

The methodology of this study is divided into three main phases, based on the methodology by Conole and Oliver [3].

The first phase involves four stages: (1) analyze the needs, resources and best practices; (2) review the existing standards in the external environment and the country; (3) collect preparation tool documents; and (4) analyze the needs of hypermedia data.

Phase 2 involves three stages: (1) form the related infostructure; (2) build prototype and tools; and (3) build a website containing supporting tools.

Phase 3 entails presenting the model, tools and interviewing 25 researchers from 12 various institutions. It was conducted through focus group sessions in July 2012 to measure the perception of potential users of the model (refer to Fig. 1). This requires the development of a questionnaire that measures eight dimensions:

- visibility,
- complexity,
- compatibility,
- flexibility,
- clarity,
- effectiveness,
- manageability, and
- evolution

Fig. 1 Focus group session

The eight-dimensional measurement instrument was adapted from [1, 2, 6, 7, 10, 11, 14, 18, 19, 20].

The visibility dimension is related to the extent of the process and relevance of the model in helping product development. The complexity measures ease to learn and understand. Compatibility refers to the consistency of the model to the values, needs and experience of the innovators.

Flexibility highlights the issue of the model's ability to minimize the planning guide. The resulting model should be adaptive and responsive to the needs of users. Clarity refers to the extent to which the phases, steps and activities proposed in the model can be used. Effectiveness measures how effective the model is in assisting the process of commercialization. The last two dimensions of manageability and evolution refer to the process and

ISBN: 978-1-61804-156-2

activities that are easy to manage by the users and the ability of the model to dynamically change according to the needs, technology and new ideas. Table 1 explains each dimension.

Table 1 Evaluation dimensions

Dimensions
1. **Visibility** The model is visible to product innovators, so that the product innovators can judge the relevance and completeness of the product development and commercialization.
2**. Complexity** The model should be easy to learn, clear and understandable. Complexity is the degree to which a model is perceived as difficult to use. The more complex the model, the more difficult to use.
3. **Compatibility** Compatibility refers to the degree to which a model is perceived as being consistent with the existing values, needs, and past experiences of product innovators.
4. **Flexibility** The model provides flexible innovation & commercialization process with minimal planning. The model is also adaptive and responsive to changing user needs. The model should be flexible and adaptable for future use.
5. **Clarity** The model as a whole is workable. The phases in the model are easily followed and steps or activities included in the model are easy to apply.
6. **Effectiveness** The model is perceived as being better than other model. By using the model, it might enhance the innovation and commercialization process.
7. **Manageability** The processes and activities in the model to be capable of being managed or controlled by product innovators.
8. **Evolutionary** The model provides a dynamic process which evolves through continuous feedback from various stakeholders. It is capable of incremental change, to cope with new ideas or technological opportunities. It also allows developers to communicate and collaborate with users continuously to incorporate their evolving requirements.

4 IPTComKit^{TM} Model

The commercialization model includes several phases, processes, activities and measures involving researchers, technology transfer office (TTO) and the industry. Models and ideas by Goldsmith [4, 5], Kennedy [9], Saville and Norsaadah [16], Jolly [8], McCoy, et al. [12] and Siegel, et al. [17] inspire the IPTComKit^{TM} development.

Generally, the IPTComKit^{TM} model has three phases: (1) concept and feasibility, (2) development and (3) commercialization and growth. This model proposes six processes that should be undertaken by researchers, TTO and industry; investigative process, feasibility, planning, pre-production, production and business maturity. Each step is viewed from a technical, market, business and socio-economic perspective. The model also suggests 19 steps to be followed to ensure better chances of commercialization.

The concept and feasibility phase determines if a product has the potential to be sold in the general market. In this phase, the product is evaluated in terms of concepts, market needs and the feasibility in the current economic market. This phase also examines the socio-economic impact of products which cover employment, health, productivity, work situations, and physical well-being of others.

The development phase involves planning of pre-produced and actual products. This phase not only emphasizes the technical aspects of product development, but also looks at the market and business perspectives such as marketing strategy, market survey and pre-commercialization. Finally, the commercialization and growth phase includes the cooperation of the industry. Among the activities in this phase are the production, sales and distribution, business growth, product support and market diversity. Here, the industry plays an important role in producing, distributing, improving the quality of the products and finding new markets.

