PSYCHOLOGICAL AND ORGANISATIONAL DETERMINANTS OF CAREER SUCCESS AMONGST WOMEN ACADEMICS IN SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS AND MEDICINE (STEMM)

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ABSTRACT

Science, Technology, Engineering, Mathematics and Medicine (STEMM) fields are commonly known to be male-dominated. The additional occupational challenges arising from the traditional roles of women in family and childcare are thereby thought to be compounded for women working in these fields. This thesis assessed the psychological and organisational factors impacting on the career success (research productivity, teaching performance, and career advancement) of women academics working in STEMM fields in Malaysia.

The first phase of the research employed a qualitative method to explore success amongst STEMM women academics from all research universities (RUs) in Malaysia. The participants took part in semi-structured interviews that investigated the meaning of success as well as the psychological and organisational barriers and means of support in achieving career success. One model emerged to address the research questions, containing two overarching themes: personal and psychological factors (e.g. relationship-related, motherhood and childcare, and gender-related challenges and means of support), and job demands and resources (e.g. family-friendly policies or facilities, unprofessional workplace behaviours, barriers and means of support relating to research, teaching and promotion, recognition, and support from colleagues, supervisor or higher management). The cultural dimensions of collectivist culture and power distance appeared to influence the meaning of success and these two themes.

The second phase combined the Job Demands-Resources model (JD-R) with the Social Cognitive Career Theory (SCCT) to the study of STEMM academics at the RUs in Malaysia. At the psychological level, factors such as person variables (i.e. age and seniority), self-efficacy, outcome expectations, and interest, are being explored in relation to career success. At the organisational level, the research investigated the impact of job demands and

resources on career success. The combination of JD-R and SCCT led to the creation of a model where a number of independent variables (grouped into person variables and environment variables) were hypothesised to predict a number of outcome variables (grouped into research productivity, teaching performance, and career advancement) with self-efficacy, outcome expectations, and interest (in research, teaching, and career advancement) as mediators. Gender was hypothesised to be a moderator in all the resulting moderated mediations. Findings revealed that the participants showed a good fit to the combined JD-R model and SCCT when the independent variables were recognition, support from colleagues and family-work conflict. Gender was in evidence amongst the participants as a significant moderator in some of these mediated relationships. Job demands (i.e. work-family conflict and family-work conflict) negatively affected outcome expectations for teaching and interest in teaching, only amongst women. On the other hand, recognition and supervisor support and feedback could improve research-related variables, only amongst men.

Theoretical and practical implications, limitations of the research, and possible future research directions to understand the gendered experience of academics in STEMM were discussed. More theories should be explored or incorporated into the model to investigate its suitability and to discover additional supporting and hindering factors for STEMM women academics' career success.

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PREFACE

This thesis reports on research that was conducted in two phases. First, it reports on a qualitative study exploring the meaning of success, and the barriers and means of support for achieving career success, amongst women academics working in Science, Technology, Engineering, Mathematics and Medicine (STEMM) fields in Malaysia. This qualitative phase used a semi-structured interview method. Next, the thesis reports on a quantitative study that collected and analysed survey data from STEMM academics in Malaysia with a view to combining the Job Demands-Resources model (JD-R) and the Social Cognitive Career Theory (SCCT) and considering the moderating role of gender.

The thesis is organised into seven chapters. The introductory Chapter 1 provides a background and states the orienting problem of the research. It gives a brief overview of women in STEMM in Malaysian Higher Education, which leads into the research objectives and the theoretical and practical significance of the research.

A literature review is provided in Chapter 2. It begins with a review of literature on career success amongst academics, covering such aspects of academic achievement as research productivity, teaching performance, and career advancement. This review formed the basis for the qualitative phase of the research, which informed the choice of theories and specific variables to be investigated in the quantitative phase. The major theories and the model applied in the work are then introduced, namely JD-R, SCCT and Gender Schema Theory. Chapter 2 continues by reviewing previous findings on the moderating effect of gender and the mediating effects of self-efficacy, outcome expectations, and interest. Subsequently, literature regarding the person and environment variables used in the study are

reviewed, and the chapter concludes with a summary of the conceptual framework of the quantitative study and the research questions and hypotheses.

A methodological account is given in Chapter 3, which provides the rationale for the selected research design and methods, covering participant selection (sampling strategy and sample size requirements), data collection, data analysis methods, and ethical issues.

Reporting on the results begins in Chapter 4 with the findings of the qualitative phase and a discussion of these findings in relation to the research framework and research questions. Chapter 5 presents the results of a pilot study conducted for the quantitative phase. Analyses of the pilot study focus on the psychometric properties of the research instruments, using reliability testing, Exploratory Factor Analysis and Confirmatory Factor Analysis. Chapter 6 proceeds with the results of the main quantitative study. It begins by reviewing the method, and then reports on tests of assumptions, results from preliminary and psychometric analyses, and results from inferential analyses. It concludes with a discussion of the findings.

A general discussion and conclusion are given in the final Chapter 7, which brings together the findings from the two research phases, discusses the theoretical and practical implications and points out limitations in the study and suggestions for future research.

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LIST OF ABBREVIATIONS AND ACRONYMS

AG	Age
AMOS	Analysis of Moment Structures
CA	Career advancement
CA1	Years spent to be promoted from senior lecturer to professor
CA2	Years spent staying at senior lecturer or lecturer position without being promoted
CAOE	Outcome expectations for career advancement
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Confidence Interval of the mean
DV	Dependent Variable
EFA	Exploratory Factor Analysis
FW	Family-work conflict
GFI	Goodness of Fit
GST	Gender Schema Theory
ICA	Interest in career advancement
IR	Interest in research
IT	Interest in teaching
IV	Independent Variable
JD-R	Job Demands-Resources
KMO	Kaiser-Meyer-Olkin
M	Mean
N	Number of cases

OLS	Ordinary least squares regression
PAF	Principal Axis Factoring
PC	Principal Component
PDI	Power Distance Index
PSE	Promotion self-efficacy
RC	Recognition
RMSEA	Root Mean Square Error of Approximation
ROE	Outcome expectations for research
RP	Research productivity
RSE	Research self-efficacy
RU	Research university
SC	Support from colleagues
SCCT	Social Cognitive Career Theory
SE	Standard Error
SD	Standard Deviation
SN	Seniority
SS	Supervisor support and feedback
STEMM	Science, Technology, Engineering, Mathematics and Medicine
TOE	Outcome expectations for teaching
TP	Teaching performance
TSE	Teaching self-efficacy
WF	Work-family conflict

CHAPTER 1 - INTRODUCTION

1.1 Chapter Overview

This chapter provides an overview of the research done for this thesis. It starts with the background of the research and a general statement of the problem. Next, a brief overview of women in Science, Technology, Engineering, Mathematics, and Medicine (STEMM) fields in Malaysia's higher education system are presented. Subsequently, the research objectives of this thesis are listed, and the significance of the research is explained. Lastly, this chapter concludes with a summary of the key contributions from the research.

1.2 Introduction

STEMM can be defined differently depending on the categorisation one uses. Some divide STEMM into five major subcategories by following the National Science Foundation's classification system, namely computer and mathematical science, engineering, life science, physical science and social science (Miller & Wai, 2015). Other researchers opt-out social and behavioural sciences, like psychology and economics (Hill et al., 2010). Although STEM is more commonly used in literature and publication, the present thesis follows the name used by Advance HE's Athena SWAN Charter (a charter that aims at recognising advancement of the careers of STEMM women), which is STEMM, as it covers another important subfield, which is medicine (Athena SWAN, 2018).

This thesis comprises of two phases of research to assess the psychological and organisational determinants impacting on the career success (research productivity, teaching performance, and career advancement) of women academics working in STEMM fields in Malaysia. The first phase of the research was a qualitative study, whereas the second phase of

the research employed a quantitative approach. The following section will proceed on detailing the background and problem statement of the research.

1.3 Background of the Research and Problem Statement

Science, Technology, Engineering, Mathematics, and Medicine (STEMM) fields have a long history of being perceived as male-dominated fields (Burke, 2007; Hill et al., 2010). Women "encounter more blocks, both obvious and subtle" when they attempt to pursue professions that are labelled as a male province (Werber, 2015, para. 8). In this research, STEMM women academics were selected to be the target research population, as women are one of the utmost focused populations that can increase diversity in STEMM fields (Aguirre, 2000). Furthermore, there are few studies that focus on STEMM women academics (Mavriplis et al., 2010; Wright et al., 2003) as compared to STEMM bachelor's to PhD girls and women (Cavazos, 2014; MacLachlan, 2006; Miller & Wai, 2015). Given the demands of traditional gender schemata of Malaysian women in family and childcare, women have more roles to play in their daily life compared to men (Abdullah et al., 2008; Hirschman, 2016). This, therefore, leads to more challenges to be successful at work.

Career success has generally covered both objective success and subjective success (Heslin, 2005; Mohd Rasdi et al., 2011). In the higher education, objective career success is generally evaluated based on the academics' research productivity (Abramo et al., 2009; Sax et al., 2002; Silverman, 1999), teaching performance (Karagiannis, 2009; Marshall & Pennington, 2009; Thanassoulis et al., 2017), and career advancement (Carr et al., 2017; Hirayama & Fernando, 2018; Ismail & Arokiasamy, 2007). Conversely, subjective career success is commonly examined through job satisfaction (Guo & Wang, 2017; Wolff & Moser, 2009) or through an individual's specific experience (Kidd, 2014). As in other geographical contexts, also in Malaysia, academics' work performance is heavily centred on research,

teaching and other academic-related tasks (Musah et al., 2016). Thus, the present research focused on both objective and subjective types of career success, including a self-defined measure of success in the qualitative study, as well as measures of research productivity, teaching performance, and career advancement in the quantitative study.

The metaphor of 'leaky pipeline' was indeed popularly used to describe women leaking out from STEMM bachelor's programme to PhD in the United States over the last three decades, but this metaphor is no longer relevant as reported by a 30-year retrospective longitudinal study because the sex differences started to close in the 1990s (Berryman, 1983; Miller & Wai, 2015). Nonetheless, male graduates in the United States, United Kingdom and the European countries still outnumber women in physical sciences, computer sciences, technology, engineering, architecture or construction-related areas and mathematics fields, though female graduates are well-represented in medical and biological sciences (Directorate-General for Research and Innovation (European Commission), 2016; Heilbronner, 2013; Miller & Wai, 2015; WISE Campaign, 2017). Although there may be some efforts in supporting STEMM women, some STEMM fields remain to be male-dominated.

There is little attention in Asian countries on this matter, except a recent publication titled as 'The Complex Formula: Girls and Women in Science, Technology, Engineering and Mathematics in Asia' by the United Nations (UNESCO Bangkok & Korean Women's Development Institute (KWDI), 2015). Although this is a hot discussion in the United States and other Western countries, there is a dearth of study regarding women representation in STEMM in developing countries, including Malaysia (Goy et al., 2018).

Due to subjective career success being best understood using an individual's personal experience (Kidd, 2014), the first study aimed to explore the meaning of success amongst STEMM women academics, and the barriers and support in achieving career success using semi-structured interviews as a method. Few studies have been conducted on the topic of work-

life issues amongst women academics in Malaysia (Jusoff, Hussein, Ju & Din, 2009; Hamid & Mohd Amin, 2014), and most of them used quantitative approaches. As for the qualitative studies in Malaysia, they focus more on Malay or Muslim women academics (Achour, Grine, & Mohd Nor, 2015; Osman, 2014) or female professors from both physical and social sciences (Ismail & Mohd Rasdi, 2006b).

Drawing on the insights emerged from the first study, the second study examined the determinants of career success amongst STEMM academics in Malaysia through the development of a new combined model [through combining the Job-Demands-Resources Model (JD-R; Bakker & Demerouti, 2007; Demerouti et al., 2001) and the Social Cognitive Career Theory (SCCT; Lent et al., 1994)]. Limited studies were done on the topic of research productivity and career advancement in Malaysia (Abrizah & Wee, 2011; Davarpanah, 2009; Ismail & Arokiasamy, 2007; Yazit & Zainab, 2007), and these studies did not compare the results between genders. As for teaching performance, only a few studies examined the gender difference (Chua & Kho, 2015, e.g. 2013). The JD-R model has demonstrated its applicability amongst the academics (Barkhuizen et al., 2014; Boyd et al., 2010). The SCCT has also been found to be a constructive framework that can be applied to the situation of academics (Wang et al., 2007). Based on the author's knowledge, no study had been carried out in Malaysia to examine the applicability of the combination of JD-R and SCCT amongst STEMM academics. Thus, the combination of JD-R and SCCT was used in this thesis to investigate the relationships between the potential predictors, mediators, and career success amongst STEMM academics in Malaysia as an innovative approach in the context. And gender served as a moderator in this study.

From the traditional gender schemata angle, most women in Asian countries, including Malaysia, feel guilty when they choose to work and spend less time with the family (J. E. Williams & Best, 1990a, 1990b). The Asian society perceives women as the sole persons that

should perform the socially assigned familial duties, and their role implies that they are not supposed to place work higher than family (Attané, 2014; Luke, 2000; J. E. Williams & Best, 1990b, 1990a). Research conducted in other Asian countries such as Japan and Hong Kong shows that women are viewed as wives, mothers, and homemakers in society (Luke, 2000). Morley (2014) explains how Japanese academic women are loaded with family and childcare responsibilities; they are expected to take care of their children, parents, and even their in-laws while performing household chores. The physical and mental burden takes away their time to concentrate on conducting research. Similar challenges can be expected in Malaysia context too.

Given that Malaysia is a collectivist country (Hofstede Insights, 2018), with an extremely high rank in power distance index (Hofstede Insights, 2018; The Star Online, 2014), and poor rank (107th, second last countries amongst the southeast Asia countries) in the Global Gender Gap report (World Economic Forum, 2014), it is not surprising to know that Malaysia has been categorised as one of the most traditional countries with regard to gender roles since the 1990s (J. E. Williams & Best, 1990a, 1990b). Malaysian women are expected to prioritise family and place self-fulfilment behind family matters, as they are expected to "maintain the traditional perception of a woman" even if they are working women (Abdullah et al., 2008, p. 454). Although Malaysian women are now more open to participate in economic activities and Malaysian men are more willing to play more roles in parenting or other domestic duties, there is still a "continuity of some aspects of the historical pattern of relative gender equality" (Hirschman, 2016, p. 33).

1.4 A Brief Overview of Women in STEMM in Malaysia's Higher Education

Currently, Malaysia has 20 public universities with 532,049 students enrolled in it (Ministry of Education Malaysia, 2017). Between these 20 public universities, four

universities, namely Universiti Malaya (UM), Universiti Kebangsaan Malaysia (UKM), Universiti Sains Malaysia (USM) and Universiti Putra Malaysia (UPM) were elected to be research universities (RUs) under the 9th Malaysia Plan, and Universiti Teknologi Malaysia (UTM) became the fifth research university during the 10th Malaysia Plan (Mohamad Sheriff & Abdullah, 2017).

Based on the statistics in Malaysia, the intake number of female students in Science, Mathematics and Computer (65.0%), Agriculture and Veterinary (58.9%), and Health and Welfare (74.0%) in 2017 were more than male students. It is also interesting to note that in terms of women with an undergraduate degree in STEMM, Malaysia has the highest proportion of female graduates in certain science programmes compared to other six countries (Cambodia, Indonesia, Mongolia, Nepal, the Republic of Korea and Viet Nam), with 72% of females in pharmacy and 36% in Engineering as of 2012 (MoHE, 2013). Although Malaysia has more female graduates in those science programmes, women remain to be the minority in certain disciplines such as physics, mathematics and engineering (UNESCO Bangkok & Korean Women's Development Institute (KWDI), 2015). In addition, the 'leaky pipeline' phenomenon seems to be prominent in Technology and Mathematics fields. In fact, female students outnumber male students during the lower education levels (i.e. diploma and bachelor levels), but they are overtaken by male students in the higher education levels (i.e. postgraduate diploma, masters and PhD levels) (Malaysian Higher Education, 2017).

In Malaysia, the academic ranks start from lecturer (DS45), senior lecturer (DS51 or 52), associate professor (DS53 or 54) to professor (VK7, 6 or 5). It is important to note that these rank arrangements are based on a hierarchy from the lowest to the highest (Md Yunus & Pang, 2015). When it comes to employment in academia, the 'sticky floor' phenomenon is evidenced in Malaysia's RUs, in which 53.8% women tend to stay at lower academic ranks

(i.e. lecturer and associate professor) as compared to men, whereas 65.6% men occupied the higher academic ranks (i.e. full professor) as compared to women (Malaysian Higher Education, 2017). No statistics regarding the distribution of academic rank by sex in Malaysia's RUs, particularly in Science, Technology, Engineering, Mathematics, and Medicine were reported.

To achieve the aspiration of transforming into a high-income nation, the Ministry of Education Malaysia (2015) places emphasis on developing a STEMM workforce and a STEMM literate society in the Malaysia Education Blueprint 2015-2025. One of its strategies is to create more graduates to pursue STEMM related advanced degrees and careers (Ministry of Education Malaysia, 2015). Thus, it can be suggested that more attention still needs to be paid to the issue of postgraduate attainment and academic employment and retention in STEMM fields for women in Malaysia.

1.5 Research Objectives

The first study was a qualitative study, titled 'An Exploratory Study of Success amongst Science, Technology, Engineering, Mathematics, and Medicine Women Academics.' It aimed to explore the meanings of success for STEMM women academics, as well as the psychological and organisational barriers and means of support for STEMM women academics in achieving career success.

In the second study, 'Determinant of Success in Research, Teaching and Career Advancement amongst Science, Technology, Engineering, Mathematics, and Medicine Women Academics', there were two research objectives. First, it targeted to examine the mediating roles of self-efficacy (in research, teaching and promotion), outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) in the relationship between a series of predictors (including both person-related

variables and environment-related variables), and three outcome variables (research productivity, teaching performance, and career advancement) amongst a sample of STEMM academics in Malaysia. Next, it sought to examine the moderating role of gender in the mediated relationship between the person and environment variables, and interest (in research, teaching and career advancement) amongst the sample when self-efficacy (in terms of research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are the mediators.

1.6 Significance of the Research

This research provides significant contributions, on both scientific and practical grounds. Firstly, it develops a new model for the prediction of career success in academia, through a qualitative research using a grounded theory approach. There is a paucity of research regarding STEMM women academics in Malaysia (Goy et al., 2018). Most studies used quantitative approaches (Jusoff, Hussein, Ju & Din, 2009; Hamid & Mohd Amin, 2014), or only focused on female professors (Ismail & Mohd Rasdi, 2006b) or Malay women academics (Achour, Grine, & Mohd Nor, 2015; Osman, 2014). The first phase of study in this thesis targeted on STEMM women academics from all research universities in Malaysia, in order to generate a theoretical model that can explain the meaning of success and the barriers and support in achieving career success.

Drawing the insights from the first study, another significant contribution of this research is that it advances a development and testing of an innovative combination of the Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007; Demerouti et al., 2001) through the incorporation of three important mediators of the Social Cognitive Career Theory (SCCT; Lent et al., 1994). The model advanced in this thesis incorporates three important mediators of SCCT (namely self-efficacy, outcome expectations and interest) into JD-R. The

JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) proposes that the conditions of work can be divided into job demands and job resources and their combined effect impacts on employees' well-being and performance. Whereas the SCCT suggests the interaction and effects of gender, culture, social context, genetic endowment, sudden life incidents, self-efficacy, outcome expectations, personal goals, interests and environmental factors on career-related choices (Prescott & Bogg, 2013; Savickas & Lent, 1994). Although the combination of JD-R and SCCT may not be new in this field, only the mediating effect of self-efficacy has been explored in the JD-R model (Demerouti & Bakker, 2011). Based on the author's knowledge, outcome expectations and interest have not been incorporated into the JD-R model before. The present research introduces and tests these two variables within the model for the first time.

