THE ROLE OF INNOVATION CULTURE IN SHAPING INNOVATIVE BEHAVIOUR AMONG STUDENTS AT HIGHER EDUCATION INSTITUTIONS IN MALAYSIA

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ABSTRACT

Guided by the concept of organisational culture and behaviour from the management field of study and applied to the context of higher education, this study examines the antecedents of innovation culture and proposes a conceptual model to understand the relationship between innovation culture and innovative behaviour among Malaysian undergraduate students. The model consists of five constructs: effective communications, climate for innovation, self-efficacy, culture of innovation, and innovative behaviour. Using the cluster sampling techniques, a 6-point Likert scale survey questionnaire was administrated to 1,110 undergraduate students of five public research universities in Malaysia. The questionnaire contains 48 items that measured the five research constructs.

Results indicated that self-efficacy is a major antecedent of innovation culture followed by effective communications and climate for innovation. The findings also revealed that innovation culture had a positive effect and significantly influenced innovative behaviour. Climate for innovation on the other hand, was found to have no significant effect on innovative behaviour. The result signifies the importance of effective communications and self-belief in moulding the intended behaviour regardless of the situations or environmental conditions.

The key finding of this study was the importance of self-efficacy in encouraging innovation culture and cultivating innovative behaviour which was rarely found in current literature. Findings of this study are beneficial to university administrators in planning appropriate actions to initiate and sustain innovative behaviour among their students.

ABSTRAK

Berpandukan konsep budaya dan perlakuan organisasi dalam bidang pengurusan dan diaplikasikan kepada konteks pendidikan tinggi, penyelidikan ini mengkaji penentu budaya inovasi dan mengemukakan sebuah model konsep yang menerangkan hubungan antara budaya inovasi dengan kelakuan inovatif dalam kalangan para pelajar ijazah pertama di Malaysia. Model ini merangkumi lima konstruk iaitu komunikasi berkesan, iklim inovasi, efikasi kendiri, budaya inovasi, dan kelakuan inovatif. Dengan menggunakan kaedah persampelan kluster, satu soal selidik yang menggunakan skala Likert enam tahap telah ditadbir kepada 1,110 pelajar ijazah pertama dari lima buah universiti penyelidikan awam di Malaysia. Soal selidik tersebut mengandungi 48 soalan bagi mengukur lima konstruk berkenaan.

Keputusan menunjukkan bahawa efikasi kendiri merupakan penentu utama budaya inovasi, diikuti oleh komunikasi berkesan dan iklim inovasi. Hasil kajian juga mendapati bahawa budaya inovasi memberikan kesan positif dan sangat signifikan dalam mempengaruhi kelakuan inovatif. Sebaliknya iklim inovasi didapati tidak memberikan kesan bermakna kepada kelakuan inovatif. Keputusan ini sekali lagi menandakan kepentingan komunikasi berkesan dan keyakinan terhadap keupayaan diri sendiri dalam membentuk kelakuan inovatif tanpa mengira situasi atau keadaan persekitaran semasa.

Penemuan utama penyelidikan ini adalah kepentingan efikasi kendiri dalam menggalakkan budaya inovasi dan memupuk kelakuan inovatif yang jarang dibincangkan dalam literatur kajian semasa. Hasil dapatan kajian ini sangat bermanfaat kepada pihak pentadbir universiti dalam usaha merancang pelan tindakan yang sesuai bagi memulakan dan melestarikan usaha menggalakkan kelakuan inovatif para pelajar di institusi masing-masing.

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LIST OF SYMBOLS AND ABBREVIATIONS

MOE	:	Ministry of Education
MOHE	:	Ministry of Higher Education
HE	:	Higher Education
HEIs	:	Higher Education Institutions
RUs	:	Research Universities
UM	:	Universiti Malaya (University of Malaya)
UKM	:	Universiti Kebangsaan Malaysia(National University of Malaysia)
USM	:	Universiti Sains Malaysia (University of Science Malaysia)
UPM	:	Universiti Putra Malaysia (Putra University Malaysia)
UTM	:	Universiti Teknologi Malaysia(University of Technology Malaysia)
EC	:	Effective Communications
CI	:	Climate for Innovation
SE	:	Self-efficacy
IC	:	Innovation Culture
IB	:	Innovative Behaviour
LMX	:	Leader-Member Exchange theory
IV	:	Independent Variable
MV	:	Mediating Variable
DV	:	Dependent Variable
ROs	:	Research Objectives
RQs	:	Research Questions
PPS	:	Probability-Proportionate-to-Size sampling
SPSS	:	Statistical Packages for the Social Sciences
SEM	:	Structural Equation Modelling

AMOS	:	Analysis of Moment Structures
CR	:	Composite Reliability
AVE	:	Average Variance Extracted
EFA	:	Exploratory Factor Analysis
CFA	:	Confirmatory Factor Analysis
BTS	:	Bartlett's Test of Sphericity
KMO	:	The Kaiser-Meyer-Olkin measure of sampling adequacy
χ^2	:	Chi-square
RMR	:	Root Mean Square Residual
RMSEA	:	Root Mean Square Error of Approximation
GFI	:	Goodness-of-Fit Index
AGFI	:	Adjusted Goodness-of-Fit Index
NFI	:	Normed Fit Index
TLI	:	Tucker Lewis Index
PGFI	:	Parsimony Goodness-of-Fit Index
PNFI	:	Parsimony Normed Fit Index
CFI	:	Comparative Fit Index
IFI	:	Incremental Fit Index

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CHAPTER 1: INTRODUCTION

This quantitative study concerns the role of innovation culture in shaping innovative behaviour among students at higher education institutions in Malaysia. This chapter begins with the background of the research which elaborates on the problem that initiates the study, the introduction on the topic of research, and the research gaps. Then the context is stated and further clarified through the research questions and objectives. Next, the terms and operational definitions are described. The end of the chapter discusses the limitations of study and the organisation of the thesis.

1.1 Background of Study: Higher Education in Malaysia

In Malaysia, pre-tertiary education is under the jurisdiction of the Ministry of Education (MOE) while tertiary education is under the Ministry of Higher Education (MOHE). MOHE was set up in 2004 for creating and developing a higher education environment to encourage the establishment of centres of knowledge, and the development of competent, innovative, and ethical individuals thus fulfilling national and international aspirations (Ministry of Higher Education, 2015). The education industry in Malaysia is fast gaining acceptance and building a reputation as the preferred study destination in the region as it offers a variety of professional programmes and highly specialised skill courses at reasonably competitive prices and quality (Lau, 2009).

For these reasons, the number of public higher education institutions (HEIs) in Malaysia has increased significantly during the last twenty years from seven in the early 1990s to twenty public universities to date (Ministry of Higher Education, 2015). These universities are categorised into three groups which are five research universities, four comprehensive universities and eleven focused universities (technical, education, defence, management). Research universities focus on research, focussed universities

concentrate on specific fields related to their establishment, while comprehensive universities offer a variety of courses and fields of study.

In 2012, the Minister of Higher Education announced that five public universities have been given autonomy in administration, human resources, financial and academic management, and student intake (Ministry of Higher Education, 2015). They are Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM), Universiti Putra Malaysia (UPM), and Universiti Teknologi Malaysia (UTM). This move is aimed at encouraging excellence among local institutions of higher learning (Education Guide Malaysia, 2015). Undergraduate studies consist of bachelor degree levels and professional studies while postgraduate studies consist of master degrees and Ph.D. levels.

In its development plan for the higher education sector, MOHE set a goal to meet the country's human resource capital needs by focusing on strengthening of the 5Cs which are critical thinking and problem solving, effective communication skills, collaboration and team building, creative and innovative, and culturally literate. The ministry hopes that the next generation will be daring enough to face challenges, take risks, and learn to embrace adventure and exploration (Ministry of Higher Education, 2015). HEIs therefore, have the task of producing graduates of high quality who will have a high level of employability.

1.2 Problem Statement: Employability among Graduates

The role of HEIs is changing now from offering heavily subsidised education to investment aimed at generating sustainable profit. This change can be seen in the public universities in Malaysia, by which a few research universities have been moving toward self-governing (autonomous) in stages (NST, 2016, January 10; Sharom, 2015, October 28). Self-sustainability requires sustainable innovation and a culture of innovation

which is shared among members of the university. Worldwide recognition (in terms of ranking, reputation, and fame) and money become as important because most universities should now be self-sustaining and profitable. In order to improve and maintain the credibility of local public universities, they need to compete with mushrooming private HEIs. This increases the need for resources to provide innovations for learning activities and sustain research facilities independently. To address these needs, several public universities are utilising their expertise and looking for ways in raising their own funds as it is unacceptable to simply charge higher fees for programmes and courses offered. A few have already set up private subsidiaries and planned to establish private medical facilities (Sharom, 2015, October 28). The restructuring of local HEIs also has involved corporatisation and the formation of strategic partnerships with private sector entities (Nik Ismail, Cheam, & Mamat, 2013, June 25-26).

Traditionally, the university was regarded as a temple of learning of art, culture and science (Faruqi, 2014, October 2), a place of knowledge and wisdom where the whole objective of education was to develop the mind and to create graduates capable of doing new things and receptive to new thoughts. The methods of instruction and evaluation today which emphasise teaching and written examinations and not so much on learning and practical skills, have created graduates with insufficient skills and competencies required by their future employers. Furthermore, parents and students view HEIs as places to prepare and groom students to secure employment and decent income. They wish to see the money spent on tertiary education to be returned in terms of good career and economic benefits in the near future. With private universities being run like businesses, public universities are increasingly emulating this business model, adopting marketing strategies and being treated as businesses where students and parents are the

obvious consumers, administrators as managers and teachers as employees. The goal then, is to provide career training and courses that teach the trade.

The purpose of higher education (HE) is to provide students with comprehensive and well-rounded education that makes graduates employable in a sustainable manner. Instead of knowing how to do, they should be able to do or practise what they have learnt while in the education process (Selvadurai, Er, & Maros, 2012). They also need practical learning activities, internship, and training to sharpen their employability skills. Employability is defined as a set of student attainments or attributes identified as understanding, skills (generic and specific), efficacy beliefs, and meta-cognition, which underpin an individual's potential for productive contribution to society through employment (Turner, 2014; Yorke & Knight, 2007).

The Corporate Recruiters Survey 2015 Report by the Graduate Management Admission Council (GMAC) revealed that to secure jobs, graduates must not only hold a degree or a certificate, they should also be able to perform (Aeria & Khor, 2015, June 21). Malaysian companies need new employees to have strong communication, leadership, and strategy skills. In another survey in 2011 (NST Online, 2014, June 28), employers cited skills mismatches between recent graduates and employers' demands as the main reason for graduate unemployment. Employers value soft skills such as the ability to think critically and creatively, and to communicate and work independently, as a main factor for hiring entry-level graduates. As such, HEIs need to build an environment capable of sustaining a culture that embraces the fear of change or uncertainty, and faces it directly instead of running away from it (Cheah, 2014, April 19).

Since thousands of graduates from HEIs flood the employment market each year plus some from private HEIs and international universities abroad, creates fierce competition

for a limited number of vacancies. Factors affecting graduate employability include the slowing economic growth, unexpected shifts in demand from one industry to another (e.g., oil and gas industry which is severely affected by the current low global price of crude oil) (Singh, Thambusamy, Ramly, Ho Abdullah, & Mahmud, 2013), hesitation in speaking a second language, being so used to spoon-feeding while studying makes them highly dependent on step-by-step coaching when entering the workforce, and not being trained to do proper research while in universities has led them to be less capable of independent or creative thinking when solving work tasks (Zaman, 2012, November 4).

Combining all these reasons, there is a dire need to emphasise a foundation in a can-do attitude, or being innovative. It is understood that not everyone can be highly creative to think outside the box; nevertheless, there should be at least a desire to adapt and adopt certain skills and attributes to achieve the minimum competence level in the workplace. To develop talent with the relevant skills, academic qualifications and the right balance of aptitude and attitude, universities are reshaping their institutional culture and rethinking their role in enhancing student engagement (Ryan, 1998) and managing attention in order for students to not lose their driving energy (Scott & Bruce, 1994). Thus culture can be seen as a control mechanism (Bellamy, 2010) which brings out the desired behaviour (or skills) in students. As noted by Bellamy, the concept of culture might be the most appropriate framework for analysing ways of life in universities and academic departments.

Several characteristics of innovation culture have been identified as the potential remedy for student employability problems. Current literature has reported various skills, attitudes, and personal attributes that are highly sought in the employment marketplace. Findings of the studies in the employability topics (Commonwealth of Australia, 2007; Ito & Kawazoe, 2015; Lowden, Hall, Elliot, & Lewin, 2011) have

recognised many characteristics of innovative or innovation culture that are also being referred to as innovativeness. These include critical thinking, creativity, task-completion skills, collaboration and networking, agility and adaptability, effective communication skills, and curiosity and imagination (Ito & Kawazoe, 2015). These characteristics and skills can further be associated with personal or individual, group or team, and institutional traits (Parzefall, Seeck, & Leppänen, 2008).

In order to generate commitment and motivation to create an innovation culture, behaviour and attitudes of people in an innovative organisation must be widely shared among them, and be encouraged and supported by the organisation. This is why innovative behaviour (IB) is important as it is the most valuable capital of the organisation (Martins & Terblanche, 2003). In psychological studies, innovative behaviour is also referred to as innovative work behaviour (IWB). Innovative behaviour typically are behaviours directed toward generating creative new and relevant ideas, implementing change and applying new knowledge or improving processes to enhance personal and/or business performance (de Jong & Den Hartog, 2008; Montani, Odoardi, & Battistelli, 2014).

Borrowing these concepts from the relevant fields of management, business and administration, psychology, and education, it is vital for HEIs to transform into learning organisations that strive for academic excellence among students in order to create opportunities to access the right knowledge at the right time, and at the right location, in order to stay competitive (Hussein, Mohamad, Noordin, & Amir Ishak, 2014; Kumar, 2005; Ng, Singh, & Jayasingam, 2012). The different educational players in this specific context affect perspectives on educational innovations. Hence, in order to operate successfully within the education institutional environment, it is important to understand the values that drive and support the culture of innovation (Zhu & Engels, 2014).

1.3 Research Gaps and Significance of Study

Although the concepts innovation culture and innovativeness have been researched over the last three decades (Ahmed, 1998; Alm & Jönsson, 2014; Crossan & Apaydin, 2010), there is a need to investigate specific components of an educational institutional culture that support innovation culture and innovative behaviour. The complexity of the concept of innovation culture is matched by the lack of empirical research on it (Jucevičius, 2007) in the HE context. Furthermore, this study integrates the cultural and institutional factors in shaping and emulating the model of innovation culture in HEIs while measuring the manifestation of the innovation culture characteristics on individual level, which is from the students' perspective.

The assessment on undergraduate students is crucial especially now in times of shifts in circumstances and expectations impact changes in certain (education) institutions (Faruqi, 2014, October 2; Ministry of Higher Education Malaysia, 2012). This has been proven in the current general Malaysian education sector (NST, 2016, January 10). Public HEIs are facing rising competition from the private universities and colleges in terms of producing marketable and employable graduates (Nik Ismail et al., 2013, June 25-26) who are work-ready upon graduation. In addition, the requirements for performing in top rankings demand talented and innovative students who can embrace a positive innovation culture which tolerates mistakes and failures and strives to learn from mistakes in order to improve and progress continuously, keeping up with goals and future targets. Therefore, an evaluation on innovation culture is essential in assessing the state of the local students prior to joining the employment market.

Although various studies on innovation culture have been done in the management field, empirical studies on higher education students are very scarce. Since the universal definition and the concept of innovation culture is rarely precisely defined (Jucevičius,

2007), the applicability of this concept in HEIs is also under-researched. Literature regarding innovation culture in educational context is often presented in the form of reports by public and private institutions. A recent example is a report titled "Building a Culture of Innovation in Higher Education: Design & Practice for Leaders, Emerging Lessons and a New Tool" (Setser & Morris, 2015). The report focused on HEI leaders rather than students. This gap in the existing literature provides the basis of this research which reviews the literature on innovation culture from education and business organisations, and later tests the hypothesised framework on the actual population.

Additionally, research on innovation culture has been focusing on the North American and the European regions. An example is a publication titled "Integration of an Innovation Culture as Part of the Institutional Strategy: Strategic Guide for Higher Education Institutions" (Westhofen et al., 2009). This report reviews innovation culture in the European HEI context. Hence, we need to conduct similar research in the local Malaysian context to address the needs highlighted by the problems faced by many graduates today such as mismatch between student skills and industry demand, securing immediate employment upon graduation, and to instil independence and entrepreneurial mindset among graduate students.

Furthermore, with regard to the different levels of analysis, many of the research studies focused on the organisation level (Anderson, Potočnik, & Zhou, 2014), which is conceptualising culture apart from the individuals who interact within the institution (Dobni, 2008; Lawson & Samson, 2001). Other publications revolve around the management to increase performance as outcome (Anderson et al., 2014; Brettel & Cleven, 2011; Calantone, Cavusgil, & Zhao, 2002; Homburg & Pflesser, 2000). With another trend emerging from the literature which is seeing culture from the perspectives of the individuals in the institution (Jaskyte & Dressler, 2004), this study posits that

positive innovation culture of the university (as an organisation) will effect positive innovative behaviour in students (individually).

One very important yet often neglected trend is to understand innovation culture from both institutional and individual levels (Anderson et al., 2014). This is so that the interaction between both entities and the elements of culture can be assessed in order to see if there is influence of culture involved in the resulting innovative behaviour among students. Thus, the design of this research is intended to fill this gap by examining characteristics of the universities and the elements of culture in innovation orientation of the university in driving the students along its goals, vision, and mission. For the institutions, this study helps to improve provision of tools (spaces, resources, networking) for students' innovativeness, as envisioned by the Ministry of Higher Education (MOHE).

As mentioned before, there is a dire need to assess student innovativeness, receptiveness to new ideas and innovation culture, and the implementation of innovation ideas as outcomes. In environments of uncertainty, innovation and innovativeness are a requirement of every job description. With the right innovation culture and behaviour, these students will boost their energy, be motivated, and drive to a successful employment goal while building a meaningful career.

1.4 Scope of Research

The study aims at identifying what influences innovation culture in the higher educational context. The antecedents of innovation culture will manifest as innovative behaviour in students. The research will concentrate on the undergraduates as target respondents because generally they are of the same age group (mostly from 18 to 25 years old), from about the same educational background, and they possess an almost standard intellectual level and opinion about certain issues pertaining to university life.

The public research universities (RUs) in Malaysia are the chosen sites for the study because all are focusing on research activities and publications, and have competitive entry requirements, thus having an equal standard of assessment. The universities are University of Malaya (UM), University of Science Malaysia (USM), University of Technology Malaysia (UTM), National University of Malaysia (UKM), and Putra University Malaysia (UPM). Further explanation on scope of study will be discussed in Chapter 3.

1.5 Research Questions

In fulfilling the purpose of the research, these questions have been asked as a guideline:

1. What are the antecedents of innovation culture of HEIs students in Malaysia?

2. How do these antecedents of innovation culture influence students' innovative behaviour?

3. What is the relationship between innovation culture and students' innovative behaviour?

1.6 Research Objectives

The purpose of the study is to examine factors that promote innovation culture among students in Malaysian HEIs. The study aims at developing a means to its assessment quantitatively in terms of values and practices. It is also to see how their interaction with the university environment affects their adoption and embracement of innovation culture. Additionally, the study determines the relationship between innovation culture and innovative behaviour.

The specific research objectives are:

1. To identify the antecedents of innovation culture of HEIs students in Malaysia.

2A. To examine the relationships between the antecedents of innovation culture and innovative behaviour of students.

2B. To examine the relationship between innovation culture and innovative behaviour of students.

1.7 Definition of Terms

The following terms and definitions are central to this research and used throughout the thesis:

Higher Education (HE) covers certificate, diploma, undergraduate, as well as postgraduate levels. The higher education providers are colleges, polytechnics, and universities. **Undergraduate studies** consist of bachelor degree levels and professional studies while postgraduate studies consist of master degrees and Ph.D. levels. The bachelor degree level is usually for students aged 19 or 20 onwards with post-secondary qualifications such as the STPM (which is equivalent to GCE "A" levels) or pre-university or university foundation qualifications. These degree programmes normally last three to five years. After obtaining a bachelor's degree, students can proceed to postgraduate studies (Education Guide Malaysia, 2015).

Higher Education Institutions (HEIs) are universities, colleges and other education institutions offering and delivering higher education. For universities in Malaysia, HEIs comprise five research universities, four comprehensive universities, and eleven focused universities (technical, education, management, defence). Research universities focus on research, focused universities concentrate on specific fields related to their establishment while comprehensive universities offer a variety of courses and fields of study (Ministry of Higher Education, 2015).

Research Universities (RUs) are five public universities which were given autonomy in administration, human resources, financial and academic management, and student intake (Education Guide Malaysia, 2015). They are existing premier universities which already have strong research cultures and excellent track record in research activities. They are centres of excellence in niche areas of the nation, are capable of producing research outputs, generate high impact publications, and are capable of attracting the best brains for teaching and research purposes. These RUs must also be able to attract graduate students of high standards and to secure research funds from industry (The Ad Hoc Committee, 2004, January 3).

In the context and scope of this study, HEIs consist of the five RUs as explained in Section 1.4. HE covers foundation studies and undergraduate level. Accordingly, **undergraduate students** are those studying for their bachelor's degree including students of foundation studies, at one of the five RUs, who have yet to receive their first degrees.

1.8 Conceptual and Operational Definitions

Constructs of the study are defined and operationalised as follows:

Effective Communications (EC): At organisational level it is defined as access to communication channels, accessibility to information (Yahyagil, 2004), availability of diverse knowledge (learning), and information exchange both within and outside the environment (Homburg & Pflesser, 2000). Such communication also determines how knowledge and information are gathered, their interpretation, evaluation, and sharing practices (Calantone et al., 2002).

EC is smooth and communicative environment for having expectations, common goals and inspiring feelings of commitment; having rules and regulations or

bureaucratic practices; and for access to internal communication channels and information exchange for students and various members of the university. In the survey questionnaire, these three variables were recognised as goals and motivation, formalisation, and internal communication.

Climate for Innovation (CI): At organisational, collective and individual levels, it is about a more concrete and tangible way to measure elements of culture in terms of specific behaviours and characteristics as reflected in students' innovative behaviour (individually, collectively) and their reactions upon interactions with people (other students, academics, staff) and the environment (campus), through social process or social learning. Organisational climate includes organisational structure, roles of student, rewards and incentives, informal practices, and the physical environment (Schein, 2004).

In this study, CI examines the features of the university or its internal environment that are conducive for innovations and innovative activities. These are associated with the campus structural and physical arrangements; reflect values and appreciation for individual and collective innovative accomplishments; present good ambience for work and innovation; promote integration among students and other university members; provide lecturer and peer support; and provide good ambience or close interactions between students and university members for various social relations. In the questionnaire, these six variables were designated as infrastructure, rewards and recognition, nature of work, teamwork, support (from lecturers and peers), and interpersonal relations.

Self-efficacy (SE): At an individual level, it is the feeling of empowerment, self-confidence, and self-assurance, as developed through a process of social learning. It is the judgement individuals make about their ability to execute a particular behaviour,

and has consistently been found to be associated with work-related performance (Bandura, 1994) or innovative behaviour in this study.

For this study, SE is a student's perception of his/her ability to explore the unknown; to imagine and envision the development of ideas and solve problems; to adopt and adapt when in need; to have control over decision-making; and to act voluntarily. In the survey questionnaires, these five variables were identified as curiosity, creativity, flexibility, autonomy, and pro-activeness.

Innovation Culture (IC): At organisational, collective, and individual levels, IC is simply an innovation-oriented culture. Cultural artefacts or symbols supporting innovation are stories (of heroes), rituals, and supporting language (Ashforth, 1985; Hogan & Coote, 2014). The three symbols also represent the transmission or exchange of culture from its environment to members of the institution.

In this study, IC is cultural artefacts, or symbols, or forms, of the university. These symbols convey how students and other campus communities transmit or exchange innovation or innovative narratives or stories; bodily movement and gesture in social activities; and convey meanings through a system of vocal signs to each other. In the survey questionnaire, the three innovation or innovative symbols were recognised as stories (of heroes), rituals, and supportive language.

Innovative Behaviour (IB): An individual or personal attribute, it is defined as the behaviour that is likely to manifest itself in response to environments in which institutions practise innovation-oriented culture (Scott & Bruce, 1994).

For this study, IB is students' abilities and willingness to be innovative. A student may have the capability to response to change and new ideas; have tolerance for error and different views; have freedom to experiment and take calculated risks; and be

willing to adopt change and new ways of doing things. In the survey questionnaire, these four behaviours were designated as empowerment, mistake/conflict handling, risk-taking, and novelty-seeking.

1.9 The Organisation of the Thesis

This thesis consists of five chapters which are summarised as follows.

Chapter 1 presents the introduction to innovation culture and innovative behaviour in general and in the educational context. This chapter also details the related information of interest such as problem statement, research significance, research questions, research objectives, and the overall terms and operational definitions used in the study.

Chapter 2 addresses the definitions of innovation and the concept of innovation culture. Following the literature review, major findings on innovation culture concepts and themes are highlighted. These are incorporated into the constructed conceptual framework. It also features the development of hypotheses in attempts at explaining the research questions.

Chapter 3 discusses the methodology of research in empirical testing of the model and hypotheses. Methods of reasoning, research design, sampling techniques, data collection, instrument design, and data analysis techniques are explained.

Chapter 4 describes the results of data analyses. Various results of preliminary test, factor analysis, reliability test, convergent validity, and discriminant validity test are discussed. The model is tested and verified in order to achieve fit of data using multiple regression and structural equation modelling (SEM). Finally, hypotheses testing results are presented.

Chapter 5 explains findings in the previous chapter and compares the findings with research findings by others. The chapter also details the implications of research, recommendations for future research and practice, and points out some limitations. It ends with a summary of the chapter.

1.10 Summary of the Chapter

The chapter discussed background to the study and provided several justifications on it. Research objectives and research questions were listed, definitions were given on a few terms, and operational definitions were specified. It ended with the thesis organisation. The next chapter will discuss the literature, and the development of the proposed framework and research hypotheses.

CHAPTER 2: LITERATURE REVIEW

This chapter describes in detail what innovation and innovation culture are in general and the specific context of the study. It discusses some theoretical frameworks in order to explaining the key concepts and models related to innovation culture. Several important definitions and common themes, and how they emerge in the educational context are detailed, followed by the antecedents of innovation culture as viewed important to the coverage of the study as a whole. The integration of these antecedents into the hypothesised model is explained before the concluding section discloses the measurement instrument and variables.

2.1 Innovation

Innovation is something original, new and important in whatever field that breaks into a market or society (Frankelius, 2009). Innovation is the development and use of new ideas or behaviours in organisations (Damanpour & Wischnevsky, 2006). It is the creation and implementation of a new idea in a social context with the purpose of delivering commercial benefits (Wan Ismail & Abdmajid, 2007). Creation of new ideas is not innovation but the utilisation and exploitation of these ideas is (Wolf & Brennan, 2014). Additionally, innovation in public service agencies can be identified as the new ways of managing, organising, and delivering services (Walker, 2008). Crossan and Apaydin (2010) had composed an abridged and comprehensive definition whereby innovation is both a process and an outcome. It is regarded as production or adoption, assimilation, and exploitation of a value-added novelty in economic and social spheres; renewal and expansion of products, services, and markets; development of new methods of production; and establishment of new management systems.

From the various definitions in the past ten years, this research perceives innovations as the use or implementation of something new and original, in terms of ideas,

behaviours, knowledge, skills, products, services, process, methods of production, or management systems (Crossan & Apaydin, 2010; Damanpour, 2014; Damanpour & Wischnevsky, 2006; Frankelius, 2009; Wan Ismail & Abdmajid, 2007).

Innovations can be technological and non-technological (Cerne, Kašea, & Škerlavajb, 2016). Innovation can also be classified as technical or administrative when viewed from its social or technological aspects (Crossan & Apaydin, 2010; Damanpour, 2014).

Technological innovations usually consist of product and process (method of production) innovation that produce changes in physical technologies, and are more observable such as new machines and equipment (Cerne et al., 2016; Damanpour, 2014). Examples of this type of innovation are application software, hardware, and many other technology-enabled devices.

Non-technological innovation is defined as non-technological product and process innovation types that do not include a technical or technological component, which includes organisational innovation, management innovation, and marketing innovation. Psychology and sociology (behavioural theory), knowledge-based perspectives, and creativity literature heavily influenced this concept of innovation. Organisational innovation can be the implementation of innovative organisational concepts (business processes or organisational structures) that produce changes in social technologies which are more abstract, less obvious, and difficult to grasp. Management innovation can include changes in strategy, structure, administrative processes, and systems. This does not embody technology and refers to patented know-how and property rights (Cerne et al., 2016; Damanpour, 2014). On the other hand, marketing innovation takes three dimensions into its definition which are product strategy, price strategy, and promotion strategy (Wolf & Brennan, 2014).