Relevant to all processes, the 19 measures to be implemented in sequence are as follows:

- idea generation and concept analysis (step 1)
- market needs assessment (step 2)
- exploration assessment (step 3)
- technical feasibility (step 4)
- market study (step 5)
- economic feasibility (step 6)
- socio economic impact study (step 7)
- product development (step 8)
- marketing strategy (step 9)
- business plan (step 10)
- pre-production (step 11)
- authentication of market overview (step 12)
- pre-commercialization (step 13)
- production (step 14)
- sales and distribution (step 15)
- business growth (step 16)
- production support (step 17)
- market diversification (step 18)
- maturity of business (step 19)

In this model, the proposed steps are supported by codes and descriptions, the activities to be

carried out in steps and checklists for each of the proposed steps. Fig. 2 depicts the whole model and it is written in the Malay language to cater for local users.

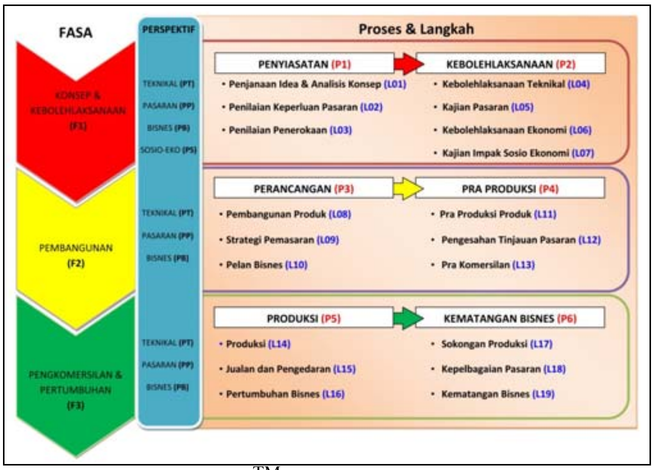


Fig. 2 IPTComKit^{TM} commercialization model

Description of each step is as shown in Fig. 3, where the code, phase, perspectives, processes, definitions, main question, objectives, and outcomes are included. Meanwhile, activities involved and other support items such as documents, tools, websites, and examples of actual cases are included in the activity table. Supporting items are dynamic, allowing changes or addition to be made. Examples of items relevant to activities are shown in Fig. 4. A checklist is also provided as shown in Fig. 5 emphasizing on measurement and status dimensions.

DESKRIPSI PEMBANGUNAN PRODUK

KOD	F2-PT-P3-L08
FASA	Teknikal
PERSPEKTIF	Pembangunan
PROSES	Perancangan
LANGKAH	Pembangunan Produk
DEFINISI	Langkah mengenalpasti bahan, proses dan rekabentuk yang sesuai dan berkesan untuk pembangunan produk komersil.
PERSOALAN UTAMA DALAM LANGKAH INI	Adakah anda mempunyai produk yang menggambarkan produk sebenar?
OBJEKTIF	Membuat penambahbaikan kepada bahan, rekabentuk dan proses dalam pembangunan produk dan memastikan produk berfungsi seperti yang ditetapkan.
HASIL	Produk atau proses rintis.

Fig. 3 Description of steps

AKTIVITI : F2-PT-P3-L08

AKTIVITI	DOKUMEN SOKONGAN	ALATAN	LAMAN SESAWANG	CONTOH KES SEBENAR
1. Kenalpasti bahan, proses, komponen dan langkah pembuatan yang diperlukan bagi memenuhi spesifikasi dan prestasi teknikal 2. Uji bahan, komponen dan proses 3. Merekabentuk produk atau proses rintis 4. Optimumkan lelaran rekabentuk 5. Kendalikan ujian akhir 6. Anggar kos pra-produksi produk	• Growth Process Toolkit (growth.pdf)	• The Calder Toolkit • Manufacturing Engineering Toolkit (METK) • E-Fuzz Wizard Toolkit • Designer's Augmented Reality Toolkit (DART) • Tangible User Interface Toolkit • Ubi-Designer Toolkit (UbiDesigner.pdf) • Pelbagai alat bantu pengujian produk (perisian) • Cost Estimation Toolkit (CET) • Pelbagai alat bantu penganggaran kos	• Growth Process Toolkit ([illegible]) • Business Owner's Toolkit ([illegible])	• Aplikasi "augmented reality" ([illegible]) • NASA ([illegible])