Both the JD-R model and SCCT have separately demonstrated their applicability amongst academics (Barkhuizen et al., 2014; Boyd et al., 2010; Wang et al., 2007). However, according to the author's knowledge, there has been no study carried out in Malaysia to examine a combined version of JD-R with SCCT amongst academics. Hence, another significant contribution of the present research is the testing of the applicability of the combined version of JD-R with SCCT amongst academics in Malaysia.

At the same time, the present research examines the role of gender in the combination of JD-R and SCCT amongst STEMM academics in Malaysia, being informed by the Gender Schema Theory (GST; Bem, 1981a). In SCCT, gender differences in some learning experiences are observed and well related to self-efficacy and outcome expectations (C. M. Williams & Subich, 2006). As for JD-R, several studies that applied the model found gender differences in job resources and demands (Hoonakker et al., 2013; Huang et al., 2016). In Malaysia, the influence of gender schemata are potentially stronger than in other contexts, given that Malaysia is still a traditional country in terms of gender roles (Hirschman, 2016; J.

E. Williams & Best, 1990b, 1990a). The outcome of the present research provides a novel explanation of the impact of gender on the combination of JD-R and SCCT in the Malaysia's context with the support of Gender Schema Theory (Bem, 1981a).

In addition, several instruments relating to academic self-efficacy, outcome expectations, interest, research productivity, teaching performance, career advancement in academia, work-family conflict, and job resources were developed and validated within an academic population in Malaysia. Researchers will be able to use these instruments in future studies in Malaysia.

Furthermore, this research contributes to answering the call of the United Nations' third Millennium Development Goal - to promote gender equality and empower women (United Nations, 2000), and fifth Sustainable Development Goal - to achieve gender equality and empower all women and girls (United Nations, 2015), and one of the six strategic thrusts of the Eleventh Malaysia Plan (Economic Planning Unit, 2015) - to enhance inclusiveness towards an equitable society. This research provides more understanding and input regarding increasing the inclusiveness of women academics, particularly in Science, Technology, Engineering and Mathematics. The Malaysian government aims to ensure all citizens "regardless of gender, ethnicity, socio-economic level, and geographic location [can] participate in and benefit from the country's prosperity" (Economic Planning Unit, 2015, p. 1-9). Some initiatives were implemented between 2010 and 2015 in the Tenth Malaysia Plan and the efforts managed to increase the female labour force participation rate from 46.4% to 53.6% and the rate of women in top management positions in the public sector from 30.5% to 32.5% (Economic Planning Unit, 2015). The inclusiveness of more women scientists and engineers in academia could improve gender equality and empower more STEMM women academics in Malaysia. The findings of this research can be used to design and develop practical plans, policies, and solutions to help STEMM women academics in Malaysia. By

looking at the significant relationships between predictors and career success through the mediators, we can utilise these findings to design and implement effective support for women academics in STEMM. By retaining more skilled and talented women in the workforce, Malaysia has a higher chance to be transformed into a high-income country (TalentCorp & the Association of Chartered Certified Accountants, 2013). In turn, the involvement of more women in STEMM fields will be able to lead to the creation of more well-represented designs that consider both genders' unique needs (Hill et al., 2010). This could avoid poor designs like early voice-recognition systems that were calibrated to male voices only, as well as the first generation of automotive airbags that were designed by a group of predominantly male engineers to suit only adult male bodies and ignore women and children's bodies (Margolis & Fisher, 2002).

1.7 Chapter Summary

This chapter has outlined the background of the research and general statement of the problem area amongst STEMM women academics. It has provided a brief overview of the situation of women in STEMM in Malaysian higher education. It also defined the research objectives and gave an account of the significance of the research. In short, the key contributions of this research are listed below:

(a) The development of a model of barriers and means of support in achieving career success.

(b) The development and testing of a new combination of JD-R and SCCT.

(c) The testing of the applicability of the combined version of JD-R with SCCT amongst STEMM academics in Malaysia.

(d) An understanding of the impact of gender on the combined version of JD-R and SCCT amongst STEMM academics in Malaysia.

(e) The development and validation of instruments relating to academic self-efficacy, outcome expectations, interest, research productivity, teaching performance, career advancement in academia, work-family conflict, and job resources within STEMM academic population in Malaysia.

(f) A contribution to the United Nations' third Millennium Development Goal – to promote gender equality and empower women (United Nations, 2000), fifth Sustainable Development Goal – to achieve gender equality and empower all women and girls (United Nations, 2015) and one of the six strategic thrusts of Eleventh Malaysia Plan – to enhance inclusiveness towards an equitable society (Economic Planning Unit, 2015), through the development of a set of recommendations to design, develop practical plans, policies, and solutions to help STEMM women academics in Malaysia.

The following chapter presents a review of key empirical literature to support the justification of this research by referring to the theoretical framework and identifying the research gaps.

CHAPTER 2 - A REVIEW OF LITERATURE

2.1 Chapter Overview

This chapter first reports on the literature review conducted before the qualitative phase of the research, which focuses on the concept of career success regarding academics in general and led to the development of the qualitative research questions. This is followed by a review of the more specific theories and a model on which the quantitative phase was based. Also reviewed are the moderating roles of gender and the mediating roles of self-efficacy, outcome expectations, and interest along with predictors of career success. Lastly, this chapter concludes with the conceptual framework of the quantitative phase, and the related formulated hypotheses.

2.2 Introduction

This literature review will highlight both phases of the research on career success in general, started with qualitatively exploring the meaning of (as well as the barriers and means of support for) the career success of STEMM women academics, then followed by elaborating an innovative combination of the Job Demands-Resources Model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and the Social Cognitive Career Theory (Lent et al., 1994). Then the literature review will elaborate the determinants that affect career success in academia context, particularly amongst STEMM women academics. The predictors consist of two person variables (i.e. age and seniority) and five environmental variables (i.e. recognition, supervisor support and feedback, support from colleagues, work-family conflict, and family-work conflict). Self-efficacy, outcome expectations, and interest are selected from the SCCT to serve as mediators. To help in understanding the moderating role of gender,

particularly pertaining to gender roles, Gender Schema Theory (Bem, 1981a) is also reviewed.

2.3 Career Success

Before proceeding to focus on career success solely, it is crucial to view from a broader perspective regarding success. According to Bostock (2014), the current standards and value judgments of success are often too narrowed, which make lesser women being categorised as being successful as compared to their male counterparts. Hence, it is critical to acknowledge that:

> …success means many different things to many different people. It may therefore seem futile to attempt to redefine it to give it more meaning and efficacy; but we must try if we are serious about creating more inclusive workplaces…A broader, richer definition of success makes it far more likely that diverse talent will be recognised. (Bostock, 2014, p. 9)

Moving on to career success, it is frequently referred to as “the positive psychological or work-related outcomes or achievements one accumulates as a result of work experiences" (Seibert et al., 1999, p. 417). There are two types of career success, namely objective and subjective, based on a conceptual distinction (Heslin, 2005; Mohd Rasdi et al., 2011). Objective success is normally measured by a person’s salary, salary growth, hierarchical status and promotions, whereas subjective success is usually determined by a person’s career or job satisfaction and comparative judgments (Arnold & Cohen, 2008).

Interestingly, women tend to favour subjective measures towards career success, whereas men prefer to favour objective measures (Heslin, 2005). Arnold and Cohen (2008)

suggest that it may be the disadvantaged career position of women that causes them to focus on subjective success rather than the hardly attainable objective success. Most researchers support the notion of measuring success by applying both measures to fully capture its meaning in a career (Arthur et al., 2005; Heslin, 2005). Kidd (2014, p. 7) suggests that objective success can be "observed and defined publicly", but subjective success is "best understood in terms of the individual's specific experiences".

As in other countries, in Malaysia the work of academics covers research, teaching, and other academic-related tasks (Musah et al., 2016). In this thesis, subjective success is explored in Chapter 4 by allowing the research participants to determine their perceived success, employing a qualitative approach. Whereas in Chapter 6 both types of subjective and objective career success are measured using a quantitative approach, by investigating three areas: research productivity, teaching performance, and career advancement.

2.3.1 Research Productivity

The axiom of 'publish or perish' has highlighted that the definition of success of an academic lies highly on publication (Silverman, 1999). Over the years, many bibliometricians have proposed varied approaches to measure research productivity. The initial researcher who applied the number of publications to measure research productivity is untraceable. Although, even as early as the 1920s, Alfred J. Lotka (1926) had already begun to apply the number of publications to measure research productivity or what he at the time coined as Lotka's law. Then in 1955, Eugene Garfield (2006) proposed the concept of an impact factor, which led to the publication of the Science Citation Index in 1961 to measure the impact factor based on the number of citations, number of substantive articles and reviews published. More recently, Hirsch (2005) introduced the h-index, which has gained increasing popularity and discussions in the field of bibliometrics. Subsequently, Abramo and D'Angelo (2014) also proposed a

novel indicator called ‘Fractional Scientific Strength’ to measure research productivity at various levels of analysis, which include individual, department, institution, region, nation, field and discipline.

In the present research, the oldest approach to measure research productivity was employed, asking the participants to each report on the number of publications. Unlike other bibliometric studies that rely on secondary data, the present research required participants to also respond to other items (e.g. their perceived levels of job demands and resources) which cannot be obtained solely through the secondary data approach. Therefore, due to the feasibility of the participants in providing this information and to protect their anonymity, the participants were requested to self-report their number of publications, rather than obtaining their research productivity via the Web of Science or other platforms.

2.3.2 Teaching Performance

One of the key success factors of a university teacher is to be valued and remembered with gratitude by their former students (Glasser, 1988; Marshall & Pennington, 2009; Steiner, 1997). Importantly, being a good teacher is a vital component of career success of an academic. Likewise, excellence in teaching can also facilitate the career progression of an academic (Marshall & Pennington, 2009). However, universities have placed an exceedingly high emphasis on research outputs when measuring the performance indicators (PIs) of academics and have neglected to measure or consider their equally important teaching function (Ramsden, 1991). Neumann (1994) introduced the ‘research-teaching nexus’ term to highlight the connections between discipline-related research and teaching and learning of a student. In this case, the fundamental purpose of research should be to use it to teach and enhance the learning of students.

Furthermore, a good or sound evaluation of teaching performance contains several sources of data with the most widely used sources of data being through students, peers, and the teachers themselves (Paulsen, 2002). The student evaluation of teaching (SET) is used to enhance the quality of higher education (Thanassoulis et al., 2017) since it provides important feedback from the end-users regarding teaching. Even though the student rating of the teaching approach is the most commonly and frequently used approach, academics continue to question its meaningfulness and appropriateness as well as the potential biases from the students (Paulsen, 2002). Indeed, gender differences and field of study of a student have significantly affected the students' evaluation of teaching of an academic (Alhija, 2017). In her study, she found that female students perceive all five dimensions of good teaching (goals to be achieved, student long-term development, teaching methods, relations with students and assessment qualities) as significantly more important than male students (Alhija, 2017). In terms of field of study, students in the natural sciences perceive goals to be achieved as significantly more important than those in the social and exact sciences, whereas students in the social sciences perceive student long-term development, teaching methods and relations with students as significantly more important than students in the exact sciences (Alhija, 2017).

As for peer reviews, these can evaluate content-based components that cannot be evaluated by students, which include mastery of content, course goals, course organisation and materials (Paulsen, 2002). However, as peer reviews require the reviewers to observe the class, they are positioned in a difficult situation to evaluate their colleagues without the ability to protect confidentiality and anonymity of the reviewer's identity and review content (Paulsen, 2002). Also, teachers may not be truly teaching in the manner in which they normally teach given the presence of a reviewer (Paulsen, 2002).

Regarding self-evaluation, it is often argued that as an approach, it lacks validity and objectivity (Centra, 1993), as student and teacher's perceptions of good teaching can often differ (Alhija, 2017), due to the fact that students can only measure the delivery of instruction and assessment of instruction (Paulsen, 2002). Nevertheless, teachers are the best experts regarding their own teaching, since they generally self-design the teaching materials from the outset and then carefully deliver it (Paulsen, 2002).

Although self-evaluation may not be the best nor preferred option to evaluate one's teaching performance, the present research selected perceived teaching performance for the evaluation of teaching performance. Notably, a good, reflective, and honest assessment of one's own teaching performance is vital in performing such an evaluation. As such, the items need to contain various components to assist the participants in self-evaluating their own teaching performance and comparing it with their colleagues. In this research, the teaching performance items were developed according to this principle, by asking the participants to rate their self-perceived teaching performance and their perceived teaching performance by comparing with other colleagues. By employing the self-evaluation approach, the participants can rate their perceived teaching performance without being influenced by an outsider (peer reviewer). Moreover, this approach can also help to protect the participants' anonymity, as the remaining two approaches risk revealing the identity of the participants.

2.3.3 Career Advancement

As described in this section, career advancement focuses on the objective success definition, particularly on hierarchical status. In the academic context, promotion to full professorship is the hierarchical status that defines the highest career success. It is common to measure this type of promotion in academia by applying the time taken to be promoted, which is typically calculated by using the unit of the year (e.g. Beasley et al., 2006; Liu &

Alexander, 2010). The ‘years spent to be promoted from senior lecturer to professor’ including the ‘years spent staying at senior lecturer or lecturer position without being promoted’ were selected in this present research to measure the career advancement of academics. The first measure was used to determine how long it takes for the academics to move up the academic ladder, whereas the latter was used to measure the potential impact of the ‘sticky floor’ phenomenon – remaining at lower rank without being promoted (Booth et al., 2003; Yap & Konrad, 2009).

Seeing from the multiple categories of career success, the pressure towards women in the male-dominated fields of STEMM, as well as the demands of traditional gender schemata of Malaysian women in family and childcare (Abdullah et al., 2008; Hirschman, 2016), it is predictable that women academics in STEMM might encounter more barriers in achieving career success. Conversely, it is also expected that they have received some means of support that have helped them to achieve success in career.

2.4 Research Questions for the Qualitative Phase

Despite several efforts in defining success by different researchers (Bostock, 2014; Cheung & Halpern, 2010; Heslin, 2005; Kalet et al., 2006), it still posits a strong rationale to explore whether the meaning of success is universal for STEMM women academics in Malaysia, given the strong influence of culture and personal life events on defining success (Kalet et al., 2006; Westring et al., 2012). These studies mentioned above primarily cover only the Western population and context. As supported by several researchers to better capture the meaning of success using multiple measures including qualitative method (Arthur et al., 2005; Heslin, 2005; Kidd, 2014), especially subjective success, that are emphasised more by women (Arnold & Cohen, 2008), the first research question for the qualitative phase in this thesis was developed to explore the meaning of success amongst STEMM women

academics in Malaysia. By understanding the meaning of success among them, we can potentially assist women in STEMM to view success from various angles instead of the general narrow view of success.

Subsequently, as stated above, career success for academics generally covers research productivity, teaching performance and career advancement (Musah et al., 2016). As mentioned earlier that the meaning of success is unique for everyone, the barriers and means of support in achieving career success are also exclusive to the participants. While many studies have been done to understand the determinants of career success (Ballout, 2007; Kirchmeyer, 1998; Ng et al., 2005; Ng & Feldman, 2014; Westring et al., 2012; Wolff & Moser, 2009), the present research was interested to study particularly the psychological and organisational barriers and means of support from STEMM women academics in achieving career success. This is because most studies highlight women in general (e.g. Bostock, 2014), or that they only focus on either the means of support (e.g. Wolff & Moser, 2009) or barriers (e.g. Azman et al., 2016) solely, while the present study aimed to feature STEMM women academics in Malaysia, as well as exploring both the means of support and barriers in achieving career success amongst them. Thus, it led to the development of second research question. By understanding the means of support and barriers in achieving career success amongst STEMM women academics in Malaysia, it can provide better insights in developing strategies and policies that can support them in achieving career success.

In summary, by referring to the review of relevant literature in the prior sections, the following research questions were developed to address the research objectives employing a qualitative study titled “An Exploratory Study of Success amongst Science, Technology, Engineering, Mathematics, and Medicine (STEMM) Women Academics”:

(a) What are the meanings of success for women in academia?

(b) What are the psychological and organisational barriers and means of support from STEMM women academics in achieving career success?

No hypothesis was formed for this study, as this is a qualitative study.

2.5 Theories and Model

The literature review reported above, on career success, represented the foundations for the qualitative phase of the present research. Based on that, semi-structured interviews on career success and related barriers and means of support were administered to ten women academics in STEMM fields. Chapter 4 will report an account of the methodology that was used and the results that emerged from the interviews, as well as a brief discussion. In accordance with the exploratory sequential mixed-methods design used in the present research (which will be discussed in Chapter 3), those results informed the next phase of the literature review, leading to the choice of theories, model and specific variables to be investigated in the quantitative phase of the research. The remaining literature review (leading to the development of the hypotheses of the quantitative phase) is reported in the remainder of this chapter, starting with the report of the theories and model used (Job Demands-Resources model, Social Cognitive Career Theory and Gender Schema Theory).

2.5.1 Job Demands-Resources Model – 2001

The Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007; Demerouti et al., 2001) challenges the existing models relating to burnout by proposing that the conditions of work can be divided into two interacting categories: job demands and job resources and explaining their impacts on employees' well-being and performance. Notably,

over the last few decades, this model has become increasingly popular amongst researchers (Schaufeli & Taris, 2014).

Job demands are defined as “those physical, psychological, social, or organi[s]ational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills and are therefore associated with certain physiological and/or psychological costs” (Bakker & Demerouti, 2007, p. 312), such as work-related stress and a non-conducive working environment. Conversely, job resources refer to “those physical, psychological, social, or organi[s]ational aspects of the job that are either/or: functional in achieving work goals, reduce job demands and the associated physiological and psychological costs, stimulate personal growth, leaning, and development” (Bakker & Demerouti, 2007, p. 312), such as the support from supervisors and colleagues, salary and role clarity.

As depicted in Figure 1, the JD-R model contains two psychological processes which influence the development of work-related strain and motivation that include the health impairment process and the motivational process (Bakker & Demerouti, 2007). The health impairment process focuses on illustrating the process of job demands affecting employees’ physical and mental resources, which subsequently leads to exhaustion and health-related issues (e.g. breakdown) (Bakker & Demerouti, 2007; Demerouti et al., 2000, 2001; Leiter, 1993). Employees may apply performance-protection strategies to cope with job-related demands by mobilising both autonomic and endocrine sympathetic activations and increasing subjective effort in managing information processing. However, these strategies are significantly draining the energy of the employees, which can ultimately lead to a collapse in the long run (Bakker & Demerouti, 2007; Hockey, 1993).