Besides these categories of innovation, another important theme in researching innovation is the adoption of level of perspective (Cerne et al., 2016; Crossan & Apaydin, 2010; Walker, 2008). Three important levels include organisational or macro level; collective, group or unified level; and individual or micro level. Organisational level analyses development of strategies relating to environmental, contextual, structural, and managerial factors of an organisation or institution involving the administration and management staff. Collective level usually studies social-interactional processes involved in teamwork between administrative and management staff, and the employees, customers and clients. The individual level describes how these employees perform in order to create and implement new ideas (Anderson et al., 2014; Cabezas, 2013). This can be in terms of work practice and all other activities related to work and office traditions.

In conclusion, innovations are anything new and original to the market or society. This research specifically studies the non-technological innovation concept that may include both organisational and management innovation that do not embody technology. It also adopts the three levels of perspective, covering organisational, collective, and individual levels.

2.2 The Concept of Innovation Culture

Globalisation and outsourcing have increased pressure on organisations to operate efficiently and effectively by outperforming their competitors. This created the need to be different and unique (Koerber, Buchfink, & Völker, 2010; Wolf & Brennan, 2014). Literature on innovation often touches on organisational culture or corporate culture before defining innovation culture (Hogan & Coote, 2014; Koerber et al., 2010; Linke & Zerfass, 2011; Prabhu, 2010). As there are many definitions of these concepts, it is rather obvious that they include the definition of culture and the manifestation of culture

on the organisation members and their behaviours, as a result of interaction within the enveloping environment. An analysis on the previous definitions of organisational culture (OC), corporate culture (CC), university culture, and innovation culture (IC) is required in order to build the concept of innovation culture. Several of these definitions are listed in Appendix A.

Organisational culture consists of values, norms, and behaviours, which collectively define the acceptable and 'normal' ways of getting things done within an organisation (Schroeder, 2013). It is also defined as values and beliefs that provide norms of expected behaviours that employees might follow (Hogan & Coote, 2014). Another definition encompasses the values, beliefs, and assumptions of employees as expressed in varied forms and which have significant implications for the working lives of organisational members (Mathew, 2008). Zhu and Engels (2014) defined it as shared philosophies, ideologies, values, assumptions, beliefs, expectations, attitudes and norms in organisations. Wolf and Brennan (2014) defined it as basic assumptions, shared values and beliefs, shared meanings, and norms. Lastly, it is also referred to as the combination set of numerous values, norms and rituals shared by members of the organisation which govern their interaction behaviours (Tan, Choi, & Rasli, 2015). From the various definitions, this study understands that organisation culture refers to values, beliefs, and norms (Hogan & Coote, 2014; Wolf & Brennan, 2014; Zhu & Engels, 2014), that are expected or acceptable (Hogan & Coote, 2014; Schroeder, 2013) to the members which shaped their behaviour as a result of interaction among themselves (Tan et al., 2015; Wolf & Brennan, 2014).

Meanwhile, corporate culture is a set of assumptions, practices (formal and informal rules), and attitudes about how a company operates (Phillips, 2011, August 3). Roughly, corporate culture revolves around Schein's (2004) definition of culture with a strong

emphasis on the company's corporate governance. The importance of having a culture is to motivate the people or employees, in specific, to generate ideas. New ideas or innovations require motivated individuals, time, effort, knowledge, and a supportive organisational environment (Linke & Zerfass, 2011). In the comprehensive concept of culture, it is "a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Linke & Zerfass, 2011; Schein, 2004).

Another concept that incorporates culture is the university culture which is relevant to the context of this study. The university as an institution of higher learning (an organisation) has its own set of stakeholders such as administrators, academics, students, board members and support staff (Fralinger & Olson, 2007). As such, a university culture is defined as values, and beliefs of these stakeholders that shape their behaviour as a result of interaction among them on and off campus (Fralinger & Olson, 2007; Kuh & Whitt, 1988).

To describe the cultural aspects of these concepts, three common attributes of organisational culture are relevant (Wolf & Brennan, 2014). Firstly, it has many layers including values, norms (Hogan & Coote, 2014; Schroeder, 2013; Tan et al., 2015; Wolf & Brennan, 2014), beliefs, and basic assumptions (Linke & Zerfass, 2011; Mathew, 2008; Schein, 2004; Wolf & Brennan, 2014). Secondly, a set of these layers needs to be shared among members of the organisation. Thirdly, it is socially influenced by environment and history which shape the member behaviour (Deshpande & Webster, 1989; Hogan & Coote, 2014; Kuh & Whitt, 1988; Schroeder, 2013; Tan et al., 2015).

Zhu and Engels (2014) described innovation culture as internal assumptions, values and management practices that foster development of new ideas into products, processes, objects and services. Innovation culture is a way of thinking and behaviour that creates and develops values and attitudes within a firm, which may accept and support ideas and changes, even though such changes may mean a conflict with conventional and traditional behaviour (Claver, Llopis, Garcia, & Molina, 1998). Hepburn (2013) defined innovation culture as an environment that supports creative thinking and advances efforts to extract economic and social value from knowledge while it generates new or improved products, services, or processes. It has a shared set of values and mutually reinforcing beliefs about the importance of innovation as well as an integrated pattern of behaviour that supports research and innovation. Another definition was about relatively stable modes of reflection, behaviour, and social organisation, directed at modernisation and development, based on shared values (Heidenreich, 2001). Meanwhile, Dobni (2008) defined innovation culture as a multi-dimensional context which was exclusively suited to her context of study, the financial services industry, which includes the intention to be innovative, the infrastructure to support innovation, operational level behaviours necessary to influence a market and value orientation, and the environment for implementing innovation.

It is clear from these definitions that innovation culture can be defined more or less the same on the cultural aspects with emphasis on values and management practices (Claver et al., 1998; Zhu & Engels, 2014) that eventually will lead to new ideas (in terms of products, processes, services) (Hepburn, 2013, May 17; Zhu & Engels, 2014) that might challenge the traditional or the usual way of doing business, or running a company (Claver et al., 1998; Heidenreich, 2001). All these developments will influence the behaviour of people in the organisation (Claver et al., 1998; Dobni, 2008; Heidenreich, 2001; Hepburn, 2013, May 17).

The concept of innovation culture thus differs in its emphasis on innovations, seen as the development of new ideas in terms of products, processes, and services (Hepburn, 2013, May 17; Zhu & Engels, 2014), and changes (Claver et al., 1998) in the direction toward modernisation (Heidenreich, 2001) which can be conventionally defiant and traditionally deviant (Claver et al., 1998). Other aspects of culture are retained (values, assumptions, management practices, beliefs, and attitudes) (Claver et al., 1998; Hepburn, 2013, May 17; Zhu & Engels, 2014), shared among members of the organisation (Heidenreich, 2001; Hepburn, 2013, May 17), and shaped their behaviour. The mix of innovation and cultural elements should occur in a supportive environment (Dobni, 2008; Linke & Zerfass, 2011) and infrastructure of the organisation with the intention to be innovative (Dobni, 2008).

2.3 Antecedents of Innovation Culture

Other than the concept, the antecedents or the characteristics of an innovation culture include commitment to innovation in the mission statement, people and ideas at the heart of the management philosophy; looking for creative talents from unusual places; hiring individuals with diverse interests, backgrounds, abilities, and personalities; giving people room to grow, to try things and learn from their mistakes; building a strong sense of openness, trust and community across the organisation; facilitating the internal mobility of talent; failure tolerance and experimentation; and valuing and accommodating constructive conflict (Leavy, 2005). "A culture that supports innovation engage behaviors that would value creativity, risk-taking, freedom, teamwork, value-seeking and solutions-oriented, communicative, instilling trust and respect, and be quick and responsible in making decisions" (Dobni, 2008, p. 544). Some of these characters are summarised in Table 2.1.

Table 2.1: The characteristics of innovation culture found in the literature

Sources	Characteristics of Innovation Culture
Wolf & Brennan (2014)	Teamwork & autonomy, risk-taking, support of change, trust & openness (communication)
Dobni (2008)	Innovation propensity, organisational constituency, organisational learning, creativity and empowerment, market orientation, value orientation, implementation context
Dombrowski et al. (2007)	(Common) mission, vision, and value statements that encourage innovation Democratic, lateral communication (lack of hierarchy, participative decision making, and problem solving) Safe spaces (areas or gatherings) supporting experimentation, allocation of time Flexibility (functional/ regional job rotation), social networking in/outside the organisation, cross-functional teams, system for advocating ideas Boundary spanning Collaboration (e.g., R&D centres, suppliers, customers, networks) Incentive schemes; leadership
Jaskyte & Dressler (2005)	Negative determinants: cultural consensus, team orientation and stability Positive determinants: values such as willing to experiment, quick to take advantage of opportunities, and risk-taking
Leavy (2005)	Commitment to innovation in mission statement, people and ideas at the heart of the management philosophy, looking for creative talents from unusual places, hiring individuals with diverse interests, backgrounds, abilities, personalities; peer involvement in the selection process Giving people room to grow, to try things and learn from their mistakes, building a strong sense of openness, trust and community across the organisation Facilitating internal mobility of talent, failure tolerance and experimentation, valuing and accommodating constructive conflict
Lemon & Sahota (2004)	Cultural dimensions: degrees of freedom, group interaction, balance, communications, working relations, time Model constructs: the environment, mission, vision & values, technology, knowledge structures, management style, organisational structure
Martins & Terblanche (2003)	Quality versus efficiency goal orientation, future-oriented vision and mission, values related to purposefulness, freedom, flexibility, cooperative teamwork, support for change, tolerance for conflict, job rotation, broad job descriptions, empowerment, autonomy, quick decision making, individual diversity, competitiveness

Adapted from Jaakson, Jørgensen, Tamm, & Hämmal (2012).Investigating cultural influences on innovation: A comparison of Estonian and Danish biotechnology organizations. In E. Carayannis et. al. (Eds.), *Innovation systems in small catching-up economies*. Springer Science & Business Media.

In relation to these characteristics, this research has identified five dimensions, also known as the components of innovation culture which are deemed suitable to the context of the research. These dimensions were used in assessing innovation culture from the perspective of students of research universities in Malaysia. They include effective communications, climate for innovation, self-efficacy, innovation culture, and innovative behaviour, which is described in detail in the following sections.

2.4 Effective Communications

In order to support and cultivate an innovation culture, having communicative environment, or effective communications (Dobni, 2008; Lemon & Sahota, 2004; Martins & Terblanche, 2003; McLean, 2005) is essential and of utmost importance. The impact of communication relies on how information exchange between people is especially suited to their preference at a level most comfortable to them (Hartmann, 2006). This can be through oral or written forms, formally or informally done.

According to Ramaley (2002), in an institution, the first thing to do prior to having a change in orientation, management or behaviour is to know the institutional culture. Next is to understand how the systems and the community members operate. It is also important to size up the environment, meaning to understand the conduct, expectations, the symbols, and the sense of pride, identity and belonging of the members because these are the layers of culture. To innovate or be able to be innovation-oriented, individual members need to develop a shared sense of purpose and learn to communicate effectively (Ramaley, 2002; Szczepańska-Woszczyna, 2014). As information flows within an institution and is clearly conveyed to each of its members, they should be able to act on whatever goals the university may have (Ahmed, Loh, & Zairi, 1999). Clarity about goals enables students and staff to focus attention on solving problems and generating ideas rather than trying to determine which goals should receive focus or priority (McLean, 2005; Szczepańska-Woszczyna, 2014).

A smooth communication process creates strong adherence to the institutional philosophy and the systems governing behaviour. It helps to have an ongoing process of affirmation and renewal (Ahmed, 1998). Students infer attachment and priorities from the environment that supports innovation which are flexible, responsive, and allow for coalition formation and connectedness. This way, cultures of giving and acting on

feedback can be cultivated. It also helps that students know where to find information actively whenever it is needed (Hartmann, 2006).

To instil a discipline and culture of innovation, students need to support their perspectives with real information, not just opinions or orders from the management or the lecturers. Communication, whether face-to-face conversation or long distance, must be encouraged in order to get everyone involved and provide support. This can be both online or direct communication. Other than communication, there should be access to information to spread the latest and updated knowledge about the institution, its performance, and condition. This activity helps all members to make informed choices given the many options, and provides immediate solutions (Ramaley, 2002).

For this study, effective communications comprise three variables: goals and motivation, formalisation, and internal communication.

2.4.1 Goals and Motivation

A clear corporate philosophy allows individuals to coordinate their activities to achieve common purposes even in the absence of direction from their managers (Ouchi, 1983; Parzefall et al., 2008). A culture of having corporate or mission statements can influence behaviour and action if properly utilised. The advantages are in guiding behaviour and decision-making, and motivating employees or inspiring feelings of commitment. These effects can impact performance as a whole (Ahmed, 1998). High level of motivation is important as innovators are viewed as displaying a devotion and total absorption in their work (Patterson, Kerrin, & Gatto-Roissard, 2009).

A study on the impact of individual motivation on organisational innovation and performance found that motivation affected both individual effort and overall quality of the innovative endeavours (Sauermann & Cohen, 2008). The findings revealed that

monetary rewards were not as important as certain aspects of motivation such as the desire to change intellectually for enhancing innovation. Other research also addressed the importance of motivation as the internal force that pushes individual students to persevere in the challenging environment or climate of campus and their respective studies (Parzefall et al., 2008). This force is what drives the students to keep going.

In a university, there are expectations of having common goals related to a shared vision and common direction that eliminate mixed messages and build concern and pride in the institution (Ahmed et al., 1999). An enlightened institution sets challenging but reasonable goals, builds its own concerns and pride, values success, and strives for the highest performance standards. Students become aware of these motives as the institution encourages them to excel. For example, a research university should play an active role in exploring new research ideas, investigating innovative methods, and participating in intellectual initiatives while continuously exploring and expanding cutting-edge knowledge. Such expectations create motivation for students to find creative solutions in their daily learning and social interactions, to create psychological ownership of goals, to enhance feelings of self-efficacy, and to improve innovative behaviour (Hogan & Coote, 2014; Parzefall et al., 2008). In the same context, supervisors' expectations are beneficial in shaping student behaviour that subsequently motivates them to become proactive and self-empowered (Scott & Bruce, 1994).

2.4.2 Formalisation

Formalisation is the degree of hierarchical distance between the authoritative figures and the students (Yahyagil, 2004). It is the extent to which work roles are structured in the institution, and to what level the student activities are governed by rules and procedures (Naqshbandi & Kaur, 2011; Parzefall et al., 2008). Another term associated

with formality is the operating principle, which can either be organic or mechanistic (King & Anderson, 2002).

An organic group structure has enough authority and responsibility, with the tendency to work in groups rather than set individual tasks. It allows diversity and individual expression in which creativity and idea generation can be more conducive and open for communicating and discussion. This is well suited for smaller organisations in particular (Parzefall et al., 2008).

A mechanistic group is generally rule bound, hierarchical and formal (McLean, 2005). In large organisations, it is harder for the administration to familiarise themselves with all employees, let alone all students in a university campus (Parzefall et al., 2008). Therefore, it appears that higher-level support might take a longer time and much more effort before reaching the intended lower level (of employees and students). Despite that, having formal organisational procedure reflects order and stability. It enhances clarity, transparency, objectivity, and streamlines the decision-making process, thus improving efficiency and speed (Naqshbandi & Kaur, 2011; Parzefall et al., 2008). This might also lead to excessive regulation and standardisation which can hamper innovativeness (Tierney, 2014).

One example is the red tape phenomenon. Red tape is an idiom that refers to excessive regulation or rigid conformity to redundant or bureaucratic formal rules which hinders or prevents action or decision-making. Formalisation in this regard is a form of control which leads to prescribed behaviour (Naqshbandi & Kaur, 2011). Bureaucratic practice impedes attempts to innovate (Tierney, 2014). The usual contribution to high degree of formalisation are procedures for rubber-stamping approval or reporting requirements (Ahmed, 1998; Tierney, 2014). This often is associated with having to take a longer time to settle such approvals, applications, permissions, claims, and many

other formal administrative documents, because of protocols and failure of protocols to process with sufficient speed. This is a practice of non-innovative institutions, and as a result can be burdensome and encourage unresponsiveness. In general, organic group structures (informal) tend to be more innovative since they enhance autonomy and freedom (Naqshbandi & Kaur, 2011).

2.4.3 Internal Communication

Institutions that value open internal communication probably have greater access to communication channels, accessibility to information (Yahyagil, 2004), and availability of diverse knowledge (learning), minimising restrictions on information exchange both within and outside the environment (Homburg & Pflesser, 2000). Such communication also determines how knowledge and information is gathered, its interpretations, its evaluation, and its sharing practices (Calantone et al., 2002).

Communication must involve all levels to reduce segmentalism apparent in many less innovative organisations (Kanter, 1983). Segmentalism is "a culture and an attitude that make it unattractive and difficult for people in the organisation to take initiative to solve problems and develop innovative solutions" (p.101). From Kanter's point of view, tensions are created because of over-segmentation where motivation is deterred by the organisational culture. To counter this situation, having a culture of pride in the institution's own achievements, reducing layers in the hierarchy (removing red tape), and improving communications about institutional plans and goals (McLean, 2005; Roffe, 1999) might reduce the effect of emphasising distinctions and boundaries between levels of students and management.

In addition, an effective internal communication relies on how the facts, objectives, goals, and instruction are communicated while at the same time motivating the intended audiences emotionally and cognitively. This also depends on timing, tone, and the relay

of messages (Linke & Zerfass, 2011). It is noted however that not all messages might be received directly, understood, and accepted in the same way. This is subject to individual interpretation. Hence, by having effective communications, a culture supportive of innovation can be developed. Communication also helps in bringing out positive innovative behaviour in students. This study then set the following hypotheses:

H1: An institution with positive effective communications will influence positive innovation culture

H2: An institution with positive effective communications will influence positive innovative behaviour in students

2.5 Climate for Innovation

Climate for innovation is a more concrete and tangible way to measure elements of culture in terms of specific behaviours and characteristics (Schein, 2004). In a study by Parzefall and colleagues (2008), the concept of climate refers to specific facets of organisational and/or team culture. It was suggested that a safe organisational climate is conducive for innovativeness. On top of that, group level perceptions of innovative climate might also be affecting levels of engagement in innovative behaviour (Parzefall et al., 2008).

Innovation seems to work best when people are empowered with sufficient information (data, knowledge, intelligence, expertise), resources (funds, materials, space, time), and support (endorsement, backing approval) to move ahead (Kanter, 1983). The key is to institutionalise innovation and the continuous desire to improve. People new to the environment should be welcome and supported but not to the point where they cannot assimilate independently. This is important in order to make individuals feel valued and accepted (Ahmed, 1998).

Presence of certain people in a social circle shapes the rules for young people. These may include parents, lecturers, peers, mentors, supervisors, and the management staff who can influence the students' beliefs, attitudes, and consequent behaviour. This is called social learning (Chell & Athayde, 2009). Innovative ideas and behaviour, then, are the result of various interactions within the institution which embraces intellectual thinking, a collaborative environment, accepting different ways of thinking and diversity, and having incentives and support in taking action and implementing change (Szczepańska-Woszczyna, 2014).

This study has recognised six variables as climatic elements for innovation. They were infrastructure, provision of rewards and recognition, good and supportive nature of work, teamwork spirit, availability of support from lecturers and friends, and warm interpersonal relations between members of the organisation.

2.5.1 Infrastructure

The distinctiveness of innovation environments is often more associated with structural and institutional rather than cultural variables (Jucevičius, 2010, November 11-12). Infrastructure deals with availability of physical arrangements (Yahyagil, 2004) or internal environment, often referred to as a "climate" of culture (Fellows & Liu, 2013). Such arrangements include the campus settings and open and accessible spaces for learning activities that may also include buildings, libraries, amenities, and grounds for innovation-related activities.

Organisational structure, design and layout can emotionally encourage involvement and create a physical environment for enhancing interaction (Ahmed, 1998). Scott and Bruce (1994) mentioned that people tend to respond to representations of environment rather than to the environment itself, so the presence of such functional buildings and

spaces indirectly influence the need and intentions of students to use them as the means for solving learning problems and holding social events or other campus activities.

2.5.2 Rewards and Recognition

Outstanding achievements such as research publications or creative ideas generated by either students or staff must not be taken for granted. Rewards and recognition most often reflect values and appreciation by the institution for such accomplishments (Hogan & Coote, 2014; Scott & Bruce, 1994). This can be done by showing that the institution values the ideas or accomplishments and implements or at least considers implementing the suggestions (Ahmed et al., 1999). However, when the focus is solely on the reward rather than the task, this can negatively affect innovation and innovativeness.

At an individual level, being personally thanked or recognised by the peer group or someone of importance in the institution invokes internal feelings of accomplishment (Ahmed, 1998). In a study by Hartmann (2006), recognition is simply addressed as rewards which can be intrinsic or extrinsic. Intrinsic reward comes from within oneself which is the feeling of meaningfulness arising with being satisfied with one's own performance or after achieving certain goals. Extrinsic rewards are external and can comprise monetary rewards, feedback, and other motivating rewards such as pay raises, benefits, flexible learning schedule, and incentives in any kind (Hartmann, 2006). Both types of reward can particularly affect motivated behaviour.

Monetary rewards or tokens can be especially essential in catalysing correct behaviour, as demonstrated by the data collection/survey questionnaire activities. Participants/respondents often are more excited about answering a survey when offered tokens of appreciation in exchange for their participation and time. However, excessive reliance on rewards might promote competitive behaviour which can disrupt

relationships between students or groups of students. The management then needs to impose supervision and justification when awarding such rewards and gifts.

2.5.3 Nature of Work

Another aspect of an internal environment is the nature of work, or the challenges to or ease of working within a campus (Yahyagil, 2004). Is work easy, challenging, or boring? Tight adherence to rules and procedures restrict flexibility while limited resources affect execution of work or projects (Ahmed, 1998). Groups of people with various backgrounds and perspectives are more likely to consider a variety of approaches to tasks, and draw upon different knowledge, skills, and disciplinary orientations. The results of mixing variety can be positive and negative. Positive in the sense that people are open to wider possibilities of accepting new ideas, knowledge and skills, as long as they are given time to integrate the difference in perspectives and approaches. Too much diversity, on the other hand, will increase the likelihood of conflict and increase stress levels within a group thus affecting performance (Parzefall et al., 2008; Patterson et al., 2009). Parzefall and colleagues (2008) also noted that interdisciplinary teams are more likely to produce creative solutions than the very homogenous ones.

Another aspect of nature of work or ambience is the presence of micromanagement. Evaluation is important in any organisation but too much of regular checks might exhaust the individuals of their freedom to think creatively or do things differently from the established systems (Tierney, 2014). In this regard, university students need a climate that rewards experimentation and a bit of well-calculated risks in their personal or collective projects and assignments.

Structural factor can also affect the nature of work in the university. This could be related to the campus layout (such as the locations of the main library and faculty

offices, availability of public parking lot and public transportation, and access to computer facilities or laboratories), the availability of assistance (both peer and lecturers) and information resources (online and offline). Providing an easy ambience of learning, doing, and finishing assignments/projects directly influences positive behaviour in students.

2.5.4 Teamwork

Teams or groups develop over time. The longer the group is together the less innovative they become as members grow habits and get used to routines, thus becoming less accepting of change. Therefore, the timing of group formation is crucial to longer term success (Patterson et al., 2009). Less innovative institutions emphasise individual goals that create an environment of independence. The innovative ones emphasise co-operation with more reasonable goal expectations and will not burden individual students with too many projects (Ahmed, 1998).

Establishing a spirit of teamwork emphasises on integration among students and focuses on diversity amongst group members. An organisational culture that values, tolerates, and even embraces diversity encourages creativity and idea exchange (McLean, 2005). Tierney (2014) noted that academic staff are often introverted and prefer to work in isolation. However, it is important that project teams encompass different expertise, different thinking styles, and different maturity levels to enrich an innovative environment as diversity in perspectives encourages creativity and some level of competition which can be beneficial in cultivating innovative behaviour. According to Ahmed, Loh, and Zairi (1999), work group structure promotes integration and transfer of skills, training, and establishment of social support for divergent thinking within the group. Integration achieved through co-operation, coordination, collaboration

and conflict resolution processes influences the success rate (Hogan & Coote, 2014) and subsequently induces appropriate supportive and innovative behaviour.

Another term describing integration is team cohesiveness which means how far team members agree on goals set and to what extent interdependency in team members' work contribute to the diverse skills and knowledge of the team as a whole (Parzefall et al., 2008). Low cohesiveness is a danger that can cause communication problems, stress, and conflict which can negatively affect innovativeness and innovative ideas.

2.5.5 Support (from Lecturers and Peers)

In a campus setting, peer support is a system for giving and receiving help, founded on key principles of respect, shared responsibility, and mutual agreement as to what is helpful. Supportive environment and innovative behaviour particularly emphasises the availability of lecturer and peer support (Tierney, 2014; Yahyagil, 2004), especially when conducting a research study, an experiment, or a project that requires time, pro-activity, determination, and patience for successful completion. In this situation, not all individuals in a team operate in the same manner. Therefore, in an innovative culture, it is important that everyone understands the consequences of taking risks while collaborating and adjusting with each other's style of handling their tasks in accordance with the stipulated work procedures (Tierney, 2014).

Support also comes in other kinds of resource such as monetary support, time, and opportunity (Tierney, 2014). Resource allocation is a signal pointing to what is important. In an RU, this can be seen as the opportunities for securing certain incentives for research such as grants and other potential funds. Certain deadline for research progress allows greater control in conducting research according to plan and other circumstantial factors. Time pressures and deadlines are helpful in stimulating creativity and pushing certain limits usually imposed on research team progress.

Having helpful supervisors, mentors, and teammates helps support on-time graduation. This assumption is supported by leader-member exchange (LMX) theory that suggests innovativeness might affect the supervisor-subordinate relationship (student in this context) (Scott & Bruce, 1994). In order to enhance student innovativeness, supervisors need to clearly communicate goals, set expectations for how those goals are accomplished, provide the necessary training and feedback to encourage mastery and increase student confidence, recognise accomplishments, and create an environment encouraging risk-taking (McLean, 2005).

2.5.6 Interpersonal Relations

A warm ambience between students and lecturers, also called an interpersonal relationship (Yahyagil, 2004), is a strong, deep, or close association or acquaintance either between two or more students or with other people by which its duration may vary widely. Such an association may be due to inference, regular studying interactions, collaboration, or some other type of on-campus social commitment, which is common in the concept of social capital (Tan et al., 2015). The contact with various social circles has influence on innovation and innovativeness (Parzefall et al., 2008). When students feel that the organisation has their welfare and best interest in mind, with an environment of open communication and discussion in place, and when trust in management exists, students can be more open to risk taking and work on creativity and innovation (McLean, 2005).

In addition, Parzefall and colleagues (2008) also emphasised that trust is the basis of the ability to collaborate; they found empirical evidence that social relations, trust and fairness is important in promoting innovativeness. Perceived fairness was shown to negatively affect the level of stress associated with uncertainty which is prevalent in the innovativeness scenario. Thus, highly innovative institutions nurture not only technical

abilities and expertise but also promote a sense of sharing and togetherness. Good interpersonal relations support and encourage motivation, teamwork, and innovative behaviour.

Therefore, the study recognises the presence of adequate infrastructure, provision of rewards and recognition, good work nature, high teamwork spirit, availability of support from friends and lecturers, and warm interpersonal relations between members, as climatic artefacts for innovation, which help in establishing a supportive innovation culture and behaviour in students. Thus, the postulated hypotheses are:

H3: A positive climate for innovation will lead to a positive innovation culture

H4: A positive climate for innovation will lead to positive innovative behaviour in students

2.6 Self-efficacy

Apart from the environment factors, the ability of individuals to assess their own strengths and weaknesses contribute to the feelings of self-empowerment, self-confidence, and self-assurance (Bandura, 1977, 1994). This is the concept of self-efficacy in which an individual behaviour, environment, and cognitive factors are all highly interrelated (Bandura, 1977; Staples, Hulland, & Higgins, 1999).

The feelings of empowerment, self-confidence and self-assurance, developed through a process of social learning, is called self-efficacy (Bandura, 1994). Such socio-cognitive skills are learnt through observation, imitation and experience which lead to mastery (Chell & Athayde, 2009). Self-efficacy relates to a person's perception of his or her ability to reach a goal. It is the expectation that one can master a situation and produce a positive outcome that will bring out positive performance through perseverance and overcoming obstacles, and from observing others succeed through

sustained effort (Bandura, 1977, 1994). This is an important concept in psychology. Bandura's self-efficacy theory recognised three factors which affect efficacy namely behaviour, environment, and personal or cognitive factors. In his conclusion, self-efficacy is the most important pre-condition for behavioural change.

Behaviours, beliefs, attitudes, values, and skills may be learnt. However, behaviour tends to be influenced by orientation toward particular goals, tasks or outcomes, and social processes. Innovation and innovative behaviour are driven by human efforts. Individuals' experience and ability to bring their knowledge and ideas into something new and fresh is absolutely of significant value (Chell & Athayde, 2009).