Fig. 4 Examples of activities

SENARAI SEMAK : F2-PT-P3-L08

DIMENSI PENGUKURAN	STATUS
1. Adakah anda mempunyai produk?	
2. Adakah anda telah mengenalpasti bahan penting yang diperlukan?	
3. Adakah anda telah mengendalikan ujian akhir ke atas produk?	
4. Adakah anda mempunyai proses produksi rintis?	
5. Adakah anda maklum mengenai kebolehpercayaan proses pembuatan?	

Fig. 5 Examples of check lists

5 Evaluation of Model

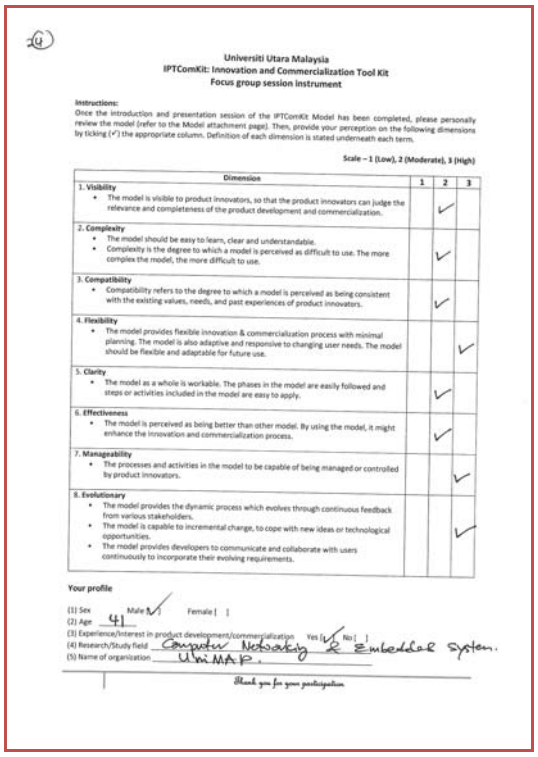
Two focus group sessions were conducted. The purpose of the session is to get feedback on the IPTComKit^{TM} model. A total of 25 respondents attended the sessions. They represented 12 distinct institutions.

The sessions involved 2 rounds; the first was an open discussion where they were asked the following questions:

- Can the model be followed and understood?
- Are the proposed phases sufficient or too much?
- Are the supporting documentation, tools, website links, and examples of cases able to assist in understanding the phases of the model?
- What are the strengths and weaknesses of this model?
- What improvements need to be made to this model?

The second round required the respondents to go through the model and tools by accessing **http://iptcomkit.t15.org/** (refer to Fig. 6). Once they were satisfied with the time spent going through most pages they were asked to complete an instrument measuring the 8 dimensions as discussed in section 3 (refer to Fig. 7).

Fig. 6 IPTComKit^{TM} web tool



Universiti Utara Malaysia
IPTComKit: Innovation and Commercialization Tool Kit
Focus group session instrument

Instructions:
Once the introduction and presentation session of the IPTComKit Model has been completed, please personally review the model (refer to the Model attachment page). Then, provide your perception on the following dimensions by ticking (✓) the appropriate column. Definition of each dimension is stated underneath each term.

Scale – 1 (Low), 2 (Moderate), 3 (High)

Dimension	1	2	3
1. Visibility • The model is visible to product innovators, so that the product innovators can judge the relevance and completeness of the product development and commercialization.		✓	
2. Complexity • The model should be easy to learn, clear and understandable. • Complexity is the degree to which a model is perceived as difficult to use. The more complex the model, the more difficult to use.		✓	
3. Compatibility • Compatibility refers to the degree to which a model is perceived as being consistent with the existing values, needs, and past experiences of product innovators.		✓	
4. Flexibility • The model provides flexible innovation & commercialization process with minimal planning. The model is also adaptive and responsive to changing user needs. The model should be flexible and adaptable for future use.			✓
5. Clarity • The model as a whole is workable. The phases in the model are easily followed and steps or activities included in the model are easy to apply.		✓	
6. Effectiveness • The model is perceived as being better than other model. By using the model, it might enhance the innovation and commercialization process.		✓	
7. Manageability • The processes and activities in the model to be capable of being managed or controlled by product innovators.			✓
8. Evolutionary • The model provides the dynamic process which evolves through continuous feedback from various stakeholders. • The model is capable to incremental change, to cope with new ideas or technological opportunities. • The model provides developers to communicate and collaborate with users continuously to incorporate their evolving requirements.			✓

