

IEBMC 2017
8th International Economics and Business Management
Conference

**ASSESSING A MEASUREMENT INSTRUMENT FOR STUDYING
STUDENT SPIN-OFF PROCESS DEVELOPMENT**

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Abstract

The establishment of student spin-off will provide many benefits such as economic development of the region where the university is located, commercialize knowledge and generate jobs to the community. However, the formation of student spin-off can be easily found in many developed countries. Hence, the student spin-off development in the context of higher education institutes should be further addressed in particular to developing countries in a way to increase the technology transfer to industry and reducing unemployment rate among graduates. This study aims to examine the reliability and validity of student spin-off process development instrument that covers three main stages which are pre-founding phase, founding and post-founding phase. Data for this study were collected from founders of student spin-off in Malaysian higher education institutes, and the measurement scales were tested on reliability. The results revealed that the instruments are valid and reliable. It is expected that this study will provide a useful measurement instrument to assess the process development of student spin-off for further research.

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Keywords: Student spin-off, process development, validity, reliability, Malaysia.



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1. Introduction

There is no doubt that entrepreneurial activities through the establishment of student spin-offs (SSOs) is become an important phenomena. However, there is limited studies on the role of students in creating these activities which has been given an increasing attention by scholars like Astebro & Bazzazian, (2010, 2011), Colombo et al., (2010), Muller, (2010), Astebro et al., (2012), Boh et al., (2015), Hayter et al., (2016) and Markuerkiaga et al., (2016). SSO companies can be founded by active students attending programs in any faculty at a university. In general, these firms are operating independently from the university; they have their own legal, technical, and commercial structures (Bailetti, 2011). The establishments of SSO in the university will benefit the industry through commercialization of technology and reducing the unemployment rate among graduates. Besides, an SSO company transforms knowledge that students acquire at a university into revenue in the form of: i) new products, services, technology, tools, and solutions; ii) higher quality goods; iii) new methods of production; iv) the opening of new markets; v) securing new sources of supply of raw materials and vi) new organizational forms (Bailetti, 2011).

Due to immense contributions of SSO, governments and universities around the world have established mechanisms to aid the creation of these firms. Many additional factors have been found to contribute to the emergence of SSOs process development but the studied literature shows those researches are being conducted in the majority of developed countries (Turker & Selcuk, 2009; Ismail et al., 2009) and very few studies have focused on the creation of SSOs in both developed and developing countries (Astebro & Bazzazian 2010; Colombo et al., 2010). As stated by Barbosa and Moraes (2004), empirical conclusions may differ between studies from developed and developing countries, even though they are equally important to significance of entrepreneurship among SSOs. In countries like Malaysia, the study of SSOs is very uncommon (see for examples of Mohd Shariff & Saud, 2009; Zain et al., 2010; Tong, et al., 2011; Keat & Ahmad 2012; Amir et al., 2013; Rasli et al., 2013; Pihie & Bagheri, 2013; Mohamad et al., 2014; Keat & Nasiru 2015; Yusof et al., 2015; Rofa et al., 2015; Mustapha & Selvaraju, 2015). The majority of these studies were to examine the area of entrepreneurship intentions (pre-founding stage) of SSOs process development but yet to focus on the comprehensive stage of SSOs process development.

Gubeli & Doloreux (2005) have suggested three phases in the spin-off process development (a pre-founding stage, the founding of the firm, and post-founding stage) along with aspects and support services involved. Figure 01 summarizes the spin-off process development in the university which can be adapted to create the measurement instrument for studying the SSO process development in Malaysian Higher Educational Institutions (HEIs). It shows that the support services of a university through its entrepreneurial center or technology transfer office is vital in all phases of spin-off process development.