Curiosity (to explore the unknown) and creativity (the ability to imagine and envision development of ideas, tackle and solve problems) are essential conditions of innovation. Through role models, students can learn how to enhance and develop confidence, skills, self-belief and ultimately self-efficacy (Chell & Athayde, 2009). Flexibility (the ability to adopt and adapt when in need) is another character that is essential when individuals are faced with uncertainties and left outside their comfortable zone. This situation often requires autonomy (having control over decision-making) and pro-activeness (acting voluntarily) when deciding what to do or the appropriate reactions to the current circumstances. The university campus provides the right environment to acquire all these characters. Therefore, this study has identified five characters that would contribute to self-efficacy namely curiosity, creativity, flexibility, autonomy, and pro-activeness.

2.6.1 Curiosity

Curiosity is an eagerness to know or learn something different. It is reflected in students through tendencies to question and scrutinise things, and to be inquisitive, investigative, and intellectually active while creativity relates to having or showing

inventiveness and being visionary and insightful (Dawson, Tan, & McWilliam, 2011). People experiencing curiosity often learns and acquires knowledge and information in a deeper and meaningful way. They concentrate more and are able to retain this knowledge for much longer. Curious students possess the desire to search for novelty even in the familiar (Hulme, Green, & Ladd, 2013).

2.6.2 Creativity

Creativity is exclusively defined as the generation of new and entirely original (Patterson et al., 2009), useful or valuable ideas, by individuals or groups in a specific organisation (Martins & Terblanche, 2003). The modern conception of creativity however, sees creativity as a person's certain behaviour (Janiūnaitė, Cibulskas, Kriaučionienė, Almonaitiene, & Tumėnienė, 2004). This is based on the statement that creativity should be understood not as personal quality or capacity, but behaviour determined by a set of particular qualities, cognitive activity capacities and social environment conditions (Amabile, 1983). Amabile also classified specific environmental factors which affect an individual's tendency for creativity including work group supports, freedom, autonomy, supervisory support and organisational encouragement (McLean, 2005; Roffe, 1999). Besides that, openness to new experience, independence of judgement, a firm sense of self as creative, and self-confidence, have been consistent characteristics among the more creative individuals (Parzefall et al., 2008). Individual students who are especially creative compared to their peers can have divergent personalities and traits, and are more inclined to behaving dominant, arrogant, hostile, confident, introverted, and independent. Such characteristics can cause problems with accepted norms and create conflicts, but are still manageable when carefully handled and resolved (McLean, 2005). Creativity in students is reflected through tendencies to experiment and be spontaneous, inventive, and imaginative (Dawson et al., 2011).

Interestingly, Scott and Bruce (1994) found that an intuitive problem-solving style would positively affect innovative behaviour by creating tendencies to process information from different perspectives and angles, thus generating novel solutions to problems.

2.6.3 Flexibility

Flexibility refers to willingness to change or compromise, or adapting to changes in the environment. It also refers to the degree to which interaction across functions is facilitated and encouraged (Ahmed, 1998). Another type of personality that affects flexibility is agreeableness. A number of researches reported negative association between innovation and agreeableness, indicating the high social rule independence among innovators and curious individuals. In other words, they are more likely to be difficult to manage. Highly creative, curious and innovative people often are described as outspoken, uninhibited, quarrelsome and sometimes asocial (Patterson et al., 2009).

Flexibility, lack of routine, and preference for something different and new have also been associated with creativity in several studies (Parzefall et al., 2008). Flexibility is also about approaches to solving problems (Hogan & Coote, 2014). An alternative to the intuitive problem-solving style is systematic problem solving, where associative thinking revolves around routines, habit, or rationale. Such problem solvers may be more likely to have the ability to do things better instead of doing them differently (Scott & Bruce, 1994). Some rebellious traits might somewhat contribute to the choice of individual problem-solving styles and influence innovative behaviour.

2.6.4 Autonomy

Greater autonomy and decision-making responsibility allows freedom to act (Dobni, 2008; Yahyagil, 2004). Autonomy refers to freedom from external control or independence and is defined as having control over means as well as the ends of one's

work (Ahmed, 1998; Tierney, 2014).It also encompasses personal control over time allocation and determination of how the work is executed (Parzefall et al., 2008). Some delegation in decision-making allows for quick and flexible actions that minimise bureaucracy. A balance between strategic autonomy (freedom to set agenda) and operational autonomy (freedom to act on a problem) is ideal. In normal practice, management retains strategic autonomy by setting and specifying the goals and mission of projects, and allows individual students operational autonomy, that is to be creative and competitive in how they achieve the stipulated goals (Ahmed, 1998).

In LMX theory, understandings that follow a role development process over time encourage mature interactions between students and supervisors characterised by trust, mutual liking, and respect. This in turn allows students the broader decision-making roles essential to innovative behaviour (Scott & Bruce, 1994). Autonomy influences pro-activeness directly and indirectly through self-efficacy and flexible role orientation where the students understand their own roles in individual or group projects.

2.6.5 Pro-activeness

Pro-active is about making efforts to act on plans, projects, and assignments. Willingness to initiate actions, come up with plans, take responsibility, and go beyond formal job requirements, can produce some form of empowerment, resulting in trust and support from friends and supervisors alike.

Flexibility and greater autonomy in turn encourage students to be pro-active and take initiative in the belief that they can have a real impact on the work/project management, and so ultimately increase their sense of ownership (Ahmed, 1998; Hogan & Coote, 2014). Climates for initiative may improve an institution's ability to deal with innovation and change, by encouraging self-starting, pro-active and persistence in students (Patterson et al., 2009).

The abilities to execute tasks successfully generate a sense of confidence. Pursuing an idea or a dream requires energy. Innovative students require persistence, pro-activity and drive, which in turn need the processes of conation (recognition of meaningfulness of the mission), cognition (involves thought and judgement about its worth), and affect (the feelings that accompany the sense of achievement or otherwise) (Chell & Athayde, 2009). Hence, expectations and aspirations affect self-confidence and self-efficacy, thus cultivate innovative thinking and behaviour. The study hence hypothesises that:

H5: Positive self-efficacy will influence a positive innovation culture

H6: Positive self-efficacy will influence positive innovative student behaviour

2.7 Innovation Culture

Values and beliefs are verbally and non-verbally communicated which shape the individual and organisational behaviours. These behaviours based on assumptions are conveyed through stories, rituals (institutional norms) and spoken language (Fralinger & Olson, 2007; Hogan & Coote, 2014). Institutional culture does influence behaviour as culture is observed through the characters of institutions. These characters, in turn, contribute to competitive advantage of the institutions because they cannot be simply copied by others (Miron, Erez, & Naveh, 2004). This can be communicated through symbolism, feelings, meaning behind language, behaviours, physical settings, and artefacts (Martins & Terblanche, 2003). Several cultural artefacts or forms, also called symbols (Ashforth, 1985) exist, such as rite, ceremonial, ritual, myth, saga, legend, story, folktale symbol, language, gesture, and physical setting (Trice & Beyer, 1984). Symbolism therefore, is a method to promote individual innovative behaviour (Hartmann, 2006).

As an institution, symbol emphasises, distorts, ignores, and attaches names and values to the university's structure, activities, purposes, and even the physical environment. As a result, the way of communicating (language), the design of its buildings, the beliefs about the use and distribution of power and privilege, the rituals which legitimate those distributions have significant functional consequences for the institution. How people of certain standing within the university behave and act sends a signal with respect to how students themselves will decide to behave (Hartmann, 2006; Hogan & Coote, 2014).

In a university setting, socialisation or otherwise also known as symbolic interactions may be achieved through the manipulation or interpretation of symbols (Tierney, 2014). Stories need to be told and as part of tradition, may be preserved in rituals, through the unique use of supportive language. This is a mutually reinforcing process. In this study, artefacts or symbols of the institution were recognised as stories, rituals, and supportive language.

2.7.1 Stories

Stories are narratives, complete with plots, protagonists, antagonists, and actions, that shape other aspects of the institutional culture such as behavioural norms. Functions of stories are providing information about institutional rules, and reflecting the beliefs that students and alumni have about how past events occurred, thereby keeping the institutional memory sharp. They also serve to increase commitment and loyalty to the institution, undergird and reinforce other artefacts of culture, and connect current students with the institutions past and present (Kuh & Whitt, 1988).

The manner of telling the institutional story, especially when addressing significant and influential events that significantly affect attitudes and behaviours of the community, acts as a symbol of that institution (Hogan & Coote, 2014). Stories might

include, for example, information about outstanding accomplishments of past alumni, charismatic chancellors and vice chancellors, outstanding academic staff track records, and prolific research findings, innovations, and achievements. A certain similar characteristic of stories at many institutions is how stories of their founding fathers being described as heroic (Kuh & Whitt, 1988). In a university, this should produce a positive influence on students as they feel motivated and inspired to follow paths of previous "heroes" (Alm & Jönsson, 2014).

2.7.2 Rituals

The people involved in a ritual generally regard it as repetitive sequences of meaningless activity, and thought of it as false belief. Ritual is the symbolic use of bodily movement and gesture in a social situation to express and articulate meaning. Hence, the main feature of ritual is its message, or to put it simply, it is about what it says or is trying to convey. It is therefore through ritual that social relationships become meaningful, valued, and taken seriously. An outstanding ritual possesses exclusiveness and distinctiveness (Pettigrew, 1979; Szczepańska-Woszczyna, 2014).

University rituals, including convocations, graduations, welcoming and initiating new students, and society activities recognise the importance of rewarding and acknowledging desired student behaviours. They help create, maintain, and invent patterns of collective action (as a result of interaction through these rituals) and social structure (Kuh & Whitt, 1988), that in turn will encourage others to also adopt these behaviours (Hogan & Coote, 2014). Kuh and Whitt (1988) defined ritual as "a standardized, detailed set of techniques and behaviors that manage anxieties but seldom produce intended technical consequences of practical importance" (p. 34). For example, the freshman induction convocation requires a chapel. Thus, rituals make statements

about the quality of life within the community and set standards of behaviour, values, activities, and relationships. They are often staged publicly and highly stylised.

2.7.3 Supportive Language

Such rituals depend on a system of vocal signs or so called language, to communicate important ideas and feelings, but also a system for organising information and releasing thoughts and responses in other organisations (Kuh & Whitt, 1988; Tierney, 2014). Tierney (2014) also identified communication between individuals as symbolic interaction. With its immense variety and complexity, language is a vehicle for achieving practical effects. Words are part of action. Language as cultural and historical heritage, is socially built and maintained, and embodies implicit social evaluations (Pettigrew, 1979). Kuh and Whitt, and Trice and Beyer (1984) defined language as "a particular form or manner in which members of a group use vocal sounds and written signs to convey meanings to each other. For example, an institution's fight song or Alma Mater" (Kuh & Whitt, 1988, p. 35).

Therefore, using appropriate language is often thought to be highly influential on students as they observe how others speak, write, and otherwise perform. This is especially true with respect to how they unconsciously learn by example. It is noted that each faculty or school in a university might use different style of conversation or addressing fellow students, lecturers, and staff. For example, in a medical school, students and lecturers might use and exchange medical terms with ease while in a military college, students are more likely to use formal terms when addressing their supervisors or one another (Tierney, 2014). With artefacts of culture, meanings are stored in symbols as they represent a multitude of meanings and emotions (Kuh & Whitt, 1988), so how students react toward stories, rituals, and supportive language, affects their subsequent innovative behaviour. The final hypothesis then is:

H7: A positive innovation culture will influence positive innovative behaviour in students

2.8 Innovative Behaviour

Innovative behaviour in people is likely to manifest itself in response to environments in which institutions practise innovation-oriented culture. Management of attention is a central problem in innovation management (Scott & Bruce, 1994). This is because, as people gradually adapt to their surroundings, they may eventually begin to lose necessary driving energy. Innovativeness must therefore be nurtured if it is to continuously prosper. In their hypothetical model, Scott and Bruce (1994) identified four interacting systems that affect individual innovative behaviour: individual, leader, work group, and climate for innovation.

Engagement in innovative behaviour requires individuals to have the abilities and willingness to be innovative. Abilities refer to having certain capabilities such as relevant task knowledge, necessary technical skills, and personality characteristics. Will on the other hand, is simply having motivation and the ability to be satisfied at the end of it all (Parzefall et al., 2008). Energy, drive, and enthusiasm are important in order to strive to achieve a goal or perform a task. Calculative risk-taking as opposed to being risk averse can reduce the chances of failing, and promotes the likelihood of succeeding. Young people should be allowed once in a while to make silly errors while ensuring they understand why these errors are mistakes and learn to reflect on them and consider alternatives and other possible solutions (Chell & Athayde, 2009).

Innovative behaviour does not stay innovative forever the same way culture is subject to gradual change. Strategy must be continuously improved by probing boundaries and pushing them forward to stay ahead (Phillips, 2011, August 3). This study has identified four variables to be investigated as innovative behaviours which

were students' self-empowerment, handling of mistakes or conflict, tendency to take risks, and the tendency to seek novelty.

2.8.1 Empowerment

Empowerment is responsiveness to change and new ideas. Positive attitudes toward change indicate a future orientation where the past is let go and there is willingness to focus more on future short and long-term goals (Ahmed et al., 1999). This drives a desire to develop, improve, and innovate. Effective time management, networking, and rationale will help develop a sense of consistency, persistency, determination, commitment, pride, and healthy self-esteem (Janiūnaitė et al., 2004).

In a strong culture of innovation, empowerment guides actions and behaviour that consistently push students toward accomplishing their goals and ambitions. The only disadvantage of empowerment is when there is a lack of a strong value system that can ensure activities align with institutional goals. People can get lost without direction. Therefore, the administration needs to draw clear mission and vision statements, and set the boundary of what is considered good or not so important to the betterment of the institution (Ahmed, 1998). This way, the level of empowerment and responsibility can be adjusted accordingly.

2.8.2 Mistake/Conflict Handling

There are three types of conflicts: relationship conflict (members with personal issues, dislikes), task conflict (diverse viewpoints and opinions about a task) and process conflict (awareness of different viewpoints on how to accomplish a task). Moderate task-related conflict along with high-level commitment is beneficial for innovation. Openness to change, experience and new ideas will further develop tolerance for ambiguities, uncertainties, and failure. Previous studies with inconsistent findings suggested that the relationship between openness and characteristics associated

with innovativeness such as being imaginative, original, flexible, and unconventional, might be moderated by contextual factors (Patterson et al., 2009).

In a university, students should have a sense that trying new things without fear of being negatively critiqued is acceptable and widely practised. The way supervisors and lecturers with their students handle mistakes, failure, or conflict will determine how they can learn through mistakes (Denison, Haaland, & Goelzer, 2003; Szczepańska-Woszczyna, 2014). Group integration skills and ability to manage conflict may affect co-operative and creative streaks in individuals (Ahmed et al., 1999).

2.8.3 Risk-taking

Aside from having relative "power" and tolerance for error, students also need freedom to take risks, play with ideas, and expand their range of meaningful and calculated risks in order to experiment and challenge the status quo without fear of negative consequences (Ahmed et al., 1999; Hogan & Coote, 2014; Scott & Bruce, 1994; Tierney, 2014). A classic empirical study on risk-taking and innovativeness by Craig and Ginter (1975) revealed that innovative people were lower on social desirability which seems to indicate that these people tended to respond according to their feelings rather than in corresponding to what might be deemed a more socially desirable way. Innovativeness makes these people less susceptible to other people's expectations of them (Craig & Ginter, 1975).

In a sense, freedom to discuss dumb ideas (Ahmed, 1998) or stupid questions without a care about sceptic reactions or direct rejections should be practised (Tierney, 2014). This in turn will encourage participation, teamwork, and involvement of not only the brilliant students, but also the nerds, geeks and socially inclined students who are often observing but not really participating. Students also need to know the level of risks that they can take safely. This helps to define the space and occasions where they can act

instinctively without fear of penalties for breaking some rules (Parzefall et al., 2008). As Tierney (2014) wrote, critique and scepticism is the coin of the academic realm which can lead to maintaining the status quo. This can hinder experimentation and risk-taking.

With emotional safety, high trust, and open communication, new ideas surface easily as people listen and accept criticism. Openness to negativity helps reduce oversensitivity (Parzefall et al., 2008). Innovativeness is strongly characterised by risk and perceptions of risk as reflected in risk-taking behaviour (Lynch, Walsh, & Harrington, 2010). Hence, willingness to take risks is essential for innovation to occur.

2.8.4 Novelty-seeking

Novelty-seeking is reflected by openness to new ideas and changes in routines (Yahyagil, 2004). Innovative behaviour usually requires exploration of opportunities, generation of new ideas and being creative. It also includes behaviours that are inclined toward accepting change, applying new knowledge or innovations, and improving processes to enhance overall performance or outcomes (de Jong & Den Hartog, 2008).

Domain-relevant skills (expertise, technical skills, talent) are important for learning and improvement. Individuals who uphold ideals and beliefs associated with the institution contribute to increased problem analysis and solutions, initiation, and adoption of technical innovations, and may eventually impact innovative behaviour (Ahmed et al., 1999; Hogan & Coote, 2014; Scott & Bruce, 1994). Therefore, willingness to change and adopt new ways of doing things is a requirement for innovativeness.

2.9 The Proposed Model for Innovation Culture

The proposed model consists of five components of innovation culture and integrates level of perspectives inclusive of the organisation, collective or group, and individual.

Some aspect of the model involves cross-level perspective in which the interaction between student and people and academics, or management staff of the university, will also reflect the administrative aspect of the institution. Figure 2.1 illustrates the proposed model of innovation culture. The model presented here aims at assessing innovation culture and the manifestations of the relationships of each component on students' innovative behaviour.

2.9.1 Statement of Hypotheses

Seven hypotheses had been developed and would be tested in the study as shown in the proposed model (see Figure 2.1). They are as listed:

H1: An institution with positive effective communications will positively influence innovation culture

H2: An institution with positive effective communications will positively influence innovative behaviour in students

H3: A positive climate for innovation will positively lead to innovation culture

H4: A positive climate for innovation will positively lead to innovative behaviour in students

H5: Positive self-efficacy will positively influence innovation culture

H6: Positive self-efficacy will positively influence innovative behaviour in students

H7: A positive innovation culture will positively influence innovative behaviour in students

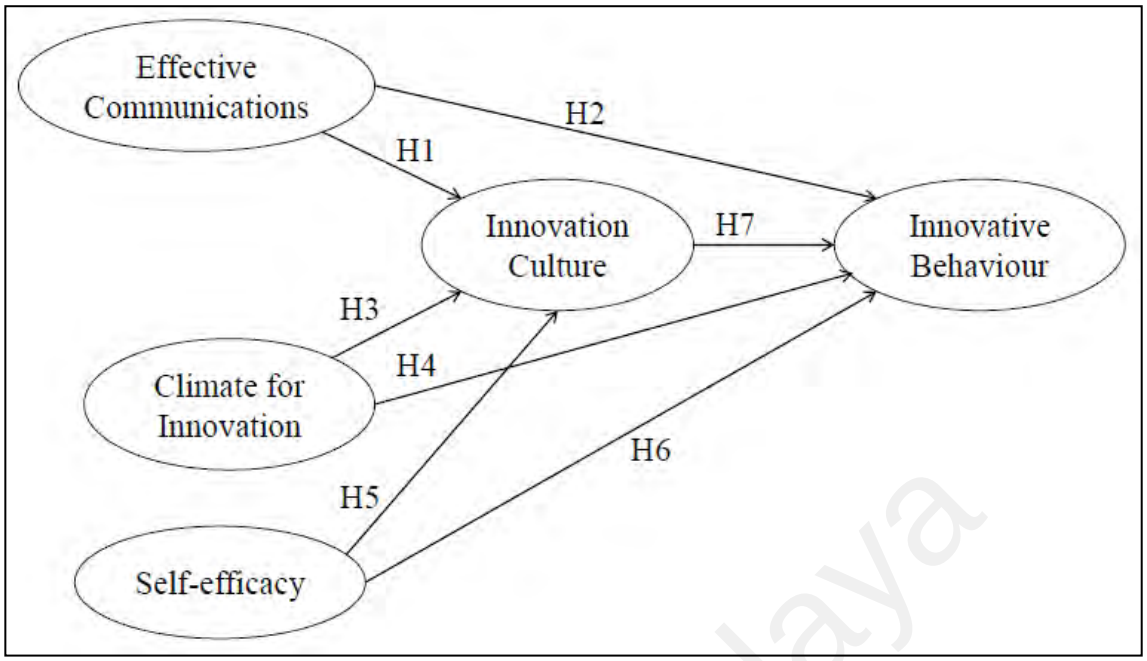

Figure 2.1: The proposed model of innovation culture and the hypotheses

2.9.2 Development of Measurements

The theoretical model of this study was designed to empirically test the structural relationships between and among the five components – EC, CI, SE, IB and IC. This research measurement scale comprises 48 items that measure 21 variables established from the literature based on previous empirical studies. Table 2.2 details the description of the concept of innovation culture.

Table 2.2: The measurement items for each component of innovation culture

Component, Characters & Sources	Measurement Items
Effective Communications (EC) - Goals & motivation - Formalisation - Internal communication **Dobni, 2008; Yahyagil, 2004**	1. My university emphasises innovation as the core value 2. My university has its vision aligned with coursework 3. My university has its vision aligned with co-curricular activities 4. My university has defined the university procedures 5. My university keeps red-tape to a minimum 6. My university has given information about university activities 7. My university offers accessibility to information on job flow 8. My university encourages interactions with others in the institution
Climate for Innovation (CI) - Infrastructure - Reward & recognition - Nature of work - Teamwork - Support (lecturers & peers) - Interpersonal relations **Hogan & Coote, 2014; Yahyagil, 2004**	1. My university has discussion rooms where students can meet to discuss new ideas 2. My university has set aside meeting areas where students can talk informally about new ways to solve problems 3. My university gives rewards for any innovative ideas/efforts 4. My university places great value on recognising and showing appreciation for students' efforts 5. My university provides a challenging nature of work 6. My university provides motivating nature of work 7. My university emphasises on teamwork/collaboration 8. My university values integration and sharing amongst teams throughout the faculty/campus 9. My university encourages assistance from the lecturers 10. My university offers availability of peer/student support 11. My university promotes warm relations between students and lecturers 12. My university provides an easy-going work atmosphere
Self-efficacy (SE) - Curiosity - Creativity - Pro-activeness - Flexibility - Autonomy **Chell & Athayde, 2009; Craig & Ginter, 1975; Dawson et al. 2011; Denison et al. 2003; Dobni, 2008; Hogan & Coote, 2014; Yahyagil, 2004**	1. My university encourages the chance to extend the range of my abilities/skills 2. I enjoy trying different approaches to see which one will work, when solving a problem 3. I like my lessons to involve lots of different creative activities 4. I like to experiment with new ways of improving my studies (i.e. research, assignments, and projects) 5. I am given the time to develop creative potential 6. I am given the opportunity to develop creative potential 7. My university expects me to have my own initiative when dealing with work tasks 8. I am willing to try new ideas 9. My university expects me to deal with my own assignments/projects at my own pace, accordingly 10. I continuously track my progress against the stated goals 11. My university encourages involvement in decision-making process 12. I feel that I am trusted to act in the university's best interests with minimal supervision
Innovation Culture (IC) - Stories - Rituals - Supporting language **Hogan & Coote, 2014**	1. My university has well-known stories about students who have developed new ideas 2. My university has stories about students who encouraged the implementation of new practices 3. My university has made an effort to acknowledge the adoption of new practices 4. My university makes an effort to reward the implementation of new ways of doing things 5. I could probably get some benefit from looking at a problem from a different perspective 6. Could I develop a new approach to solving this problem? 7. Are there other ways I could go about resolving this issue?
Innovative Behaviour (IB) - Empowerment - Risk-taking - Mistake/ conflict handling - Novelty-seeking **Calantone et al. 2002; Craig & Ginter, 1975; Dawson et al. 2011; Denison et al. 2003; Dobni, 2008; Yahyagil, 2004**	1. I try to adopt new ways to do work 2. I feel empowered to apply what I have learned 3. My university encourages risk-taking 4. I like to take a chance 5. I view failure as an opportunity for improvement 6. I reflect on the lessons learned over unsuccessful endeavours 7. My university welcomes new and original ideas/practices 8. I like being exposed to new ideas 9. I like having changes in my routines

2.10 Definition of Variables of Measurements

There were three types of variables in the model: independent variable (IV), mediating variable (MV), and dependent variable (DV). These variables consist of the five components or dimensions of innovation culture as described in the previous sections by which each component may be subject to a different level of analysis. They may include organisational level analysis which analyses development of strategies relating to environmental, structural, and managerial factors of the institution involving the administration, management staff, academics, and the students; collective level which usually studies social-interactional processes involved in teamwork between the administrative, management staff, and academics, and the students; and the individual level which describes how students perform, react, or behave to create and implement innovative ideas, practices and all other learning and social activities and traditions in the campus (Cabezas, 2013).

2.10.1 Independent Variables

There were three IVs in the proposed model: effective communications (EC), climate for innovation (CI), and self-efficacy (SE).

EC at organisational level is defined as smooth and communicative environment for having expectations, common goals and inspiring feelings of commitment; having rules and regulations or bureaucratic practices; and for access to internal communication channels and information exchange for students and various members of the university. In the survey questionnaire, eight items measured these three variables which were recognised as goals and motivation, formalisation, and internal communication.

At organisational, collective, and individual levels, CI examines features of the university or its internal environment that are conducive for innovations and innovative activities. These features are associated with the campus structural and physical

arrangements; reflect values and appreciation for individual and collective innovative accomplishments; present good ambience for work and innovation; promote integration among students and other university members; provide lecturer and peer support; and provide good ambience or close interactions between students and university members for various social relations. The questionnaire employed twelve items measuring these six features designated as infrastructure, rewards and recognition, nature of work, teamwork, support (lecturers and peers), and interpersonal relations.

At an individual level, SE is a student's perception of his/her ability to explore the unknown; to imagine and envision the development of ideas and solve problems; to adopt and adapt when in need; to have control over decision-making; and to act voluntarily. In the survey questionnaires, twelve items were measuring these five abilities identified as curiosity, creativity, flexibility, autonomy, and pro-activeness.

2.10.2 Mediating Variable

One MV in the proposed model is IC. At organisational, collective, and individual levels, IC is defined as cultural artefacts, or symbols, or forms, of the university. The symbols represent the transmission or exchange of culture from its environment to the students and other university members through narratives or stories; bodily movement and gesture in social activities; and a system of vocal signs to convey meanings. Seven items in the survey questionnaire were measuring the three innovations or innovative symbols which were recognised as stories (of heroes), rituals, and supportive language.

2.10.3 Dependent Variable

The DV in the proposed model is individual IB which is defined as students' abilities and willingness to be innovative. A student may have the capability to response to change and new ideas; have tolerance for error and different views; have freedom to experiment and take calculated risks; and be willing to adopt change and new ways of

doing things. Nine items in the survey questionnaire were measuring these four behaviours designated as empowerment, mistake/conflict handling, risk-taking, and novelty-seeking.

2.11 Summary of the Chapter

The chapter discusses previous definitions and concepts of innovation and innovation culture, organisational culture, and the proposed model of innovation culture. Several hypotheses have been generated to illustrate relationships of the components/dimensions of innovation culture and the innovative behaviour of students. The next chapter discusses details of research methodology employed in this study.

CHAPTER 3: RESEARCH METHODOLOGY

The previous chapter discussed the context and concepts of the study that led to the proposed conceptual framework. This chapter continues with details of the research methodology, involving the empirical test of the research hypotheses and the proposed model. It explains the research design, sampling techniques, data collection, research instrument, research techniques, and the hypotheses. It ends with the summary of the chapter.

3.1 Research Paradigm

Methods of social research are closely associated with how social reality should be studied or viewed (Bryman, 2008; Walliman, 2011). It is how the social scientist sees the connection between different views about the nature of reality and how it should be examined. Secondly, research data are collected in relation to something that might be a social problem, a concern out of personal experience, or more usually a theory (Bryman, 2008). This raises the issue of the relationship between theory and research.

All research has a philosophical foundation (Creswell & Clark, 2011) as everyone has an opinion or a concept of the world. All philosophical positions and their methodologies hold a view about reality. The research and how it is carried out is deeply influenced by the theory or philosophy that underpins it (Walliman, 2011). The researcher should be aware of the assumptions made during the study or the process of acquiring knowledge (Creswell & Clark, 2011). The methodology of a research thus depends on the researcher's assumptions about what actually exists in reality and what can be known (ontology), and how the knowledge is acquired (epistemology) (Walliman, 2011).

As theory of knowledge, epistemology is especially about validation and the methods used. It concerns the reliability of the senses and the power of the mind. There are two basic approaches in acquiring knowledge: empiricism, and rationalism. **Empiricism** is knowledge gained by sensory experience using inductive reasoning whilst **rationalism** is knowledge gained by using deductive reasoning. A middle way to overcome the shortcomings of each is called the **hypothetico-deductive method** (Walliman, 2011).