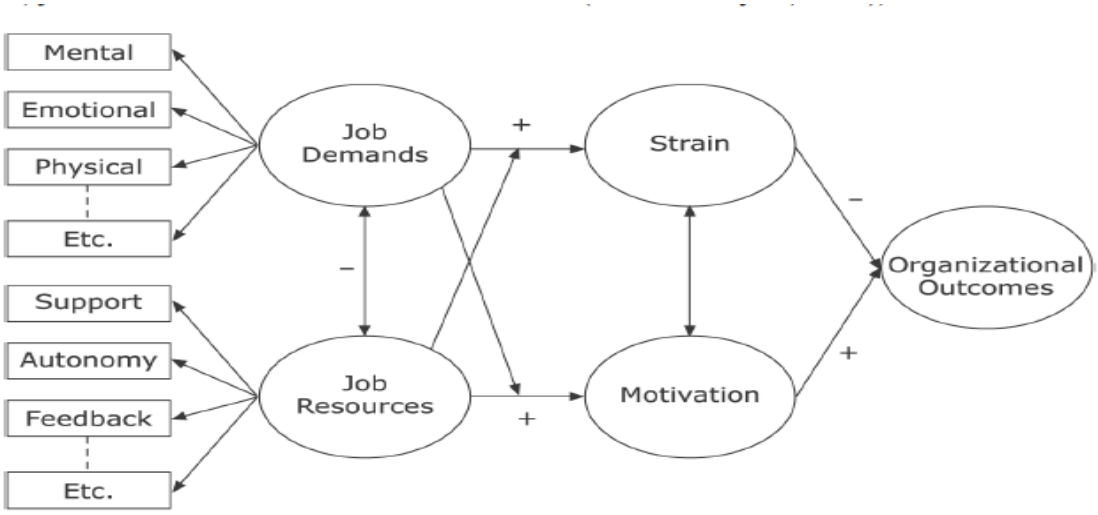


Figure 1. The Job Demands-Resources model (Adopted from Bakker & Demerouti, 2007)

In contrast, the motivational process targets the motivational potential of job resources and their positive impacts on work engagement and outstanding work performance (Bakker & Demerouti, 2007). Job resources play both intrinsic and extrinsic motivational roles in nurturing the development and growth of an employee and becoming instrumental in accomplishing work-related targets (Bakker & Demerouti, 2007). Notably, a lack of job resources will inevitably lead to an emerging cynical attitude towards the job (Bakker & Demerouti, 2007) and withdrawal behaviour and disengagement from work (Demerouti et al., 2001). Job resources can be a buffer between job demands and job strain (Bakker & Demerouti, 2007).

Rationale for using the JD-R model in the present research

This section will explain the rationale for adopting the JD-R model in the present research. First, one of the strengths of the JD-R model is in its breadth and flexibility towards allowing any types of demands and resources for explaining the factors that impact employees' health and well-being and organisational outcomes (Demerouti & Bakker, 2011; Schaufeli & Taris, 2014). Thus, the model allows the present research to investigate several

job resource variables (i.e. recognition, supervisor support and feedback, and support from colleagues) and job demand variables (i.e. work-family conflict and family-work conflict), that have been chosen based on the literature reviewed in this chapter.

Second, the JD-R model has been widely employed amongst researchers and practitioners from different organisational settings (Bakker & Demerouti, 2007; Demerouti & Bakker, 2011; Schaufeli & Taris, 2014). Additionally, the JD-R model has been applied amongst academics and has demonstrated its applicability amongst them (Barkhuizen et al., 2014; Boyd et al., 2010). Hence, the JD-R model is a suitable fit for the existing research.

Third, the authors of the JD-R model have encouraged researchers to integrate additional constructs to better explain the complicated phenomena of an organisation (Demerouti & Bakker, 2011). This reflected prior studies showing additional relevant factors that were not encompasses by the original theory. Personal resources (self-efficacy, organisational-based self-esteem and optimism) are mediators in the relationship between job resources and engagement or exhaustion (Xanthopoulou et al., 2007). While conversely, emotional exhaustion was discovered to have correlations associated with psychological job demands and workplace social support amongst Dutch nursing employees (Janssen et al., 2004). Further, there were also correlations found between job satisfaction and both job control and workplace social support amongst the same sample (Janssen et al., 2004). Additionally, as understood from the SCCT, self-efficacy, outcome expectations, and interest have been serving as mediators between both person and environmental inputs and career outcome variables (Lent et al., 1994). Demerouti and Bakker (2011) took particular notice of the value of using self-efficacy as a mediator in the JD-R model. Therefore, in order to provide a more comprehensive explanation of the relationship between the predictors and career success, the JD-R model has incorporated some of the variables of the SCCT (Lent et al., 1994) in the present research. The literature supports this incorporation of the JD-R model

with the SCCT, particularly the mediators from the SCCT (i.e. self-efficacy, outcome expectations and interest) in the present research. This aims to capture the impact of job demands and resources of the JD-R model and jointly explain the sophisticated process of the mediators from the SCCT leading to women academics' career success.

2.5.2 Social Cognitive Career Theory – 1994

Even though the Social Cognitive Career Theory (SCCT; Lent et al., 1994) was developed based on Albert Bandura's (1986) social cognitive theory (SCT), it has since outgrown the original model by targeting the interaction and effects of gender, culture, social context, genetic endowment and sudden life incidents on career-related choices (Prescott & Bogg, 2013; Savickas & Lent, 1994). This theory discusses "the connection of self-efficacy, outcome expectations and personal goals, interests and environmental factors that influence an individual's career choice" (Prescott & Bogg, 2013, p.142). Notably, self-efficacy, outcome expectations and personal goals are the three fundamental variables in SCCT (Lent et al., 2002).

Lent, Brown and Hackett (2002) describe SCCT as follows:

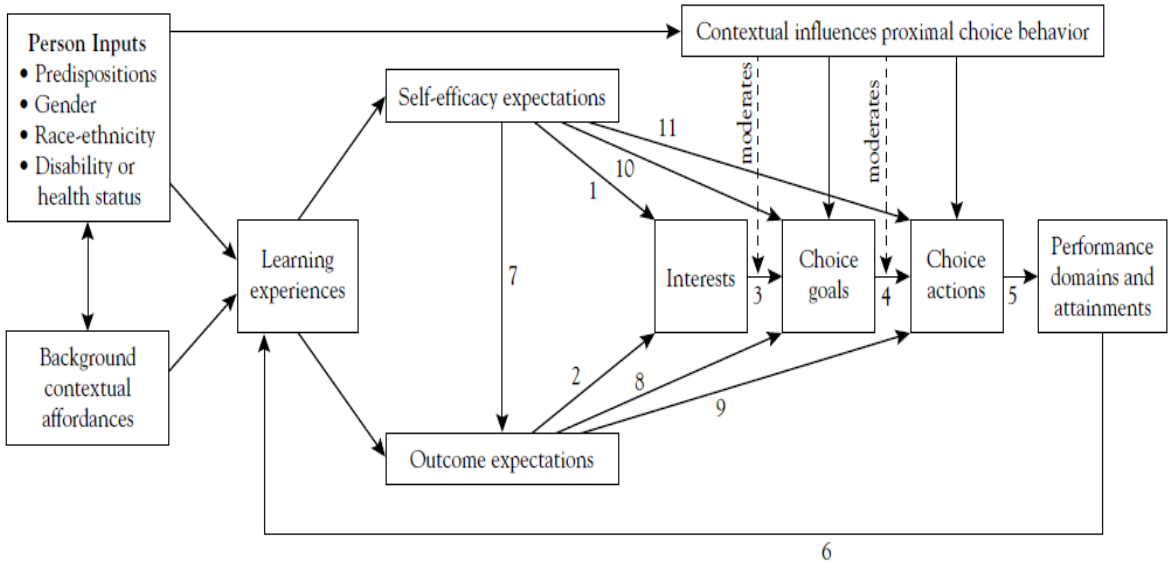
> SCCT stems more directly from social cognitive theory, reflecting an increased emphasis on cognitive, self-regulatory, and motivational processes that extend beyond basic issues of learning and conditioning…SCCT is more concerned with the specific cognitive mediators through which learning experiences guide career behaviour; with how variables such as interests, abilities, and values interrelate; and with the specific theoretical paths by which person and contextual factors influence career outcomes. (p. 259)

SCCT is divided into two levels of theoretical analysis: (1) the first level (cognitive-person variables): self-efficacy, outcome expectations, personal goals, and (2) the second level: physical attributes, conditions of the environment, and certain learning experiences (Lent et al., 1994). The majority of studies tend to concentrate on SCCT's cognitive-person variables solely without including the influential environmental variables into the framework (Lent et al., 2000). However, Lent and colleagues (2000) stress the fundamental concept of SCCT regarding the interactions between the person and environmental variables during the process of making a vocational choice.

The SCCT explains that self-efficacy beliefs are developed through personal performance accomplishments, vicarious learning, social persuasion and physiological states and reactions which will invariably affect one's career choice (Bandura, 1997; Prescott & Bogg, 2013). On the other hand, outcome expectations consist of numerous beliefs, i.e. extrinsic reinforcement (e.g. monetary gains for a well-performed project), output that results during the process of working on a task (e.g. enjoying the task) and the outcome, which is self-directed (e.g. being proud of achieving something) (Lent et al., 2002). As explained in the SCCT (refer to Section 2.5.2), self-efficacy can affect outcome expectations and interest. Likewise, outcome expectations can affect self-efficacy and interest as well, which, in turn, will affect performance domains and attainments (Lent et al., 1994, 2000, 2002).

The full SCCT framework comprises of three interconnected models, namely the interest development model, choice model, and performance model (Lent et al., 2002). As illustrated in Figure 2, we can see that one's learning experiences are influenced by one's person inputs, such as predispositions, gender, race-ethnicity, and disability or health status including background contextual affordances or environmental variables (Lent et al., 1994, 2000, 2002). Indeed, these experiences then strengthen or weaken one's self-efficacy and outcome expectations. Moreover, self-efficacy can affect outcome expectations. Accordingly,

one is more likely to increase or decrease interests, goals and actions related to that specific activity. Finally, the choice actions will affect performance domains and attainments (Lent et al., 1994, 2000, 2002). For example, due to societal gender stereotypes, being a woman might affect the learning experiences in STEMM, lowering self-efficacy and outcome expectations, and leading to lower interest in STEMM, affecting goals and actions, and ultimately leading to poorer performance.



Note: Direct relations between variables are indicated with solid lines; moderator effects (where a given variable strengthens or weakens the relations between two other variables) are shown with dashed lines.

Figure 2. Social Cognitive Career Theory Model (Adopted from Lent et al., 2002)

The interest development model focuses on the development of interest through cognitive and experiential factors (e.g. exposure to different activities). In this process, the individual begins to develop self-efficacy (e.g. Do I have the ability to do it?) and outcome expectations (e.g. What consequence will I get if I do it?), which will lead to the direct development of vocational related interest (Lent et al., 2002). Accordingly, increased interest will endorse the intentions or goals for involvement in the activity (e.g. setting goals to have further similar activities) and the selection and training of the activity (e.g. engaging more in

those activities), which subsequently will lead to performance outcomes (e.g. grades) (Lent et al., 2002).

SCCT's choice model builds upon the previously discussed interest development model and discusses the process of career choice, in which self-efficacy, outcome expectations, and interest can affect career choice goals and actions (Lent et al., 2002). Here, when an individual has a clear choice goal, he or she will take appropriate action to accomplish the goal, which will lead to performance attainments, either success or failure and in turn, will either strengthen or weaken his or her self-efficacy and outcome expectations (Lent et al., 2002). Also, distal contextual influences affect the career choice made by an individual (e.g. chances for developing a skill) and proximal influences (e.g. financial and social support when making a decision) (Astin, 1984; Lent et al., 2000, 2002; Mitchell & Krumboltz, 1996).

Lastly, the performance model targets the performance level or quality and behavioural perseverance in achieving career success (Lent et al., 2002). An ability or past performance (e.g. winning a Science award) will affect self-efficacy and outcome expectations, which will subsequently influence performance goals and sub-goals (e.g. having plans to engage in more science-related experiments) and lastly changes the performance attainment level (e.g. becoming a more successful scientist) (Lent et al., 2002). Successful performance can promote ability formation, which will affect self-efficacy and outcome expectations, leading to a cycle that is dynamic (Lent et al., 2002).

Rationale for using the SCCT in the present research

Upon reviewing the literature, the present research adopted the SCCT to be combined with the JD-R model primarily because researchers report a good fit of the SCCT-based model of interest and choice goals within empirical studies looking at gender and university type (Lent

et al., 2005). SCCT, compared to other career theories, has a relatively more comprehensive framework that connects social cognitive variables, self-efficacy, outcome expectations, vocational interests, choice goals and actions, and performance attainments together in explaining the progress of career development across genders, given it has incorporated the theory and study on career development using women in its design (Hackett & Betz, 1981; Lent et al., 2002). In contrast, the theory of Ginzberg and colleagues' (1951) does not suit this research framework as its lack the recognition of issues concerning gender (Trice & Greer, 2017). Similarly, Super's theory (1953) is not suitable as it has omitted women in the development of the theory (Savickas & Lent, 1994). Also, Holland's career typology (1959) was found to be gender-biased (Su et al., 2009; Xu & Tracey, 2016). Moreover, gender differences in some learning experiences were observed and well related to self-efficacy and outcome expectations (C. M. Williams & Subich, 2006). Therefore, SCCT is selected as one of the theoretical frameworks for this research to examine the moderating effect of gender. Furthermore, SCCT is found to be a constructive framework that can be generalised amongst students in STEMM professions (DiBenedetto & Bembenutty, 2013; Lent et al., 2008; Patrick et al., 2011) and academics (Wang et al., 2007).

Second, Patton and McMahon (2014), in their categorisation of career theories, show how some theories only focus on content, such as Holland's theory (1959) or only focus on process, such as Ginzberg and colleagues (1951) and Super's theories (1953). Whereas, the SCCT (Lent et al., 1994) is a more comprehensive theory that focuses on both content and process (Patton & McMahon, 2014).

Third, while the JD-R model predicts the career outcome variables using job demands and resources, the SCCT also supports personal factors as predictors (Lent et al., 1994). As this research considers person (age and seniority) and environmental factors (job demands and

resources) as predictors for academics' career success or performance, the more comprehensive SCCT model is incorporated.

2.5.3 Gender Schema Theory – 1981

Sandra Bem (1981a) developed the Gender Schema Theory (GST) in 1981, which is a social-cognitive-based theory, containing features from both the cognitive-developmental and the social learning theories in explaining sex-typing (Bem, 1983). Based on Bem (1981a), sex-typing occurs when a society assign individuals into masculine and feminine categories, while society and culture also define which behaviours are gender-appropriate to either men or women. Further, Bem believes that children develop their self-concept through learning sex-linked information, behaviours and attributes since young from the cultural definitions of maleness and femaleness, and 'choose' the gender 'appropriate' schemata once they identify the sex of themselves (Bem, 1981a, 1981b). Therefore, men and women are distinguishable based on their self-concept on sex-linked information, behaviours, and attributes. She also emphasises that GST is a theory of process, as sex-typed individuals process information by partitioning it into two equivalent classes using gender schemata (Bem, 1981a). Here, gender-schematic people are more inclined to categorise information and regulate behaviours based on gender as compared to gender-aschematic individuals, who are slower to endorse gender 'appropriate' attributes (Bem, 1981a). Additionally, men or women who are gendered, also expect other individuals to play gendered roles (feminine or masculine roles) that are relevant to their gender (Bem, 1983).

GST proposes that "the phenomenon of sex typing derives, in part, from gender-based schematic processing, from a generalised readiness to process information based on the sex-linked associations that constitute the gender schema" (Bem, 1981a, p. 354). GST also believes that sex-typing is mediated by the cognitive processing of the child (when a child

learns to encode and to organise information relating to gender schema) as proposed by the cognitive-developmental theory and that sex-typing can be derived as neither inevitable nor unchangeable learned phenomenon based on the sex-differentiated practices of the social community from the social learning theory (Bem, 1983).

Central in GST is the concept of gender schemata, which is conceptualised as the "cognitive networks of associations related to gender that are shaped by sociali[s]ation" (Batalha & Reynolds, 2013, p. 171). Here, even as young as four or five years of age, girls and boys begin to prefer activities that are 'appropriate' for their sex based on the definitions of the culture in defining 'masculine' or 'feminine' (Bem, 1983). GST suggests that "people in society become gendered from an early age and the impact of this gendering on their cognitive and categorical processing occurs throughout their lifetime" (Starr & Zurbriggen, 2017, p. 2).

The GST attempts to explore "how the gender polarisation so evident in the culture gets internalised by individuals without their realising it" (Golden & McHugh, 2017, p. 9). Some of the common unconscious internalisations are that housework and childrearing are the responsibilities of the wife and that the priority should always be placed on the career of the husband (Bem & Bem, 1970). Researchers have identified several gender schemata relating to academia and the workplace, such as 'think manager-think male' (Schein, 1973, 1975), 'think crisis-think female' (Ryan et al., 2011), 'think professor-think male' (Tharenou, 1994) and 'think vice chancellor-think male' (Tilbrook, 1998). Accordingly, these schemata are initiating linking of the sex of an academic to a heuristic cognitive processing in which they suit a particular role or not within the university setting. For instance, if a woman is appointed as a manager or professor, gender-schematic men or women might perceive such an appointment as 'gender-inappropriate' for women and that women are not fit to hold such roles (Bem, 1983). Despite the gender-aschematic women who may be confident to opt for

these roles, if the society is filled with gender-schematic people, it is very challenging for women to be successful or to be acknowledged in these roles (Bem, 1983).

Hence, Bem (1974) coined the term ‘psychological androgyny’, referring to a psychological state which has “both stereotypically feminine and masculine attributes within the same individual” (Dean & Tate, 2017, p. 643). Bem strongly endorsed this notion, despite the traditional belief of that time that women should hold feminine attributes and men should hold masculine attributes for optimal mental health (Bem, 1975). It is believed that the cognitive flexibility of psychological androgyny allows an individual to participate in any activity freely without being concerned with the traditional masculine or feminine stereotypes (Dean & Tate, 2017).

Even though this theory has been established for nearly four decades, Starr and Zurbriggen (2017) found that GST remains widely quoted not only in United States’ psychology journals but also in international journals and business and communication journals, making it a theory of wide scope and impact.

Applying the GST

GST can help highlight some of the processes behind gender differences in academic career success. STEMM fields are perceived as being male-dominated fields (Cheryan et al., 2015; C. C. Hayes, 2010; Hill et al., 2010) in which women tend to encounter more challenges (Burger, 2012; Burke, 2007; Veltri et al., 2010) given the historically strong associations of ‘science and math fields with males’ and the ‘humanities and arts fields with females’. Accordingly, this has led to implicit bias if women are holding ‘masculine’ or STEMM careers as compared to the more ‘feminine’ fields of non-STEMM (Hill, Corbett & Rose, 2010). There is a form of gender schemata in which men are stronger in mathematical skills and thus are more suited to STEMM fields’, despite this being disproved by several

studies (Hyde et al., 2008; Lindberg et al., 2010; Lynn & Irwing, 2004). This explains how gender could be a strong moderator in STEMM context. The application of GST is based on the reasons provided below.

First of all, this theory is also a social-cognitive theory, like SCCT (Lent et al., 1994). As such, this can ensure better integration between theories to the main selected model of this research – the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001). Given both theories emphasise on both social and cognitive aspects in explaining gender, it can provide a consistent explanation. SCCT targets on the interaction and effects of gender on career-related choices (Prescott & Bogg, 2013; Savickas & Lent, 1994) by emphasising on cognitive, self-regulatory, and motivational processes (Lent et al., 2002). While GST uses the cognitive-developmental and the social learning theories in explaining sex-typing (Bem, 1983), a condition that happens when a society assign individuals into masculine and feminine categories as well as which behaviours are gender-appropriate to either men or women (Bem, 1981a). Hence, GST was selected.

Second, this theory focuses on gender schemata and how they can be internalised unconsciously, especially with regards to gendered roles (Bem, 1981a; Golden & McHugh, 2017). The application of this theory to the present research can assist in explaining the main variable – gender and how it can influence other variables better. This theory proposes that sex-typing is changeable since it is learnt from society and culture, and as such, it can also be unlearnt (Bem, 1983). This can help to support in providing various practical suggestions on how we can help people (men and women) unlearn gender schemata and not be excessively influenced by their attitudes towards gender.