Supports	University <input type="text"/>			
Services:				
Aspects:	Interest in Entrepreneurship: <ul style="list-style-type: none"> ▪ Motivation ▪ Interest ▪ Vision ▪ Opportunity recognition Inclination in Entrepreneurship: <ul style="list-style-type: none"> ▪ Perception of barriers 	<ul style="list-style-type: none"> ▪ Skills ▪ Experiences ▪ Business Idea 	<ul style="list-style-type: none"> ▪ Business Plan ▪ Legal Issues ▪ Financing ▪ Prototype ▪ Market Analysis ▪ Office Space ▪ Networking 	<ul style="list-style-type: none"> ▪ Management Skills ▪ Financing ▪ Marketing ▪ Product Development ▪ Office Space ▪ Networking
	Pre-founding stage (Phase 1)	Founding stage (Phase 2)		Post-founding stage (Phase 3)

Figure 01. Spin-off process development

Source: Gubeli & Doloreux (2005)

2. Problem Statement

Universities and public research organizations around the world have played a key role in innovation through their contribution to the production and diffusion of a knowledge-based economy. Various national strategies have targeted to improve the relationship between public research and industry. In Malaysia, the government has allocated a huge budget to commercialize the output from research and development (R&D) for public institutions, especially universities. For instance, RM 741 million was allocated in the first two years of the 5-year plan under the Tenth Malaysia Plan (2011-2015) for Malaysian universities. Despite this, only a small percentage of Malaysian HEIs R&D outcomes have passed through to commercialization activities. Zaidan (2014) stated that Universiti Teknologi Malaysia has commercialized 239 products, followed by Universiti Putra Malaysia with 85 and Universiti Malaya 39 products since 2000. Mohd Yasin & Mohd Osman (2015) mentioned that less than 2 percent from 27,449 research outputs has been commercialized in the last 5 to 10 years by Malaysian public universities. It shows that a commercialization activity in Malaysian HEIs is at an unsatisfactory level as compared to USA, Japan, Germany, France, Great Britain and the Republic of Korea (World Intellectual Property Report, 2015). More importantly, findings from World Intellectual Property Report (2011), Malaysia has a lower percentage of Patent Cooperation Treaty (PCT) registrations at only 4 percent from the year of 1980 to 2010. The findings indicate that Malaysian HEIs must work harder to apply more PCT filings in the future through a solid entrepreneurial ecosystem as well as SO process development in the university. Hence, the roles of academic spin-offs and SSOs could support the current needs to increase the PCT filings.

Further, the topic of the unemployment rate is considered more important as this issue affects many countries in the world. It is critical for all countries, including Malaysia, where the unemployment rate is consistently at 3 percent over the years and with majority of the unemployed being undergraduates. One of the solutions by the government to solve this issue is by promoting entrepreneurship development among undergraduates (Central Bank of Malaysia, 2014). However, the percentage of graduates to become an

entrepreneur after graduation is less than 6 percent. This is echoed by Higher Education Institution Entrepreneur Action Plan 2016-2020 (2016) which revealed that the percentage of graduate to become an entrepreneur is still very low. In example, only 2833 or 5.9 percent graduates had chosen entrepreneur as their profession in the year 2015. In order to increase the rate of studentpreneurs, Malaysia Ministry of Higher Education (MOHE) has launched the Malaysia Education Blueprint 2015-2025 (Higher Education) (MOHE, 2015). The Blueprint outlined 10 Shifts that will spur the continuation of excellence in the higher education system. The Shift-1 is highly related to this study. Shift-1 indicated that the Malaysian HEIs should produce holistic, entrepreneurial, and balanced graduates in the future. This shift plans to produce students with higher skills and more entrepreneurial spirit and will initially help to transform job seeker graduates into job creators (MOHE, 2015).

Since the majority of the empirical studies were from the developed countries and very limited in Malaysia, this study insists to focus on the SSO process development as most studies conducted in Malaysia are mainly examined the area of entrepreneurship intentions (pre-founding stage) of SSOs process development but never focus to assess the complete stages of SSOs process development.

3. Research Questions

The research question for this study is as below;

How does the measurement instrument of SSO process development in Malaysian HEIs is valid and reliable?