Specific observations or sensory experiences start the **inductive reasoning** where these then develop into a general conclusion. In order for the conclusions to be reliable, a large number of observations must be undertaken and repeated under a large range of circumstances to ensure that no observations contradict the generalisation made from the repeated observations (Walliman, 2011). **Deductive theory** represents the works from the more general ideas/theories to the more specific particular and situations which refer to the context of the study. On the basis of what is known to the researcher of a particular issue, and of theoretical considerations in relation to that issue, the researcher deduces a hypothesis (or hypotheses) that must then be subjected empirical scrutiny (Bryman, 2008). A hypothesis must be falsifiable. This means it is logically possible to make true observational statements which conflict with the hypothesis, and thus can falsify it (Walliman, 2011). In other words, the statement/hypothesis can be rejected. A deduced hypothesis must then be translated into operational terms by which the data are collected in relation to the concepts making up the hypothesis (Bryman, 2008).

Hypothetico-deductive reasoning or scientific method employs the usual procedure of identification or clarification of a problem, developing a hypothesis (testable theory) inductively from observations (or literature), implying their implications by deduction, practical or theoretical testing of the hypothesis, and rejecting or refining it in the light of the results (Walliman, 2011). There are five

certain assumptions that underlie scientific method which are order, external reality, reliability, parsimony, and generality.

First, it is assumed that the universe is **an ordered system** which can be investigated, and where the underlying rules can be exposed. The second assumed that the **same reality is shared**, and does not depend on existence. Therefore, everybody can equally contribute to and share knowledge that reflects this reality. Third, senses and reasoning are **reliable** in producing facts that reliably interpret reality. Fourth, the simpler the explanation, the better the theories could be refined to the most compact formulation (**parsimony**). Lastly, the rules of reality discovered through research **can be applied in all relevant situations** regardless of time and place (Walliman, 2011).

Epistemology is concerned with what can be known about reality (regardless of how that is defined) and how to know that reality. Epistemology is about knowledge where the scientific method is based on an empirical epistemology (Willis, 2007). A central issue in this context is the concern whether the social world can and should be studied according to the procedures of the natural sciences (Bryman, 2008). It is regarding the position of the human subject and the researcher, and the status of social phenomena (Walliman, 2011). The position that agrees with imitating the natural sciences in studying social reality and beyond (or human behaviour) is known as **positivism** (Bryman, 2008; Collis & Hussey, 2003).

Positivistic approaches seek to identify, measure and evaluate any phenomenon and to provide rational explanation for it (Neville, 2007). This explanation will attempt to establish causal links and relationships between the different elements (or variables) of the subject and relate them to a particular theory or practice. There is a belief that people do respond to stimulus or forces, and rules (norms) external to themselves. These

can be discovered, identified, and described using rational, systematic, and **deductive processes**.

Interpretivism, on the other hand, is the opposite of positivism (Bryman, 2008), often referred to as **relativism**, **idealism**, **constructivism** or even **constructionism** (Walliman, 2011). The view is that the subject matter of the social sciences (people and their institutions) is fundamentally different from that of the natural sciences. The clash refers to a division between an emphasis on the explanation of human behaviour that is the chief ingredient of the positivist approach, and the understanding of human behaviour (Bryman, 2008). The latter is concerned with emphatic understanding rather than with the forces that are deemed to influence human action.

Table 3.1 compares the positivist and interpretivist approaches. However, these two extreme approaches guarantee that some middle approaches are possible, given the many alternative bases for interpreting the world.

Table 3.1: Comparison between positivist and interpretivist approaches

Issue	Positivist	Interpretivist/Relativist
Philosophical basis	Realism: the world exists and is knowable as it really is	Idealism: the world exists but different people construe it in very different ways
Research role	To discover universal laws and generalisations	To reveal different interpretations of the world as made by people
Researcher role	Natural observer	Part of the research process
Theoretical approach	Rational, using inductive and scientific methods and value free data	Subjective, using inductive methods and value laden data
Methods	Experiments or mathematical models and quantitative analysis to validate, reject or refine hypotheses	Surveys and observations with qualitative analysis to seek meaningful relationships and the consequences of their interactions. Analysis of language and meaning
Analysis of society	Search for order. Society is governed by a uniform set of values and made possible only by acceptance of these values	Search for dynamics. Multitude of values leading to complex interactions. Society made possible by negotiation

Source:Bryman (2008). *Social research methods* (3rd ed.). New York, NY: Oxford University Press.

Ontology is about what can exist or what is real, while epistemology is about knowledge (Willis, 2007). The central issue is whether social entities can and should be considered objective entities that have a reality external to social actors, or whether they can and should be considered social constructions built up from the perceptions and actions of social actors (Bryman, 2008). The positions are referred to as objectivism and constructionism.

An ontological position that implies social phenomena confronts the researcher as external facts that are beyond his/her reach or influence is called **objectivism**. This means the social phenomena and their meanings have an existence that is independent of or separate from social actors (Bryman, 2008).

Constructionism, or **constructivism**, is completely the opposite of objectivism in such that it challenges the suggestion that social actors are continually accomplishing social phenomena and their meanings. This means that social phenomena and categories are not only produced through social interaction but they are in a constant state of revision, or in short, they are socially constructed (Bryman, 2008).

The topic of this research was taken from a broad variation of fields such as business and management, psychology, and social sciences. This ultimately led the researcher to test the hypotheses with specific data as a confirmation of the original theories, that is, taking the theories to be tested in the context of higher education with a totally different set of subject of study. This kind of theory is principally used in sociology to guide empirical inquiry (Merton, 1967) where the theory and hypothesis deduced from it come first and drive the process of gathering data. The deductive strategy is always associated with a quantitative approach (which this study employed) while the inductive strategy is typically associated with a qualitative research approach (Bryman, 2008). However, prior to hypotheses testing, the study involved some inductive reasoning

where the researcher began with specific observations taken from the available secondary data obtained from the library and online resources. Patterns and similarities observed were analysed to develop and explore aspects of these observations that could be adopted and adapted to the context of choice. Finally, the development of hypotheses and measurements, and the assessment of their usefulness in the survey were conducted. Within this inductive stance, theory was the outcome of the (secondary) research (Bryman, 2008).

Overall, the study employed a hypothetico-deductive strategy or scientific method, which used both deductive and inductive reasoning, albeit with more emphasis on the deductive part. At an organisational level, the positivist perspectives (imitating the natural sciences) on culture and its related concepts can be described as the view that culture is something the organisation has or is (Fellows & Liu, 2013).

3.2 Research Design

The research design aimed at collecting data to assess the innovation culture among students of higher education institutions in Malaysia. In addressing the research objectives and questions, the study applied conclusive research which was designed to test specific hypotheses and examine specific relationships. This kind of research is more structured and formal, based on large and representative samples, and the data obtained are subjected to quantitative analysis. This conclusive research was further classified as descriptive as it was more about determining the nature of the relationships among variables (Malhotra, 1999). As there were five samples of respondents, and information from each sample was obtained only once and at different times, the overall research design adopted by this study was multiple cross-sectional as shown in Figure 3.1.

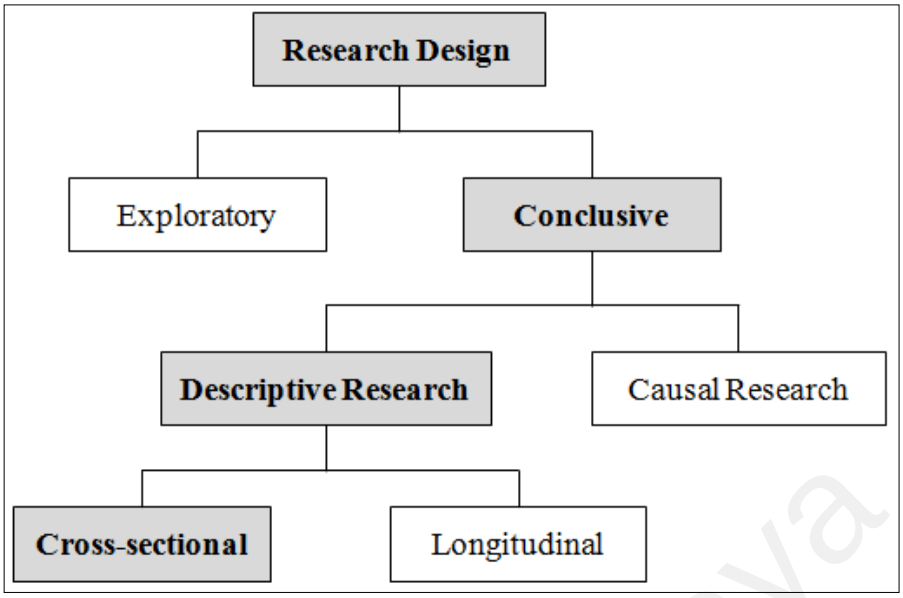

Figure 3.1: Research design of the study

Source: Malhotra (1999). *Marketing research: An applied orientation* (3rd ed.). New Jersey: Prentice-Hall.

Quantitative approach was used in addressing the research objectives (ROs) through empirical assessment that involves precise measurements and hypotheses testing using statistical analysis (Zikmund, Babin, Carr, & Griffin, 2010). Quantitative research was appropriate for this study as its ROs were intended to capture how samples of students rated innovation culture in their respective HEIs and how this has affected or was manifested in their own innovative behaviour. Each student would rate the "presence" of this concept using numeric scales. The numeric values would then be used in statistical computations and hypothesis testing. The emphasis was on collecting and analysing numerical data, and concentrated on measuring the scale, range, and frequency of a phenomenon (Neville, 2007).

3.2.1 Descriptive Research Design: Survey

As a type of descriptive research, this study utilised the survey method to generate its primary data by using questionnaires (Leary, 2014). It was highly structured thus collected specific information through a list of pre-arranged questions in the form of close-ended choices, or fixed-alternative questions. The process was direct as the true purpose of the research was disclosed to the participants.

The advantage of this method was that the data collection allowed for structured response where the categories were provided (Zikmund et al., 2010). Hence the data obtained were reliable as the responses were limited to the options given. This in turn reduced the variability in the results that may be caused by differences in answers. The coding, analysis and interpretation of data were relatively simple (Malhotra, 1999). Apart from that, the researcher was independent as her presence in the research would not affect the results of the surveys, and therefore the results were more objective. This method is often used in management research as its research design involves descriptive analysis and causal links or relationships between each antecedent (Neville, 2007). Its disadvantage however is the usual requirement of having larger samples in order to produce generalisable results (Zikmund et al., 2010). In addition, participants might have been unwilling to answer sensitive or personal questions.

Hence, for the above-mentioned advantages, a questionnaire survey was employed in this study because of its flexibility and usefulness; six untrained and part-time enumerators were employed to administer the surveys. As participants and the researcher met face to face, the researcher could administer, explain, and clarify difficult questions. In addition, the researcher had a moderate degree of sample control over which participants to be reached. This method allowed for anonymity that

encouraged them to be more relaxed, open and truthful (Leary, 2014; Malhotra, 2007; Oppenheim, 2000).

3.2.2 Measurement and Scaling

The assignment of numbers or other symbols to characteristics of objects according to certain specific rules is called measurement. Scaling, an extension of measurement, involves generating a continuum on which measured objects are rated by which respondents would classify as having favourable, neutral, or unfavourable answer towards the question asked. A scale is a set of items that all assess the same construct (Leary, 2014). An interval scale is a scale in which numbers are used to rate objects such that numerically equal distances on the scale represent equal distances in the characteristic being measured. That means the difference between 1 and 2 is the same as that of 2 and 3 or 5 and 6. The location of the zero point is not fixed. Since both the zero point and the units of measurement are arbitrary, the positive linear transformation will preserve the scale properties. In marketing research, attitudinal data obtained from rating scales are often treated as interval data (Malhotra, 1999, 2007; Zolkepli, 2013).

An itemised rating scale provides respondents with a scale that has numbers or brief descriptions associated with each category. The categories are ordered in terms of scale position. The respondents must choose from the specified category that best describes the object being rated. Likert scales were used in this study to indicate respondents' degree of agreement or disagreement with each of a series of statements about the stimulus objects. Each scale item had six response categories: Strongly Disagree (1), Disagree (2), Slightly Disagree (3), Slightly Agree (4), Agree (5), and Strongly Agree (6). When conducting the analysis, each statement was assigned a numerical score of 1 to 6. These rating scales were presented by expressing the categories by numbers assigned to them in boxes to be marked or circled by the respondents. The analysis was

conducted on a total (summated) score which can be calculated for each participant by summing across items. The advantage of using a Likert scale was that the participants readily understand how the scale was used, making it suitable for capturing information.

In order to obtain objective data, the number of favourable and unfavourable categories was equal which made them a balanced scale. The rating scale had an even number of categories in order to compel the respondents to answer. The researcher believed that no neutral or indifferent response should be entertained. This is because from previous experience, the researcher found that undergraduates were more inclined to choose the 'no-opinion/neutral' category or scale in situations where they simply could not decide the answer. Hence, this was a forced-choice rating scale (Malhotra, 2007; Zikmund et al., 2010).

3.2.3 Questionnaire Design

A questionnaire is a formalised set of questions for obtaining information from respondents which is also called a schedule, interview form, or measuring instrument. It includes fieldwork procedures (instructions for selecting, approaching, and questioning respondents) and some reward, gift, or payment offered to respondents. This study presented its printed questionnaire on several pages and on a double-page spread. For this reason, it took the form of a booklet rather than a number of sheets of paper clipped or stapled together. Booklets do not come apart or separate easily. They allow for a double-page format and look professional (Malhotra, 1999). The questionnaire is included in Appendix B.

The questionnaire uses measurements and scale items obtained from the literature based on previous empirical studies. Item refers to any prompts that lead the participant to provide an answer, rating, or other verbal response on a questionnaire (Leary, 2014). There were three sections in the questionnaire: Part A, Part B and Demographic Section.

Parts A and B were specifically designed to investigate associations between particular variables, or specific hypotheses, and to find explanations or predictions. The closed ended questions or items aim at obtaining the basic information (Malhotra, 1999). The forty-one (41) items in Part A described the antecedents or characters of innovation culture and innovative behaviour. In Part B, the seven (7) items described the artefacts or symbols of innovation culture. Together, all 48 items were made up of a six-point Likert scale ranging from Strongly Disagree (1) to Strongly Agree (6).

The Demographic Section was concerned with describing the students' profile and understanding patterns of basic life events and experiences. This part consisted of nine (9) descriptive questions: the name of university, the faculty, the area of study, the programme enrolled, the study year, the sex, the ethnicity, the age group, and the financial dependency of the participant. These open-ended questions could be categorical or multiple choice.

3.2.4 Sampling Technique: Cluster Sampling

A sample is a sub-group of the population of the study. Sampling is the process whereby a researcher selects a sample of participants for a study. Data were collected from a subset, or sample, of individuals in the population. It is important for increasing the validity of the collected data and ensuring representativeness of the sample to the population. A representative sample is one from which accurate, unbiased estimates of the characteristics of the larger population can be drawn (Leary, 2014). Sampling methods allow for representative cross-sections, or particular groups to be identified or targeted (Neville, 2007). This allows for the generalisation of the research findings (Malhotra, 2007; Zolkepli, 2013).

Probability sampling technique was applied as it allows the researcher a significant measure of control over who is selected and on the selection methods for choosing them. Sampling units were selected by chance. This study employed the cluster sampling technique as the clusters were well defined and of different geographic areas (the five RUs). Cluster sampling advantages include feasibility and low cost. As the total sample size for this study is large, only a sample of each cluster was selected as the sample units needed to have highly similar background characteristics.

For this study, the method of probability-proportionate-to-size (PPS) sampling was used as the clusters were not equal in size, which meant the sampling units would not be the same number (Malhotra, 2007). The probability of selecting sampling units in a selected cluster varies with the cluster size. First, the target population was divided into sub-populations called clusters. Then a random sample of clusters was selected based on a probability sampling technique such as simple random sampling. For each selected cluster, a sample of participant was drawn probabilistically.

The students of public higher educational institutions (HEIs) in Malaysia were the population of this study within which the target population was specifically the undergraduate students. The sampling frame was undergraduate students from five public RUs in Malaysia. In reaching the target population and ensuring accurate representation of students, the surveys had been conducted at all five sites namely the University of Malaya (UM), University of Science Malaysia (USM), University of Technology Malaysia (UTM), National University of Malaysia (UKM), and Putra University of Malaysia (UPM). The RUs were chosen because, as they are supported by the government, these institutions are increasingly focusing on research, development, and commercialisation activities, and publications (Tan et al., 2015). This ensures that RUs have an equal standard of assessment or key performance index (KPI). In addition,

the RUs have competitive entry requirements and quality lecturers contributing to an active role in exploring new research ideas, investigating innovative methods and participating in intellectual initiatives to continuously expand cutting edge knowledge (Education Guide Malaysia, 2015; Ministry of Higher Education, 2015).

Sample size refers to the number of participants for the study. As the study would eventually use factor analysis and multivariate analysis techniques, the sample size thus was large. The population size which is the number of students in the HEIs in Malaysia is large and 1% of the total population is about 870 students. As the study used PPS sampling, in order to get equal representation of students from each RU, the sample should be about 200 students per RU. Hence, the target sample was set at 1,000. Sample size estimation was calculated based on the enrolment of bachelor degree students in the five public RUs (the cluster) obtained from the National Education Statistics 2013 for Higher Education Sector (Ministry of Education Malaysia, 2014). The total population size of undergraduates was 86,926. Samples of 1,000 are about 1.15% from the total population size. For calculation, each RU undergraduate size was multiplied by the sample size and divided by the total population size (Hunt & Tyrrell, 2001). In the following, a calculation example of cluster size for UM is shown while the detailed calculation of each RU is in Table 3.2.

$$\text{Cluster size of RU} = \frac{\text{RU undergraduate size} \times \text{Target sample size}}{\text{Total population size}}$$

e.g. UM undergraduate size = 13,333
Target sample size = 1,000
Total undergraduate population size = 86,926

$$\text{Therefore, UM cluster size} = \frac{13{,}333 \times 1{,}000}{86{,}926} = 153$$

Table 3.2: The probability-proportionate-to-size (PPS) sampling procedure

RUs	Year	Bachelor enrolment	PPS sampling	
			Target N	%
UM	2013	13,333	153	15.3
USM	2013	20,103	231	23.1
UKM	2013	16,035	184	18.4
UPM	2013	17,617	203	20.3
UTM	2013	19,838	228	22.8
Total		86,926	999	99.9

Matching the respondents on the basis of pertinent background information was for controlling systematic error by assigning subjects in a way that their characteristics are the same in each group (Zikmund et al., 2010). The sample units were the undergraduates, chosen simply to highlight the specific subgroup or cluster within the population (of undergraduates and post-graduates) thus ensuring sample homogeneity (Malhotra, 1999). In addition, bachelor degree students are mostly made up of generation-Y (those born between 1980 and 1999) who represent the current young adult population of the country. In addition, bachelor degree programmes make up the majority of faculty courses. As they usually stay in the residential colleges (on campus all semester), undergraduate students are mostly involved in campus activities, associations, extra-curricular activities, and other college and university events, thus spending time almost exclusively in campus. In addition, the rationale of targeting the undergraduates was based on their homogeneity especially in relation to their age group, background of education, standard of intellect and their opinions about certain general issues. Figure 3.2 shows the overall sampling process.

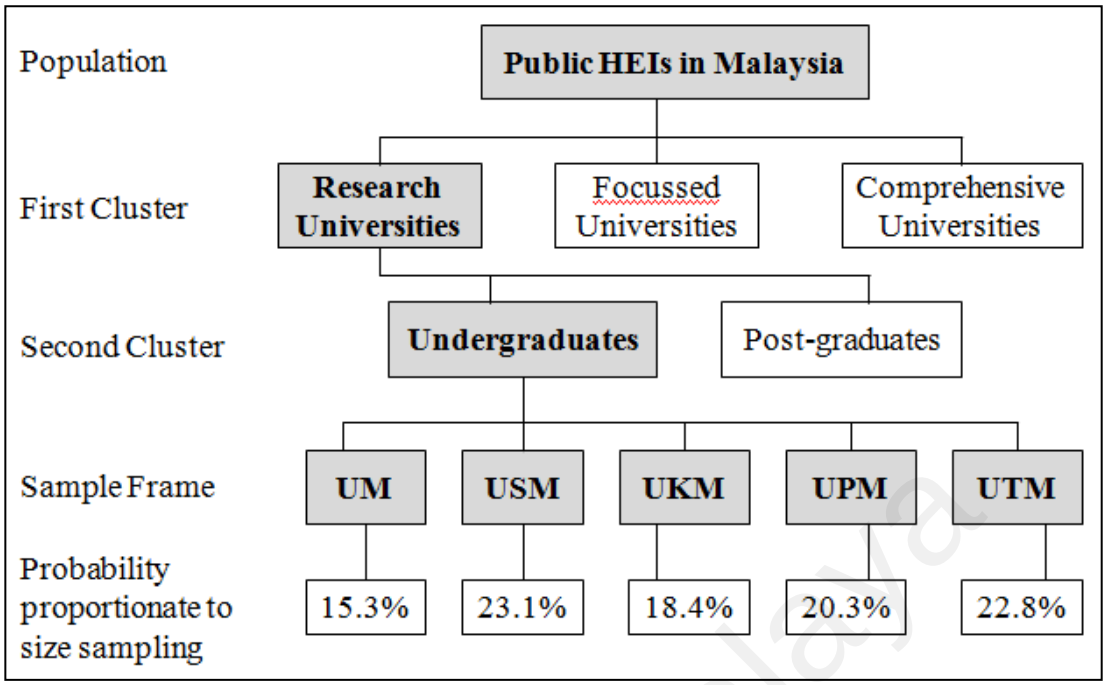

Figure 3.2: The sampling process of the study

3.3 Data Collection

The fieldwork involved selecting, briefing, and supervising the persons who collected the data. Six enumerators were selected and employed for the fieldwork. The selection was based on several characteristics. First, they should be university students, preferably with access to the data collection sites. Secondly, they needed to have a pleasant personality in order to intercept and attract the target respondents. Thirdly, they should be familiar with administering questionnaires. The rate of pay for enumerators was on a per-booklet basis at a rate of approximately RM2/booklet.

The data collection commenced between mid-May and mid-June 2015. About 1,110 self-administered printed questionnaires were distributed via the six enumerators to the undergraduates of the five RUs. Small stationery gifts were given out to respondents as a token of gratitude. Some incentives certainly increase people's willingness to participate in the survey. This works as a way to tackle the non-response problem as well (Leary, 2014).

3.3.1 Data Preparation

The raw data obtained in the questionnaires must be converted into a form suitable for analysis before being subjected to statistical analysis. This is to ensure data accuracy (on individual basis) thus allowing for smooth transition from raw to cleaned (reduced or processed) data. Preparing data involved checking the questionnaire for completeness, editing (to handle illegible, incomplete, inconsistent, ambiguous and unsatisfactory responses), coding, transcribing, and data cleaning. The next step included treatment of missing responses and statistical adjustment of data. Later, data analysis strategy and statistical techniques were selected (Malhotra, 1999, 2007; Ramayah, 2011).

Questionnaire checking for completeness and editing were done immediately after data collection. For coding, a number was assigned to each possible response to each question. For example, participant gender was coded as 1 for males and 2 for females. A field represents a single item for data such as sex of the respondent. A record refers to the related fields such as sex, age, name of university, and so forth. The data of all records for all respondents were stored in an Excel file before conversion to SPSS format for statistical analysis which is called the transcribing or transferring. The data cleaning involves checking for consistency and treatment of missing responses. Identifying missing values for each item was very important as much as adjusting data which consisted of variable re-specification with a purpose to create variables consistent with the objectives of the study.

3.3.2 Preliminary Tests

Preliminary assessments in which the process of inspecting the data and exploring the nature of the variables were done once the data were cleaned (Pallant, 2005). Examination of data involved inspecting and rearranging data in search of meaningful

patterns, descriptions and possible relationships between the groups of data (Ramayah, 2011). Preliminary analyses such as checking the appropriate sample size, presence of outliers, multicollinearity and singularity, are usually employed at the beginning of analysis.

Samples should be at least five times the number of variables (Bryant & Yarnold, 1995; Pallant, 2005). A general rule of thumb is to have a sample size of at least 300 for factor analysis (Tabachnick & Fidell, 2001). The target sample size of this study was 1,000. Outlier assessment was done by looking at cases with values well above or below the majority of other cases (Pallant, 2005), or members of intended sample population that had more extreme scores than a normal distribution by which out-of-range cases were deleted (Tabachnick & Fidell, 2007). Multicollinearity happens when a correlation matrix is made up of variables which are too highly correlated for example in a correlation of above .90. On the other hand, singularity happens when redundant variables are present, such as one of the variables is a combination of two or more of other variables (Pallant, 2005; Tabachnick & Fidell, 2001).

Prior to factor analysis, assumptions to be met are namely normality, linearity, and homoscedasticity. Aside from these, there are reliability and validity tests to ensure that the data were ready for further analyses, and to test the derived hypotheses.

In order to perform parametric analysis, the sample must be normally distributed and randomly selected to indicate its appropriateness in representing the actual population. Normality of data is tested either by graphical or statistical analysis including the use of histograms, stem-and-leaf plots, boxplots and descriptive statistics (Lau, 2009). For single variables, normality is assessed by skewness and kurtosis (Tabachnick & Fidell, 2007). Skewness indicates symmetry while kurtosis provides information about "peakedness" of the distribution. A normal distribution has a skewness and kurtosis

value of 0 which is rather uncommon in the social sciences. Normality also implies linearity (linear relationships) among pairs of variables. Homoscedasticity is when the variability in scores for variable X is similar at all values of variable Y. When looking at a scatterplot, there should be a roughly straight line (for linearity) and a fairly even cigar shape along its length to show a strong correlation (for homoscedasticity) (Pallant, 2005).

3.4 Research Techniques for Data Analysis

Selecting appropriate analysis techniques required some basic guidelines when identifying the statistical technique to adopt. In this study, a relationship between two variables to be analysed simultaneously required the use of bivariate data analysis while analysis of a relationship of more than two variables at a time required multivariate analysis (Kamarulzaman, 2006; Malhotra, 2007). The Statistical Packages for the Social Sciences (SPSS) version 20 was used for factor analysis, and multiple regressions. Subsequently, Analysis of Moment Structures (AMOS) version 21 was used for model validation through Structural Equation Modelling (SEM).

3.4.1 Descriptive Analysis

The purpose of descriptive research is to describe the characteristics or behaviours of a certain population in a systemic and accurate fashion. Usually, it is not designed to test hypotheses but to provide information about the social, behavioural, economic, or psychological characteristics of some group of people (Leary, 2014). Univariate and bivariate analyses describe the distribution of the variables of interest. Frequencies and cross-tabulations were for nominal or categorical variables while means and sub-group means were for continuous data. This type of analysis is useful when describing the profile of sample and in ensuring the representativeness of the research. Pearson's

correlation, multiple regressions, and factor analysis were used to establish relationships (Ramayah, 2011).

3.4.2 Construct Reliability and Validity

An important part of an analysis is to assess goodness of measures in terms of data validity and reliability. Validity is demonstrating the adequacy of measures such as being one-dimensional, consistent, reliable, and valid. Being one-dimensional means scale items have only one underlying construct, while consistency refers to obtaining goodness-of-fit in structural equation analysis. Reliability refers to the degree of consistency which also concerns with manoeuvring data to reduce measurement error before finally establishing validity which is to indicate the scale items are measuring what they should. Thus validity reflects how well a measure reflects its unobservable or latent construct (Ping Jr., 2004).

Scale reliability or internal consistency demonstrates the homogeneity of items making up a measurement scale. For this study, it is the degree of togetherness of items in a scale by which they should be measuring the same underlying construct (Leary, 2014; Pallant, 2005). Scale reliability was based on the correlations between individual items relative to the variances of the items, with reference to the inter-item correlations (Zolkepli, 2013). Higher inter-item correlations indicate higher possibility of the items measuring the same latent construct. The normally accepted value is between .3 and .8. Very low value of less than .3 indicates that the item is measuring something else, thus differing from the scale as a whole (Kamarulzaman, 2006). This indicator was also important when establishing convergent validity. Another indicator used for measuring reliability was Cronbach's alpha coefficient. The commonly accepted value is .7 and above (Lau, 2009; Leary, 2014; Pallant, 2005). This is because it indicates that 70% of the total variance in participants' scores on the measure is systematic, true-score

variance. This way, the items on the measure are systematically assessing the same construct and that less than 30% of the variance in people's scores on the scale is attributed to measurement error (Leary, 2014).

Three types of validity of measurements are content validity, criterion-related validity, and construct validity. This study was concerned with establishing construct validity using factor analysis (in SPSS) and SEM (using AMOS) which deal with the degree to which the scale represents the concept being measured (Ping Jr., 2004; Ramayah, 2011). Factor analysis was carried out to reduce a large set of scale items into a smaller and more manageable number of factors (Lau, 2009; Pallant, 2005). Using a Likert scale with six categories also contributed to improving construct validity. Additionally, construct validity was established in two ways, convergent validity and discriminant validity. In establishing construct validity, a measure should both correlate with other measures that it should correlate with (convergent validity) and not correlate with measures that it should not correlate with (discriminant validity) (Leary, 2014). Figure 3.3 illustrates how scale evaluation was carried out through reliability and validity tests.

Convergent validity tells whether each scale item (which usually comes from different sources) of a construct or dimension has high correlation with each other. On this basis, the scale items should load together on a single construct. To establish convergent validity, the composite reliability (CR) was calculated and the formula is as follows.