Your profile
(1) Sex Male [✓] Female [ ]
(2) Age 41
(3) Experience/Interest in product development/commercialization Yes [✓] No [ ]
(4) Research/Study field Computer Networking & Embedded System.
(5) Name of organization UniMAP.

Thank you for your participation

Fig. 7 An example of a completed instrument

Of the 25 respondents, 18 (72%) are male and 7 (28%) are women. Respondents aged over 40 years are 52% of the total respondents. Meanwhile, 84% of respondents are interested or having experienced in product commercialization process. The majority (80%) of the respondents are researchers from HEIs.

For the visibility dimension, 52% of the respondents felt that this model has high visibility to help creators make an assessment of the relevant product and complete the development and commercialization of products. Only 8% of respondents felt that the model is less helpful in development and commercialization process.

For the dimension of complexity, 40% of the respondents thought that the model is very difficult to understand and use. While, 52% of the respondents felt that the model has a moderate compatibility, a total of 48% of them felt that this model is highly compatible and consistent with the current value, needs and past experiences owned by the innovator of a product. None of the respondents have a negative opinion about the compatibility of this model in helping to implement the commercialization process.

Percentage of the respondents who think this model has a high and moderate level of flexibility is about 88%. This shows the model is able to be customized with minimal planning.

The percentage of respondents who felt that this model provides a high level of clarity is 32%. Exactly 68% of respondents felt that this model has a moderate level of clarity which suggests that this model is easy to follow and be applied. This show is the clarity of the model is at a very satisfactory level.

Majority (84%) of the respondents thought that the IPTComKit^{TM} model has a moderate level of effectiveness in improving the innovation and commercialization process. Another 12% of them felt that this model is very effective in helping innovators follow the process of innovation and commercialization. Only 4% felt that the effectiveness of the model is low.

A sum of 52% of the respondents is of the view that this model is well suited in increasing the reliability of the commercialization processes and activities. Only 8% felt the opposite.

For the evolution dimension, the majority (92%) felt that this model has the rate of evolution that is able to undergo changes to suit any new ideas or the latest changes in technology. Only 8% of respondents felt otherwise.

From the findings presented above, Fig. 8 summarizes all the percentages and it can be concluded that this model generally has a moderate strength of 6 dimensions except for visibility and manageability with high strength. The effectiveness is found to be moderate and this shows that, although the model is seen to be effective, but to a lesser degree of confidence, as per a high view of efficiency is the lowest compared with the other dimensions.

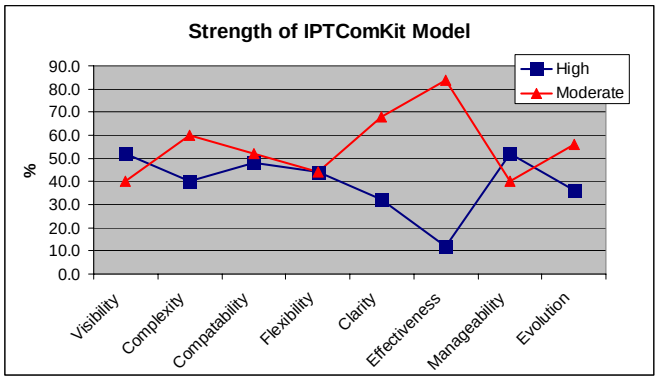


Fig. 8 Strength of Model

Further comments by some respondents state that process 1 to 4 is more suitable for implementation in HEIs but the 5 and 6 are unsuitable. It is also proposed that a step to identify foreign investors and financial resources be included. Some also felt that the model is a valuable guide; however, it is less suitable for use in commercialization of theoretical based research.