4. Purpose of the Study

This paper targets to contribute to an immature area in the literature related to SSO process development in the context of Malaysian HEIs. Obviously, the study objective is to assess the reliability and validity of a measurement instrument for SSO process development. This study will help the future researchers or practitioners to empirically study the SSO process development. Hence, the formation of more SSO will assists in increasing technology transfer to the industries and creating more job creators among university students.

5. Research Methods

To study the SO process development, an organized literature review was conducted. The exploration was limited to the entrepreneurial inclination using web based search engines. Topics search were used to identify publications that refer to motivation and inhibition factors to set up a business among university students, entrepreneurial capabilities and SO performance in title, abstract, and author keywords. The search then was further narrowed down to English language articles. Moreover, the search included only journal articles whereas books and press papers were excluded and then each of paper was categorized as either empirical or conceptual. When a paper categorized as conceptual, the review ended at this stage while empirical papers were further examined.

Major online databases, for instances Science Direct, Springer International Publishing, John Wiley and Sons Online Library, Taylor and Francis Online, Emerald Group Publishing, Sage Publication and Elsevier were used to identify the related articles. Given the aim to gain a depth understanding of those

factors in SO process development which already identified by other researchers, seventy two articles were found to contain discussion about the components of SO process development in the context of university students. In relation to develop the measurement instrument of SSO process development in Malaysian HEIs, this study follows procedure of instrument development in which consists of five phases: (1) construct conceptualization; (2) general items to represent the construct; (3) assessment of the face and content validity of the items; (4) translation and back-translation and (5) scale evaluation and refinement (refer Table 01). This procedure is a guide for researchers to develop a good survey instrument which will provide reliable and valid information. The procedure is partly followed the suggestion from Chandler & Lyon's, (2001), DeVellis, (2003), Netemeyer et al., (2003) and Slavec & Drnovsek, (2012).

Table 01. Five steps in instrument development

Phase	Procedure	Technique
1	Construct conceptualization	Literature review
2	Generate items to represent the construct	Literature review
3	Face and content validity assessment	Expert opinion, pre-test
4	Translation and back-translation	Expert translator
5	Scale evaluation and refinement	Pilot study and reliability test

6. Findings

The items in the questionnaire are being developed based on multiple indicator measurement scales adapted from the previous work of researchers such as Davidsson, (1995), Pruett et al., (2009), Linan & Chen, (2009), Turker & Selcuk, (2009), Hofer et al., (2010), Keat et al., (2011), Goldstein et al., (2013), Dinis et al., (2013), Pihie & Bagheri, (2013), Huynh & Patton, (2014). Most of the indicators are re-worded to match the SSO process development in the context of Malaysian HEIs. The constructs displayed in Table 02 as follows: Founders' characteristics; University roles; Entrepreneurial environments; Perception of barriers; SSO intentions; Entrepreneurial capabilities and SSO performance. The constructs were developed according to SO process development stages recommended by Gubeli & Doloreux (2005).

Table 02. Constructs and Sources

Construct	No. of items	Source
Founders' Characteristics.	20	Davidsson (1995); Dinis et al., (2013); Pihie & Bagheri, (2013).
University Roles.	7	Turker & Selcuk, (2009); Keat et al., (2011); Hofer et al., (2010); Goldstein et al., (2013).
Entrepreneurial Environments.	4	Turker & Selcuk, (2009).
Perception of Barriers.	8	Pruett et al., (2009).
SO Intentions.	6	Linan & Chen, (2009).
Entrepreneurial Capabilities.	16	Huynh & Patton, (2014).
SO Performance	10	Huynh & Patton, (2014).
Total items	71	

A total of 71 indicators are used to explain exogenous and endogenous constructs. The items were selected based on two main criteria like reliability test and construct validity (where reported). The items

chosen must achieve the least standard requirement (examples Cronbach Alpha value equal to or higher than 0.70). The indicators are grouped into eleven latent constructs such as founders' characteristics (need for achievement, innovativeness, propensity of risk taking, locus of control, and self-efficacy), university roles, entrepreneurial environments, perception of barriers, SSO intentions, entrepreneurial capabilities and SSO performance.