Lastly, this theory remains relevant to existing society despite being introduced nearly four decades ago (Starr & Zurbriggen, 2017). Regarding gender roles, Malaysia is still a traditional country despite there being some improvements in gender equality (Hirschman,

2016; J. E. Williams & Best, 1990b, 1990a) due to the high collectivist culture as suggested by Hofstede Insights (2018). Therefore, this theory is deemed suitable to be used in this research to explain the impact of gender in the context of Malaysia.

2.6 The Moderating Role of Gender

The moderator in the context of this research can be defined as the third variable (Z) that:

> …changes the relationship between a predictor (X) and an outcome (Y), thereby affecting the strength and/or direction of the relation between the two variables. The moderator (typically a covariate or secondary predictor of interest) interacts with the primary predictor variable to influence the outcome, such that any effects of the primary predictor on the dependent variable are conditional on, or dependent on, values of the moderator. (Fairchild & McQuillin, 2010, p. 59)

In this thesis, gender serves as a key moderator in the mediated relationships. The rationale for selecting it as a moderator is explained below.

As outlined in the previous section, in Gender Schema Theory (Bem, 1981a), it proposes that people are believed to form gender schemata based on gender (e.g. ‘gendered household chores’) since early childhood, and that these schemata subsequently affect their perceptions of themselves and others during their lifetime (Starr & Zurbriggen, 2017). At the same time, in Social Cognitive Career Theory, Lent and colleagues (2002) included gender as a variable under the ‘person input’ that will affect self-efficacy, outcome expectations, interest, and eventually affect career success. Thus, in SCCT, gender represents one of those person variables that interact with environmental variables in affecting career outcomes.

STEMM fields are regarded as mainly male-dominated fields (Cheryan et al., 2015; C. C. Hayes, 2010; Hill et al., 2010) in which women tend to encounter greater challenges (Burger, 2012; Burke, 2007; Veltri et al., 2010). While several researchers have observed the strong moderating effect of gender on career success in general (Melamed, 1995; Ng et al., 2005), numerous studies have highlighted gender differences in research productivity (Fox, 2005; Prpic, 2002; Stack, 2004; Xie & Shauman, 2003), which seems to favour particularly STEMM men academics (Abramo et al., 2009; Fox, 2005). The same effect has been found with regard to teaching performance (Centra & Gaubatz, 2000; Chua & Kho, 2015, 2013; Hamermesh & Parker, 2005; MacNell et al., 2015; Subbaye & Vithal, 2017; Zhukov, 2012). Taken together, these differences have yielded inconsistent outcomes and unequal career advancements, with greater opportunities for men academics (Carr et al., 2003; Liu & Alexander, 2010; Sexton et al., 2012).

Researchers have produced several metaphors to represent the conditions or issues encountered by women, which include STEMM women academics, such as a leaky pipeline (Blickenstaff, 2005; Miller & Wai, 2015), glass ceiling (Barreto et al., 2009; Frenkiel, 1984), sticky floor (Booth et al., 2003; Yap & Konrad, 2009), tokenism (Alpay et al., 2010; Kamberidou, 2010; Smith et al., 2012) and gender fatigue (Kelan, 2010). Additionally, as mentioned earlier, there are numerous gendered occupational or professional stereotypes such as ‘think manager-think male’ (Schein, 1973, 1975), ‘think crisis-think female’ (Ryan et al., 2011), ‘think professor-think male’ (Tharenou, 1994) and ‘think vice chancellor-think male’ (Tilbrook, 1998). Therefore, founded on these scenarios and stereotypes, we can perceive the struggles of women academics, especially those in STEMM fields.

As will be discussed in detail in what follows, gender has been shown to function as a moderator in studies on career success. However, limited studies have been undertaken in the context of Malaysia to explore gender as a moderator on career success amongst academics

(Abrizah & Wee, 2011; Chua & Kho, 2015, 2013; Davarpanah, 2009; Ismail & Arokiasamy, 2007; Yazit & Zainab, 2007). This research gap represents an additional valid reason for selecting gender as a moderator in this current research.

Review of Gender as a Moderator

The following section provides a more in-depth review of the literature supporting the selection of gender as a moderator in the mediated relationships in the present thesis.

STEMM fields are male-dominated fields

As mentioned previously, STEMM fields are commonly acknowledged as male-dominated fields (Cheryan et al., 2015; C. C. Hayes, 2010; Hill et al., 2010) and women often face significant challenges when trying to pursue a career in STEMM fields (Burger, 2012; Burke, 2007; Veltri et al., 2010). Historically, the strong association of 'science and math fields with males' and 'humanities and arts fields with females' has led to implicit bias that invites people to hold negative opinions of women holding 'masculine' or STEMM careers, and tend to judge the ability and competency of STEMM women as lesser compared to men's (Hill, Corbett & Rose, 2010). Many people remain steadfast in their views and beliefs that men are much stronger in mathematical skills and as such, are more suited to STEMM fields, although a few studies have disproved this belief (Hyde et al., 2008; Lindberg et al., 2010; Lynn & Irwing, 2004). Therefore, it is not difficult to understand why women generally have little interest in STEMM subjects and, even once beginning a career in these fields, are more likely to leave these fields compared their male counterparts. Accordingly, this condition suggests that existing STEMM women academics are indeed precious and important to retain, given they had overcome so much to attain a STEMM academic position in the first place.

Gendered metaphors

Nevertheless, several metaphors have been generated by researchers in describing the various conditions or issues encountered by women, which capture issues or struggles closely related to STEMM women academics, such as leaky pipeline, glass ceiling, sticky floor, tokenism, and gender fatigue.

The metaphor, 'leaky pipeline' is a commonly used metaphor to portray the scenario of females leaving the academic pathways of STEMM fields gradually. However, not only women leave these fields, but also men as well; although the number of men leaving these fields is generally fewer than the number of women (Blickenstaff, 2005). Given the situation in which those who leave the fields are being labelled as 'leaks' or 'drips', Miler and Wai (2015) report that such negative connotations often instil some level of guilt in some women. Some researchers suggest reconceptualising this as it does more-harm-than-good and labelling it to a 'singular pipeline with a network of multiple pathways into and out of STEMM', in order to acknowledge other entry points into STEMM rather than the Bachelor's degree. Also, to recognise women who have chosen to leave the academia due to other more satisfying ambitions (Cannady et al., 2014; Miller & Wai, 2015; Webb et al., 2002; Xie & Killewald, 2012; Xie & Shauman, 2003).

Blickenstaff (2005) postulates that it could be the masculine nature of science that leads to the falling or 'dropping off' of women from the STEM 'pipeline', such as biological differences between both genders, girls' lack of academic preparation for a science major or career, poor attitude toward science and lack of childhood's positive experiences with science, lack of female scientists as role models, irrelevant science curricula to many girls, pressure from traditional gender roles, 'chilly climate' for girls in science, masculine work view in scientific epistemology, and masculine pedagogy of science. This issue cannot simply

be resolved by ‘pouring more fluid down a drain’ to ‘fix a leak’ (Association for Women in Science, 2013), which is what western educators have been doing for well-over 20 years, using programmes like ‘Project Access’ in the US, ‘Girls Into Science and Technology’ (GIST) and ‘Women in Science and Engineering’ (WISE) in the UK (Blickenstaff, 2005; Sonnert & Holton, 1995). Therefore, it is essential to examine the possible obstacles that women encounter and what drives them to leave academia.

Next, ‘glass ceiling’ refers to subtle and glass-like barriers that obstruct women from moving up the organisational ladder, as if they have already reached the upper limit (Barreto et al., 2009, p. 5). This term was initially documented by Gay Bryant, a magazine editor who used the term to describe the scenario where women stop and get trapped at the top of middle management (Frenkiel, 1984). However, even if women manage to break through the ‘glass ceiling’, they are more than likely to encounter another hurdle, which is called the ‘glass cliff’; a phenomenon where women are promoted during the downtime with a high risk of experiencing failure (Ryan & Haslam, 2005). Nevertheless, the saddest case is where women may not even make it through the ‘glass door’, which is an initial hiring barrier that refrains them from entering the organisation (Barreto et al., 2009). Whereas in contrast to women, men are travelling on the ‘glass escalator’ more compared to women (Kamberidou, 2010). The glass escalator is a term coined by the sociologist Christine Williams (1992) that is used to describe those who experience positive discrimination whereby they move up the corporate ladder much faster than others.

In contrast, the ‘sticky floor’ is a phenomenon where women are paid at the bottom of the same pay scale or grade, while men with identical qualifications, skills and tasks are paid further up the scale (Booth et al., 2003). The term is also used to describe larger differentials for those at the lower organisational levels, such as large promotional disadvantages amongst women at lower organisational levels (Yap & Konrad, 2009). There is speculation that some

women rarely reach out to obtain a senior position due to their reticence regarding their abilities, the experience of encountering discrimination, unwillingness to take up heavy job demands that accompany the position and uncertainty regarding their decision in moving forward (Chesterman et al., 2005). Also, women are less likely to apply for a promotion as compared to men even though they have outperformed men. Interestingly, men would apply for a promotion even though they only met 60% of the promotion criteria while women would only apply for positions where they were certain of meeting all the criteria (Desvaux et al., 2008).

Next, ‘tokens’ refer to individuals who are employed or treated better given their minority status, in reference to gender, ethnicity, skin colour, and so on (Kamberidou, 2010). In some situations, the low visibility of female scientists in a department may be seen as if they were promoted due to tokenism rather than their actual capability (Alpay et al., 2010). In this case, some people may not be aware of their existence, skills, and capability. Even though both men and women experience tokenism when they enter a profession where most employees are of the opposite gender, they obtain significantly different treatment. Females who are seen as serving as tokens often receive reminders of their outsider status, are used to beautify the male group's solidarity, and are offered little opportunities of taking up prominent positions (Kamberidou, 2010), and may experience sexual harassment given their minority identity (Smith et al., 2012). On the contrary, when men are treated as tokens, they often have distinct advantages in recruitment and promotion, receive more encouragement to move up the organisational ladder and usually travel in the ‘glass escalator’ in their career (Kamberidou, 2010).

‘Gender fatigue’ is defined as the loss of energy and limited interest in overcoming issues related to gender, or being unable to acknowledge or to be aware of the existence of gender discrimination issues (Kelan, 2010). Indeed, it is disturbing to think that there is a

problem, but no one else seems to view or recognise it as a problem. Occasionally, the questions are not as simple as ‘don’t we already have some women who are on higher academic ranks/grades or even in leadership positions?’ or ‘do we really still need more women on the board when we already have so many?’ Notably, women still face discrimination, be it subtle or obvious in their workplace.

Furthermore, the gendered occupational or professional stereotypes mentioned earlier, such as ‘think manager-think male’ (Schein, 1973, 1975), ‘think crisis-think female’ (Ryan et al., 2011), ‘think professor-think male’ (Tharenou, 1994) and ‘think vice chancellor-think male’ (Tilbrook, 1998) could contribute to perceived unsuitability and unfavourable evaluations of the actual behaviours of female leaders, which places women in a lose-lose scenario in both cases (Ryan et al., 2011).

Gender as a moderator in relation to research, teaching and career advancement

Though many factors affect career success, one may be surprised to see how strong the role of gender identity plays in the achievement of career success. Melamed (1995) discovered that gender is a strong moderator for career success. He found that women obtain career success through merits, lack of domestic duties, and favourable characteristics of organisational and occupational opportunity structure, whereas the career success of men is achieved via their personality and societal opportunity structure. A meta-analysis study also observes the moderating effect of gender between several predictors and career success (Ng et al., 2005). For instance, the organisational tenure-salary relationship is stronger for men than for women, indicating that despite women being loyal contributors to the organisation, their salary does not reflect that, whereas the hours worked-salary and education-salary relationships are weaker for men than for women, implying that women may need to prove their credentials by having greater educational experiences to obtain higher-paid jobs, and

that women need to work longer hours to demonstrate their commitment to the organisation and obtain recognition by managers (Ng et al., 2005). A qualitative study also supports that gender is one of the important career barriers influencing career success, particularly amongst Portuguese women academics (Santos, 2016).

Gender differences in research. Also when looking specifically into gender differences in research work, many studies have revealed that males tend to achieve higher research productivity compared to females (Fox, 2005; Prpic, 2002; Stack, 2004; Xie & Shauman, 2003). Research is overvalued and is currently viewed as work exclusively performed by men, whereas teaching is undervalued and is mainly assigned to women (Armenti, 2004). Also, STEMM men, in particular, have higher research productivity compared to women overall (Abramo et al., 2009). In a study by Fox (2005), gender disparity in extreme levels of research productivity was revealed, in which male scientists were twice as likely to publish 20 or more papers, compared to women scientists who were twice as likely to publish fewer than two publications.

Some explanations for the lower research productivity of women academics have been found to rely on the lower visibility of women as productive academics and potential collaborators given the less likelihood of men viewing the work of women (Baker, 2012); increased difficulties in attaining collaborations due to relatively fewer women in the fields of science and engineering (Bentley, 2003; Tower et al., 2007); fewer female journal editors and board members (Kennedy et al., 2001; Metz & Harzing, 2009; Stegmaier et al., 2011); significantly higher amounts of time spent on administration and teaching roles (Aiston & Jung, 2015); less access to information relating to research (e.g. funding opportunities, invitation for publications, co-authorship and networking) (Franca & Padilla, 2017); and gender bias in grant funding applications favouring male applicants over female applicants (R. van der Lee & Ellemers, 2015).

Gender differences in teaching performance. There appears to be a gender difference in teaching performance too. Female teachers in general tend to receive a lower rating in teaching performance compared to male teachers (Centra & Gaubatz, 2000; Hamermesh & Parker, 2005), which raises the concern of potential bias of students regarding the teachers' gender. In an experimental study in the United States, gender bias used in rating teaching performance was examined. The students evaluated the perceived male identity lecturer with significantly higher ratings in teaching performance compared to the perceived female identity lecturer, particularly concerning professionalism, promptness, fairness, respectfulness, enthusiasm, giving praise, and the student rating index (MacNell et al., 2015).

However, such results are not always consistent. Fittingly, in a study conducted in Malaysia, the students evaluated female lecturers as having significantly better teaching performance than the male lecturers (Chua & Kho, 2015, 2013). Similar results were reported in another study conducted in South Africa (Subbaye & Vithal, 2017), supporting females as better teachers compared to their male counterparts.

Gender differences in career advancement. Gender also plays a role in career advancement in higher education. A longitudinal study in Netherlands found that more men academics (61%) were promoted to full or associate professor positions as compared to women (32%) (van den Besselaar & Sandström, 2016). In Switzerland, women academics who are treated as 'tokens', in which the proportion of women is lower than 15%, networks with few structural holes can reduce years without internal promotion, whereas men benefit from networks with multiple structural holes (C. Schoen et al., 2018). Conversely, another study in Nigeria showed that gender did not affect women academics' career advancement (Yusuff, 2014).

Particularly in academic medicine field, gender discrimination is ranked as the top reason (followed by limited time for professional work and lack of mentoring) that obstructs

the career advancement of women (Carr et al., 2003). In a study by Sexton and colleagues (2012), a total of 80% of women academic physicians believed that their gender was one of the reasons that would limit their opportunities of obtaining a promotion, whereas 70% of their male colleagues believed that gender would not limit their promotional opportunities. In the United States, male medical assistant professors and associate professors were found to be promoted much faster than their female counterparts in a longitudinal study undertaken between 1967 and 1997 (Liu & Alexander, 2010). In the same study, male medical assistant professors and associate professors were promoted on average 0.3 years faster than females in the cohorts between 1987 and 1996 (Liu & Alexander, 2010). Although, in a different study, gender did not affect the promotion rate amongst academics in medicine (Beasley et al., 2006).

It has been suggested that one of the main challenges that obstacle women career advancement relates to gender expectations. Outside of work, women academics are often expected, if not required, to play a more active role compared to men in the context of the family, household chores and childcare. One of the ways in which this affects women academics is the so called ‘moving ethic’. Women remain affected by the ‘patriarchal professional values’ in academia, since the willingness to relocate or the ‘moving ethic’ is viewed as an indication of their career commitment, without considering other potential personal costs towards personal relationships, community ties, preference for a particular region, children’s lives, elderly parents and friendship networks that often affect more women more so than men (Franca & Padilla, 2017; Kauffman & Perry, 1989). Women who are ‘geographically bound’ also have limited academic mobility, less career advancement opportunities, and less access to research-related information that can enhance their research productivity compared to their male counterparts (Franca & Padilla, 2017; Kauffman & Perry, 1989).

These expectations tend to be much stronger in certain cultural contexts, historically characterised by gender role ideologies that firmly recognise the differences between male and female duties and obligations (Williams & Best, 1990). Since the 1990s, Malaysia has been amongst the most traditional countries regarding gender roles (Williams & Best, 1990), which is likely to relate to Malaysia's collectivist culture, as categorised by Hofstede Insights (2018) with a score of 26/100 in the individualism dimension.

Another phenomenon that has been suggested to be at the basis of gender differences in career advancement in academia is the impostor syndrome (Clance & Imes, 1978). Since the early 1970s it has been shown repeatedly how the impostor syndrome affect high achieving individuals, particularly women (Clance & Imes, 1978). 'Imposters' perceive themselves as incompetent and as not belonging to a successful group of peers, despite their excellent performance in academic and workplace settings (Clance & OToole, 1987). Such syndrome or phenomenon continues to affect women academics more in recent years (Fotaki, 2013).

Limited Studies in Malaysia

Several studies were undertaken to investigate research productivity and career advancement in Malaysia, although, these studies failed to include gender as a variable (Abrizah & Wee, 2011; Davarpanah, 2009; Ismail & Arokiasamy, 2007; Yazit & Zainab, 2007). The author of this thesis observed that there appears to be limited studies relating to teaching performance in higher education conducted in Malaysia as the studies either focus on teaching styles in higher education (e.g. Amira & Mohd Jelas, 2010) or peer review of teaching in higher education (e.g. S. Thomas et al., 2014), with only limited studies examining gender differences in teaching performance (Chua & Kho, 2015, e.g. 2013). Some studies recruited only women academics as participants but failed to compare with men

academics. For instance, Achour, Mohd Yusoff and Mohd Nor (2014) investigated the moderating effect of supervisor support between work-family demands and life satisfaction amongst women academics, whereas Ismail and Mohd Rasdi (2007) explored the impact of networking on career advancement amongst women professors.

Therefore, the present thesis attempts to close this research gap by focusing on the role of gender in the mediated relationships between person and environment variables on interest in research productivity, teaching performance, and career advancement through self-efficacy and outcome expectations. As also supported by JD-R (Bakker & Demerouti, 2007; Demerouti et al., 2001), SCCT (Lent et al., 1994) and GST (Bem, 1981a), gender was expected to moderate the effects of age, seniority, recognition, supervisor support and feedback, support from colleagues, work-family conflict and family-work conflict on interest (in research, teaching and career advancement) through self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement).

2.7 The Mediating Roles of Self-Efficacy, Outcome Expectations, and Interest

The term ‘mediator’ in this study refers to the third variable that:

> …explains how or why two other variables are related. The mediation model is a three-variable model where an independent variable (X) predicts a mediator variable (M), which in turn predicts an outcome (Y). The mediator intervenes in the relation between X and Y, thus illustrating the mechanism through which the two variables are related. (Fairchild & McQuillin, 2010, p. 68)

In the present research, self-efficacy, outcome expectations, and interest are selected as the mediators based on the following rationale.

First, as discussed in Section 2.5.2, SCCT has been supporting the concept for which self-efficacy, outcome expectations, and interest serve as mediators between both person and environmental inputs and career outcome variables (Lent et al., 1994). As such, there is strong theoretical support to explain the mediating role of self-efficacy, outcome expectations, and interest between the relationship of both person and environmental inputs and career outcome variables.