Composite Reliability (CR) =

$$\frac{(\text{Sum of standardised loadings})^2}{(\text{Sum of standardised loadings})^2 + \text{Sum of indicator measurement error}}$$

Or $= \dfrac{(\sum\lambda)^2}{(\sum\lambda)^2 + \sum(1 - \lambda^2)}$

On the other hand, discriminant validity is the establishment of minimal correlations between two or more unrelated constructs (Malhotra, 2007; Ramayah, 2011), and it can be measured by the average variance extracted (AVE). For this study, AVE measured the percentage of variance captured by a construct by a ratio of the sum of the variance captured by the construct and its measurement variance (Gefen, Straub, & Boudreau, 2000). For constructs to discriminate, the square root of the AVE should be larger than any of the correlations among the constructs (Zolkepli, 2013). The formula for calculating AVE is as follows.

Average Variance Extracted (AVE) =

$$\frac{\text{Sum of squared standardised loadings}}{\text{Sum of squared standardised loadings} + \text{Sum of indicator measurement error}}$$

Or $= \dfrac{\sum\lambda^2}{\sum\lambda^2 + \sum(1 - \lambda^2)}$

where $\lambda =$ item standardised loading

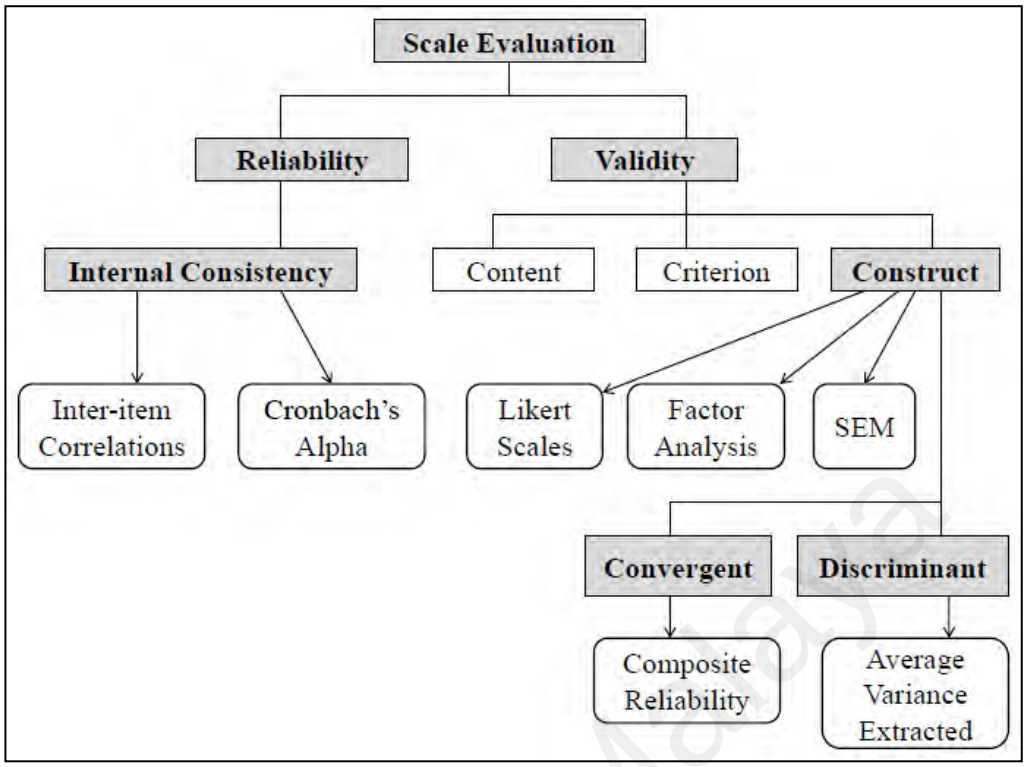

Figure 3.3: The scale evaluation and validation process

3.4.3 Multivariate Techniques

Multivariate techniques are capable of providing a study with three things. First, this analysis can give a firm idea of the total variance accounted for by the independent variables (IVs). Second, it tells the significance of each IV (which IV is the most important antecedent, which one is less important). Third, it shows how powerful each antecedent is after its links with other variables have been discounted. In summary, this analysis tells how powerful each antecedent is when other things are being equal, or when other things are held constant (Oppenheim, 2000). These techniques differ from univariate techniques in that the focus shifts to the degree of relationships (correlations or co-variances) among two or more phenomena (Malhotra, 2007). Two types of multivariate techniques are dependence and interdependence techniques. Multiple regressions used in this study are an example of dependence technique while interdependence techniques involved factor analysis and structural equation modelling.

3.4.4 Exploratory Factor Analysis (EFA)

Factor analysis refers to a class of statistical techniques used to analyse the interrelationships among a large number of variables (Leary, 2014). The purpose is to develop scales and measures in determining the underlying structure of a data matrix. It allows a large set of variables or scale items to reduce into smaller dimensions or factors. This is by summarising the underlying patterns of correlation and grouping the items together (Pallant, 2005). As an interdependence technique, an entire set of interdependent relationships is examined in which no distinction is made on whether one variable is the dependent or independent (Malhotra, 1999). These factors would be used in subsequent analysis such as regression and discriminant analysis by which the identified key variables should reflect closely the hypothesised factors. This approach eliminated the redundancy involved in analysing many measures of the same thing while concurrently analysing factors more powerful and reliable than measures of individual items (Leary, 2014). Three steps were followed in conducting EFA.

Firstly, the assessment of the suitability of the data for factor analysis was pertaining to the sample size requirement. As a general rule, this study assumed that a sample between 200 and 300 should be sufficient for solutions of fair loading marker variables (above .5) (Tabachnick & Fidell, 2001). The second issue concerned the factorability of the data. Bartlett's test of sphericity (Bartlett, 1954) should be significant (p<.05) for appropriate factor analysis. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser, 1974) should give a KMO index ranging from 0 to 1, with .6 as the minimum value for a good factor analysis (Pallant, 2005).

Secondly, factor extraction involved determining the smallest number of underlying factors or dimensions. The extraction techniques include principal components, principal factors, image factoring, maximum likelihood factoring, and alpha factoring

by which the most commonly used approach is principal components analysis (PCA). According to Pallant (2005), Tabachnick and Fidell (2001) recommended that researchers adopt an exploratory approach, experimenting with different numbers of factors until a satisfactory solution was found. In deciding on number of factors to retain, two techniques were used in this study namely Kaiser's criterion, and scree test. According to Kaiser's criterion or eigenvalue rule, only factors with values above 1.0 should be retained. Catell's scree test (Catell, 1966) recommended retaining factors above the elbow or break in the plot that explains most of the variance in the data set (Pallant, 2005). However, a priori determination was also considered because the researcher had prior knowledge on how many factors to expect and thus could specify the number of factors to be extracted beforehand (Malhotra, 1999). The extraction of factors ended with the extraction of the desired number of factors.

Thirdly, the factor rotation and interpretation step. When the number of factors to be retained had been decided upon, the next step would be to interpret them by rotating. According to Pallant (2005), understanding of the content of the variables, underlying theories and past research, allows the researcher to propose possible interpretations. Two main approaches to rotation are orthogonal or oblique factor solutions. Orthogonal rotation assumes that the underlying constructs are independent or not correlated, while oblique approaches allow factors to be correlated. The most common practice is to conduct both rotations and report the clearest, easiest, and closest to theory to interpret (Malhotra, 1999; Pallant, 2005). Among the techniques provided by SPSS are Varimax, Quartimax and Equamax for orthogonal rotation, and Direct Oblimin and Promax for oblique rotation. The variables should load strongly on only one component (factor or dimension) by a number of strongly loading variables. This study applied the oblique factor solutions and Promax rotation because the factors in the population were strongly correlated thus was useful in simplifying the factor pattern matrix (Malhotra, 1999).

Finally, the solution to a factor analysis was presented in a factor matrix. The original variables were on the left column while at the top were the factors that had been identified from the analysis. The numerical entries in the table were factor loadings which show the correlations of the variables with the factors. A variable that correlates with a factor is said to load on that factor. Researchers could identify and interpret the nature of a factor by scrutinising variables that have large loadings on that factor (Leary, 2014; Malhotra, 2007).

The key statistics associated with factor analysis include Bartlett's test of sphericity, correlation matrix, communality, eigenvalue, factor loadings, factor loading plot, factor matrix, factor scores, Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, percentage of variance, residuals, and scree plot as listed in Table 3.3.

Table 3.3: The statistics associated with factor analysis

Statistics	Features
Bartlett's test of sphericity	A test statistic used in examining the hypothesis that the variables are uncorrelated in the population. In other words, the population correlation matrix is an identity matrix within which each variable correlates perfectly with itself (r = 1) but has no correlation with the other variables (r = 0)
Correlation matrix	A lower triangle matrix showing the simple correlations, r, between all possible pairs of variables included in the analysis. The diagonal elements which are all 1, are usually omitted
Communality	The amount of variance a variable shares with all the other variables being considered. It is also the proportion of variance explained by the common factors
Eigenvalue	Represents the total variance explained by each factor
Factor loadings	Simple correlations between the variables and the factors
Factor loading plot	A plot of the original variables using the factor loadings as coordinates
Factor matrix	Contains the factor loadings of all the variables on all the factors extracted
Factor scores	Composite scores estimated for each respondent on the derived factors
Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy	An index used to examine the appropriateness of factor analysis. High values between .5 and 1.0) indicate factor analysis is appropriate. Values below .5 imply that factor analysis may not be appropriate
Percentage of variance	The percentage of the total variance attributed to each factor
Residuals	The differences between the observed correlations, as given in the input correlation matrix, and the reproduced correlations, as estimated from the factor matrix
Scree plot	A plot of eigenvalues against the number of factors in order of extraction

Source: Malhotra (1999). *Marketing research: An applied orientation* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.

3.4.5 Multiple Regressions

Multiple regressions by SPSS were used to explore the predictive ability of a set of independent variables on one continuous dependent measure. One advantage of multiple regression was that the researcher could determine the order of sequence in which the variables would enter the analysis (Oppenheim, 2000). The basic regression model is $Y_i = \beta_0 + \beta_1 X_i + e_i$, where Y_i is dependent of criterion variable, X_i is independent or predictor variable, β_0 is intercept of the line, β_1 is slope of the line, and e_i is the error term associated with the ith observation. The estimated or predicted value of Y_i is $\hat{Y}_i = a + bx$, where $\hat{Y}_i$ is the predicted value of Y_i, and a and b are the estimators of β_0 and β_1, respectively (Malhotra, 1999). Statistics associated with multiple regressions include coefficient of determination (r^2), regression coefficient, scattergram, standard error of estimate, standard error, standardised regression coefficient, sum of squared error, t-statistic, adjusted R^2, coefficient of multiple determination (R^2), and F-test as listed in Table 3.4.

Table 3.4: The statistics associated with multiple regressions

Statistics	Features
Coefficient of determination, r^2	The strength of association, varies between 0 and 1, and signifies the proportion of the total variation in Y that is accounted for by the variation in X
Regression coefficient, b	The estimated parameter b is usually referred to as the non-standardised regression coefficient
Scattergram	A scatter diagram, is a plot of the values of two variables for all the cases or observations
Standard error of estimate	SEE is the standard deviation of the actual Y values from the predicted $\hat{Y}$ values
Standard error	The standard deviation of b or SE_b
Standardised regression coefficient	Also called the beta coefficient or beta weight, the slope obtained by the regression of Y on X when the data are standardized
Sum of squared error	The distances of all the points from the regression line are squared and added together to arrive at the sum of squared error
t-statistic	A t-statistic with $n - 2$ degrees of freedom can be used to test the null hypothesis that no linear relationship exists between X and Y
Adjusted R^2	R^2 is adjusted for the number of independent variables and the sample size to account for the diminishing returns
Coefficient of multiple determination (R^2)	The strength of association in multiple regression, measured by the square of the multiple correlation coefficient, R^2
F-test	To test the null hypothesis that the $R^2_{pop}=0$

Source: Malhotra (1999). *Marketing research: An applied orientation* (3rd ed.). Englewood Cliffs, NJ: Prentice-Hall.

3.4.6 Structural Equation Modelling (SEM)

This technique allows the test of various models concerning the inter-relationships among a set of variables, instead of developing models. The models therefore, should always be based on theory, knowledge or even hunches (Norman & Streiner, 2003). SEM also evaluates the importance of each independent variables and the overall fit of the model to data (Pallant, 2005).

SEM was used in the study first because it takes a confirmatory hypotheses testing rather than exploratory approach to the data analysis. As the pattern of intervariable relations was specified a priori, SEM is suitable for data analysis for inferential purposes. Second, SEM provides explicit estimates of measurement error. Finally, SEM procedures can incorporate both unobserved (latent) and observed variables (Byrne, 2001; Gefen, Rigdon, & Straub, 2011).

The first step in obtaining the structural model was by specifying the relationships among latent variables which were based on theory. This is called the model specification or measurement model (Norman & Streiner, 2003). This step involved the confirmatory factor analysis (CFA) in order to validate each variable with a more robust procedure. The second step proceeded with the structural model analyses which would examine the overall fit of the proposed research model. Finally, the hypothesised links among latent constructs would be established (Byrne, 2001; Kamarulzaman, 2006). This study adopted **the two-step approach** which began with validation of the measurement model. When that was established, the second step followed (i.e., the estimation of the overall structural models).

In SEM, there are latent or measured variables commonly referred to as factors in a factor analysis. Latent variables were observed directly by physical measurement or on a scale/rating. Latent trait is an unseen construct that is described by the correlations

among the measured variables that have been taken (Byrne, 2001; Norman & Streiner, 2003).

Among these variables, some are called exogenous and some endogenous. An exogenous variable has paths coming from it and none leading to it. Curved arrows are not considered to be paths because they simply describe correlations among variables. An endogenous variable has at least one path leading to it. Also, all endogenous variables have an error term tacked on, which corresponds to the assumption in multiple regressions that the dependent variable is measured with some degree of error (Norman & Streiner, 2003).

A limited number of paths could be analysed in any one diagram. In particular, the number of parameters should be less than or equal to the number of observations (Norman & Streiner, 2003). The number of observations was not based on the sample size, but rather, on the number of variables in the model (k). The specific formula is as follows.

Number of observations = $[k (k + 1)] / 2$

Where k = the number of variables in the model

This led to the determination of the number of parameters. In order to do so, these had to be determined first (as described by Norman & Streiner, 2003):

1. Which paths were important (the straight arrows)
2. What the variances of the exogenous variables were
3. How the exogenous variables related to one another (the curved arrows, or covariances)
4. What the error terms (disturbances) of the endogenous variables were

The formula for number of parameters is as follows.

Number of parameters = The number of paths +
The number of variances of exogenous variables +
The number of covariances +
The number of disturbance terms

Therefore, the goal was to keep the model as simple as possible, but no simpler. To see how well the model fit the data, the path coefficients or parameters (as beta weights in SPSS) and their respective standard errors (SE) were examined. These measures provided *z*-test (parameter divided by SE) for the individual component of the model, by which a value greater than 1.96 means the parameter was statistically significant (Norman & Streiner, 2003). Looking at the model as a whole it was necessary to check the overall fit. Putting it all together, five steps are involved in achieving the final structural model, as summarised in Table 3.5.

Table 3.5: The five steps in obtaining the structural model

Model specification (measurement model)	Specifying the relationships among latent variables Determining how latent variables will be measured Specifications are made based on knowledge or theory
Model identification	Number of parameters cannot exceed the number of observations The number of parameters should be postulated by theory/knowledge Fixing/constraining some of the paths/variances
Estimation	Maximum likelihood method (to run the model) It is not dependent on the scale of measurement It requires multivariate normality
Test of fit	χ^2 to be non-significant χ^2/df to be less than 2 Comparative fit: NFI, NFI2 Variance explained: GFI, AGFI
Respecification	Improving model to get a better fit To have a firm grounding theory and the literature so that the study captures the important information

Source: Norman & Streiner (2003). Chapter 17: Path analysis and structural equation modelling. In *PDQ Statistics* (3rd ed.). Ontario, Canada: BC Decker Inc.

Several aspects of SEM set it apart from other multivariate procedures. For one, it took a confirmatory rather than exploratory approach to the data analysis as the pattern of intervariable relations was specified a priori. SEM is suitable for data analysis for inferential purposes. Second, SEM provided explicit estimates of measurement error. Finally, SEM procedures could incorporate both unobserved (latent) and observed variables (Byrne, 2001).

3.4.7 Summary of Research Techniques for Data Analysis

In fulfilling the objectives of this research, a number of analyses were used upon the data obtained from the questionnaire. Table 3.6 shows the related data analysis techniques as discussed previously.

Table 3.6: Summary of statistical techniques for data analysis

Data Type	Type of Analysis	Technique/Indicator
Univariate	Descriptive analysis	Frequency scores
		Central tendencies (Mean)
		Dispersion (Std. Deviation)
Multivariate	Scale reliability and validity analysis	Reliability test
		▪ Inter-item correlations
		▪ Cronbach's alpha
		Exploratory factor analysis (EFA)
		▪ Kaiser-Mayer-Olkin's (KMO) measure of sampling adequacy test
		▪ Bartlett's test of sphericity
		▪ Factor loadings
	Regression analysis (using SPSS)	Test of assumptions
		▪ Multicollinearity
		▪ Outliers
		▪ Homoscedasticity, linearity and normality
		Model tests
		▪ Standard regression coefficients
		▪ *t*-value, significant value and collinearity
		▪ *F*-value, *R*, R^2 and adjusted R^2
	Structural equation modelling / SEM (by Analysis of Moment Structures /AMOS)	Measurement model
		▪ Confirmatory factor analysis (CFA)
		▪ Composite reliability (CR)
		▪ Average variance extracted (AVE)
		▪ Fit indices measure
		Structural model
		▪ Absolute fit measures
		▪ Incremental fit measures
		▪ Parsimonious fit measures

Source: Kamarulzaman (2006). *The adoption of internet shopping for travel services*. PhD thesis for the Cardiff Business School, Cardiff University, United Kingdom.

3.5 Testing of Hypotheses

The summary of the hypotheses explaining relationship between each antecedent of innovation culture, and the evaluation of possible relationship between innovation culture and students' innovative behaviour is as shown in Table 3.7.

Table 3.7: Hypotheses derived for the study

Research Question	Hypothesis	Instrument	Data analysis procedure
1) Relationship between EC and IC	H1: An institution with positive EC has a significant positive relationship with IC	Questionnaire survey	Quantitative Correlation test Multiple regression Path analysis (SEM)
2) Relationship between EC and IB	H2: An institution with positive EC has a significant positive relationship with IB	Questionnaire survey	Quantitative Correlation test Multiple regression Path analysis (SEM)
3) Relationship between CI and IC	H3: A positive CI has a significant positive relationship with IC	Questionnaire survey	Quantitative Correlation test Multiple regression Path analysis (SEM)
4) Relationship between CI and IB	H4: A positive CI has a significant positive relationship with IB	Questionnaire survey	Quantitative Correlation test Multiple regression Path analysis (SEM)
5) Relationship between SE and IC	H5: Positive SE has a significant positive relationship with IC	Questionnaire survey	Quantitative Correlation test Multiple regression Path analysis (SEM)
6) Relationship between SE and IB	H6: Positive SE has a significant positive relationship with IB	Questionnaire survey	Quantitative Correlation test Multiple regression Path analysis (SEM)
7) Relationship between IC and IB	H7: A positive IC has a significant positive relationship with students' IB	Questionnaire survey	Quantitative Correlation test Multiple regression Path analysis (SEM)

3.6 Pre-test Results

The testing of the questionnaire on a small sample of respondents in order to identify and eliminate potential problems is called pre-testing. The online pre-test survey commenced between mid-March and April 2015. The respondents were similar in profile to the targeted participants in the actual survey (Malhotra, 1999) in terms of background characteristics, familiarity with the topic, and attitudes and behaviours of interest. Due to accessibility among University of Malaya students, respondents were gathered from the university's own email database (Siswamail), undergraduates and postgraduates included. The feedback from the pre-test was examined; most respondents had not experienced any problems when answering the questionnaire. A sample of 50 respondents was collected. Due to inconsistency in the initial factor analysis of the survey items, it was decided that for the actual survey, the target

participants should consist only of undergraduates instead of all graduate students to control for systematic error and ensuring more homogeneous samples (Zikmund et al., 2010).

3.7 Summary of the Chapter

This chapter has discussed the research design and research techniques employed by the study. It has also detailed the sampling, the instrument used and the development of scale items. It ends with hypotheses testing which will be discussed in detail in the next chapter.

CHAPTER 4: DATA ANALYSES AND FINDINGS

The previous chapter discussed research methodology including the summary of data analysis to be performed. This chapter presents the findings of analyses performed on the data. Descriptive analysis will be presented first, followed by the preparation of data and preliminary test. The mid-section features discussions on factor analysis, reliability test, and discriminant validity test. Subsequently, the structural model and model fit to the data are demonstrated. Finally, hypotheses testing will be discussed.

4.1 Descriptive Analysis

This section presents the result of responses, demographic profile of participants, and the non-response bias.

4.1.1 Analysis of Response

Questionnaires were distributed in surveys to undergraduate students at the selected sampling sites consisting of five research universities (RUs) in Malaysia which are University of Malaya (UM), University of Science Malaysia (USM), University of Technology Malaysia (UTM), National University of Malaysia (UKM), and University of Putra Malaysia (UPM). Approximately 1,110 questionnaires were distributed with 1,059 responses successfully returned, representing a response rate of 95.4 percent. However, a total of 51 participants were excluded from analysis because 36 were postgraduate students (eliminated as they were not the target samples) and 15 were dismissed due to unengaged responses by which there was very little variance in answer across all 48 items in the survey questionnaire (by which the dismissal was based on very low standard deviation values of between .0 and .2). The remaining 1,008 participants accounted for 95.2 percent of the total number of responses and were usable for subsequent analyses. The report of sampling is given in Table 4.1.

Table 4.1: Detail of sampling results

RU	Collected	Non-usable	Usable	Response Rate (%)
UM	217	4	213	20.1
USM	240	5	235	22.2
UKM	184	2	182	17.2
UPM	203	23	180	17.0
UTM	215	17	198	18.7
Total	1,059	51	1,008	95.2

4.1.2 Profile of Participants

With regard to institutional background, from a sample size of 1,008, the highest number of participants were from USM (23.3%), followed by UM (21.1%), and UTM (19.6%). There were more science stream students (56.8%) as compared to the non-sciences (43.2%). This reflected the normal composition of degree courses offered in Malaysian RUs. The target sample of undergraduates was met with 99.4% while the remaining 0.6% was made up of foundation students. In terms of study year, the highest proportion was third year students (37.3%), followed by first year students (28.1%), and then second year students (24.6%). Only 10.0% of them were in fourth year and beyond.

There were more female (62.4%) than male (34.8%) participants, while some refused to disclose their gender (2.8%). The majority of them (88.2%) were Malay (65.7%) and Chinese (22.5%) students. In terms of age group, the majority of participants were between 21 and 24 years old (78.3%) and 17 to 20 (17.1%). As for financial freedom, approximately half of them were supported by a scholarship (50.2%), followed by family members (24.3%), and by securing loans (21.6%). Only a mere 3.9% were financially independent. Again, this reflected the normal composition of gender, ethnicity, and age group in Malaysian undergraduates, and the ability to support their education independently. The summary of demographic profile of participants is shown in Table 4.2.

Table 4.2: Demographic profile of participants

Variable	Category	Frequency (N=1,008)	Valid percent (%)
Research university	UM USM UKM UPM UTM	213 235 182 180 198	21.1 23.3 18.1 17.9 19.6
Discipline	Sciences Non-sciences	573 435	56.8 43.2
Programme	Foundation Undergraduate	6 1,002	0.6 99.4
Study year	1st year 2nd year 3rd year 4th & above	283 248 376 101	28.1 24.6 37.3 10
Gender	Male Female Not specified	351 629 28	34.8 62.4 2.8
Ethnicity	Malay Chinese Indian Malaysians Not specified	662 227 69 41 9	65.7 22.5 6.8 4.1 0.9
Age group	17-20 21-24 25-28 29-32 33-36 37 & above	172 789 38 7 1 1	17.1 78.3 3.8 0.7 0.1 0.1
Financial freedom	Family support Scholarship Loan Independent	245 506 218 39	24.3 50.2 21.6 3.9

4.1.3 Non-response Bias

Non-response bias can affect findings of a study when the degrees to which people who respond differ from those who do not. If responders and non-responders are very similar, the non-response does not impair the ability to draw valid, unbiased conclusions from the data (Leary, 2014). With respect to that, in this study, there was no difference in the non-response questionnaires as students mostly decided against participating simply due to lack of time and interest. Thus, it was assumed that there were no invalid or biased conclusions from the data. Furthermore, the incentive given out to students helped in attracting and sustaining their interest level.

4.2 Preparation of Data

Preparing data, normality test, factor analysis, reliability test, and validity test were conducted in order to ensure that the data were ready for further analyses, and to test the derived hypotheses. All analysis was done using the SPSS software version 20.

4.2.1 Data Cleaning

Data cleaning process involved checking for consistency, missing responses, and adjustment. This study chose to replace each missing value with the estimation of the overall tendency (mode of scores) of each participant (Ramayah, 2011). The most common editing involved participants circling two rating scales on a 6-point rating scale for an item. Usually, the next item was left without any rating. These responses were resolved by assigning the next rated scale for the next missing item. Another unsatisfactory type of responses was when there were missing responses, usually because the participants overlooked the question. This was handled by substituting an imputed response which was the rate based on the pattern of responses to other questions (Malhotra, 1999), usually of the questions before and after the missing question. Adjustment of data consisting of variable re-specification (aimed at creating variables consistent with the objectives of the study) was done for the 'area of study'. Originally, there were six response categories which later were collapsed into just two categories: sciences and non-sciences.

4.2.2 Normality Test

The importance of normally distributed data is to ensure homoscedasticity and to indicate the sample is representative of the population. The study deduced normality from the results of the skewness and kurtosis. The normal range for skewness and kurtosis is between -2 and + 2 (Lau, 2009; Sekaran, 2003). However, in a large sample the significance level of skewness is not as important as its actual size because a

variable with statistically significant skewness often does not deviate enough from normality to make significant difference in the analysis (Tabachnick & Fidell, 2001).

All items were positively worded in the questionnaire with mean score of above 4.00. This indicates the overall agreement with the statement of items for each variable. The summary of the mean score and standard deviation of each item, and the skewness and kurtosis results for each measurement item are as shown in Table 4.3. All items had values within the normality curve, between -0.77 and +1.01. These values together with the abovementioned guidelines thus indicated that the normal distribution requirement had been fulfilled and further treatment of the data was not required due to the large sample size (N=1,008).

Table 4.3: Descriptive analysis of all items

Item	N	Min	Max	Mean	Std. Deviation	Skewness	Kurtosis
EC1	1008	1	6	4.42	0.98	-0.67	0.98
EC2	1008	1	6	4.39	0.94	-0.51	0.59
EC3	1008	1	6	4.40	1.00	-0.59	0.69
EC4	1008	1	6	4.35	1.02	-0.58	0.55
EC5	1008	1	6	4.23	1.08	-0.54	0.47
EC6	1008	1	6	4.49	1.03	-0.60	0.43
EC7	1008	1	6	4.44	1.02	-0.42	0.14
EC8	1008	1	6	4.50	1.00	-0.38	-0.12
CI1	1008	1	6	4.50	1.10	-0.70	0.61
CI2	1008	1	6	4.34	1.04	-0.44	0.10
CI3	1008	1	6	4.37	1.05	-0.55	0.44
CI4	1008	1	6	4.35	0.99	-0.56	0.65
CI5	1008	1	6	4.39	0.99	-0.57	0.60
CI6	1008	1	6	4.43	0.97	-0.43	0.26
CI7	1008	1	6	4.53	1.03	-0.54	0.52
CI8	1008	1	6	4.49	0.95	-0.51	0.55
CI9	1008	1	6	4.44	1.00	-0.64	0.81
CI10	1008	1	6	4.37	1.05	-0.77	1.01
CI11	1008	1	6	4.39	1.06	-0.46	0.19
CI12	1008	1	6	4.41	1.01	-0.56	0.62
SE1	1008	1	6	4.44	0.95	-0.37	0.28
SE2	1008	1	6	4.52	0.93	-0.42	0.24
SE3	1008	1	6	4.61	0.98	-0.41	0.01

SE4	1008	1	6	4.64	0.96	-0.52	0.33
SE5	1008	1	6	4.37	1.00	-0.47	0.41
SE6	1008	1	6	4.40	0.98	-0.51	0.36
SE7	1008	1	6	4.50	0.95	-0.51	0.56
SE8	1008	1	6	4.64	1.00	-0.60	0.59
SE9	1008	1	6	4.53	0.98	-0.65	0.87
SE10	1008	1	6	4.43	0.94	-0.25	-0.03
SE11	1008	1	6	4.45	0.98	-0.54	0.67
SE12	1008	1	6	4.36	1.03	-0.49	0.51
IB1	1008	1	6	4.56	0.97	-0.44	0.13
IB2	1008	1	6	4.54	1.03	-0.75	1.23
IB3	1008	1	6	4.48	1.05	-0.58	0.52
IB4	1008	1	6	4.70	0.99	-0.71	0.86
IB5	1008	1	6	4.66	1.02	-0.71	0.71
IB6	1008	1	6	4.59	0.99	-0.48	0.30
IB7	1008	1	6	4.62	1.04	-0.62	0.54
IB8	1008	1	6	4.77	0.96	-0.53	0.05
IB9	1008	1	6	4.60	1.07	-0.50	0.06
IC1	1008	1	6	4.36	1.04	-0.50	0.42
IC2	1008	1	6	4.32	1.05	-0.46	0.30
IC3	1008	1	6	4.42	1.04	-0.55	0.54
IC4	1008	1	6	4.40	1.06	-0.44	0.25
IC5	1008	1	6	4.44	1.01	-0.56	0.58
IC6	1008	1	6	4.37	1.03	-0.46	0.28
IC7	1008	1	6	4.33	1.06	-0.46	0.25

4.2.3 Exploratory Factor Analysis (EFA)

The correlations amongst constructs/components were extracted from the resulting Correlation Matrix from the EFA. According to Brown (2009), the best way to decide between orthogonal and oblique rotation is to look at the correlation among factors. If the factor correlations exceed .32, then there is 10% (or more) overlap in variance among factors by which enough variance to warrant oblique rotation unless there are compelling reasons to use orthogonal rotation (Brown, 2009; Tabachnick & Fidell, 2007). As shown in Table 4.4, all correlations exceeded the Tabachnick and Fidell (2007) threshold of .32, hence the use of Promax rotation.