ISBN: 978-1-61804-156-2

6 Conclusion

The model ought to be used as a systematic guideline to assist researcher understands the processes and chooses the tools and appropriate resources for commercialization. The collection of existing resources and best practice examples can too be adapted and reused for various areas and purposes. The model can also be treated as a reference for improving the R&D policy or innovation management in HEIs.

The tools developed in this study could not be fully tested by potential users due to time and budget constraints. Therefore, it is recommended that testing with more number of users where they apply the model and tools within a period of at least 6 months be implemented. Such testing could provide a better evaluation measure.

References:

[1] Bonner, N. *Acceptance of system development methodologies: testing a theoretically integrated model*. PhD Dissertation. The University of Texas. 2008.

[2] Ciconte, B., Devgan, M., Dunbar, S., Go, P., & Prem, J. *J2EE software development methodologies*. InformIT.com. 2003.

[3] Conole, G. & Oliver, M. Embedding Theory into Learning Technology Practice with Toolkits, *Journal of Interactive Media in Education*, Vol.8, 2002, pp.1-27.

[4] Goldsmith, H. R. *Technology Commercialization Model*. 2003. Downloaded from https://www.asbtdc.org/DocumentMaster.aspx?doc=1033

[5] Goldsmith, R. *The Goldsmith Commercialization Model*. 2012. Arkansas Small Business and Technology Development Center (ASBTDC). Downloaded from https://asbtdc.org/DocumentMaster.aspx?doc=1033

[6] Hecksel, D. *Methodology evaluation and selection*. White paper. Sun Microsystems. 2004.

[7] Henderson-Sellers, B. Who needs an object-oriented methodology anyway? *Journal of Object Oriented Programming*, Vol. 8, No. 6, 1995, pp. 6-8.

[8] Jolly, V. K. *Commercializing New Technologies: Getting from Mind to Market*. USA: Harvard Business School Press. 1997.

[9] Kennedy, W. *So What? Who Cares? Why You? The Inventor's Commercialization Toolkit*. Ottawa: Wendykennedy. com Inc. 2006.

[10] Kerzner, H. *Project management: best practices, achieving global excellence*. London: John Wiley. 2006.

[11] Lang, M. & Barry, C. Techniques and methodologies for multimedia systems development: a survey of industrial practice. In N.L. Russo, et al. (Eds.), *Realigning Research and Practice in Information Systems Developmenrt*, Proceedings of IFIP WG8.2 Conference, 2001, pp. 77-86.

[12] McCoy, A.P., Thabet, W., & Badinelli, R. Towards establishing a domain specific commercialization model for innovation in residential construction. Construction Innovation: Information, Process, *Management*, Vol. 8, No. 2, 2008, pp. 137–155.

[13] Najib Abd. Razak. *Modal Teroka Cara Terbaik Komersial R&D*. Utusan Malaysia, 27 Mac 2007.

[14] Platts, K. *Manufacturing audit in the process strategy formulation*. PhD Thesis. University of Cambridge, UK, 1990.

[15] Richard, J. & Thursby, M. Proofs and Prototypes for Sale: The Licensing Of University Inventions, *American Economic Review*, Vol. 91, No. 1, 2001, pp. 240-259.

[16] Saville, C., & Norsaadah, I. *The Commercialization of Research and Intellectual Property Assets: A Competency Development Module*. Malaysia Ministry of Higher Education, 2010.

[17] Siegel, D. S., Waldman, D. A., Atwater, L. E., & Link, A. N. Toward a model of the effective transfer of scientific knowledge from academicians to practitioners: qualitative evidence from the commercialization of university technologies. *Journal of Engineering and Technology Management*, Vol. 21, No. 1–2, 2004, pp. 115 – 142.

[18] Syamsul Bahrin, Z. *Mobile Game-based Learning (mGBL) Engineering Model*, Tesis PhD, Universiti Utara Malaysia. 2011.

[19] Veryard, R. What are methodologies good for data processing, *Data processing*, Vol. 27, No. 6, 1985, pp. 9-12.

[20] Yu, E. & Cysneiros, L.M. *Agent-oriented methodologies-towards a challenge exemplar*. Proceedings of the 4th International Workshop on Agent-oriented Information System. Toronto, 2002.