Second, by incorporating these mediators, we can respond to the calling of the author of the JD-R model to integrate further constructs to better explain the complicated phenomena regarding an organisation (Demerouti & Bakker, 2011). By including self-efficacy, outcome expectations, and interest as mediators in the JD-R model, we can integrate both theoretical concepts in order to provide a more in-depth explanation of the phenomena confronted by academics in Malaysia.

Third, while using self-efficacy as a mediator in the JD-R model (Demerouti & Bakker, 2011; Xanthopoulou et al., 2007) has already been done in previous research (Demerouti & Bakker, 2011), outcome expectations and interest have not, to the author knowledge, been used within the JD-R model until now. Thus, this research is contributing to the literature by combining these additional two variables from SCCT into JD-R.

2.7.1 Self-Efficacy

Self-efficacy is typically defined as “people’s judgments of their capabilities to organise and execute courses of action required to attain designated levels of performance” (Bandura, 1986, p. 391). Self-efficacy focuses on the individual’s ability (‘Can I do this?’) (Lent et al., 2002, p.262).

Historically, even from many decades ago, male students were recognised as having equally high efficacy beliefs for both traditionally male and female occupations, but female

students tended to view themselves to be capable of only performing traditional female occupations (Betz & Hackett, 1981). Unfortunately, this continues to affect males and females upon entering the academic field. Also, women academics were found to be most confident in teaching, followed by administration, and, only last, research, whereas for males, they were most confident in teaching but least confident in performing miscellaneous tasks (L. G. Schoen & Winocur, 1988).

Research self-efficacy has a significant but small correlation with research productivity amongst academics. According to Pasupathy and Siwatu (2014), higher total quantitative research self-efficacy strength index leads to higher total research productivity amongst academics that primarily conduct quantitative research. This study also found that total qualitative research self-efficacy had a significant positive correlation with the publication of research studies in peer-reviewed journals amongst academics that conducted primarily qualitative research. In contrast, the total multi-method research self-efficacy strength index was shown to have a significant positive relationship with higher book chapter publication amongst academics who performed both quantitative and qualitative research (Pasupathy & Siwatu, 2014). In another study, research self-efficacy was shown to have a direct and indirect association with an interest in research through research outcome expectations amongst academics in life sciences (Sawitri et al., 2018). A different study also ascertains that research self-efficacy, and research outcome expectations still accounted for 37% of the variance in interest in research despite controlling personal and professional background variables, , with the highest percentage (31%) resulting from research self-efficacy (Eam, 2015). The effect of research self-efficacy on interest in research failed to show any significant differences across disciplines (Social Science and related fields, Natural Science and related fields, and Humanity and related fields) (Eam, 2015).

Teacher' self-efficacy has received significant interest and attention from researchers (e.g. Chesnut & Burley, 2015; Coladarci, 1992; Guskey & Passaro, 1994; A. W. Hoy & Spero, 2005; W. K. Hoy & Woolfolk, 1993; Tschannen-Moran, Hoy, & Hoy, 1998; Zee & Koomen, 2016). A meta-analysis study found that teachers' self-efficacy is a strong predictor of teaching performance (Klassen & Tze, 2014). As for career self-efficacy, it has been positively associated with salary and career success, but not with career promotions (Day & Allen, 2004). However, higher self-efficacy was found to improve both objective careers success (i.e. income) and subjective career success amongst women (Valcour & Ladge, 2008).

2.7.2 Outcome Expectations

Outcome expectations can be defined as the "personal beliefs about the consequences or outcomes of performing particular behaviours" (Lent et al., 2002, p.262), and evolve on the potential outcome of a certain behaviour ('If I do this, what will happen?') (Lent et al., 2002, p.262).

In a study by Bieschke (2000), outcome expectations for research was shown to account for as high as 60% of the variance in predicting research interest. On the other hand, in the study by Eam (2005) mentioned above, it was found that research self-efficacy and research outcome expectations still accounted for 37% of the variance in interest in research even after controlling for personal and professional background variables, though the highest percentage came from research self-efficacy (Eam, 2015). Notably, there was no significant difference observed across disciplines regarding the effect of research outcome expectations on interest in research (Eam, 2015). Based on the author's knowledge, studies relating to outcome expectations for teaching and career advancement are scant. Therefore, this research aims to close this gap.

2.7.3 Interest

In SCCT, interests are referred to as vocational interests, defined as “patterns of likes, dislikes, and indifferences regarding career-relevant activities and occupations” (Lent et al., 1994, p. 88).

Interest is “a joint function of self-efficacy beliefs and outcome expectations”, as shown in the SCCT’s interest model (Lent et al., 2002, p. 272). The SCCT considers that self-efficacy and outcome expectations are predictors for educational and vocational interests (Kidd, 2014). In SCCT, increased interest will lead to increased intentions or goals for involvement in activity and selection and training of an activity, which subsequently will lead to improved performance outcomes (Lent et al., 2002). Interest in research is argued to lead to higher research productivity (Bishop & Bieschke, 1998; Kahn & Scott, 1997), but recent studies tend to find research self-efficacy as a more stable variable that predicts research productivity better than interest (Garnasih et al., 2018; Pasupathy & Siwatu, 2014; Sawitri et al., 2018). Interest in teaching is one of the qualities of effective college teachers (Okpala & Ellis, 2005) in which women are specifically observed to acquire a greater interest in teaching compared to research (Edmunds et al., 2016). As for interest in career advancement, there is a paucity of studies, but a study conducted in Nigeria (Kolade & Kehinde, 2013) showed that women’s career advancement was affected due to lack of interest.

The mediating roles of self-efficacy, outcome expectations and interest will be further explained in Section 2.9 and 2.10 by relating them to the person variables and environmental variables. In this thesis, the mentioned three variables were selected as mediators to explain the potential links between the person variables (i.e. age and seniority) and environmental variables (i.e. recognition, supervisor support and feedback, support from colleagues, work-family conflict and family-work conflict), and career success (i.e. research productivity, teaching performance and career advancement).

2.8 The Predictors of Career Success

In a meta-analysis study, human capital and sociodemographic variables were found to predict objective career success, whereas organisational sponsorship and stable individual differences were stronger predictors for objective career success (Ng et al., 2005). Also, person-environment fit and organisational support have been indicated as the key antecedents of career success (Ballout, 2007).

The predictors of career success in this thesis are divided into two categories employing the combination of the JD-R model and SCCT: the person variables and environment variables. The terms ‘person’ and ‘environment’ are selected rather than terms that are commonly used like ‘demographic’ and ‘working climate’ respectively to follow the unique terms (‘person input’ and ‘environment variables’) used in the SCCT (Lent et al., 1994, 2002). As supported in the JD-R model and SCCT, person inputs and environment inputs (divided into job demands and job resources) can affect self-efficacy, outcome expectations, interest, and eventual career success (Bakker & Demerouti, 2007; Demerouti et al., 2001; Lent et al., 1994).

The reasons for selecting the following predictors are briefly justified below before proceeding with a more detailed literature review of these predictors (leading to the development of the hypotheses in this thesis) in the subsequent sections:

- **Age** – Age appears to affect the research productivity of women academics negatively, whereas it has been found to have minimal impact on men’s research productivity (Eloy et al., 2013; Larivière et al., 2011). Regarding teaching performance, recent studies tend to show that younger academics display better teaching performance (Arah et al., 2012; Raphael et al., 2018; Zabaleta, 2007). A few studies have investigated the impact of age on career advancement and have found that age has positive impact on the probability of obtaining full professorship

(Checchi et al., 2018; Waaijer, 2015). Additionally, given the extremely high power distance index and high collectivist culture in Malaysia (Hofstede Insights, 2018), age would be an important variable for further investigation along with the moderating effect of gender, as younger STEMM women academics may have more disadvantages compared to men (Ghosh, 2011).

- **Seniority -** Van den Besselaar & Sandström (2016) found that research productivity for both genders is similar in the early stage of their career. However, after conducting a 10-year follow-up study, they found that men academics outperform women at later stages. Similar to age, seniority is also expected to be a strong variable in the Malaysia's context, given the extremely high power distance index and high collectivist culture in Malaysia (Hofstede Insights, 2018). It is believed that STEMM junior women academics may experience more challenges compared to men academics (Ghosh, 2011).
- **Recognition** - Recognition assists academics to access resources that facilitate their research and hence, leads to an increase in research productivity (David, 1994). However, STEMM women academics receive significant less recognition to that of men (Fox, 2010).
- **Supervisor support and feedback -** Supervisor support and feedback can affect subjective career success positively (Ng & Feldman, 2014) and has been found to have a positive correlation with salary, but no relation with promotion (Ng et al., 2005).
- **Support from colleagues -** Support from colleagues can lead to better subjective career success (Ng & Feldman, 2014) and higher research productivity (K. Kim & Choi, 2017). It is worth interesting whether this is the case for the specific group of STEMM women academics.

- **Work-family conflict** - Work-family conflict has been shown to negatively affect job performance (Frone et al., 1997; Karatepe & Sokmen, 2006; Netemeyer et al., 2005). STEMM women academics report that they are challenged by work-family conflict more than men (Fox, 2010; Grant et al., 2000).
- **Family-work conflict –** STEMM women academics have significantly higher family-work conflict compared to that of men, and that could be due to the gendered role in the household and family (Fox, 2010). Women face tremendous challenges when attempting to manage and balance both their work and family roles equitably fairly (Misra, 1998). As such, family-work conflict affects their job performance negatively (Frone et al., 1997; Karatepe & Sokmen, 2006; Netemeyer et al., 2005).

2.9 Person Variables as Predictors of Career Success

As mentioned above, two-person variables were selected in this thesis as predictors, namely age and seniority.

2.9.1 Age as a Predictor

Age is considered to be one of the main factors affecting a person's research productivity. Biological age is a vital individual-level factor that needs to be controlled when investigating research productivity (Hunter & Leahey, 2010). In one study, older physics academics were found to have a lower number of publications compared to younger academics (Lissoni et al., 2011). In another study, top scientists were found to be the youngest (around 45 years old) compared to medium-class (45 to 50 years old) and low-class scientists (around 55 years old) in natural resources, biology and biomedicine and materials science areas. Research productivity was also noticed to decline with age (Costas et al., 2010). Furthermore, some studies showed that scientists reached the pinnacle of their

research productivity when approaching 40 years of age and in the years after that their productivity tended to deteriorate as they became older (Bonaccorsi & Daraio, 2003; Fox, 1983).

Regarding teaching performance, based on a review study by Feldman (1983), even though some studies have failed to show any association between age and the overall evaluation of academics by students, other studies appear to show a negative association between age and the overall evaluation of the academics by students. Recent studies by Zabaleta (2007), Arah and colleagues (2012) and Raphael and colleagues (2018) have shown that younger faculty members obtain higher scores for teaching performance compared to their older colleagues, particularly on providing feedback and portraying a positive attitude towards the students.

Additionally, age can also affect career advancement. Based on a study in Germany, the average age of completing a PhD ranged between 31 and 33, whereas the average age in obtaining a professorship amongst those who completed their PhD ranged between 38.1 and 44.3 years (Waaijer, 2015). Therefore, this indicates that a PhD holder takes between 7 and 11 years to be promoted and around 15 years to move from PhD to professorship (Waaijer, 2015). In a study conducted in Italy, age was shown not to affect the probability of obtaining an associate professorship. However, age did have a positive effect on the probability of obtaining full professorship amongst non-bibliometric academics following a reform in the formation of selection committees for qualifying as a university professor; the older the age, the more likely to obtain full professorship (Checchi et al., 2018).

The role of age in this thesis as a predictor of career success makes the concepts of power distance and collectivism highly pertinent. Power distance refers to “the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally” (Hofstede Insights, 2018, para. 2). In a high

power distance context, respect is given to older employees by younger employees given their age, and not because of their competency (Ghosh, 2011). Older people are not simply respected in a high power distance context: they are often feared (Hofstede, 2011). On the other hand, collectivism refers to a culture in which "people from birth onwards are integrated into strong, cohesive in-groups, often extended families (with uncles, aunts and grandparents) that continue protecting them in exchange for their unquestioning loyalty, and oppose other in-groups" (Hofstede, 2011, p. 11). Power distance is not only significantly associated with collectivist culture but is found to be deep-rooted in it (Ghosh, 2011). Given the extremely high Power Distance Index (PDI = 100/100) in Malaysia that topped the global PDI amongst other countries globally, (Hofstede Insights, 2018; The Star Online, 2014) and that Malaysia is also a collectivist based society (with a score of 26/100 on the individualism dimension) (Hofstede Insights, 2018), it was postulated that age would have a strong effect on career success amongst academics in Malaysia.

As stated in the SCCT (Lent et al., 1994, 2000, 2002), age can serve as a person input. It can affect one's learning experiences, then strengthen or weaken one's self-efficacy and outcome expectations, and then lead to the increment or decrement of interests, goals and actions related to that specific activity. Finally, the choice actions will affect performance domains and attainments (Lent et al., 1994, 2000, 2002).

In summary from the reviewed literature, younger STEMM academics generally have better research productivity (Bonaccorsi & Daraio, 2003; Costas et al., 2010; Fox, 1983; Lissoni et al., 2011) and teaching performance (Arah et al., 2012; Raphael et al., 2018; Zabaleta, 2007). On the other hand, as can be predicted, it takes time for one to build their career, thus older academics are more likely to obtain full professorship (Checchi et al., 2018; Waaijer, 2015). Altogether, it is still unclear what makes age and research productivity, age and teaching performance, and age and career advancement correlate with each other. In this

study, it is argued that self-efficacy, outcome expectations and interest may play a mediating role in which younger academics might think they are more capable in research and teaching (self-efficacy) and have better expectations of outcome in research and teaching (outcome expectations), hence have higher interest in research and teaching, compared to older colleagues. As for career advancement, it could be that when the academics are older, they have fulfilled more promotion criteria, which makes them have higher self-efficacy, outcome expectations and interest in career advancement.

Given the theoretical foundation in SCCT (Lent et al., 1994, 2000, 2002) and the studies outlined above, age was expected to indirectly impact career success via self-efficacy, outcome expectations and interest. Thus, the following hypotheses were advanced for the current research:

> **Hypothesis 1:** Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between age and career success (research productivity, teaching performance, and career advancement).

> **Hypothesis 2:** Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between age and career success (research productivity, teaching performance, and career advancement).

Further, gender may play a significant role in producing different outcomes. Based on various studies, age tends to affect research productivity adversely, but the effect is more consistent and pronounced amongst STEMM women academics and minimal amongst men

(Eloy et al., 2013; Larivière et al., 2011). One study reported that when women professors passed the age of 38, on average, they received fewer research grants and became less productive in publications (Larivière et al., 2011). In certain fields, like internal medicine, men were found to have higher research productivity during their early-career stage (Eloy et al., 2013). Although age does not appear to affect male paediatric academics' research productivity, Eloy and colleagues (2013) found that their research productivity remained higher than their female counterparts regardless of their age group.

For teaching performance, previous studies have yielded inconsistent results concerning the impact of age and gender. Although more recent studies show that younger academics have better teaching performance (Arah et al., 2012; Feldman, 1983; Raphael et al., 2018; Zabaleta, 2007), studies also reveal that women academics tend to achieve lower rating in teaching performance (Centra & Gaubatz, 2000; Hamermesh & Parker, 2005; MacNell et al., 2015).

As for career advancement, as mentioned earlier, gender has been shown to affect women academics more negatively as compared to men (Carr et al., 2003; Liu & Alexander, 2010; Sexton et al., 2012; van den Besselaar & Sandström, 2016). In addition, gender adds another dimension to power distance, given women perceive the level of power distance more intensely than men in a male-dominated context (Ghosh, 2011). Due to the high collectivism and PDI in Malaysia (Hofstede Insights, 2018), it is not surprising that women may face higher intensity of power distance compared to men, especially in STEMM fields, that are commonly known as male-dominated fields. Likewise, given the impact from both the high-power distance index and collectivist culture, younger STEMM women academics are perceived to have greater challenges in achieving career success in the areas as research publication, teaching performance and career advancement as opposed to men.

As indicated in SCCT (Lent et al., 1994), self-efficacy and outcome expectations serve as a mediator between person input (i.e. age) and career success. When it comes to the relationships between age, self-efficacy and interest, or age, outcome expectations and interest, it is important to also explore the impact of gender. In line with SCCT (Lent et al., 1994) and Gender Schema Theory (Bem, 1981a), gender was postulated to serve as a moderator in the mediated relationship between age and interest via self-efficacy and outcome expectations. In terms of research, teaching and career advancement, the mediated relationship between age and interest via self-efficacy and outcome expectations was predicted to be different depending on the gender of the participants. The mediated relationship between age and interest via self-efficacy and outcome expectations was hypothesised to be positive especially if the participants were women. Women in STEMM are postulated to have higher self-efficacy and outcome expectations only when they are older in age. Accordingly, the following hypothesis is posited:

> **Hypothesis 3:** Gender moderates the mediated relationship between age and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

The investigation of age can help to promote anti-discriminatory practices in relation to age amongst academics in Malaysia.

2.9.2 Seniority as a Predictor

Regarding research productivity, inconsistent research findings on the impact of seniority are found. Mishra and Smyth (2013) suggest that senior academics are more

productive in research publication, since they are more experienced, have more research competencies and knowledge and a strong research network, are paid a higher salary, have less teaching loads and require less time to prepare for a lecture compared to junior lecturers. However, the researchers also counter-argue this point that junior lecturers may be more productive given they have less administrative and leadership roles, have more up-to-date research-related skills and experience greater pressure to publish in order to secure tenure (Mishra & Smyth, 2013). After all, no correlation is found between academic seniority and publication amongst lecturers in their study (Mishra & Smyth, 2013). In a different study, seniority was found to have a negative impact on self-reported total publications (K. Kim & Choi, 2017).

Teachers in higher education frequently need to learn to teach on their own. Thus, it is postulated that teaching performance will improve over time and through experience (Silva et al., 2017). However, seniority was found to have a negative association with the overall evaluation of the teacher(s) or teaching performance in some studies (Feldman, 1983; Raphael et al., 2018; Zabaleta, 2007), while in other studies, no correlation was found (Feldman, 1983; Silva et al., 2017).

According to Ghosh (2011), senior employees expect respect from junior employees in a high power distance context, regardless of their competency level. Given Malaysia's PDI is extremely high (Hofstede Insights, 2018; The Star Online, 2014), seniority is anticipated to be positioned highly during the promotion procedure. For instance, senior academics could be expected to deserve to be promoted first despite junior colleagues being more competent.

The present study aims to examine the impact of seniority on research, teaching and career advancement as the existing empirical findings are mixed and do not yield conclusive findings. As supported in the SCCT (Lent et al., 1994, 2000, 2002), it is proposed that seniority, as one of the person inputs, can affect career success through self-efficacy and

interest. One's self-efficacy and interest are likely to be affected by his or her seniority, which subsequently affects his or her career success. Hence the following hypothesis was formed:

> **Hypothesis 4:** Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between seniority and career success (research productivity, teaching performance, and career advancement).

Similarly, seniority is predicted to affect career success through outcome expectations and interest in the SCCT framework (Lent et al., 1994). It is predicted that the seniority of academics can affect their outcome expectations and interest, and as a result, their career success will be influenced as well. This leads to the development of Hypothesis 5:

> **Hypothesis 5:** Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between seniority and career success (research productivity, teaching performance, and career advancement).