Table 4.4: Correlation matrix of factors from the EFA

	EC	CI	SE	IC	IB
EC	1	.728**	.594**	.572**	.581**
CI	.728**	1	.646**	.579**	.561**
SE	.594**	.646**	1	.576**	.639**
IC	.572**	.579**	.576**	1	.560**
IB	.581**	.561**	.639**	.560**	1

***Correlation is significant at the 0.01 level*
EC = Effective Communications, CI = Climate for Innovation, SE = Self-efficacy, IC = Innovation Culture, IB = Innovative Behaviour

All 48 items were factor analysed using Principal Component Factor Analysis, by Promax Rotation with Kaiser Normalisation. The EFA result indicated that the pool of items captured seven distinct factors, including the dependent variable. According to Pallant (2005), two ways to assist in decision concerning the number of factors to retain is through the Catell's scree test (Catell, 1966) and the eigenvalue rule. The eigenvalue of a factor shows the amount of total variance explained by that factor.

The initial EFA result indicated that the items captured seven factors with eigenvalue of 1.0 and more. However upon consulting the scree plot (to find a point at which the shape of the curve changes direction and becomes horizontal) (Pallant, 2005), only four to five factors should be retained. The Pattern Matrix further confirmed this as it showed three items (SE2, SE3, SE4) loaded on Factor 6 while only one item (CI1) loaded on Factor 7. Fixing the number of factors at five (in tandem with the theorised model as described in Chapter 2), all items were subjected to EFA again. Upon inspection of this Pattern Matrix, eight items were deleted (i.e. SE2, SE3, SE4, IB3, SE8, SE1, CI7, CI5) and no longer included in the subsequent analyses.

As suggested by Pallant (2005), two statistical measures to help assess the factorability or adequacy of the pattern matrix of the data were used including the Bartlett's Test of Sphericity (BTS) and the Kaiser-Meyer-Olkin (KMO) measure of

sampling adequacy (Kaiser, 1974). The result of the KMO value was well above 0.9, at 0.964, exceeding the recommended value of 0.6 (Kaiser, 1974). The BTS reached statistical significance (p<.001) thus supporting factorability of the correlation matrix.

For a good factor analysis, a few factors explain a substantial portion of the variance and the remaining factors explain relatively small amounts of variance. In social sciences, information is often not as precise as in natural sciences. A combination of factors that accounts for 60 percent of the total variance (and in some cases even less) is deemed satisfactory (Kamarulzaman, 2006; Malhotra, 1999; Ramayah, 2011). The results showed that the first factor (construct) accounted for a large percentage of the total variance (40.2%) and the five factors extracted accounted for 59.1% of the total variance. Table 4.5 provides the summary of the eigenvalues, percentages of variance explained and cumulative variance explained by the factor solution. These findings thus indicated that all five factors could be used to investigate the research questions.

Table 4.5: Eigenvalues and total variance explained by the five factors

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	16.095	40.237	40.237	16.095	40.237	40.237	12.151
2	2.587	6.467	46.703	2.587	6.467	46.703	10.532
3	2.130	5.324	52.028	2.130	5.324	52.028	10.591
4	1.566	3.916	55.944	1.566	3.916	55.944	11.660
5	1.246	3.114	59.058	1.246	3.114	59.058	10.752

4.2.4 Reliability Tests

The most common indicators for internal consistency are Cronbach's alpha coefficient and the inter-item correlations. Both indicators were used to show reliability of scale. Ideally the alpha value should be above .7 (Lau, 2009; Pallant, 2005; Ramayah, 2011) while the normally accepted value of inter-item correlations (ITC) is between .3

and .8 (Zolkepli, 2013). Table 4.6 examines the initial reliability of all items of scale. The Cronbach's alpha of each construct was above .85, showing a high degree of internal consistency. The climate for innovation (CI) scale showed the highest alpha value at .92, while self-efficacy (SE) recorded the lowest alpha at .89. No items were deleted as all ITCs were of above .50.

Table 4.6: Results of reliability test

Items	Item-Total Correlation	α	Items	Item-Total Correlation	α
EC1	0.654	0.902	CI1	0.579	0.921
EC2	0.710		CI2	0.689	
EC3	0.721		CI3	0.665	
EC4	0.669		CI4	0.750	
EC5	0.626		CI5#	0.664	
EC6	0.716		CI6	0.723	
EC7	0.707		CI7#	0.645	
EC8	0.708		CI8	0.698	
SE1#	0.586	0.899	CI9	0.684	
SE2#	0.627		CI10	0.655	
SE3#	0.575		CI11	0.659	
SE4#	0.599		CI12	0.638	
SE5	0.647		IC1	0.726	0.911
SE6	0.693		IC2	0.771	
SE7	0.671		IC3	0.747	
SE8#	0.576		IC4	0.760	
SE9	0.609		IC5	0.723	
SE10	0.586		IC6	0.700	
SE11	0.629		IC7	0.688	
SE12	0.591				
IB1	0.672	0.904			
IB2	0.646				
IB3#	0.638				
IB4	0.691				
IB5	0.700				
IB6	0.681				
IB7	0.708				
IB8	0.716				
IB9	0.622				

Note: #Deleted items

4.2.5 Validity Tests

Validity refers to how well a measure reflects its unobservable or latent construct (Ping Jr., 2004). To claim validity of an instrument, it is necessary to have both convergent and discriminant validity (Ramayah, 2011). This study derived its convergent validity from the EFA and composite reliability (CR). Discriminant validity was confirmed when the construct as a whole differed from the other constructs.

4.2.6 Convergent Validity

The result of EFA as shown in Table 4.7 showed that all items loaded on their measured construct/factor and all item loadings were at values of above .5. The average loading of all factors was above .65 which was adequately high (Ramayah, 2011). This indicated that convergent validity was established. Convergent validity was also measured based on items loading through the composite reliability (CR). A CR with a value of .7 and above indicates satisfactory convergent validity (Barclay, Thompson, & Higgins, 1995). The results as shown in Table 4.7 and Table 4.8 indicated that all constructs exceeded the minimum requirement for validity with all constructs being above the acceptable value of .7. This result signified that convergence was established because all items loaded strongly on their associated factors (loading>0.50) and each factor loaded stronger on their respective factors rather than on any other factors.

Table 4.7: Results of convergent validity and discriminant validity analysis

Item	Item loading	Average loading	CR	AVE
EC1	0.707	0.724	0.899	0.53
EC2	0.724			
EC3	0.754			
EC4	0.817			
EC5	0.818			
EC6	0.718			
EC7	0.692			
EC8	0.561			
CI1	0.745	0.699	0.906	0.494
CI2	0.723			
CI3	0.708			
CI4	0.724			
CI6	0.544			
CI8	0.593			
CI9	0.759			
CI10	0.804			
CI11	0.759			
CI12	0.629			
SE5	0.773	0.657	0.843	0.439
SE6	0.802			
SE7	0.63			
SE9	0.58			
SE10	0.605			
SE11	0.615			
SE12	0.592			
IB1	0.587	0.71	0.893	0.516
IB2	0.525			
IB4	0.792			
IB5	0.827			
IB6	0.761			
IB7	0.656			
IB8	0.839			
IB9	0.693			
IC1	0.857	0.796	0.924	0.638
IC2	0.885			
IC3	0.812			
IC4	0.817			
IC5	0.773			
IC6	0.746			
IC7	0.682			

**CR=Composite reliability, AVE=Average variance extracted*

4.2.7 Discriminant Validity

Discriminant validity was evaluated by comparing the AVE values associated with each construct to the correlations among constructs (Staples et al., 1999). The validity of the individual items and the construct should be reflected by an AVE value of more than 0.50 (Fornell & Larcker, 1981). The result (see Table 4.7) showed that Factor 2 and Factor 3 indicated somewhat low validity at AVE values of 0.494 and 0.439 respectively. Despite these, three other factors indicated satisfactory AVE above 0.50. In summary, the reliability of the measures was supported.

A result of further discriminant validity analysis is shown in Table 4.8. Diagonal numbers showed the square root of AVE values while the off-diagonal numbers represented the correlations among construct/component. To establish discriminant validity, the diagonal numbers should be greater than any other corresponding row or column entry (Barclay et al., 1995). The results showed that CR values were all well above 0.84 indicating convergent validity, and AVE values were above 0.5 except for CI and SE which showed AVE values of 0.494 and 0.439 respectively. The AVE for CI was rather satisfactory (about 0.50) whilst the AVE value of SE did not show satisfactory validity. Regardless, the values of square root of AVE were all larger than the correlation coefficients, thus establishing discriminant validity.

Table 4.8: Discriminant validity analysis

	CR	AVE	EC	CI	SE	IB	IC
EC	0.899	0.530	**0.728**				
CI	0.906	0.494	0.692	**0.703**			
SE	0.843	0.439	0.532	0.583	**0.662**		
IB	0.893	0.516	0.536	0.502	0.590	**0.718**	
IC	0.924	0.638	0.549	0.553	0.550	0.523	**0.798**

EC=Effective Communications, CI=Climate for Innovation, SE=Self-efficacy, IB=Innovative Behaviour, IC=Innovation Culture, CR=Composite Reliability, AVE=Average Variance Extracted
Values in bold=Square Root of AVE. Other readings show the correlation coefficients between constructs

Other than EFA and AVE, convergent validity can be measured by examining the confirmatory factor analysis (CFA). The results of CFA will be presented in the SEM analysis.

4.3 Multiple Regression Analysis

At the beginning of this analysis, several assumptions must be met in order to prepare and establish that data were appropriate before being subjected to multiple regression. Therefore, preliminary analyses such as checking the multicollinearity and singularity, presence of outliers, and homoscedasticity, linearity and normality were conducted.

4.3.1 Pearson's Correlation Test

Pearson's product-moment correlations test will help in identifying significance of independent and dependent constructs, strength, and magnitude of each relationship (Pallant, 2005). Table 4.9 shows the correlation analysis which revealed moderately large positive relationships between all five constructs. There was a strong and positive correlation between CI and EC constructs [r=.73, n=1,008, p<.001] which indicated high levels of CI associated with high levels of EC. The least strong, positive correlation was between constructs IC and IB [r=.56, n=1,008, p<.001] which meant presence of high levels of IC associated with high levels of IB.

Table 4.9: Pearson's correlation between constructs

	IB	EC	CI	SE	IC
IB	1.000				
EC	.581**	1.000			
CI	.562**	.733**	1.000		
SE	.678**	.605**	.650**	1.000	
IC	.560**	.572**	.572**	.587**	1.000

***Correlation is significant at the 0.01 level (2-tailed)*

IB=Innovative Behaviour, EC=Effective Communications, CI=Climate for Innovation, SE=Self-efficacy, IC=Innovation Culture

4.3.2 Multicollinearity and Singularity

Multicollinearity is a condition when a correlation matrix consists of variables which are too highly correlated for example in a correlation of above .90. On the other hand, singularity happens when redundant variables are present, such as one of the variables is a combination of two or more of other variables (Pallant, 2005; Tabachnick & Fidell, 2001). The result of multicollinearity test is as reported in Table 4.10. The results of the multiple regression showed that values of the independent variables were quite respectable (*r* between .560 and .678), so the variables appeared not to violate the assumption.

4.3.3 Outliers

Outliers are cases with values well above or below the majority of other cases (Pallant, 2005), or members of intended sample population that have more extreme scores than a normal distribution by which out-of-range cases are usually deleted (Tabachnick & Fidell, 2007). Outlier presence could be detected from the scatterplot (see Figure 4.1). Outliers are often operationally defined as cases that have a standardised residual of more than 3.3 or less than -3.3 (Pallant, 2005; Tabachnick & Fidell, 2001). In large samples, it is common to find a number of outlying residuals. To check the outliers for the multiple regressions, the Mahalanobis distances from the SPSS multiple regressions output were used. A critical Chi-square value of the regression model was used as the minimum acceptable value. The Mahalanobis distances for each case were checked against the critical value. For five independent variables of a regression model, the critical value taken from the guidelines was 20.52 (Tabachnick & Fidell, 2001). There were no major excess from the critical value.

4.3.4 Homoscedasticity, Linearity, and Normality

Homoscedasticity, linearity, and normality were checked simultaneously by inspecting the scatterplot residuals and by using a Normal Probability Plot of the regression standardised residuals (Pallant, 2005). The homoscedasticity assumption was approximately equal for all predicted dependent variable (DV) scores. This property was checked by looking at the residual plot, which also examined linearity and normality. Figure 4.1 shows that the scatterplot of standardised residuals linearity was roughly rectangularly distributed, with most scores concentrated in the centre, thus demonstrating that the data met the linearity and normality assumptions. The residual plot shows that the data were fairly homoscedastic as there was little deviation from the centralised rectangular (Kamarulzaman, 2006).

In the Normal Probability Plot (see Figure 4.2), the points were in a reasonably straight diagonal line from bottom left to top right. As for linearity, this meant that there was a straight-line relationship between the IVs and the DV. This assumption was important because regression analysis only tests for a linear relationship between variables. Therefore, there were no major deviations from normality.

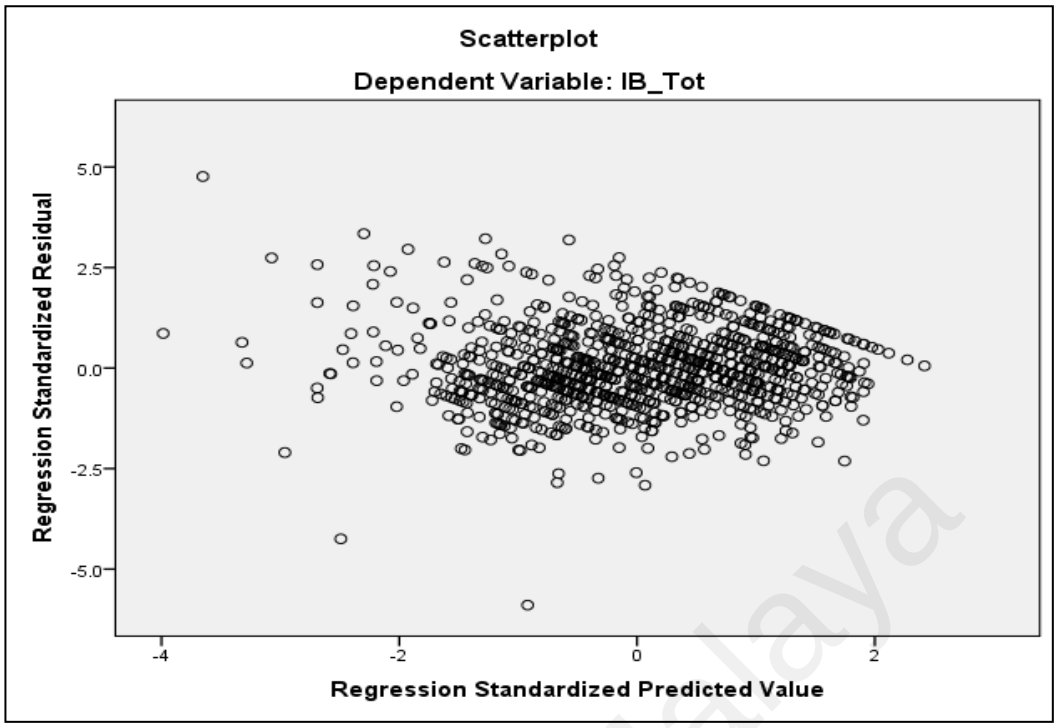

Figure 4.1: Scatterplot of standardised residuals

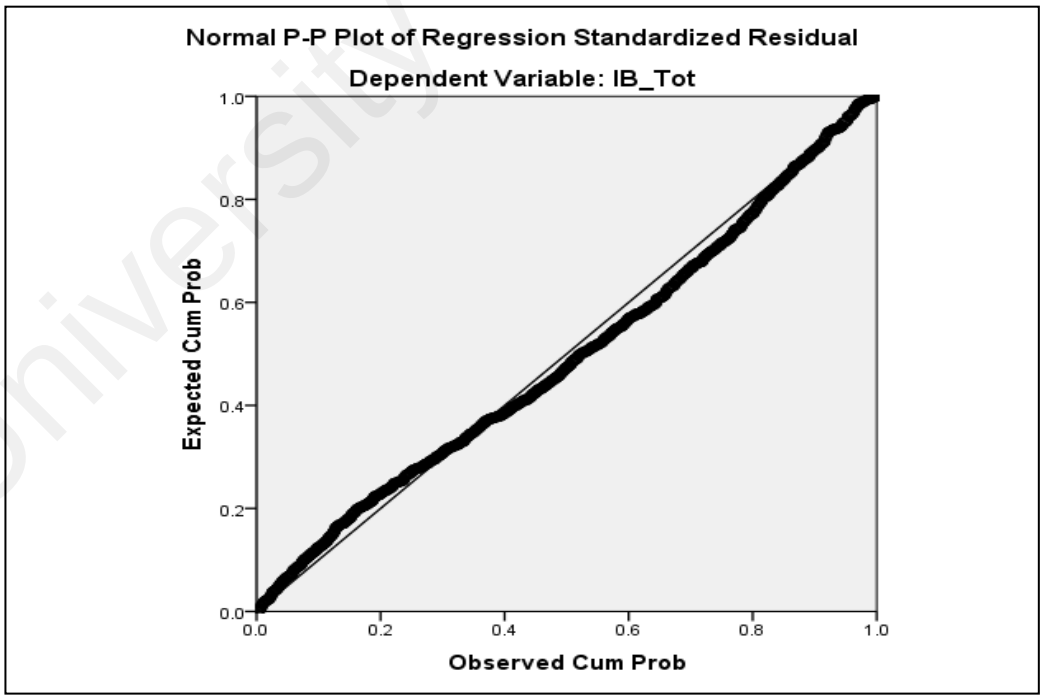

Figure 4.2: Normal probability plot of standardised residuals

4.3.5 Results of Multiple Regressions

The regression analysis was divided into three models which were conducted separately to make up the entire model of IC. Figure 4.3 illustrates the conceptual model with hypotheses paths. All the original items measuring each construct were averaged in order to obtain a single score for each variable (mean) for the regression analysis. The result for each regression model is as shown in Table 4.10.

Table 4.10: Results of multiple regressions of the proposed model

Model	Dependent Variable	Independent Variables	Beta	t-value	Sig.	Collinearity	Summary of Model
1	IC	EC CI SE	.243 .186 .320	6.724 4.910 9.914	.000** .000** .000**	.572 .572 .587	F=255.551 Sig.= .000 R=.658 R^2=.433 Adj. R^2=.431
2	IB	EC CI SE IC	.188 .042 .436 .172	5.575 1.191 14.052 5.956	.000** .234# .000** .000**	.581 .562 .678 .560	F=276.567 Sig.=.000 R=.724 R^2=.524 Adj. R^2=.523

***p<.001; #insignificant*
Beta= Standardised regression coefficient (β)

The proposed model showed two dependent variables that built upon Models 1 and 2 of the regressions. The results of the two models tested were statistically significant (p<.001) and the variances explained (R^2) by each model were 43 percent (Model 1 – Innovation Culture) and 52 percent (Model 2 – Innovative Behaviour). In Model 2, CI did not significantly explain IB (with a t-value of 1.2, p = .234). This parameter should be further tested in the next step of validation of structural model of innovation culture using SEM.

The results of Model 1 suggested that all three variables, organisational EC, CI, and SE might explain the innovation culture of HEIs. Many previous studies had found the same effect of these three variables on IC (Alm & Jönsson, 2014; Cantwell, Aiman-

Smith, & Mullen, 2007; Dobni, 2008; Janiūnaitė et al., 2004; Wan Ismail & Abdmajid, 2007).

In Model 2, only three variables might significantly explain about 52 percent of the variance in IB. These were EC, SE, and IC. SE contributed the highest amount of variance explained in IB, followed by EC and IC. The statistically non-significant coefficient for CI indicated that this variable could possibly be dropped from Model 2. Table 4.11 presents a summary of the regression results explaining all related hypotheses with regard to the model of IC.

Table 4.11: Multiple regressions and hypotheses test results

Hypotheses & Paths				Results
H1	Effective Communications	→	Innovation Culture	Accepted
H2	Effective Communications	→	Innovative Behaviour	Accepted
H3	Climate For Innovation	→	Innovation Culture	Accepted
H4	Climate For Innovation	→	Innovative Behaviour	Rejected
H5	Self-efficacy	→	Innovation Culture	Accepted
H6	Self-efficacy	→	Innovative Behaviour	Accepted
H7	Innovation Culture	→	Innovative Behaviour	Accepted

The regression analyses showed that from seven hypotheses only one path was not supported by the collected data. In the regression model, CI seemed to not influence IB. Possibly, CI might be removed from the model to improve model parsimony as it was not significant in explaining the proposed model. For this reason, in the next step, the proposed model would have to be re-tested to see whether the observed effects in the current results of regression would be reflected in SEM.

4.4 Structural Equation Modelling (SEM)

SEM was used in validating the previously discussed results of multiple regression analysis, and to observe the consistency of the results. This technique allowed the test of various models concerning the inter-relationships among a set of variables, instead of

developing models. The models therefore, should always be based on theory, or knowledge (Norman & Streiner, 2003). SEM also evaluated the importance of each independent variable and the overall fit of the model to data (Pallant, 2005). This study used IBM AMOS version 21, which aimed at testing the hypothetical conceptual model that described relationships between or among the constructs, particularly between the IVs, mediating variable (MV) and the DV (see Figure 4.3).

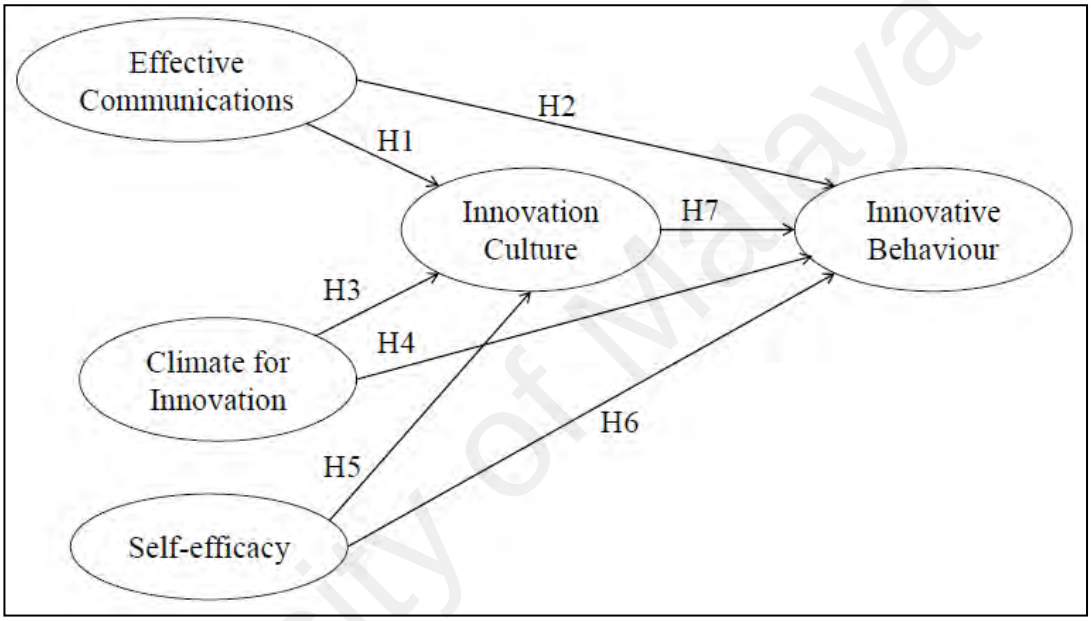

Figure 4.3: The proposed model

4.4.1 Measurement Model

The measurement model encompasses how the latent variables or the hypothetical constructs were measured in terms of the observed variables. Its main purpose was to describe how well the observed indicators serve as a measurement instrument for the latent variables. The test of the structural model might be meaningless unless it was first established that the measurement holds (Gefen et al., 2011). The measurement model process began with preparing and screening of data or preliminary tests. Then the Confirmatory Factor Analysis (CFA) was conducted through SEM-AMOS followed by

the assessment of goodness-of-fit tests of the model. The details of each step are described in the following subsection.

4.4.2 Preliminary Tests

First, data preparation and screening were done mainly because SEM required certain assumptions about the distributional characteristics of the data set used for analysis, and because data-related problems could be the reasons for failure of model estimation and fitting programs to produce solutions. Three issues were going to be addressed namely missing data, outliers, and normality.

Second, the issue of missing data was crucial, as data analysis procedures were not designed to include the missing data. However, the missing data had been addressed previously (see Section 4.2.1) by replacing each missing value with the estimation of the overall tendency (mode of scores) of each respondent (Ramayah, 2011). This was done to ensure that data were accurate (on an individual basis). As a result, there were no missing values present in the data.

Third, outliers could be extreme cases on one variable, or a combination of variables, or a score that significantly departs from others. Outliers might or might not be influential in the sense that their removal could cause substantial changes in the overall estimation of a specific analysis. This issue also had been addressed in the previous section (see Section 4.3.3). The result showed several outlier cases. However, upon inspection of the extreme cases, it was found that the respondents might have differing opinions, as indicated by the extreme scores compared to the majority of the sample. Other than that, they definitely belonged to the targeted population. Thus, the scores regarded as extreme did not distort the SEM analysis as the sample size is quite large.

Finally, normality could be assessed by looking at a normal probability plot (see Section 4.3.4). In the Normal Probability Plot (see Figure 4.2), the points were in a reasonably straight diagonal line from bottom left to top right. As for linearity, this meant that there was a straight-line relationship between the IVs and the DV. This assumption was important because regression analysis only tests for a linear relationship between variables. Hence, there were no major deviations from normality.

4.4.3 Confirmatory Factor Analysis (CFA)

CFA determines whether the number of factors and the loadings of observed variables on them conform to the pre-established theory. CFA allows identification and clustering of observed variables in the hypothesised model to evaluate the extent to which a particular collected data set confirms what is theoretically believed to be its underlying constructs (Byrne, 2001). This study tested the measurement model in one stage in which CFA using the estimation method of maximum likelihood (ML) was performed on the overall model, which consisted of five construct measures derived from the EFA. All significant results from the measurement model were presented and discussed.

First, convergent validity was measured by examining the *t*-test for CFA loadings. For SEM, statistically significant *t*-tests for all CFA loadings indicated effective measurement of the same construct. In the AMOS programme, *t*-values were reported as critical ratios. The widely accepted cut-off point for standardised loadings was when *t*-values exceeded ±1.96 or ±2.58 at .05 or .01 levels respectively (Mueller, 1996). In CFA, large factor loadings as compared to the standard errors implied that the indicators had adequately captured the underlying construct. As a general rule, a standardised loading of .6 or greater was suggested (Bagozzi & Yi, 1988). The measures of the resulting measurement model indicated acceptable convergent validity. The

standardised loadings of most items were above .6 with each item being significantly related to its underlying factor, and the *t*-values were statistically significant (above ±1.96).

Second, discriminant validity implied that a given construct differs from other constructs (Barclay et al., 1995). To confirm the discriminant validity of the CFA model, the correlation index among factors was examined, where low to moderate correlations implied attainment of discriminant validity (Ramayah, 2011). Another way of doing this was by comparing the AVE with squared correlations among latent constructs. If the AVE value exceeds the squared correlation value, this indicated discriminant validity was achieved (Fornell & Larcker, 1981). Overall, the results of the CFA model indicated that discriminant validity had been established (see Table 4.12).