The developed measurement used a Likert-type rating scale to gather data for each construct of the research model. The Likert-type scale is one of the most popular tools to evaluate psychological properties (Maeda, 2015) such as opinions, preferences, and attitudes (Likert, 1932). The scale response categories or Likert response sets used in the survey items may influence the findings of the survey significantly. This study's intent is to use a 5-point Likert-type scale and in line with previous studies conducted by Keat et al., (2011) and Rasli et al., (2013). The scale is categorized as: 1 (strongly disagree) and 5 (strongly agree). The scale is used to measure such constructs as founders' characteristics, university roles, entrepreneurial environments, perception of barriers, SO intentions, and entrepreneurial capabilities. Whereas, the SSO performance is measured by a different scale and labelled as: 1 (much lower) and 5 (much higher). This scale is suitable for measuring the performance of SSOs because it was suggested by Wall et al., (2004). The used of multi-item constructs will ease the problem of using a single item measure and to ensure a comprehensive evaluation from respondents (Nunnally, 1978; Churchill, 1979; Peter, 1979).

Based on the identified constructs and indicators, the questionnaire is being designed and divided into five sections. The first four sections of the questionnaire comprise of 61 items relating to the constructs and the last part pertains to demographic questions. The estimated completion time for each respondent to answer the questionnaire is within 25 minutes. In specific, the first section consists of 37 questions asking respondents to evaluate their perception towards the motivational factors in setting up a business like founders' characteristics (need for achievement, innovativeness, propensity of risk taking, locus of control, and self-efficacy), university roles and entrepreneurial environments. In section B the researcher is interested to examine the barriers in setting up a business by asking respondents with eight questions. The following Section C includes the entrepreneurial capabilities (16 questions) that are needed to manage the business. Next, Section D contains of 10 questions to measure the current business performance of SSO. Finally, Section E consists of nine questions asking respondents related to gender, age, ethnicity, religion, place of origin, level of study, year of study, type of university, and nature of business. Additionally, a cover letter is placed on the early page of the survey form.

The following phase was implemented to determine the face validity and content validity of the indicators because they have been used in a different setting from this study. Establishing face and content validity are the initial step before ascertains construct validity (Burton & Mazerolle, 2011). The face and content validity can be assessed through a panel of experts, field test (Hair et al., 2010; Campbell et al., 2015) and literature reviews (Straub, 1989). For this study, two parties (expert opinion and pre-test) were used to validate the face and content validity of the questionnaire. As to comply with the face and content validity purposes, the questionnaire was endorsed by a panel of experts in the SSO and the academic sector to maximize the validity of the indicators. There are five experts who are involved in this process. One of them is the director of entrepreneurship center, two academicians, and two alumni from Malaysian public university. The experts were asked to rate each indicator in the questionnaire and rated only one value to

represent the level of relevance of the indicator in the particular construct. They also were asked to give the feedback or recommendations to improve the questionnaire items. Each item was given a 5-point scale ranging from 1 (unsuitable) to 5 (extremely suitable). Only items with an average score value clearly rated 3 and above were retained. Items were then evaluated several times based on feedback from these experts. The expert suggestions were integrated into the questionnaire.

The procedure of face validity is continued with a pre-test. A pre-test of the instrument is vital in making sure of the clarity of wording, format, length, comprehensiveness of the response scale, missing topics and the appropriateness of item sequencing. The draft of the instrument was presented to SSO founders in Malaysian HEIs. A total of twenty respondents (SSO founders) were conveniently selected for the pre-test procedure. The main target of pre-test is to eliminate any vagueness or indistinct words from the survey form before it was ready for data collection in a pilot test. The process also could help in improving the face of validity and content validity of the questionnaire (Frazer & Lawley, 2001). Only a few of the indicators from the survey questionnaire was modified as suggested by the pre-testing respondents.