When it comes to gender, in terms of research in the early career stage, it is shown that research productivity for both genders is similar, but men academics tend to outperform women, as revealed in a 10-year follow-up study (van den Besselaar & Sandström, 2016). For teaching performance, female junior instructors receive 28% of a standard deviation lower student teaching evaluation scores compared to men, especially if the courses have math-related content (Mengel et al., 2019). A study found that women are less likely to apply

for promotion compared to men, as they only apply for a promotion when they feel confident that they have all the required criteria (Desvaux et al., 2008). As mentioned above when reviewing the literature for age as a predictor, power distance and collectivist culture may add another dimension to gender, in which women perceive the level of power distance more deeply than men in a male-dominated context (Ghosh, 2011). STEMM women in Malaysia are not only in STEMM fields, which are male-dominated (Burke, 2007; Hill et al., 2010), but they are also in Malaysia, which is reflected by the extremely high PDI (Hofstede Insights, 2018). Therefore, given these circumstances, STEMM women academics may be more affected by seniority compared to STEMM men. As such, gender was predicted to moderate the effect of seniority on interest via self-efficacy and outcome expectations. The mediated relationship between seniority and interest trough self-efficacy and outcome expectations was expected to be positive, especially if the participants were STEMM women academics. Thus, the following hypothesis was developed:

> **Hypothesis 6:** Gender moderates the mediated relationship between seniority and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

By examining the impact of seniority, potential discriminatory practices relating to seniority can be verified and practical actions can be proposed to mitigate them.

2.10 Environment Variables as Predictors of Career Success

As described in Section 2.5.1, the Job Demand-Resource model has been widely used amongst researchers and practitioners from different organisational settings (Bakker &

Demerouti, 2007; Demerouti & Bakker, 2011; Schaufeli & Taris, 2014), including amongst academics (Barkhuizen et al., 2014; Boyd et al., 2010). Based on a meta-analysis study, organisational resources have a positive association with career success (salary and promotions) (Ng et al., 2005), while job demands affect career success negatively (Bakker & Demerouti, 2007; Demerouti et al., 2001). Both job demands and resources are used as predictors in the present research, and, following SCCT, they are both grouped under the environment variables. In this research, job resources are comprised of recognition, supervisor support and feedback, and support from colleagues, while job demands are comprised of work-family conflict and family-work conflict.

2.10.1 Job Resources – Recognition as a Predictor

The term ‘recognition’ in the context of this study can be defined as “being valued by others for one’s contribution to the job” through “an affective, a tangible, or a monetary reward” (Fernet et al., 2016, p. 483). Moreover, it refers to the “belief that the organi[s]ation appreciates and recogni[s]es one's efforts”, in which contributions are likely to increase “the perceived meaningfulness of work” (S. P. Brown & Leigh, 1996, p. 360).

As such, recognition is considered as a form of career success in all cultures (Mayrhofer et al., 2016). Under the context of academe, recognition comes in multiple forms, such as recognition in research, publications, teaching and services (Ismail & Mohd Rasdi, 2006a) from administrators, colleagues, students and parents (Fernet et al., 2016).

In terms of the effects of recognition on research, it has been shown that, fundamentally, recognition helps academics to access resources that facilitate research and subsequently, leading to an increase in research productivity (David, 1994). With regards to teaching, the strong emphasis on research has resultantly caused teaching to be undervalued. However, some universities have started to recognise teaching performance under the

teaching quality movement and by offering more recognition and rewards (Chalmers, 2011). According to the author's knowledge, there is a paucity of research on the impact of recognition on career advancement.

Recognition is treated as a form of job resources in the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001), in which it can affect the career success of an employee. By incorporating the SCCT (Lent et al., 1994) into the JD-R model, it was proposed that recognition can affect career success positively via self-efficacy and interest. By adding self-efficacy and interest as mediators, it helps to explain the unclear link between recognition and career success. Recognition was hypothesised to improve self-efficacy (individual's capability is confirmed through recognition) and in turn led to increase one's interest, and subsequently led to better career success, which leads to the formation of the following hypothesis:

> **Hypothesis 7:** Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between recognition and career success (research productivity, teaching performance, and career advancement).

On the same basis, it is also proposed that recognition can enhance career success via outcome expectations (one can have better expectations of career-related outcome when they receive recognition) and interest (one becomes more interest in career success when they have high outcome expectations), as indicated in the following hypothesis:

> **Hypothesis 8:** Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship

between recognition and career success (research productivity, teaching performance, and career advancement).

Again, the impact of gender may be present. STEMM women academics receive significantly less recognition compared to men (Fox, 2010). For instance, women scientists are less likely to gain recognition for their achievements as there has only been 2.9% of women who have won a Nobel Prize in the field of Chemistry, Medicine, and Physics as well as a Fields Medal in Mathematics as compared to men (97.1%) (UNESCO Bangkok & Korean Women's Development Institute (KWDI), 2015). Some efforts have been made by the pioneering programme – 'For Women in Science Programme' by UNESCO and the L'Oréal Corporate Foundation to increase the visibility of women scientists, and these programmes have managed to recognise 87 exceptional women since 1998, with two of them successfully obtained Nobel Prizes (UNESCO, 2015).

It seems that the desire for recognition is a strong predictor for research productivity only amongst men (Sax et al., 2002). This condition could be due to women being more driven towards direct societal impact rather than research related recognition (Sax et al., 2002). Traditionally, the ability and competency of STEMM women are often judged as being weaker compared to men (Hill, Corbett & Rose, 2010), due to the common belief that men are stronger in mathematical skills thus are more suited to STEMM fields, despite disproval by several studies (Lynn & Irwing, 2004; Hyde et al. 2008). Such condition may cause the impostor syndrome (Clance & Imes, 1978) amongst STEMM women academics to be even stronger due to the poor recognition that they receive, and lead to poorer performance in research, teaching and career advancement.

Accordingly, recognising STEMM women academics can assist them in countering the wrong belief that they are unsuitable in the male-dominated fields of STEMM, which can

invariably lead to higher interest via better self-efficacy and outcome expectations, as supported in SCCT (Lent et al., 1994). The mediated relationship between recognition and interest via self-efficacy and outcome expectations was predicted to be stronger, especially if the participants were women. Hence, the below hypothesis is posited:

> **Hypothesis 9:** Gender moderates the mediated relationship between recognition and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

Through studying the impact of recognition, practices and policies that encourage recognition can be recommended.

2.10.2 Job Resources – Supervisor Support and Feedback and Support from Colleagues as Predictors

Social support in the academic workplace generally originates from supervisors and colleagues (Arthur et al., 2005). It is suggested that social support from both supervisors and colleagues can lead to reciprocity in exchange from the employees when they view the support as helpful and supportive, which means employees are more likely to engage in employee advocacy behaviours rather than merely based on the formally required job scope (Tsarenko et al., 2018). Previous studies on the relation between these two variables and career success will be reviewed in this section.

Supervisor support and feedback. Supervisor support and feedback can be defined as “the extent to which supervisors provide emotional and work-related social support” and “give helpful feedback about job performance” (Ng et al., 2005, p. 380-381). It can take the

form of providing emotional and instrumental support, role modelling behaviours, opportunities to learn, career guidance, career-related information, work assignments that can lead to career advancement and creative work-life management strategies (Chen, 2010; Hammer et al., 2009).

It has been shown that supervisors play a significant role in supporting employees for career development (Kidd & Smewing, 2001) and career success. A study from Pakistan showed that supervisory support can predict 53% of an academic's work performance (Saleem & Amin, 2013). It is found that employees' commitment to their organisation increases when they perceive that their supervisors believe in them, give them authority in performing their job, and engage them in goal-setting and feedback (Kidd & Smewing, 2001). Based on a meta-analytic review, supervisor support and feedback can positively affect subjective career success (Ng & Feldman, 2014). Kirchmeyer (1998) also confirms that supervisor support is a significant predictor of both men and women's managerial perceived career success. Moreover, supervisor support has a positive correlation with salary, but no relation with promotion (Ng et al., 2005). By referring to past studies, supervisor support and feedback tend to lead to better career success; however, it may not be effective for all forms of career success (e.g. promotion). Hence, the present study can fill up this gap by investigating its impact on various forms of career success in academe.

In addition, given the high collectivist culture that encourages building relationships and support amongst each other (Hofstede, 2011; Hofstede Insights, 2018), including the PDI that emphasises the power from more powerful individuals, in which supervisor is perceived as an authority figure (Hofstede Insights, 2018), it is proposed that supervisor support and feedback can have a particularly strong impact on academics in Malaysia. For instance, a study that recruited 300 women academics from various RUs in Malaysia revealed that supervisory support serves a significant moderator in the relationship between work-family

demands and life satisfaction (Achour et al., 2014). Looking from the angles of high collectivism (Hofstede Insights, 2018) as well as the strong gendered roles in household chores and family (Bem, 1981a), if the supervisor practises family-supportive supervisor behaviours, which means they display empathic and understanding behaviours towards their employees' aspiration in balancing work and non-work demands (such as allowing switched schedules in accommodating family responsibilities), these supportive behaviours can significantly improve job satisfaction (L. T. Thomas & Ganster, 1995).

Supervisor support and feedback can be considered a form of job resources under the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001). Supervisors can act as standards of reference given their authority status, thus their support and feedback are powerful enough to increase the employees' career success through enhancing their self-efficacy and interest, as supported by SCCT (Lent et al., 1994). The relationship between supervisor support and feedback and career success through self-efficacy and interest was predicted to positive. Hence, it leads to the formation of the following hypothesis:

> **Hypothesis 10:** Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between supervisor support and feedback and career success (research productivity, teaching performance, and career advancement).

Under the same framework of JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and SCCT (Lent et al., 1994), supervisor support and feedback is also formulated to lead to better career success through enhancing outcome expectations (as employees can visualise their work outcome much more easily with the assurance and feedback from the supervisors) and interest. Hence, the following hypothesis is posited:

Hypothesis 11: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between supervisor support and feedback and career success (research productivity, teaching performance, and career advancement).

Mentoring is particularly helpful in empowering and supporting women in a male-dominated workplace (Jones, 2017). Hirayama and Fernando (2018) recommend promoting female mentors in the male-dominated organisational culture, as it can support female surgeons to handle both workplace-related challenges and life-related issues. A study by Kidd & Smewing (2001) showed supervisor support to have a positive linear relationship with commitment to organisation amongst women, while this relationship was less straightforward for men. The mediated relationship between supervisor support and feedback and interest through self-efficacy and outcome expectations was hypothesised to be stronger especially if the participants were STEMM women academics. Therefore, the following hypothesis was developed:

Hypothesis 12: Gender moderates the mediated relationship between supervisor support and feedback and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

The investigation of supervisor support and feedback is foreseen to be able to provide practical contribution in promoting good supervisor practice in academe context to better support STEMM women academics.

Support from colleagues. Support from colleagues refers to the "self-rated quality of relationship with co-workers" and "the extent to which co-workers or peers provide desirable resources to them" (Ng & Feldman, 2014, p. 173).

A qualitative study pinpointed that poor collegiality is one of the career barriers influencing career success amongst Portuguese academics (Santos, 2016). In a review study, support from colleagues is correlated positively with subjective career success (Ng & Feldman, 2014). Moreover, another study that investigated 375 full-time employees found that co-worker support is a significant moderator between shyness and subjective career success, indicating that support from co-workers can lead to better subjective career success also for shy employees (Taormina, 2019). Furthermore, support from colleagues has been demonstrated to have a significant positive association with self-reported total publications (K. Kim & Choi, 2017). These results highlight the impact of support from colleagues on career success in general.

Support from colleagues is categorised as a form of job resources in the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001); when incorporating the mediating effects of self-efficacy and interest, as proposed by the SCCT (Lent et al., 1994), it is predicted that support from colleagues can enhance career success through self-efficacy and interest. A study amongst nurses confirmed that support from colleagues has significant correlations with self-efficacy and career success (Dan et al., 2018).

The high collectivist culture in Malaysia (Hofstede, 2011; Hofstede Insights, 2018) has advocated in relationship building and providing support to members of the society. Hence, support from colleagues in Malaysia is supposed to be particularly important. Based on the above literature and on the importance of collegial support in a collectivist context, the following hypothesis was formed:

Hypothesis 13: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between support from colleagues and career success (research productivity, teaching performance, and career advancement).

It is also postulated that support from colleagues can lead to a positive outcome on career success via outcome expectations (assurance and support from colleagues allows individuals to better conceptualise their work outcome) and interest in the same framework, which put forward the following hypothesis:

Hypothesis 14: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between support from colleagues and career success (research productivity, teaching performance, and career advancement).

Gender may serve as a significant moderator in this case too. It is crucial to note that men academics tend to obtain higher support from colleagues due to the practice of "old boys network" (Davidson & Burke, 1994, 2000; Ismail & Mohd Rasdi, 2007; Vinnicombe & Colwill, 1995) – a network based on men solely. This has made it harder for women academics to develop relationships with other colleagues and made them feel as if they are "outsiders" in masculine cultures (Ismail & Mohd Rasdi, 2007). Another study also supports this statement, in which peer support is found to be strongly correlated with men's subjective career success, whereas women seem to only benefit from personal support in achieving subjective career success (Nabi, 2001).

Colleagues can provide extra support and help to assure STEMM women of their ability and their work outcome, which can significantly improve their self-efficacy and outcome expectations under a high collectivist country, such as Malaysia (Hofstede Insights, 2018). This form of support may include covering for a colleague during her maternity leave, encouraging in career advancement plan, providing mental and physical support and so on. In a study in Malaysia, networking is seen as a strategy that can enhance the promotion rate of women professors (Ismail & Mohd Rasdi, 2007). It is argued that the mediated relationship between support from colleagues and interest via self-efficacy and outcome expectations was stronger, especially if the participants were women. Thus, based on the literature above, and on the particular cultural context, the following hypothesis was developed to investigate STEMM academics:

> **Hypothesis 15:** Gender moderates the mediated relationship between support from colleagues and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

By understanding whether support from colleagues can enhance STEMM women academics' career success or not, more practical strategies can be proposed to promote this mean of support.

2.10.3 Job Demands – Work-family Conflict and Family-work Conflict as Predictors

During the last five decades, social scientists have increasingly been concerned with work-life quality and work-life balance (Achour, Grine, & Mohd Nor, 2015). Managing work-life balance has always been a troubling issue to women academics, including those

from Malaysia (Achour, Grine, Mohd Nor, et al., 2015) as they need to spend excessive energy, time and effort to manage both their family and career well. Consequently, juggling between these two aspects can occasionally make women forget about having adequate self-compassion and self-care. As such, this kind of prolonged struggle will tend to lower their personal well-being (Achour, Grine, Mohd Nor, et al., 2015).

The literature provided below on these two constructs will focus mainly on how these variables affect specifically STEMM women academics.

Work-family conflict. Work-family conflict refers to "a particular type of interrole conflict in which pressures from the work role are incompatible with pressures from the family role" (L. T. Thomas & Ganster, 1995, p. 7). Both women and men academics in STEMM report that they face both work-family and family-work interference, and that the interference of work on the family is stronger compared to family-work interference (Fox, 2010).

In a meta-analysis study, it was confirmed that work-family conflict negatively affects job performance (Gilboa et al., 2008). Other studies also found that work-family conflict generally leads to poor performance (Frone et al., 1997; Karatepe & Sokmen, 2006; Netemeyer et al., 2005). Although individuals that experience such conflict still maintain their job performance at a certain level, they are not able to take on any additional work-related tasks (Gilboa et al., 2008).

Nevertheless, the link between work-family conflict and career success is still not well-established. It is argued that work-family conflict predicts career success via self-efficacy and interest. Given work-family conflict is considered a form of job demands in the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001), by incorporating with the SCCT (Lent et al., 1994), it is postulated that work-family conflict negatively affects career success via self-efficacy and interest. STEMM women academics who encounter high level

of work-family conflict might perceive themselves as less capable in research, teaching and career advancement, thus have lesser interest in these three areas and undoubtfully affect their career success. In light of this, the following hypothesis was formed:

> **Hypothesis 16:** Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between work-family conflict and career success (research productivity, teaching performance, and career advancement).

Likewise, work-family conflict can decrease one's outcome expectations (by thinking that they are unable to expect a better outcome in career), interest and career success, which leads to the formation of the following hypothesis:

> **Hypothesis 17:** Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between work-family conflict and career success (research productivity, teaching performance, and career advancement).

To better understand the perceptions of women academic staff and their struggle in work-life, some important qualitative studies have been conducted and should be considered. Monroe, Ozyurt, Wrigley and Alexander's qualitative study (2008) reported that women do not blame the university for causing them to experience problems in balancing work-life, as they perceive it as the individual's responsibility. There are also some qualitative studies on the topic that have been conducted in Malaysia. These studies have targeted Muslim women academics' work-family conflict and coping strategies (Achour, Grine, & Mohd Nor, 2015),

young Malay academic women's views on marriage and family life (Osman, 2014) and career development experiences amongst Malaysia's women professors in both physical sciences and social sciences (Ismail & Mohd Rasdi, 2006a). Since most literature focused on Malay and Muslim women academics, or on women academics at the professor's level, the present research can help in filling the gaps by qualitatively and quantitatively investigating this issue on STEMM women academics of all ethnic backgrounds and from both senior lecturer and professor positions.

Women's performance can be affected by their difficulties and struggles in balancing professional and family life (Stack, 2004). Based on the literature review, STEMM women academics tend to experience significantly higher work-family conflict compared to men, and the interference of work on the family setting is much stronger than family-work conflict given 'science as a greedy institution' (Fox, 2010; Grant et al., 2000). Therefore, we can see that STEMM women academics are more strongly affected by work-family conflict than men in STEMM due to the high demands afforded by science (Fox, 2010) as well as the challenges imposed from the male-dominated fields of STEMM (Cheryan et al., 2015; C. C. Hayes, 2010; Hill et al., 2010).

As supported by SCCT (Lent et al., 1994) and GST (Bem, 1981a) and the literature reviewed above, gender was predicted to be the key moderator in the mediated relationship between work-family conflict and interest via self-efficacy and outcome expectations. The mediated relationship between work-family conflict and interest via self-efficacy and outcome expectations was hypothesised to be negative especially if the participants are STEMM women academics. Hence, the following hypothesis is posited:

Hypothesis 18: Gender moderates the mediated relationship between work-family conflict and interest (in research, teaching and career advancement), when self-

efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

Family-work conflict. Family-work conflict is "a form of inter role conflict in which the general demands of, time devoted to, and strain created by the family interfere with performing work-related responsibilities" (Netemeyer et al., 1996, p. 401), thus family too, not only science, can be seen as a 'greedy institution'. The adverse impact of family-work conflict on job performance has been observed by several authors, including (Frone et al., 1997; Karatepe & Sokmen, 2006; Netemeyer et al., 2005).

As supported by the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and SCCT (Lent et al., 1994), it is argued that a higher level of family-work conflict can decrease the academics' self-efficacy and interest, and as a result, leads to a lower level of career success. The following hypothesis is listed to predict the impact of family-work conflict on career success through self-efficacy and interest:

Hypothesis 19: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between family-work conflict and career success (research productivity, teaching performance, and career advancement).

In terms of the role of outcome expectations, Fox (2010, p. 1006) states that "work and family/household are greedy-and potentially competing-institutions, especially when scheduled benchmarks for performance make it difficult to take time off, temporarily". This is believed to take away their time to arrive at a work outcome. As supported in the JD-R

model and SCCT, family-work conflict can negatively affect career success via outcome expectations and interest, which leads to the development of the following hypothesis:

> **Hypothesis 20:** Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between family-work conflict and career success (research productivity, teaching performance, and career advancement).

Women experience a significantly greater level of work-family and family-work interference compared to men, especially on family-work interference (Fox, 2010). A narrative review study consisting of eight different studies from the USA, Canada, Japan, and Saudi Arabia between 1992 and 2014 found that women are particularly concerned about work-life balance if they choose to be an academic (in this case, specifically an academic medical doctor). The results of the study found that parenthood affected the residency training of women 12% more compared to men (Edmunds et al., 2016).