Third, unidimensionality suggests the existence of one construct underlying a set of items. The characteristics of unidimensionality is that the items should hang together (internal consistency), and no item should tap more than one construct (external consistency). Convergent validity then, explains the unidimensionality of scales. In CFA of the measurement model, goodness-of-fit indicators along with other diagnostic tools such as standardised residuals and modification indices assess unidimensionality. This study used a variety of fit indices such as Goodness-of-Fit Index (GFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). The overall fit of the hypothesized model was also tested by using the Chi-square (χ^2) statistics (Hooper, Coughlan, & Mullen, 2008). Since χ^2 is sensitive to sample size, the adjusted χ^2 (χ^2/df; where df is degree-of-freedom) was also examined. It was recommended that this metric should not exceed 5 for models with good fit. The results for unidimensionality are as shown in Table 4.13.

Finally, in an AMOS output, individual item reliability is reported as squared multiple correlations (R^2). The R^2 values above .50 showed acceptable reliability (Hooper et al., 2008). CR and AVE were calculated using the formula as presented earlier. A CR value of .7 and above indicated satisfactory composite construct reliability (Barclay et al., 1995) while a higher AVE implied that the indicators were truly representing the latent construct, and was recommended to exceed .5 (Fornell & Larcker, 1981).

4.4.4 Assessment of Goodness-of-fit of the Measurement Model

The measurement model specified how the latent variables or the hypothetical constructs were measured in terms of the observed variables. It was used, therefore, as a means to describe how well the observed indicators serve as a measurement instrument for the latent variables. The EFA results reported in the earlier section were used as the starting point for specifying the measurement model. The model of five constructs was examined and tested. The constructs were EC, CI, SE, IB, and IC.

From the previous EFA results, 40 observed variables that made up five latent constructs were tested. CFA focused more on standard error, squared multiple correlations (R^2) and standardised loadings for each individual item. Upon inspection of the results, three items were deleted (CI1, SE12, SE10) because they had relatively lower *t*-values, higher standard errors and low explained variances, as indicators of the particular constructs. The widely accepted cut-off point for standardised loadings was when *t*-values exceeded ±1.96 or ±2.58 at .05 or .01 levels respectively (Mueller, 1996). As a rule, a standardised loading of .6 or greater was suggested by Bagozzi and Yi (1988). The squared multiple correlations (R^2), as mentioned before, should be high (above .5) to indicate reliability.

The path diagram presented in Figure 4.4 illustrates the measurement model. In the figure, latent variables are indicated as ellipses and observed indicators are shown as rectangles. The path coefficients for the estimated regression weight of observed indicators onto unobserved latent variables are presented above/below each arrow. These values represent the amount of change in Y, given a standard deviation unit change in X. The measurement error associated with each observed indicator is shown as a small circle (e1 – e40). The values above ellipses are the estimations of variance, while the figures on the two-headed arrows between the latent constructs show the correlations between the constructs. In this measurement model, 37 observed indicators loaded onto five constructs. Eight observed indicators loaded onto EC, nine loaded onto CI, five loaded onto SE, eight onto IB, and seven loaded onto IC. These measures were evaluated as a full CFA model and the results are summarised in Table 4.12.

The results showed that all indicators fell on their posited underlying factors and were statistically significant. All *t*-values were significantly greater than ±2.5 at the .01 level which clearly demonstrated convergent validity (Mueller, 1996). The standardised factor loadings were evaluated to determine the relative importance of the observed variables, and the results were in a range between .60 and .82. The R^2 values for all indicators were in the range between .36 and .68. This indicated that several individual items in this measurement model failed to satisfy the acceptable threshold level of convergent validity of .5. Nevertheless, all constructs reached CR values of greater than .7 as recommended by Bagozzi and Yi (1988). Evaluation on reliability based on AVE satisfied the recommended value of .5 (Fornell & Larcker, 1981). This implied that the variance captured by the construct was greater as compared to the variance accounted for due to measurement error. Finally, all constructs satisfied the level of acceptable

reliability of Cronbach's alpha values of greater than .7.

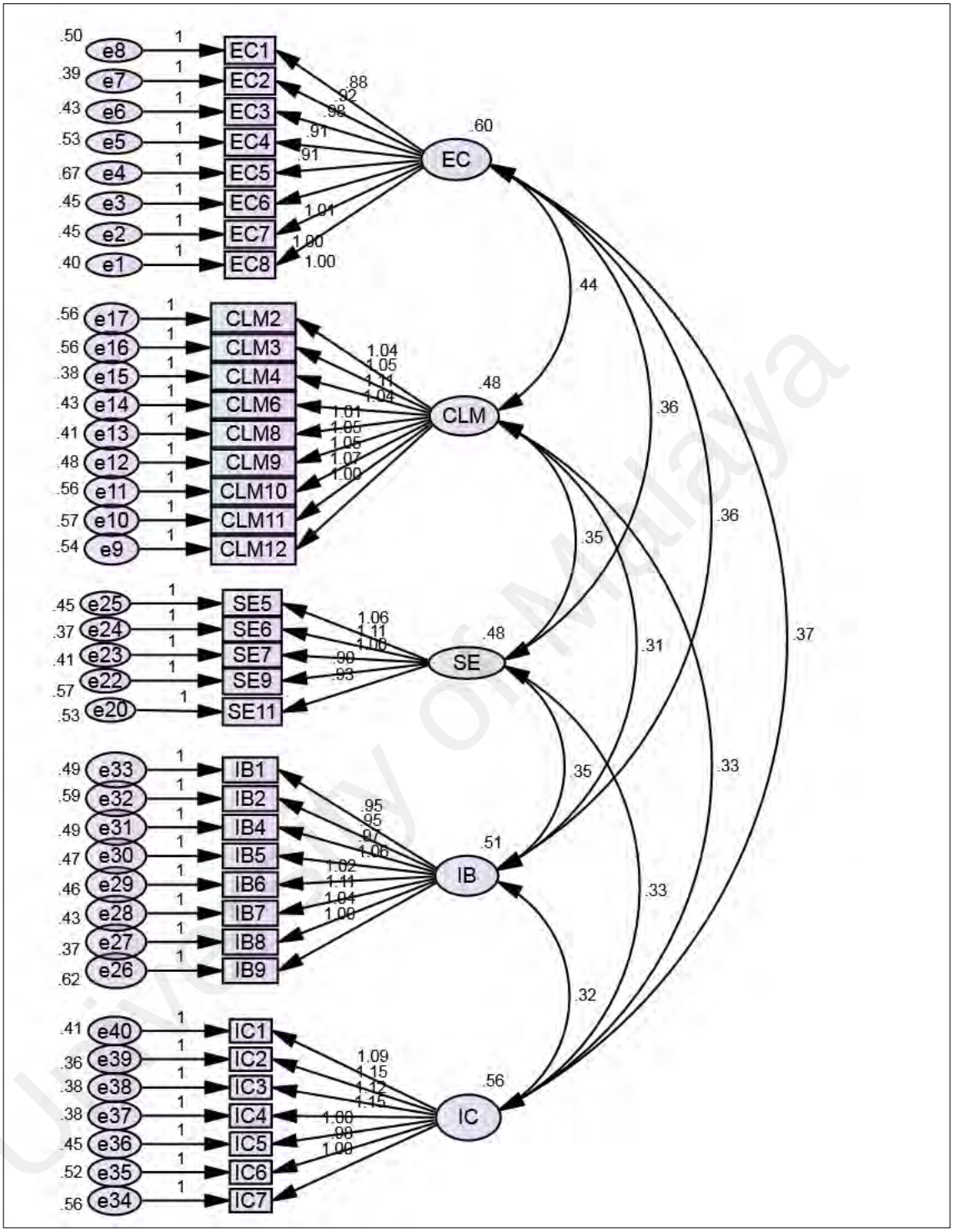

Figure 4.4: The measurement model for all constructs

Table 4.12: CFA results of the measurement model

Items	Standardised loadings	*t*-values	R^2	CR	AVE	α
EC1	0.694	22.835	0.482	0.902	0.535	.901
EC2	0.753	25.121	0.567			
EC3	0.759	25.385	0.577			
EC4	0.695	22.849	0.482			
EC5	0.650	21.185	0.423			
EC6	0.759	25.376	0.576			
EC7	0.756	25.244	0.571			
EC8*	0.775	n/a	0.601			
CI1#	0.603	17.832	0.364	0.905	0.515	.904
CI2	0.694	20.418	0.481			
CI3	0.696	20.481	0.485			
CI4	0.778	22.690	0.606			
CI6	0.737	21.586	0.543			
CI8	0.738	21.609	0.544			
CI9	0.725	21.269	0.526			
CI10	0.695	20.463	0.484			
CI11	0.701	20.623	0.492			
CI12*	0.687	n/a	0.472			
SE5	0.738	22.092	0.544	0.836	0.507	.833
SE6	0.782	23.360	0.611			
SE7*	0.732	n/a	0.535			
SE9	0.636	19.044	0.404			
SE10#	0.637	17.877	0.406			
SE11	0.662	19.816	0.438			
SE12*#	0.660	n/a	0.436			
IB1	0.696	19.908	0.485	0.896	0.519	.895
IB2	0.661	19.008	0.437			
IB4	0.704	20.103	0.496			
IB5	0.742	21.041	0.550			
IB6	0.734	20.840	0.538			
IB7	0.771	21.761	0.595			
IB8	0.776	21.867	0.601			
IB9*	0.673	n/a	0.453			
IC1	0.786	23.723	0.617	0.911	0.595	.911
IC2	0.822	24.795	0.676			
IC3	0.804	24.257	0.646			
IC4	0.813	24.538	0.662			
IC5	0.744	22.498	0.554			
IC6	0.714	21.605	0.510			
IC7*	0.708	n/a	0.502			

*Note: *Fixed parameter; #Deleted items*

Subsequently, the hypothesised model was examined by using three types of goodness-of-fit indices such as absolute fit indices, incremental fit indices, and parsimonious fit indices. The results are summarised in Table 4.13 which shows the Absolute Fit Index to assess how closely the model compared to a perfect fit and was measured by indices such as χ^2 of estimate model, GFI, RMR, and RMSEA. The goodness-of-fit indices showed that the overall measurement model yielded a satisfactory fit which means the measurement model was sufficiently supported by the data. However, the NFI, GFI and AGFI indices, which were a little below the acceptable level of .90, suggested that the model could be improved by eliminating a few problematic items. These indices should be close to 1.00 to indicate a good fit model (Gefen et al., 2011). The χ^2 value of 3,205.167 with 730 degrees of freedom was statistically significant at $p<.001$, thereby signifying the need to re-specify the hypothesised overall measurement model with five constructs and 40 indicators (items) in order to reach an acceptable level of fit.

In improving the model fit, three poorly-fitting items, CI1, SE10, and SE12 were identified and deleted, due to low *t*-values, higher standard error (SE), and low explained variances (R^2). The evaluation of goodness-of-fit statistics for the re-specified model too is shown in Table 4.16. The re-estimated model yielded χ^2 value of 2,667.329 with 619 degrees of freedom ($p=.000$), while the GFI was .863, still below the acceptable level of .9. The RMR was .042 and the RMSEA was at .057. The RMSEA value indicated moderate fit by which a value greater than .08 indicated reasonable errors of approximation in the population (Gefen et al., 2011). The result of the re-specified model indicated that all of the fit indices slightly improved and produced a model that moderately fitted the data.

Table 4.13: Goodness-of-fit statistics for the measurement model

Goodness-of-fit measures	Initial	Re-specified
Absolute Fit measures		
Chi-square (χ^2) of estimate model	3,205.167	2,667.329
	(df=730, p=.000)	(df=619, p=.000)
CMIN/df	4.391	4.309
Root mean square residual (RMR)	.042	.042
Root mean square error of approximation (RMSEA)	.058	.057
Goodness-of-fit Index (GFI)	.850	.863
Incremental Fit measures		
Adjusted Goodness-of-fit Index (AGFI)	.832	.845
Normed Fit Index (NFI)	.870	.883
Tucker Lewis Index (TLI)	.889	.900
Parsimonious Fit measures		
Parsimony Goodness-of-fit Index (PGFI)	.757	.760
Parsimony Normed Fit Index (PNFI)	.814	.820
Comparative Fit Index (CFI)	.896	.907
Incremental Fit Index (IFI)	.896	.907

The Incremental Fit indices showed the proportionate improvement in fit by comparing the target model with a more restricted, nested base line model. The results of AGFI of .845 and NFI of .883 were slightly below the recommended level of .9. Only the result of TLI managed to reach .9. The Parsimonious Fit indices provided information for comparison between models of differing complexity and objectives by evaluating the fit of the model versus the number of estimated coefficients needed to achieve level of fit. The PGFI was .76, the PNFI was .82, the CFI was .907, and the IFI was .907. Since both CFI and IFI values were .907, it was only sufficient to confirm a reasonable well fit of the model to the data (Byrne, 2001) and this is acceptable (Gefen et al., 2011).

A review of the three types of overall re-specified measurement model revealed that the consistent patterns of values of fit indices supported the fact that the model fit the data moderately well. This indicated that the re-specified model was reliable and valid for subsequent analysis, besides providing evidence of the unidimensionality,

convergent validity, and reliability of the model. In conclusion, the measurement characteristics were adequate to enter the second stage of SEM analysis, the structural modelling.

4.4.5 Structural Model

The structural model specifies the theoretical relationships between or among the constructs besides identifying whether the constructs directly or indirectly influence or change the values of other constructs in the model (Byrne, 2001). In this section, the hypothetical conceptual model that prescribed relationships between antecedents of IC and IB was tested as shown in Figure 4.3. In the assessment of goodness-of-fit of the proposed model, all constructs demonstrated acceptable estimates.

In assessing the structural model, only the most popular measures were reported. The structural model was assessed based on the χ^2 of the estimated model, the GFI, the CFI, and the RMSEA indices. To show highly satisfactory fits to data, these criteria were applied in the assessment: GFI values not less than .9, CFI values greater than .95, and RMSEA between .05 and .08 (Byrne, 2001; Gefen et al., 2011). Path coefficients were tested for significance using critical ratios (*t*-values) where a *t*-value of 1.96 is considered statistically significant at the .05 level (Mueller, 1996).

Subsequently, the goodness-of-fit indices of the hypothesised model were assessed and the results are shown in Table 4.14. The model yielded a χ^2 value of 2.911 with 1 degree-of-freedom (p>.05) which indicated a marginal fit. As the sample size of this study was considered large and exceeded the minimum required of 300, the use of the χ^2 value provided enough guidance in determining the extent to which the proposed model fit the data (Byrne, 2001). In addition, other goodness-of-fit indices had been suggesting that the hypothesised model showed satisfactory fit to the data as well. A GFI value of

.999 meant the model fit the data fairly well. A CFI value of .999 indicated the hypothesised model fit the sample data well.

Finally, the RMSEA value of .044 was below the threshold of .05 (Byrne, 2001), indicating good fit. As a whole, the fit indices indicated that the hypothesised model was an adequate fit to the data. Hence, no modification was needed to achieve a better fit model. As Byrne (2001) suggested, if the fit measure was adequately achieved, the tenability of the hypothesised relationship would be accepted as this implied possible linkages between the constructs.

Table 4.14: Goodness-of-fit measures for the hypothesised structural model

Goodness-of-fit measures	Initial	Final
Absolute Fit measures		
Chi-square (χ^2) of estimate model	438.241	2.911
	(df=1, *p*=.000)	(df=1, *p*=.088)
Root mean square residual (RMR)	7.603	0.257
Root mean square error of approximation (RMSEA)	0.659	0.044
Goodness-of-fit Index (GFI)	0.876	0.999
Incremental Fit measures		
Adjusted Goodness-of-fit Index (AGFI)	-0.855	0.983
Normed Fit Index (NFI)	0.833	0.999
Tucker Lewis Index (TLI)	-0.673	0.993
Parsimonious Fit measures		
Parsimony Goodness-of-fit Index (PGFI)	0.058	0.067
Parsimony Normed Fit Index (PNFI)	0.083	0.100
Comparative Fit Index (CFI)	0.833	0.999

4.4.6 The Final Model

The findings offered empirical evidence to the literature that there were causal relationships between EC, CI, SE, IC, and IB. The schematic representation of this final model is shown in Figure 4.5.

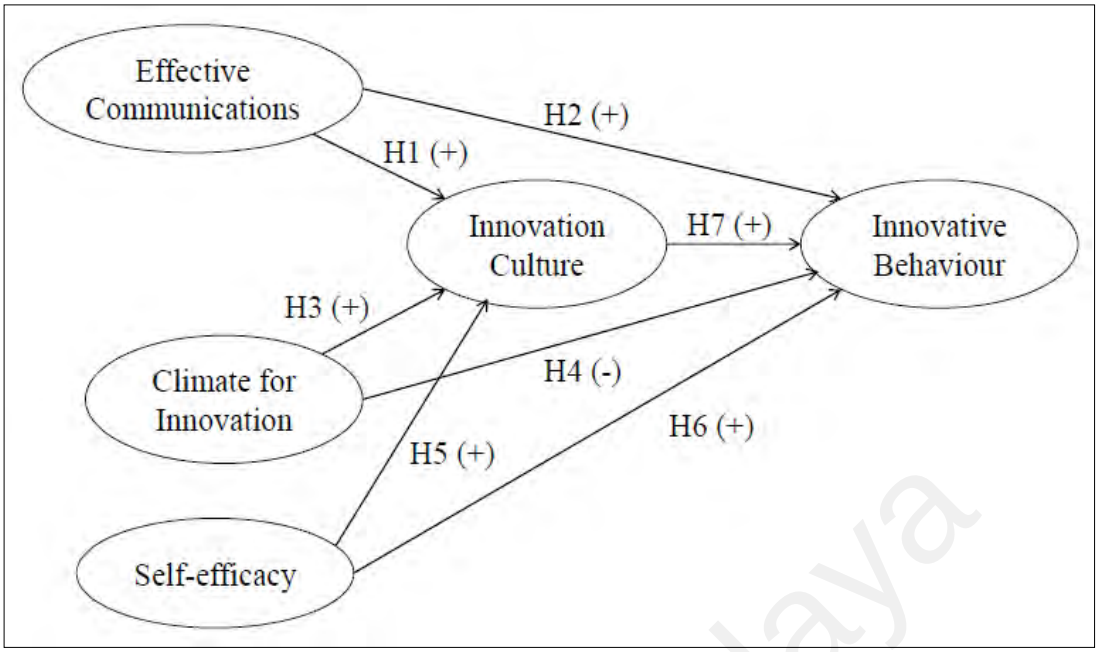

Figure 4.5: The final model

4.5 Hypotheses Testing

As disclosed in the previous section, the relationships between constructs were examined based on *t*-values associated with path coefficients between the constructs. If an estimated *t*-value was greater than a certain critical value ($p<.05$, *t*-value=1.96), the null hypothesis that the associated estimated parameter is equal to 0 was rejected (Mueller, 1996). Subsequently, the hypothesised relationship was supported.

This section tested whether the empirical results of the structural model evaluation supported the hypothesised model as postulated in the conceptual framework. The results as shown in Table 4.15 were with reference to the standardised estimates, critical ratio (*t*-value), and significance level. Overall, the estimation of the hypothesised model showed that six of the hypothesised paths were significant while one was not. With reference to the multivariate analysis (see Table 4.11), H4 was indeed rejected as the estimate was not significant with CR value below the 1.96 threshold (Mueller, 1996).

Table 4.15: The structural model and hypotheses test results

Hypothesis				Std. Reg. Weight	Critical Ratio	Result
H1	EC	→	IC	.243	6.809***	Accepted
H2	EC	→	IB	.238	8.012***	Accepted
H3	CI	→	IC	.212	5.632***	Accepted
H4	CI	→	IB	.060	1.707#	Rejected
H5	SE	→	IC	.294	9.181***	Accepted
H6	SE	→	IB	.380	12.753***	Accepted
H7	IC	→	IB	.205	7.017***	Accepted

*Note: ***p<.001, # insignificant path*

4.5.1 EC (H1 and H2)

H1: An institution with positive EC will influence positive IC - *Supported*

The H1 result in Table 4.15 showed that the relationship between EC and IC was positive and significant (*t*-value=6.809, *p*<.001). This result implied that if a smooth communication process flows within an institution (in this case, a university), students and academics are able to act on whatever goals the institution may have. Having shared vision and goals, and good internal communication, encourage students to willingly be involved with IC. In this way, the culture of giving and acting on feedback would be observed. This finding was consistent with a finding by Yahyagil (2004) which suggested that bureaucratic nature of organisations should be minimised to facilitate business functioning.

H2: An institution with positive EC will influence positive IB in students - *Supported*

The H2 result in Table 4.15 showed that the relationship between EC and IB was positive and significant (*t*-value=8.012, *p*<.001). This indicated that a clear communication with innovations as focus helps create innovative thinking, which can foster the innovative image of the institution and eventually lead to even stronger IB within the institution (Pallas, Böckermann, Goetz, & Tecklenburg, 2013). This finding

aligned with previous findings by Pallas and colleagues (2013) where strategic innovative focus and extrinsic motivation system (as in the Goals & Motivation variable) and openness in communication (as in the Internal Communication variable) encourage IB and serve as motivation to innovation. The finding also indicated that less formality and rigidity (as in the Formalisation variable) should allow students to act and react in positive IB without being intimidated by restrictions and unnecessary procedures or requirements.

4.5.2 CI (H3 and H4)

H3: A positive CI will lead to a positive IC - *Supported*

Table 4.15 showed that the relationship between CI and IC was positive and significant (t-value=5.632, p<.001). This suggested that a supportive and encouraging environment or climate of innovative activities or practices had a positive effect on the institutional IC and its people. Warm interpersonal relations between members support and encourage teamwork, presence of adequate infrastructure, provision of rewards and recognition, good work nature, availability of support from friends and lecturers, thus helping to establish a positive IC. This finding was in agreement with previous study by Yahyagil (2004) indicating that supportive culture or provision of managerial support to the organisation members is a must. The ability to share resources and knowledge with others (through teamwork and collaboration) and warm interrelation among members will help in creating the right environment for innovative supporting activities or practices.

H4: A positive CI will lead to positive IB in students – *Not Supported*

The proposed relationship in H4 as shown in Table 4.15 was not supported (t-value=1.707) which meant that a positive CI did not lead to positive IB. This finding

surprisingly did not contradict a previous study which suggested support and collaboration (or teamwork) had no significant effect on innovativeness (Hurley & Hult, 1998). Values such as teamwork, stability, co-operation, and lack of conflict when highly shared did not foster innovation efforts (Jaskyte & Dressler, 2005). This could be attributed to the nature of current campus life. Often, students were left to themselves to figure out many things in relation to studying materials, campus layout, and details of their respective timetables. In time, this developed their sense of independence, regardless of whether or not they had support from friends or lecturers. A special note is that the university rarely acknowledges small achievements by students especially at individual levels. When students participated in collaborative effort, it was usually compulsory rather than voluntary. This could explain the lack of connection between internal environment and IB.

4.5.3 SE (H5 and H6)

H5: A positive SE will influence a positive IC – *Supported*

As shown in Table 4.15, the relationship between SE and IC was positive and significant (t-value=9.181, p<.001) thus indicating that feelings of empowerment, self-confidence and self-assurance which were developed through socialisation (SE) were supportive of positive IC be it at organisational or individual level. Being creative, flexible, pro-active, and having freedom from external control (autonomy) helped in cultivating positive IC. Yahyagil (2004) emphasised personal freedom to become more creative as to encourage and enable members to take risks in order to make business decisions independently. Another study stated that creativity alone was insufficient in fostering innovation. It had to be complemented by self-belief, self-assurance, feelings of empowerment, and social confidence in order to exploit opportunities, generate innovative ideas, and manage risks (Chell & Athayde, 2009).

H6: A positive SE will influence positive student IB - *Supported*

The relationship between SE and IB was positive and significant (*t*-value=12.753, *p*<.001) as shown in Table 4.15. This implied that SE or the ability to produce a desired or intended result, had a positive effect on individual IB. This finding was very much in line with previous findings by Bandura (1977), and Staples, Hulland, and Higgins (1999) which suggested that SE was a good predictor of subsequent behaviour. Having mutual respect and positive interactions between students and academics help in allowing students the broader decision-making roles essential to IB (Scott & Bruce, 1994). Autonomy influences pro-activeness directly and indirectly through SE and flexible role orientation where the students understand their own role when involved in individual or group projects.

4.5.4 IC (H7)

H7: A positive IC will influence positive IB in students – *Supported*

As shown in the Table 4.15, the relationship between IC and IB was positive and significant (*t*-value=7.017, *p*<.001). How students reacted toward or perceived stories, rituals, and supporting language used in their respective university campus affected their subsequent IB. This finding agreed with previous study findings by Hogan and Coote (2014) which found IB frequently depended on artefacts that supported such behaviours although empirical support for a direct link between the two was mixed. In particular, the study also found that expectations of behaviours for innovation which appeared in stories, rituals, and language supporting IB were important when eliciting such behaviours (Hogan & Coote, 2014). Another study found critical importance of artefacts for guiding market-oriented behaviour (Homburg & Pflesser, 2000), which in the context of this study, was reflected by the IB of student.

4.6 Summary of the Chapter

This chapter began with descriptive analysis. The assessments of reliability and validity of each measurement scale were presented and the overall result indicated that the five constructs demonstrated both convergent validity and discriminant validity. Results observed in this procedure were important for the subsequent statistical analysis in which the study employed the more robust and sophisticated procedures such as EFA, CFA, multiple regression analysis, and structural equation modelling (SEM).

The next chapter will discuss the research questions based on the results of the hypothesis testing, together with research implications, suggestions, and contributions of the study.

CHAPTER 5: DISCUSSIONS AND CONCLUSION

This chapter continues the discussion of the findings from the previous Chapter 4 with emphasis on answering the research questions (RQs) from Chapter 1. Firstly, the chapter presents analysis on how the results of the hypothesis testing have contributed to addressing the research questions. Secondly, implications of the research findings for theory and practice will be explored. The end of the chapter discusses several limitations of the present study and suggestions for future research.

5.1 Discussion of Research Questions

A structural equation model was used to test a series of hypotheses that tried to identify the structural relationship between the constructs on the proposed innovation culture of higher educational institutions (HEIs) model. As reported in Chapter 4, six of seven hypotheses generated statistically significant *t*-values (critical ratios) and standardised coefficient scores (standardised regression weights). Figure 5.1 shows the model for innovation culture and innovative behaviour. The sections afterwards discuss the findings as addressed by the following research questions:

RQ1: What are the antecedents of innovation culture of HEIs students in Malaysia?

RQ2: How do these antecedents of innovation culture influence students' innovative behaviour?

RQ3: What is the relationship between innovation culture and students' innovative behaviour?

In answering these RQs, the upcoming discussions will focus on assessing each hypothesis path which includes investigating the interrelationships among constructs, examining several constructs simultaneously, and in certain cases clarifying specific

issues or concerns (for RQ2s). The contributions of this study are highlighted by addressing and answering each RQ.

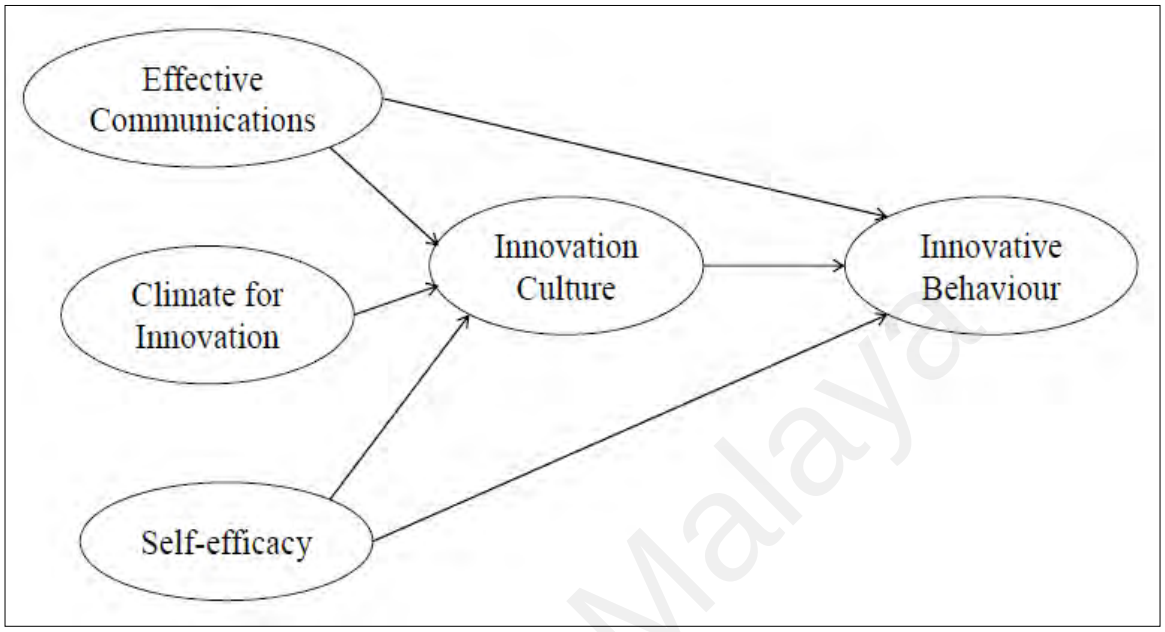

Figure 5.1: The model for innovation culture and innovative behaviour

5.2 Research Question 1

RQ1: What are the antecedents of innovation culture of HEIs students in Malaysia?