The next stage is called translation process. The translation process was conducted in this study because the majority of the respondents (SSO founders) were non-English speakers. Other than that, all measurements used in this study are from English language; therefore, the translation process is highly requested. This study followed the Brislin's (1986) model of translation because the model is claimed as the most reliable method for developing an equivalent instrument (Jones et al., 2001; Yu et al., 2004). The translation model consists of three processes namely forward translation, back translation and decentering. At the beginning, two bilingual translators competent in both English and Malay language were selected. The translation process first started with forward translation. In this process, the source language is translated into a target language and then the questionnaire was reviewed by a Malay monolingual reviewer to identify any ambiguous wordings. Further, the back translation is implemented after completing the first process. Under back translation process, the Malay language version was then translated back into the English version. This method of blinding has ensured that the meaning of the target language (Malay language) would be adequately reflected in the back translated version (Brislin, 1970; Cull et al., 2002). The last process of translation is called decentering. According to Chapman and Carter, (1979) decentering defines as a translation process in which the original and the target language versions are both subject to modification. This process was conducted by two experts as to ensure that the words used for forward and back-translations are equivalent. The results of the process show that the SSO questionnaire in English and Malay language has no issue with inequivalent. To accommodate both English and Malay speakers, the final survey form consists of dual languages (English and Malay).

Finally, the pilot study was conducted to check the reliability of the instrument. Besides, the main objective of the pilot study is to obtain valuable information about the survey questionnaire. That is, to determine the underlying factors and psychometric properties of the SSO development process. The process will help the researcher to capture the constructs' reliability and validity; thus, the final data which the researcher plans to collect will be significant and accurate. To capture these qualities, the developed questionnaire was subjected to a pilot testing procedure. It then leads to the refinement of the survey questionnaire. A convenience sampling technique was used in choosing the sample in the pilot study and

the questionnaire was distributed through online. The respondents in the pilot test received the survey questions through online (email) and they answered the questionnaire using the similar platform. Following the suggestion made by (Luckas et al., 2004; Viechtbauer et al., 2015), this pilot study succeed to capture a total of 75 participants (SSO founders). The number is sufficient to run the appropriate statistical tests.

The data of pilot study then was analysed using IBM SPSS Statistics for Windows, Version 24. The first analysis that was recommended to examine the quality of the instrument used in the study is always referred to reliability test (Churchill, 1979). Hence, the researchers must focus on the Cronbach alpha coefficient value for each construct. According to Hair et al., (2003), the Cronbach's Alpha value from 0.60 to 0.70 is considered as lower acceptance. The Cronbach's Alpha values reported in this pilot study were ranging from 0.701 to 0.951. In specific, four constructs like need for achievement, innovativeness, propensity of risk taking and locus of control have recorded Cronbach's Alpha values of above 0.70 and considered good internal consistency. Furthermore, the Cronbach's Alpha for the three factors namely self-efficacy, entrepreneurial environments and perception of barriers were above 0.80 and can be referred as very good internal consistency (Hair et al., 2003). In addition, four constructs (university roles, SSO intentions, entrepreneurial capabilities and SSO performance) with Cronbach's Alpha value above than 0.90 and considered excellent. Thus, the indicators in each constructs were considered well written, clear and appropriate in this study. Table 03 summaries the results of reliability test.

Table 03. Summary results of reliability test

Construct	Number of items	Cronbach Alpha
Need for achievement	4	.721
Innovativeness	4	.701
Propensity of risk taking	4	.750
Locus of control	4	.714
Self-efficacy	4	.827
University roles	7	.917
Entrepreneurial environments	4	.819
SSO Intentions	6	.951
Perception of barriers	8	.877
Entrepreneurial capabilities	16	.945
SSO performance	10	.919

7. Conclusion

The major contribution of this study is to the development of a set of validated measurement instrument of SSO process development in Malaysian HEIs for collecting data in further studies. To design the instrument, this study has followed five stages of procedure for the purpose to validate and test the reliability of scale measurement. The researchers believe that the instrument developed in this study is parsimonious and will be useful for further studies of SSO process development in the context of HEIs. The results of reliability test show that all constructs are reliable with the values of Cronbach Alpha more than 0.70.

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