Furthermore, in a study, it was noticed that women academics in natural, physical, and social sciences needed to be ‘strategic’ in managing work-life, such as having greater collaboration in research, limiting the number of children though they would prefer to have more, as well as restricting non-work-life activities (Grant et al., 2000). As these ‘strategies’ were seen to help them in overcoming the negative impact of family-work conflict.

One of the ways in which collectivism manifests in Malaysia is the strong tendency for Malaysians to perceive harmony, social behaviours, relationships, self-sacrifice and family integrity as vital elements in their life (Noordin & Jusoff, 2010). Moreover, in line with the collectivist ethos, as mentioned earlier, women are expected to prioritise family by placing their own self-fulfilment behind family matters. Even if they are working women,

they are expected to “maintain the traditional perception of a woman” (Abdullah et al., 2008, p. 454), and play more roles in childcare or other domestic duties, although more Malaysian men are seen to be willing to take charge of childcare or other domestic duties, as reported in a recent study by Hirschman (2016).

As supported by research, family-work conflict contributes negatively to job performance (Frone et al., 1997; Karatepe & Sokmen, 2006; Netemeyer et al., 2005). As such, it is proposed that STEMM women academics in Malaysia have more family-work conflict given the high collectivist culture (Hofstede Insights, 2018), which will negatively affect self-efficacy, outcome expectations and interest, subsequently affecting career success negatively as well. As shown by the review of past literature and theoretical support from the GST (Bem, 1981a), it is proposed that family-work conflict is a particularly stronger variable that affects STEMM women academics as compared to STEMM men academics. This is due to the gendered roles in the family and household, under the male-dominated areas, and to the pressures to balance both the ‘greedy institutions’ of science and the family. As supported by SCCT (Lent et al., 1994), the mediated relationship between family-work conflict and interest through self-efficacy and outcome expectations was proposed to be negative, especially if they are women. Hence, the last set of hypotheses is hypothesised as follow:

> **Hypothesis 21:** Gender moderates the mediated relationship between family-work conflict and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

By investigating the impact of work-family conflict and family-work conflict on career success amongst STEMM women academics, the present study can suggest relevant family-friendly policies and practices to support them in achieving career success.

2.11 The Conceptual Framework of the Quantitative Phase

The conceptual framework for the quantitative phase of the present research is illustrated in Figure 3. The framework is developed as a result of combining the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and the SCCT (Lent et al., 1994).

In the framework, the person variables cover age and seniority, while environment variables, which are also included in the framework, are job resources (recognition, supervisor support and feedback, and support from colleagues) and job demands (work-family conflict and family-work conflict).

For self-efficacy, it consists of research self-efficacy, teaching self-efficacy, and promotion self-efficacy. While regarding outcome expectations, outcome expectations for research, outcome expectations for teaching, and outcome expectations for career advancement are covered. There are also three types of interest, which consist of interest in research, teaching, and career advancement. As for career success, research productivity, teaching performance, and career advancement are selected.

It is proposed that the relationship between person variables (age and seniority) and environment variables (job resources, and job demands), and self-efficacy and outcome expectations can be moderated by gender. The predictors (person and environment variables) can affect self-efficacy and outcome expectations. Higher self-efficacy and outcome expectations can increase the level of interest as proposed in the SCCT (Lent et al., 1994). Here, higher interest is believed to lead to better career success (research productivity,

teaching performance, and career advancement). On the contrary, lower self-efficacy and outcome expectations can affect interest and career success negatively.

The relationships between predictors, mediators (i.e. self-efficacy, outcome expectations, and interest) and outcome variables (i.e. research productivity, teaching performance, and career advancement) were tested first, followed by the relationships between predictors, moderator (i.e. gender), and mediators (i.e. self-efficacy, outcome expectations, and interest).

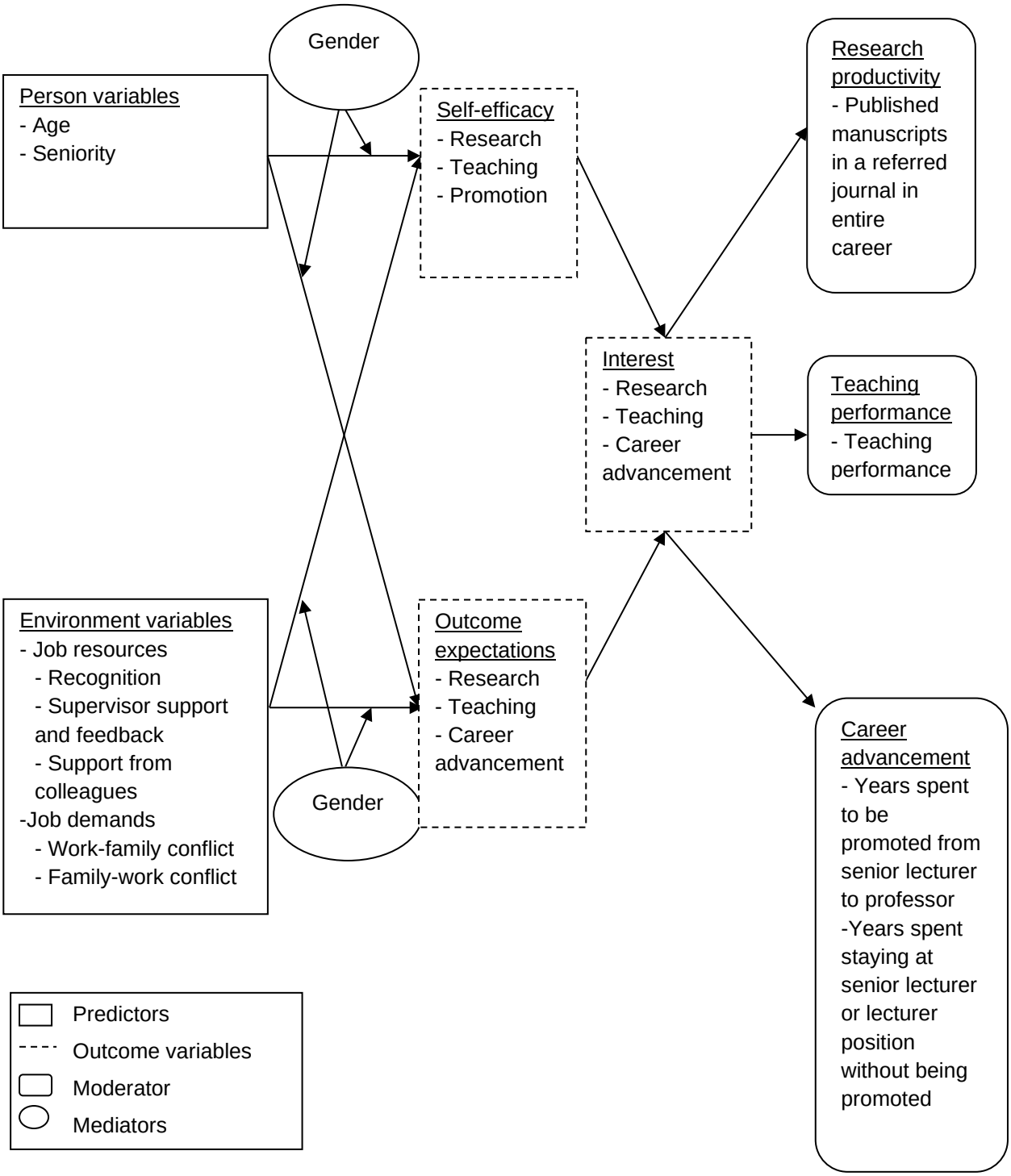


Figure 3. The Conceptual Framework

2.12 Research Questions for the Quantitative Phase

Based on the literature review in Section 2.9 and 2.10, we can see the impact of person variables (i.e. age and seniority) and environment variables (i.e. recognition, supervisor support and feedback, support from colleagues, work-family conflict, and family-work conflict) on career success (i.e. research productivity, teaching performance, and career advancement). As indicated in the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001), job demands and job resources as covered under the environment variables of this study, can affect employees' performance. Whereas, as supported by SCCT (Lent et al., 1994), both person and environment inputs can lead to performance domains and attainments. Additionally, SCCT also emphasises the mediating roles of self-efficacy, outcome expectations, and interest on the relationship between person and environment variables, and career success (Lent et al., 1994). This allows a better connection and explanation on how person and environment variables affect career success, by highlighting the mediating roles played by self-efficacy, outcome expectations, and interest. In order to examine whether such connections are applicable to the Malaysia context, particularly the STEMM academics, the first and second research questions were designed.

As emphasised on Section 2.6, gender was selected to be the moderator in the mediated relationship between person variables and environmental variables, and interest (in research, teaching and career advancement). Gender Schema Theory (Bem, 1981a) describes the impact of gender due to gender schemata that are particularly challenging to women. SCCT, on the other hand, has also included gender as a variable under the 'person input' that will affect self-efficacy, outcome expectations, interest, and eventually affect career success (Lent et al., 2002). Other than the support from the above mentioned theories, due to the fact that STEMM fields are male-dominated fields (Cheryan et al., 2015; C. C. Hayes, 2010; Hill et al., 2010), in which women tend to encounter greater challenges (Burger, 2012; Burke,

2007; Veltri et al., 2010), researchers have noticed the strong moderating effect of gender on career success in general (Melamed, 1995; Ng et al., 2005), on research productivity (Fox, 2005; Prpic, 2002; Stack, 2004; Xie & Shauman, 2003), on teaching performance (Centra & Gaubatz, 2000; Chua & Kho, 2015, 2013; Hamermesh & Parker, 2005; MacNell et al., 2015; Subbaye & Vithal, 2017; Zhukov, 2012), and on career advancements (Carr et al., 2003; Liu & Alexander, 2010; Sexton et al., 2012). Several gendered metaphors and occupational or professional stereotypes have also explained the conditions or issues encountered by women, including STEMM women academics, such as a leaky pipeline (Blickenstaff, 2005; Miller & Wai, 2015), sticky floor (Booth et al., 2003; Yap & Konrad, 2009) and 'think professor-think male' (Tharenou, 1994) to name a few. Hence, these arguments have led to the development of the third research question for quantitative phase.

Below is a summary of the research questions developed on the basis of the relevant literature to address the research objectives through a quantitative study titled "Determinants of Career Success in Research, Teaching and Career Advancement Amongst Science, Technology, Engineering, Mathematics, and Medicine Women Academics":

(a) What are the mediating roles of self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) in the relationship between the predictors (person variables and environmental variables) and career success (research productivity, teaching performance, and career advancement)?

(b) What are the mediating roles of the outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) in the relationship between the predictors (person variables and environmental variables) and career success (research productivity, teaching performance, and career advancement)?

(c) What is the moderating role of gender in the mediated relationship between the predictors (person variables and environmental variables) and interest (in research,

teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are the mediators?

2.13 Hypotheses for the Quantitative Phase

The following is a summary of the hypotheses developed to address the research questions listed in Section 2.12:

H1: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between age and career success (research productivity, teaching performance, and career advancement).

H2: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between age and career success (research productivity, teaching performance, and career advancement).

H3: Gender moderates the mediated relationship between age and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

H4: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between seniority and career success (research productivity, teaching performance, and career advancement).

H5: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between seniority and career success (research productivity, teaching performance, and career advancement).

H6: Gender moderates the mediated relationship between seniority and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

H7: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between recognition and career success (research productivity, teaching performance, and career advancement).

H8: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between recognition and career success (research productivity, teaching performance, and career advancement).

H9: Gender moderates the mediated relationship between recognition and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

H10: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between supervisor support and feedback and career success (research productivity, teaching performance, and career advancement).

H11: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between supervisor support and feedback and career success (research productivity, teaching performance, and career advancement).

H12: Gender moderates the mediated relationship between supervisor support and feedback and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

H13: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between support from colleagues and career success (research productivity, teaching performance, and career advancement).

H14: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between support from colleagues and career success (research productivity, teaching performance, and career advancement).

H15: Gender moderates the mediated relationship between support from colleagues and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

H16: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between work-family conflict and career success (research productivity, teaching performance, and career advancement).

H17: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between work-family conflict and career success (research productivity, teaching performance, and career advancement).

H18: Gender moderates the mediated relationship between work-family conflict and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

H19: Self-efficacy (in research, teaching and promotion) and interest (in research, teaching and career advancement) mediate the relationship between family-work conflict and career success (research productivity, teaching performance, and career advancement).

H20: Outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) mediate the relationship between family-work conflict and career success (research productivity, teaching performance, and career advancement).

H21: Gender moderates the mediated relationship between family-work conflict and interest (in research, teaching and career advancement), when self-efficacy (in research, teaching and

promotion) and outcome expectations (for research, teaching and career advancement) are mediators in parallel.

2.14 Chapter Summary

A literature review was undertaken in this chapter relating to career success, theories and model, the moderator, the mediators and the predictors. Also presented in this chapter were the formulated research questions and hypotheses based on the outcome of the literature review. The following chapter addresses the research design and methodology relating to the studies in this thesis.

CHAPTER 3 - RESEARCH DESIGN AND METHODOLOGY

3.1 Chapter Overview

Continuing from the literature review in the previous chapter, this chapter begins with explaining the philosophical assumptions and rationale for the research design and methodology of the two phases of research. Then, it follows with the rationale of participant selection, data collection, the rationale of data analysis selection and ethical issues.

3.2 Introduction

Gorard (2017) emphasised that the suitability of research design to answer the research question(s) is crucial, as it allows the feasibility of analysis, and produces trustable results and conclusions. Thus, the selection of research design to better address the targeted research questions is vital. This thesis aimed to assess the psychological and organisational factors that impact STEMM women academics' career success in Malaysia using mixed methods research and design (MMRD) (an exploratory sequential design). The design starts with a qualitative phase of research, followed by a quantitative phase of research.

3.3 The Philosophical Assumptions and Rationale for the Research Design and Methodology

The mixed methods research and design (MMRD) refers to "a procedure for collecting, analy[s]ing, and 'mixing' both quantitative and qualitative methods in a single study or a series of studies to understand a research problem" (Creswell, 2015, p. 535). A more comprehensive definition of MMRD is stated below:

> Mixed methods research is a research design with philosophical assumptions as well as methods of inquiry. As a methodology, it involves philosophical assumptions that guide the direction of the collection and analysis of data and the mixture of qualitative and quantitative data in a single study or series of studies. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems that either approach alone. (Creswell & Clark, 2018, p. 5)

Philosophical assumptions. The MMRD in this thesis employed the exploratory sequential design. According to Creswell and Clark (2018), this design generally starts with a qualitative strand during the first phase of the research using constructivist principles in order to view from different perspectives and acquire in-depth understanding. Moving on to the second phase of the research, the overall philosophical assumptions are transformed to a postpositivist philosophical stance by using a quantitative strand to lead the identification and measurement of variables and statistical trends. Multiple worldviews are exercised by shifting worldviews from one phase to another.

In the first phase of the research, the qualitative data that was obtained from a small and purposeful sample has led to the development of a theoretical model inductively through grounded theory. The model that is grounded based on the interviewees' perspectives helped in deciding which variables and what relationships to be assessed in the next phase of the research. The qualitative findings were then identified as being contemplated within existing theories in the literature, which, combined, led to the development, in the second phase of the research, of a theoretical framework that was tested in a new sample of participants - large in number but from same population for generalisation purpose (Creswell & Clark, 2018).

Specifically, the qualitative findings were collected from ten STEMM women

academics by using a grounded theory approach. The model generated from the interviewees' verbatim was combined with the JD-R model and SCCT, which led to the decision of selecting age, seniority, recognition, supervisor support and feedback, support from colleagues, work-family conflict and family-work conflict as predictors and testing their impacts on career success through a series of mediators (self-efficacy, outcome expectations and interest). A few instruments were developed to quantitatively measure the variables and their relationships on a bigger group of STEMM academics in Malaysia for generalisation purpose.

Rationale of selection. It can be said that MMRD is an advanced method that employs both quantitative and qualitative methods in understanding a particular topic of interest, which is deemed adequate and suitable in a doctorate degree research (Creswell, 2015). This design is lengthy not just due to its extensive data collection and analysis, it also requires a complicated procedure of performing the two strands of research – qualitative and quantitative studies through integrating, merging, embedding or linking (Creswell, 2015)..

The present thesis employed the most popular type of MMRD: an exploratory sequential design (working on "an exploratory QL [refers to qualitative] component (e.g., interviews)" then on "a QN [refers to quantitative] component (e.g., questionnaire)" (Bergman, 2012, p. 274). This design uses preliminary qualitative input as a complementary method and quantitative approach as the core method (Morgan, 2014), which is what was done in the present research. Below is a list of reasons for selecting the MMDR in this thesis.

The mixed methods research and design (MMRD) was selected as the research design for this thesis, as it has been a popular method to generate "a critical mass of theoretical and empirical contributions" for more than a century (Bergman, 2012, p. 271). Thus, this approach can help to produce massive theoretical and empirical contributions to the topic of interest in this thesis.

Additionally, the MMDR approach is being perceived as having more values than a monomethod approach, as it has “rigorous methods, a newer history, and providing a deeper meaning of the phenomenon” (McKim, 2015, p. 202). Also, based on Creswell (2015), the qualitative study can yield actual verbatim of the participants, multiple viewpoints as well as a comprehensive scenario of the topic, whereas the quantitative approach can generate frequency and magnitude of trends of a large number of participants that are statistically analysed. By employing this approach, its rigorous methods that combine both qualitative and quantitative approaches can give a profound meaning of the situation and a more complex picture of the phenomenon encountered by STEMM women academics in Malaysia.

Furthermore, another reason for selecting MMDR is that the topic of interest (gender and STEMM academics in Malaysia) is still under-researched. MMDR is a commonly used approach when the topic or the population of interest is not being studied or rarely being researched (Creswell, 2015; Leavy, 2017). So far, the studies that investigate research productivity and career advancement in Malaysia do not include gender as a variable (Abrizah & Wee, 2011; Davarpanah, 2009; Ismail & Arokiasamy, 2007; Yazit & Zainab, 2007). There seem to be only little studies examining gender differences in teaching performance amongst academics in Malaysia (Chua & Kho, 2015, 2013). Some studies in Malaysia targeted specifically women academics only, but did not use gender as a moderator (Achour et al., 2014; Ismail & Mohd Rasdi, 2007). Hence, by using MMDR, the topic of interest of this thesis can be studied more in-depth.

3.3.1 First Phase of the Research

The first phase of this thesis was done by using a qualitative approach in order to explore the meaning of success for women academics, psychological and organisational barriers and support in achieving career success (through semi-structured interviews)

(Chapter 4). A qualitative method was employed in study 1 (Chapter 4) instead of the quantitative method because this method permits the discovery of real-life behaviour (Kuper et al., 2008) by allowing participants to voice out their historically, individually, and socially constructed perceived reality (Denzin & Lincoln, 2005). This method can allow a more in-depth exploration of the voice of STEMM women academics.

The semi-structured interview approach is relatively flexible, as it permits the researcher to follow an interview guide but also allows questions that are not initially included if the interviewer picks up certain interesting content that is shared by the interviewee (Bryman, 2008). This approach was particularly useful as the interview guide could serve as a guide for the interviewer to lead the interview content in the beginning by setting an interview framework; however, it allowed the interviewees to freely share any story which may be a novel and rich finding. After obtaining data from the qualitative study, the next phase of the research was to use a quantitative approach.

3.3.2 Second Phase of the Research

The second phase consisted of a pilot study and a main study. Prior to the main study, a pilot study was carried out to examine the psychometric properties of the instruments by using reliability testing, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA).