The study found three antecedents of innovation culture (IC) of undergraduate students. These are effective communications (EC), climate for innovation (CI), and self-efficacy (SE).

Based on the final model, this research question consisted of three related hypotheses. In answering the RQ, the study found that all three antecedents namely effective communications (EC), climate for innovation (CI), and self-efficacy (SE) have positive effect and significantly influence innovation culture (IC) of undergraduate students.

Hypothesis Paths				Results
H1	Effective Communications	→	Innovation Culture	Accepted**
H3	Climate For Innovation	→	Innovation Culture	Accepted**
H5	Self-efficacy	→	Innovation Culture	Accepted**

*Note: **p<.001*

5.2.1 EC and IC

EC was found to influence IC by which this finding validates Yahyagil's argument about how institutions with open internal communications probably have greater access to communication channels and information. This availability or accessibility in turn will minimise restrictions on information exchange and determine how such information is interpreted and evaluated (Calantone et al., 2002; Homburg & Pflesser, 2000; Yahyagil, 2004).

A previous study by Pallas and colleagues (2013) had also found that strategic innovative focus, openness in communication, adequate motivation system and management encouragement proved to be reliable and valid in measuring innovativeness and its cultural aspect. This finding is also consistent with Hogan and Coote (2014) where the relationship between norms and values with artefacts were positive and significant. For this study, this corresponded with the positive and significant relationships between EC (norms and values) and IC (artefacts). Yahyagil (2004) found that bureaucratic nature of organisations should be minimised for business channels to function simultaneously.

5.5.2 CI and IC

The study found that CI influenced IC. Hence, a university campus with diverse student intakes is more likely to produce a stimulating environment for innovation by having a mix of multiracial international and local students, from different cultural background and traditions (Chell & Athayde, 2009). This is also in agreement with Ahmed's theory (1998) which demonstrated that the presence of adequate

infrastructure, provision of rewards and recognition, good work nature, high teamwork spirit, availability of support from friends and lecturers, and warm interpersonal relations between members, would help in establishing a supportive IC.

This finding is supportive of previous finding by Yahyagil which provided empirical evidence of interdependence between the cultural characteristics of institutions and their climatic medium. He concluded that interaction between cultural and climatic elements logically tends to create suitable platforms for organisational functioning (Yahyagil, 2004). The finding also replicates prior work by Scott and Bruce who provided evidence that organisation members who had good relationships with their supervisors reported the organisation as supportive of innovation. This good relationship was reflected in having high levels of support and trust (Scott & Bruce, 1994).

5.2.3 SE and IC

SE was found to significantly influence IC. This finding indicates that abilities to carry out tasks successfully within an environment of contact supported the Bandura SE theory. This finding supported Dobni's study (2008) which found that the main dimension contributing to IC was the implementation context. She explained that for the organisation to execute value-added ideas, it must consider the ability to proactively co-align systems and processes with changes in the competitive environment. Another dimension, innovation infrastructure which was focused especially on creativity and empowerment was also significantly influencing IC albeit less strongly than the other factor. She reckoned that the freedom to express creativity had affected employee ability to improvise and act on stated goals (empowerment) (Dobni, 2008).

This research takes note of the lack of empirical research and theoretical background in assessing the direct effect of SE on IC, especially in this context. Even so, the finding has found positive relationship between these two variables.

5.2.4 Summary of RQ1

The results suggest that SE is a major antecedent of IC followed by EC and CI (see Table 5.1). This simply indicates that a personal level of energy and determination is essential in carrying out plans and action to innovate and make use of innovations. This individual force needs supportive institutional management that applies effective information exchange for disseminating goals and the philosophy of the institution. A clear goal and plan, along with environmental climatic artefacts for innovation, provide much needed support for innovation-related activities. The findings are expected as several previous studies have found the same effects of EC, CI and SE on the culture supportive of innovation (Cantwell et al., 2007; Dobni, 2008; Pallas et al., 2013; Yahyagil, 2004).

Table 5.1: The structural model and hypothesis test results

Hypothesis				Std. Reg. Weight	Std. Error	Result
H1	EC	→	IC	.243	6.809***	Accepted
H3	CI	→	IC	.212	5.632***	Accepted
H5	SE	→	IC	.294	9.181***	Accepted

*Note: ***p<.001*

Yahyagil (2004) implied that IC required a much higher degree of freedom and autonomy for introducing, discussing, and practising new and awkward ideas in organisations. This study has proven this true as SE did exert major influence on IC. Secondly, Yahyagil recognised that climatic factor had relatively lower level of relation with culture of innovation, which is again demonstrated by this study in which CI influenced IC on noticeably a weaker weight than SE. Thirdly, he emphasised the importance of person-organisation fit (Yahyagil, 2004). The organisation IC is built on the values, beliefs, and paradigms of its members, thus the IC should reflect the environment in order to function with maximum efficiency.

Pallas et al. (2013) studied the cultural aspect of innovativeness and formalised the constructs consisting of strategic innovative focus, extrinsic motivation system, management encouragement, and openness in communication. These constructs are extremely similar with this study's variable EC, which comprised of goals and motivation, formalisation, and internal communication. They found that 12 of 15 key constituents significantly contributed to the four constructs, where every construct was significantly contributing to the cultural aspect of firm innovativeness. This study somehow replicated the results of the Pallas et al. (2013) study without deviation. EC was found to contribute to IC with a medium strength. As Dobni's study (2008) has proven, her two constructs (implementation context and innovation infrastructure) corresponded with the SE variable of this study. She reported that pro-activeness and freedom (autonomy) to express creativity significantly contributed to IC and encouraged empowerment. In this study, empowerment is one of the key contributors to behaviour. This will be discussed further in the next discussion of relationships between the antecedents of IC and IB. Overall, SE, EC, and CI have demonstrated to be fundamental antecedents of IC.

5.3 Research Question 2

RQ2: How do these antecedents of innovation culture influence students' innovative behaviour?

Three related hypothesis paths addressed this research question. The study found that two antecedents, EC and SE, have positive effect and significantly influence students' IB. CI however, had no significant influence on IB.

Hypotheses & Paths				Results
H2	Effective Communications	→	Innovative Behaviour	Accepted**
H4	Climate For Innovation	→	Innovative Behaviour	Rejected
H6	Self-efficacy	→	Innovative Behaviour	Accepted**

*Note. **p<.001*

5.3.1 EC and IB

The findings show that smooth communication of goals and philosophical statements of an organisation significantly influenced student behaviour. This is because clear communication with innovations as focus helps create innovative thinking, which can foster the innovative image of the institution and eventually leads to even stronger innovative behaviour of students within the institution. The finding also indicates that less formality and rigidity should allow students to act and react in positive behaviour without being intimidated by restrictions and unnecessary procedures or requirements.

This finding is consistent with the findings of Hogan and Coote (2014) on the positive and significant relationship between IB and norms and values (EC in this study). In expectancy-value theory (Bandura, 1994), motivation is aligned with the expectation that a certain outcome will be produced by a given course of behaviour as people act on their beliefs about what they can do. By adopting goals they set for themselves, people give direction to their behaviour and create incentives to persist in their efforts until they fulfil their goals.

Another study by Verschuere, Beddeleem, and Verlet (2014) showed that IB is strongly developed when organisations entered into strategic alliances, and later proactively anticipated developments and opportunities in their environment. In this research, it seems that by having goals and motivation, together with uninterrupted communication among members of the institution, a certain level of IB in students can be cultivated and encouraged.

5.3.2 CI and IB

Exhibiting an opposite result from the hypothesis, CI was significantly not affecting behaviour. This simply means that behaviour may not be predicted by the presence of infrastructure or physical arrangements. This finding surprisingly does not contradict a

previous study that suggested support and collaboration (or teamwork) had no significant effect on innovativeness (Hurley & Hult, 1998). Scott and Bruce (1994) also found a negative relationship between climate perceptions of support for innovation and IB. Another study however observed significant relationship between participation and collaboration (variables of CI in this study), and IB (Verschuere, Beddeleem, & Verlet, 2014).

One explanation for this finding is that values such as teamwork, stability, co-operation, and lack of conflict when highly shared do not foster innovation efforts (Jaskyte & Dressler, 2005). This could be because of the nature of current campus life where students rely on themselves to resolve many uncertainties in relation to studying materials, campus layout, and scheduling. This develops their sense of independence, regardless of having support of friends or lecturers. Universities rarely acknowledge small achievements by students especially at individual levels. When students participate in collaborative effort, it is usually compulsory rather than voluntary. This could explain the lack of connection between environmental factor and behaviour.

5.3.3 SE and IB

SE was found to significantly influence student behaviour. This shows that efficacy or the ability to produce a desired or intended result plays a significant role in individual behaviour or sometimes referred to as attitude. These two variables were of the same dimension, and analysed from the same level (individual).

Scott and Bruce (1994) in their study explained that having mutual respect and positive interactions (in this context, between students and academics) will help in allowing for broader decision-making roles essential for innovative behaviour. Autonomy influences pro-activeness directly and indirectly through self-efficacy and

flexible role orientation, whereby students understand their own role when involved in individual or group projects.

This finding is also very much in line with previous findings by Bandura (1977, 1994), and Staples, Hulland, and Higgins (1999) suggesting that self-efficacy is a good predictor of subsequent behaviour. As explained by the expectancy-value theory (see Bandura, 1994), self-beliefs or efficacy partly governs the motivating influence on outcome expectancies and behaviour. With growing independence during the university years, some experimentation with risky behaviour is quite common among students. They should be encouraged to expand and strengthen their sense of efficacy by enabling them to learn to deal with potential troubling matters instead of being protected from real world problems.

5.3.4 Summary of RQ2

The results clearly distinguished that SE is a major antecedent of IB followed by EC, whilst CI had no significant direct effect on behaviour as shown in Table 5.2.

Table 5.2: The structural model and hypothesis test results

Hypothesis				Std. Reg. Weight	Std. Error	Result
H2	EC	→	IB	.238	8.012***	Accepted
H4	CI	→	IB	.060	1.707#	Rejected
H6	SE	→	IB	.380	12.753***	Accepted

*Note. ***p<.001, # insignificant path*

This indicates that EC along with strong sense of self-belief help in moulding the intended innovative behaviour regardless of the environmental situations or conditions. In spite of that, the emphasis is on student preparedness in facing the reality of their environment and the people they meet.

SE beliefs determine how people feel, think, motivate themselves and behave (Bandura, 1994). Bandura believed that self-efficacy lies within people's beliefs in their

capabilities to exercise control over their own functioning and over events affecting their lives. This personal belief is affected by life choices, level of motivation, matching goals expectation, and resilience to stressful experiences and harsh environment. The nature and scope of efficacy undergo changes throughout the course of life. As students learn to face and manage environmental demands, they observe effective skills and strategies often shown by examples and actions taken by their superiors, in this case, the academics, management, and parents. In this process, students express their ways of thinking most often through their behaviour. Different students will adopt different kinds of thinking and behaviour as the choice lies in personal judgement. Influence comes in the way students perceive their own abilities, seek guidance in someone who possesses the matching competencies, and develop their own skills and efficacy accordingly. Higher expectations and positive models lead to better efficacy, skills, and behaviour. This helps in countering negative feelings when faced with problems.

The findings of this section are actually in line with Kanter's view (Kanter, 1983) which argued that when it comes to practice, the need to change the organisational structure is underscored, but more emphasis is put on improving the quality of work life and tapping the full potential of human talent. As this study proves, SE which focused on human self-beliefs was more significant in determining IB as compared to EC. Kanter reiterated that to innovate quickly, the organisation needs more flexibility (SE), flatter hierarchies (EC), and more talents (SE). She also identified empowerment (IB) as a degree of openness in valuing people (IB), and inclusiveness (CI) which is making sure that people's contributions are recognised (Puffer & Kanter, 2004).

5.4 Research Question 3

RQ3: What is the relationship between innovation culture and students' innovative behaviour?

This hypothesis path addressed this research question.

Hypothesis				Std. Reg. Weight	Std. Error	Result
H7	IC	→	IB	.205	7.017***	Accepted

*Note: ***p<.001*

In answering RQ2B, the study found that IC had positive effect and significantly influenced IB of students. This implies that exchange of the right IC of an institution, in terms of spoken language, rituals and stories, will have significant effect on the behaviour of its members (in this particular study, its students).

Hogan and Coote's (2014) empirical study found mixed support for a direct link between artefacts of innovation (IC) and IB even though they were consistently positive and moderately significant. They cited method factor and different classification of organisation culture as factors contributing to this mixed support. Another study which showed direct positive relationship between IB and IC, however, had a different definition of culture in which it acknowledged culture as the importance of participation, learning and collaboration (Verschuere et al., 2014). Therefore, this study has recognised that there is a lack of empirical backing for this particular hypothesis.

5.5 Research Implications

This section will list out the research implications in terms of practicality and theory.

5.5.1 Practical Implications

Since the universal definition and the concept of IC is not that well defined, this study has contributed in assessing the applicability of this concept in the HEI context from the perspective of students instead of the academics or management staff. It is also believed that this study will add to the publications not in the form of report on IC but in the form of empirical study. This study has managed to diffuse two different areas (education and business organisational culture) to be tested on an actual population, in a

local setting. Lastly, the study has managed to highlight the IC and IB of undergraduate students of Malaysian public research universities by examining properties of the universities (as the environment) and the elements of culture in innovation orientation of the university in driving the people (students) along the goals, vision, and mission.

Another contribution of this study is the linking of SE theories which generally are studied in the field of psychology, with IC which is more popularly studied in business management. The convergence of these two fields however, is not unheard of as it is usually studied in the area of organisational behaviour. This study found it hard to find any previous empirical research that has studied the relationship between SE and IC especially in the similar context of this study. In a study, Chell and Athayde (2009) measured the relationship between SE and IB and indicated that IB can benefit from the diversity of cultural background of students. This had encouraged this study to assess this relationship which found that SE did influence IC very significantly.

5.5.2 Theoretical Implications

As there are no previous studies to the best knowledge of the researcher that have studied the direct relationship between IC and IB, this research contributes to the body of knowledge with its empirical finding that shows positive relationship between these two variables. This void is mainly probably because IC is more concentrated and has more exposure in the business and management field whereas IB is about behaviour, traditionally associated with the field of psychology and humanities. Interestingly, it is not absolutely a new or recent phenomenon either, as Kanter had already discussed this question more than a decade ago (Puffer & Kanter, 2004). She argued that institutions with high innovation have a culture of pride in which the members feel they must be powerful in order to be working in and for these institutions. The management must have certain people that can move and shift and shape behaviour in order to get the

members to be accountable, start collaborating, overcome differences, stop feeling passive and to awaken their initiative (efficacy).

The study has brought to light the understanding of IC from the institutional, collective, and individual levels in order to see the interaction between these entities and the elements of culture. The main interpretation of this is that culture in itself is more discussed at collective and individual levels, something that is shared between members of an institution or a geographical location. On the other hand, IC is a concept that connects cultural elements to innovation, which is rather technical, and at organisational level in nature. A combination of these two will result in a behavioural outcome which is IB, seen at individual level. Overall, it is possible to see how individuals react to their surroundings, adopting and adapting to them, while learning to make the best of their experience there to produce an outcome that might shape their future behaviour.

5.6 Research Limitations and Suggestions

This section addresses the limitations that were restricting generalisation of the findings. It ends with some suggestions for future research.

5.6.1 Research Limitations

Some caution in the interpretation of the present research findings is due because of several limitations. Nevertheless, necessary caution was taken to ensure minimum possible effect of these limitations on the results.

Firstly, there is the issue of generalisation of the findings. The study has been conducted on bachelor degree students whose perceptions of environment of their institutions might be influenced by their socio-economic background and lifestyle; thus making generalisation of the findings to other groups of students requires careful interpretations and thorough understanding of the physical setting and arrangements of

such campus settings and the interactions between members of the campus and their environment. This requires more research in order to address other groups of students.

Secondly, the data were collected from students of various faculties and areas of studies, from five public RUs in Malaysia. As a mechanism for generalisation, these students were divided into two fields of study namely the sciences and arts/humanities.

Thirdly, the study was restricted to the context of the local public universities. Therefore, the generalisation of findings is limited to the characteristics of this specific sector which is higher education, and organisation which is the HEI. Thus, caution must be taken when generalising the findings to other institutions.

Fourthly, another issue concerns respondents' comprehension of the questionnaire. The scale items were developed by adapting some established questionnaires from previous researches, inclusive of varying fields such as marketing, management, psychology, and education. For this reason, some respondents might not understand the subject or specific terms being asked or made inaccurate assumptions in deciding which level of agreement or disagreement to select for each questionnaire item. Hence, evaluation on level of understanding remains unknown.

Lastly, the measures of all the research constructs and items were gathered at the same point in time and possibly via the same instrument, thus giving a high potential for common method variance (CMV). Since discriminant validity was established among principal constructs, it is assumed that the usual sign for CMV was not present. However, future research could do well to take extra caution in preventing respondents from giving uniform responses across all constructs.

5.6.2 Future Research

The abovementioned limitations provide guidance and directions for future research in order to extend and enhance the generalisation of the research findings.

Although the study has included several variables to explain innovation culture and innovative behaviour of students, it is clear that a few more factors associated with institutional climate and individual attitudes and characteristics should be explored for a more complete theoretical model. Future research could include factors such as personality or attitude, technological and leadership effects on IC, and consequently on IB. This would add more options in choosing reference models for the concepts of IC and IB.

Secondly, this study was done in the HEI context. It certainly will be interesting to see what different settings could do to further validate this study. Future research could emulate this conceptual model based on other contexts and industries. Should other studies be held in the same context, they could compare the findings accordingly.

Thirdly, comparisons can be made between different groups of student population, especially between first degree and the postgraduate students. This study can also be replicated in other types of universities such as public and/or private teaching universities.

Fourthly, it was found that climate did not affect behaviour directly, which could mean that it is possible that climate can influence behaviour indirectly through the combination effects of EC, SE, and IC. This offers room for future modification of the existing model of IC. Apart from this, future study should check whether IC is more of a mediator or moderator for IB. This will add credibility and provide validation to the model of IC.

Finally, future research should define and establish the type of innovation and culture being researched. This is to ensure that the respondents have the right meaning of the questions when asked during interviews or the survey questionnaire.

5.7 Conclusion of the Chapter

This chapter discussed the findings of this study and reported the hypothesis testing while answering the research questions and describing the research objectives. In addition, some implications and suggestions for future research were described.

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APPENDIX A: DEFINITIONS OF TERMS

Definitions of innovation culture and other terms associated with it as found in the literature

Innovation Culture (IC)	
Zhu & Engels (2014)	A culture of innovation is one in which internal assumptions, values and management practices foster developing new ideas into products, processes, objects and services
Hepburn, (2013, May 17)	An environment that supports creative thinking and advances efforts to extract economic and social value from knowledge, and, in doing so, generates new or improved products, services, or processes. It has a shared set of values and mutually reinforcing beliefs about the importance of innovation as well as an integrated pattern of behaviour that supports research and innovation
Dobni (2008)	A multi-dimensional context which includes the intention to be innovative, the infrastructure to support innovation, operational level behaviours necessary to influence a market and value orientation, and the environment to implement innovation
Heidenreich (2001)	Relatively stable modes reflection, behaviour, and social organisation, directed towards modernisation and development, based on shared values
Claver at al. (1998)	A way of thinking and behaviour that creates and develops values and attitudes within a firm. This firm may accept and support ideas and changes, even though such changes may mean a conflict with conventional and traditional behaviour

Organisational Culture (OC)	
Tan, Choi & Rasli (2015)	The combination set of numerous values, norms and rituals which shared by members of the organization and govern their behaviors of interaction among each other within the organization
Hogan & Coote (2014)	The values and beliefs that provide norms of expected behaviours that employees might follow
Wolf & Brennan (2014)	Defined as basic assumptions, shared values and beliefs, shared meanings, and norms
Zhu & Engels (2014)	Shared philosophies, ideologies, values, assumptions, beliefs, expectations, attitudes and norms in organizations
Schroeder (2013)	Organizational culture consists of values, norms, and behaviours, which collectively define and comprise acceptable and "normal" ways of getting things done within an organization
Mathew (2008)	The values, beliefs, and assumptions of employees which are expressed in varied forms and which have significant implications for the working lives of organisational members
Watson (2003)	A pattern of assumptions developed, invented, or discovered by a group in learning to cope with internal and external pressures
Deshpande & Webster (1989)	The pattern of shared values and beliefs that help individuals understand organisational functioning and thus provide them norms for behaviour in the organization

Corporate Culture (CC)	
Linke & Zerfass (2011)	A pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems (Schein, 2004, p. 17)
Phillips (2011, August 3)	The set of assumptions, beliefs, practices, formal and informal rules, and attitudes about how a company operates

University Culture	
Fralinger & Olson (2007)	The values and beliefs of university stakeholders (i.e., administrators, faculty, students, board members and support staff), based on tradition and communicated verbally and non-verbally
Kuh & Whitt(1988, p. 6)	Persistent patterns of norms, values, practices, beliefs, and assumptions that shape the behavior of individuals and groups in a college or university and provide a frame of reference within which to interpret the meaning of events and actions on and off the campus

Culture	
Fellows & Liu (2013)	Patterns, explicit and implicit of and for human behaviour acquired and transmitted by symbols, constituting the distinctive achievements of human groups, including their embodiment in artefacts The collective programming of the mind that distinguishes the members of one group or category of people from another
Ahmed (1988)	The pattern of arrangement or behaviour adopted by a group of people or an organisation as the accepted way of solving problems
Tylor (1870)	That complex whole which includes knowledge, belief, art, morals, laws, customs, and any other capabilities and habits acquired by man as a member of society

APPENDIX B: QUESTIONNAIRE SURVEY

UNIVERSITY OF MALAYA
KUALA LUMPUR

INNOVATION CULTURE IN MALAYSIAN HIGHER EDUCATION INSTITUTIONS

Assalamualaikum and Greetings dear respondents,

The purpose of this research is to investigate the determinants of innovation culture amongst students in higher education institutions (HEIs) in Malaysia. This research aims to assess innovation culture amongst students and the possibility of improving their learning behaviour and environment.

It will take about 7 minutes to complete this questionnaire. Your participation is completely voluntary strictly confidential. Thank you for your time, co-operation and support.

SINCERELY,

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PART A: The following items are about your description of your respective higher learning institution and innovative behaviour.
Instruction: Please rate the following statements based on the scale below.

1	2	3	4	5	6
Strongly Disagree	*Disagree*	*Slightly Disagree*	*Slightly Agree*	*Agree*	*Strongly Agree*

No	**My university….**	**Strongly Disagree**					**Strongly Agree**
GM1	emphasises innovation as the core value	1	2	3	4	5	6
GM2	has its vision aligned with coursework	1	2	3	4	5	6
GM3	has its vision aligned with co-curricular activities	1	2	3	4	5	6
FML1	has defined the university procedures	1	2	3	4	5	6
FML2	keeps red-tape to a minimum	1	2	3	4	5	6
IC1	has given information about university activities	1	2	3	4	5	6
IC2	offers accessibility to information on job flow	1	2	3	4	5	6

IC3	encourages interactions with others in the institution	1	2	3	4	5	6
IS1	has discussion rooms where students can meet to discuss new ideas	1	2	3	4	5	6
IS2	has set aside meeting areas where students can talk informally about new ways to solve problems	1	2	3	4	5	6
RR1	gives rewards for any innovative ideas/efforts	1	2	3	4	5	6
RR2	places great value on recognising and showing appreciation for students' efforts	1	2	3	4	5	6
NW1	provides a challenging nature of work	1	2	3	4	5	6
NW2	provides motivating nature of work	1	2	3	4	5	6
TW1	emphasises on teamwork/collaboration	1	2	3	4	5	6
TW2	values integration and sharing amongst teams throughout the faculty/campus	1	2	3	4	5	6
SPT1	encourages assistance from the lecturers	1	2	3	4	5	6
SPT2	offers availability of peer/student support	1	2	3	4	5	6
IR1	promotes warm relations between students and lecturers	1	2	3	4	5	6
IR2	provides an easy-going work atmosphere	1	2	3	4	5	6
CRS1	encourages the chance to extend the range of my abilities/skills	1	2	3	4	5	6
CRS2	I enjoy trying different approaches to see which one will work, when solving a problem	1	2	3	4	5	6
CRTV1	I like my lessons to involve lots of different creative activities	1	2	3	4	5	6
CRTV2	I like to experiment with new ways of improving my studies (i.e. research, assignments, and projects)	1	2	3	4	5	6
CRTV3	I am given the time to develop creative potential	1	2	3	4	5	6
CRTV4	I am given the opportunity to develop creative potential	1	2	3	4	5	6
PA1	expects me to have my own initiative when dealing with work tasks	1	2	3	4	5	6
PA2	I am willing to try new ideas	1	2	3	4	5	6
FLX1	expects me to deal with my own assignments/projects at my own pace, accordingly	1	2	3	4	5	6
FLX2	I continuously track my progress against the stated goals	1	2	3	4	5	6
AUT1	encourages involvement in decision-making process	1	2	3	4	5	6
AUT2	I feel that I am trusted to act in the university's best interests with minimal supervision	1	2	3	4	5	6
EPW1	I try to adopt new ways to do work	1	2	3	4	5	6
EPW2	I feel empowered to apply what I have learned	1	2	3	4	5	6
RT1	encourages risk taking	1	2	3	4	5	6
RT2	I like to take a chance	1	2	3	4	5	6

MCH1	I view failure as an opportunity for improvement	1	2	3	4	5	6
MCH2	I reflect on the lessons learned over unsuccessful endeavours	1	2	3	4	5	6
NS1	welcomes new and original ideas/practices	1	2	3	4	5	6
NS2	I like being exposed to new ideas	1	2	3	4	5	6
NS3	I like having changes in my routines	1	2	3	4	5	6

PART B: The following items are about your description of the culture of innovation.
Instruction: Please rate the following statements based on the scale below.

1	2	3	4	5	6
Strongly Disagree	*Disagree*	*Slightly Disagree*	*Slightly Agree*	*Agree*	*Strongly Agree*

No	Items	**Strongly Disagree**					**Strongly Agree**
ST1	My university has well-known stories about students who have developed new ideas	1	2	3	4	5	6
ST2	My university has stories about students who encouraged the implementation of new practices	1	2	3	4	5	6
RIT1	My university has made an effort to acknowledge the adoption of new practices	1	2	3	4	5	6
RIT2	My university makes an effort to reward the implementation of new ways of doing things	1	2	3	4	5	6
SL1	I could probably get some benefit from looking at a problem from a different perspective	1	2	3	4	5	6
SL2	Could I develop a new approach to solving this problem?	1	2	3	4	5	6
SL3	Are there other ways I could go about resolving this issue?	1	2	3	4	5	6

DEMOGRAPHIC SECTION
Instruction: You are required to answer ALL the questions in this section. Please tick one of the option boxes (where applicable).

1) Your university			
2) Your faculty			
3) Your area of study:			
	Pure Sciences		Social Sciences
	Arts & Humanities		IT & Computer Sciences
	Engineering & Applied Sciences		Medicines & Wellness
4) Programme enrolled:			
	Foundation studies		Post-graduate studies
	Undergraduate studies		Doctoral studies

5) Study year:					
	1st year		3rd year		
	2nd year		4th year and above		
6) Sex:					
	Male		Female		
7) Ethnicity:					
	Malay		Chinese		Indian
	Others (please specify)				
8) Age group:					
	17 - 20		25 – 28		33 – 36
	21 - 24		29 – 32		37 and above
9) Your educational expenses are borne by:					
	Parents / Father / Mother		Family members (e.g., brother, sister, or close relative)		
	Spouse	Others (please specify):			
	A scholarship				
	Myself				

THANK YOU FOR YOUR PARTICIPATION.

APPENDIX C: PUBLICATION 1

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Innovation culture in higher learning institutions: A proposed framework

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Abstract

This paper systematically reviews literature on the establishment of innovation culture among students in higher learning institutions. It takes a close look at the concept of innovation culture and its influence on the resulting student innovative behaviour. This paper proposes an operational framework for measuring innovation culture and its relationship with innovative behaviour specifically in a higher education context. This framework is important in facilitating institutions to design activities cultivating innovation culture among students. This will eventually lead to the production of more innovative graduates and product innovation, which will in turn be beneficial for institutions in achieving global recognition.

Peer-review under responsibility of the Organizing Committee of the 3rd GCBSS-2015

Keywords: Higher education institutions (HEIs); higher learning institutions; innovation culture; innovative behaviour; innovation framework

1. Introduction

This study explores literature, mainly in marketing and management fields, that discusses innovation-related issues, innovativeness, innovative behaviour and innovation culture. Specifically, it tries to identify concepts usually associated with the concept of organisational culture or corporate culture of innovation culture in higher learning institutions. In general, when components of culture are used to derive the concept of innovation culture, there is a tendency to involve elements that are not quite visible but being manifested in the way people within an organisation

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