The main study aimed to examine the determinants of career success amongst STEMM women academics in Malaysia through the development of a combination of the JD-R Model and the SCCT. At the organisational level, the research looked into the impact of job demands and resources towards research productivity, teaching performance, and career advancement. At the psychological level, factors such as self-efficacy, outcome expectations, interest, and gender-related demands (e.g. work-family conflict) were explored in relation to

career success. The framework was tested amongst STEMM participants to examine the sequential mediations, that is, whether each predictor affected the mediators and the outcome variables. Then gender was used as a moderator to test if gender plays a role in affecting the mediations amongst the participants.

A cross-sectional survey method was used for the pilot study and the main study (study two). The cross-sectional design was selected for the second phase of the research because the data collection for two or more groups can be completed through a single occurrence and it can help explaining research questions that are comparative in nature (Gorard, 2017).

A self-completion questionnaire was used as it was less expensive and more time-efficient to administer, was more convenient for respondents, and was not affected by the interviewer (Bryman, 2008). The survey was sent to a large number of potential respondents online, as through this method, it could reach the targeted population immediately with no printing fee or travel cost involved. The participants were given options to respond to the survey at their convenient time. This approach was well-suited to academics that are often busy with different tasks at the same time. Social desirability issues and interviewer variability issues could be avoided, as the respondents did not need to worry to report negative response and risk being identified or judged by faking good; and the issue in which the interviewer may raise questions in a different order was tackled as the online survey showed questions in the same order. As for some of the disadvantages of self-completion questionnaire, such as the researcher not being able to probe or ask for more questions in order to collect additional data and the fact that there may be an issue of lower response rate (Bryman, 2008), these issues were resolved by having the qualitative approach in this thesis and by sending several rounds of reminders to the participants.

By using the MMDR design, these two phases of research complemented each other and produced rich findings to explain the phenomena faced by STEMM women academics in Malaysia.

3.4 The Rationale of Participant Selection

Academics were selected as the participants in the present research. In order to increase diversity in STEMM fields, women are one of the utmost focused populations (Aguirre, 2000). Most studies in STEMM focus on the bachelor's to PhD girls and women (Cavazos, 2014; MacLachlan, 2006; Miller & Wai, 2015), whereas little researches emphasize on STEMM's women in the academia (Mavriplis et al., 2010; Wright et al., 2003).

In terms of institutions, all RUs in Malaysia were targeted as the RUs have a stronger emphasis on research while non-RUs may be focusing on teaching and other areas. Given one of the key outcome variables were research productivity, the RUs were more ideal.

For the first phase of the research (study one), STEMM women academics from all RUs in Malaysia were recruited for semi-structured interviews.

As for the second phase of the research, academics from a private university (for EFA) and academics from all RUs in Malaysia (for CFA) were employed for the quantitative pilot study. The selected private university is heavily focused on research, and, as such, comparable to the RUs of the main study. For study two, STEMM academics from all RUs in Malaysia were targeted. Women academics from STEMM were selected to be the main target research population, whereas men academics served as a comparison group.

3.4.1 Sampling Strategy

Although random sampling is "the gold standard of sampling strategies because of its unbiasedness and the possibility to evaluate the reliability (precision) of the resulting

estimates" (van Hoeven et al., 2015, p. 2), this sampling approach was not feasible to be employed in the present thesis. Academics are known for extreme busyness in their jobs (Schrager & Sadowski, 2016), using a random sampling approach would limit the survey from approaching the non-selected population during the randomised process. Hence, this would be risky for having a lower response rate. Thus, sending survey link through email to all STEMM academics from all RUs in Malaysia was a more feasible option in order to maximise the response rate.

Moreover, random sampling may not be a feasible sampling option and may not be representative of all studies, instead, purposive sampling can provide a representative sample (van Hoeven et al., 2015). Non-probability sampling strategies, such as maximum variation sampling, purposive sampling and snowballing sampling are proven to be able to provide the lowest prediction error and engage better with hard-to-reach communities as compared to the resource-intensive random sampling (M. A. Valerio et al., 2016; van Hoeven et al., 2015).

Based on the above rationale, purposive sampling and snowballing technique were applied to reach potential interviewees (study one). The qualitative study (semi-structured interview) recruited ten interviewees (women academics) from STEMM fields based on academic rank (senior lecturer and professor) and university (all RUs in Malaysia). Only senior lecturers and professors were recruited. The experience of an associate professor can be covered by the experience of a senior lecturer and a professor. Also, the experience of a lecturer can be covered by the experience of a senior lecturer. Another reason why less senior academics were not included in the sample is because of the general practice in Malaysia's RUs, where a lecturer position is offered to those without PhD while senior lecturer position is offered to those with PhD. Those with senior lecturer positions and above are required to produce a certain amount of research publication whereas those with lecturer positions have relatively minimal research-related requirements in their Key Performance Index, as can be

seen in the Key Performance Index document by one of the Rus in Malaysia - Universiti Teknologi Malaysia (Pejabat Pendaftar Bahagian Pengurusan Modal Insan Sinergi Teras Kualiti UTM, 2019). Given that the focus of this thesis is on the three areas of teaching, career advancement and research, the sample needs to include academics for whom all three areas have strong relevance. Lists of potential interviewees were searched through the official university websites to target those with a full professorship and those with senior lecturer position. Recommendations from the participants and friends that had academic network were sought in order to reach out to the suitable interviewees. An invitation email detailing the interview and the study was sent to the potential interviewees.

In terms of the second phase of the research, purposive sampling was employed to collect quantitative data from academics who served in a private university from Malaysia (for the EFA of the pilot study), and academics who served in the research university (RU) of Malaysia (for the CFA of the pilot study and for study two). For the EFA of the pilot study, a total of 292 emails of all academics in a private university were collected through the university's official website. For CFA of the pilot study and for study two, a total of 6998 emails of all academics (4924 emails from STEMM and 2074 emails from non-STEMM) from all RUs were collected through the university's official website. Invitation to participate in this study was sent to all collected emails. This sampling strategy aimed to reach to all academics from all the selected universities.

The pilot study for EFA obtained 33% response rate, whereas the pilot study for CFA and study two obtained a total response rate of 7.85% (6.76% from STEMM and 10.41% from non-STEMM). The response rate for the pilot study (for EFA) was adequate. The pilot study (for CFA) and study two showed a relatively lower response rate. Based on a study done in Malaysia, it had a response rate of 20% in recruiting academics from three selected RUs in Malaysia (267 filled up the online survey, out of 1300 questionnaires that were sent)

(Panatik et al., 2012). However, the total number of participants in the pilot study (for CFA) and study two (333 STEMM participants) was comparatively higher than the mentioned study.

3.4.2 Sample Size Requirements

In this section, the sample size requirements for both phases of the research are discussed.

(a) The First Phase of the Research

Deciding the number of interviews is not a clear-cut task as compared to estimating the minimum sample size for quantitative research. Although frequencies are not that significant in qualitative studies, it is important to select a qualitative sample size that is large enough to discover meanings relevant to the study, but not so large that the content becomes redundant (Mason, 2010).

The concept of saturation is generally applied to discontinuing further interview when there is no more new theme in a qualitative study (Glaser & Strauss, 1967). However, this concept is challenged as there were “no practical guidelines for estimating sample sizes for purposively sampled interviews” due to “poor job of operationali[s]ing the concept of saturation” by various literature and “no description of how saturation might be determined” (Guest et al., 2006, p. 60).

Based on a meta-analysis study done by Galvin (2015), the mean number of interviews was 19.3 for all 54 papers that were reviewed. The highest employed number of interviews in these studies was 11 to 15 (25.93%), followed by 6 to 10 (22.22%) and 16 to 20 (14.81%) as the second and third highest. In a study on their own qualitative sampling, Guest and associates (2006) discovered that 73% of the nodes had emerged by coding the first 6

interviews, and by the time they reached the 12th interview, they had already coded 92% of the nodes and reached a good internal consistency with a Cronbach's Alpha of .70.

Mason (2010) conducted a content analysis to explore the qualitative interview sample size in PhD studies by universities in Great Britain and Ireland since 1716. In general, he notices that the numbers of 10, 20, 30 and 40 were the four highest sample sizes employed in these PhD theses. To be specific, the number of interviews for qualitative studies using a grounded theory approach ranges from 4 to 87 (M=32, SD=16.6) (Mason, 2010).

By referring to the above literature, the number of interviews for study one (10 interviews) is considered acceptable and commonly used, especially given that this thesis employs more than one research method, thus it is justifiable that the first phase may require a lower number of interviewees compared to the average number in research involving only qualitative methods (D. T. F. Lee et al., 2002).

(b) The Second Phase of the Research

For the pilot study of quantitative study, Exploratory Factor Analysis (EFA) was employed. For EFA, the most commonly used subject to item ratio is >2:1 to ≤5:1 (25.8%), followed by >5:1 to ≤10:1 (22.7%) (Costello & Osborne, 2005). The quantitative pilot study had 97 participants, whereas the highest number of item in one instrument was 15 items; thus the study used a subject to item ratio of 6.47:1. This ratio is higher than the most commonly used ratio (>2:1 to ≤5:1). The minimum sample size for EFA in the quantitative pilot study was fulfilled.

As for the common rules of thumb for the minimum sample size (*N*) for Confirmatory Factor Analysis (CFA), Myers, Ahn and Jin (2011) suggest the ratio of *N* to the number of variables in a model should be equivalent to or more than 10. Nevertheless, they propose that the recommended sample size for CFA theoretical model should be equivalent to or more

than 200. With a subject to item ratio of 19.4:1, the quantitative pilot study fulfilled the minimum sample size requirement for CFA, with a sample size of more than 10 per number of variable. The sample size for CFA (*N*=549) was higher than the recommended sample size requirement, which is equivalent to or more than 200.

Lastly, in order to obtain sample size estimation for the quantitative study (study two), a statistical power analysis was performed using G*Power 3.1.9.2 (Faul et al., 2007, 2009). A priori power analysis type was selected. For the quantitative study, by setting the linear multiple regression of fixed model with increase R^2, the total sample size calculated was 130 with 95% power and an alpha value of .05, to obtain a medium effect size (f^2 =.15),which is between the recommended minimum practical significant effect size for social science studies of .04 to moderate effect of .25 as suggested by Ferguson (2009). The details of the calculated sample size can be viewed in Figure 4. The proposed minimum sample size of 143 was used after including 10 per cent attrition rate. With a number of participants of 333, the quantitative study had met the minimum sample size criterion.

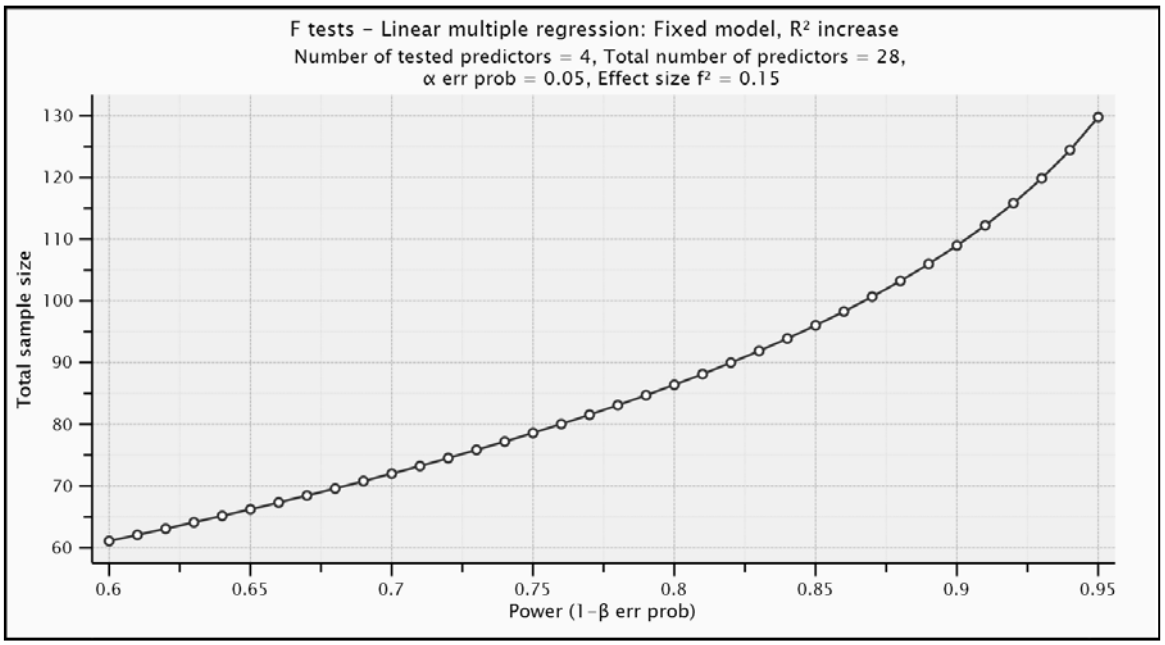


Figure 4. A priori power analysis of power on the total sample size

3.5 Data Collection

The following diagram (see Figure 5) illustrates the study timeline for data collection for the two phases of research (first phase: qualitative study and second phase: quantitative studies with pilot study and actual study).

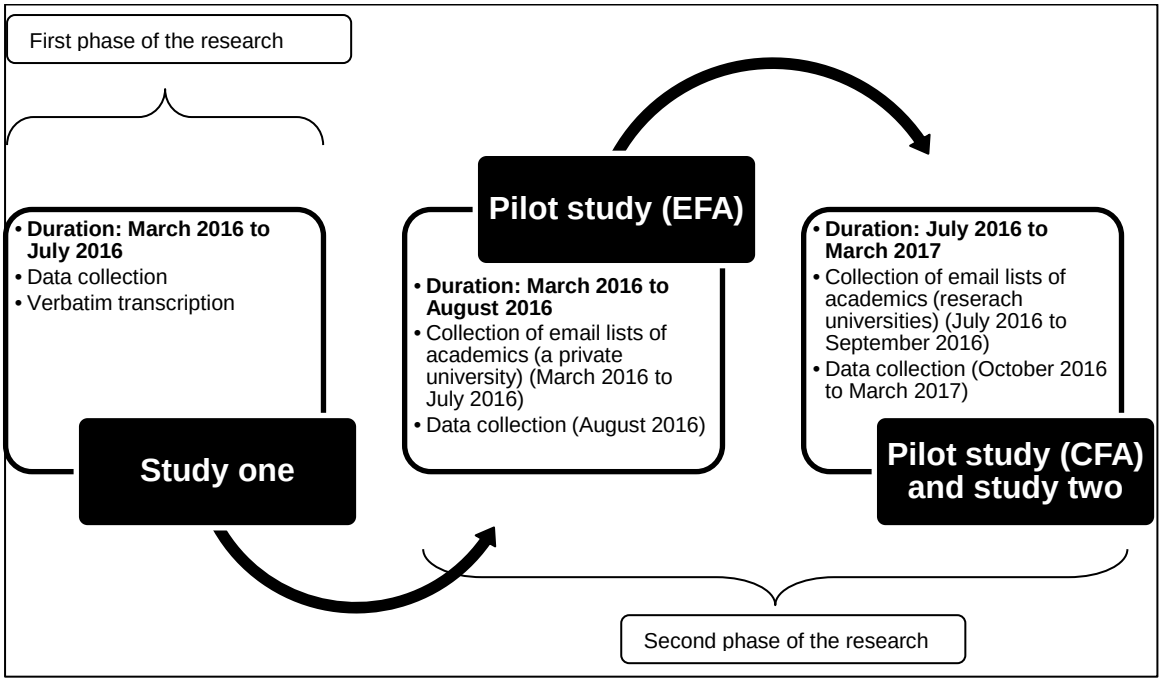


Figure 5. The study timeline for data collection for the two phases of research

The entire data collection process was carried out within one year (March 2016 to March 2017). For the first phase of the research (March 2016 to July 2016), study one was a qualitative study that employed a one-to-one semi-structured interview. The audio recording of the interview was transcribed and analysed. The second phase of the research consisted of the pilot study and study two (March 2016 to March 2017). The pilot study for EFA was carried out by collecting email lists of academics from a private university (March 2016 to July 2016). Invitation to participate in the study was sent through email by using an online survey (August 2016). The collected data was then analysed. In the meantime, the collection of email lists of academics from all RUs in Malaysia was done (July 2016 to September 2016). Data collection was carried out after the EFA (October 2016 to March 2017). Data

were analysed using CFA followed by the inferential analyses to address the research questions.

3.6 The Rationale of Data Analysis Selection

In this section, the rationale of data analysis selection is presented. These include data analyses regarding qualitative analysis for the first phase of the research (study one) and inferential analysis for the second phase of the research (study two).

3.6.1 Qualitative Analysis for Study One

Grounded theory (GT; Glaser & Strauss, 1967) was chosen to analyse the qualitative data in order to generate theories that can explain the individual career development experiences of women academic staff in STEMM fields. The advantages of using grounded theory are that it "provides for intuitive appeal", "fosters creativity", is "potential to conceptuali[s]e", is a "systematic approach to data analysis" and "provides for data depth and richness" (Hussein et al., 2014, p. 3).

Moreover, GT has been a commonly employed qualitative analysis approach used in social sciences, particularly in industrial and organisational psychology studies, for more than a century, as it is suitable to explore organisational cultures and can generate theories and models that are obtained through semi-structured interviews and participant observation (Länsisalmi et al., 2004; K. D. Locke, 2001; K. Locke & Golden-Biddle, 2002; Martin & Turner, 1986).

NVivo 11, a computer-assisted qualitative data analysis software, was selected to manage all the qualitative data, which includes storing and retrieving all verbatim transcripts, coding selected quotations, forming codes and categories, writing memos and notes, and developing the model.

3.6.2 Inferential Analysis for Study Two

This section explains that rationale of selecting bias-corrected bootstrapping based PROCESS (A. F. Hayes, 2012) over the structural equation modelling (SEM) and the traditional Baron and Kenny's causal steps approach (Baron & Kenny, 1986) for the inferential analyses of study two.

PROCESS was chosen over structural equation modelling (SEM), because PROCESS is relatively easier to use than any SEM programme, and has a set of pre-programmed models that can run complicated analyses automatically, whereas most SEM programmes require writing additional codes to run the same analysis (A. F. Hayes et al., 2017). Moreover, the basics of the results from PROCESS and Mplus (a type of SEM programme) are substantively the same, although standard errors are different in small samples. However, this is not case in bigger samples (A. F. Hayes et al., 2017), and, in addition, it has been argued that the difference in standard error is actually misleading as most SEM programmes employ the default estimation method that relies on large samples (A. F. Hayes et al., 2017). On top of that, none of the research in this thesis has a sample size over 500, which was recommended by Hu, Bentler and Kano (1992) for SEM using the Maximum Likelihood Estimation method to execute well. Thus, the PROCESS is more suitable to be used in the present research.

Besides SEM, another alternative could have been the traditional Baron and Kenny's causal steps approach (Baron & Kenny, 1986). The causal steps approach requires all paths in the simple mediation model to be tested, and all 'a' path (predictor links to mediator), 'b' path (mediator links to dependent variable) and 'c' path (total effect: predictor links to dependent variable without the influence from the indirect effect) have to be significant for one to interpret that there is a significant mediation effect (Baron & Kenny, 1986). However, as argued by A. F. Hayes (2009, p. 410-411), "it is possible for an indirect effect to be

detectably different from zero even though one of its constituent paths is not". He recommends using the bootstrapping approach rather than the debatable Baron and Kenny's approach, as the bootstrapping approach can produce an estimate of the indirect effect by generating a large number of samples using the original sample through repeated resampling (A. F. Hayes, 2009). Moreover, the bias-corrected bootstrapping approach used in PROCESS employs a more contemporary view by perceiving "the model as a whole rather than just its pieces" while the Baron and Kenny's approach perceives "mediation as a procedure rather than as a model" (A. F. Hayes et al., 2017, p. 78).

3.7 Ethical Issues

The ethics applications to carry out the two phases of the research were submitted to the Faculty of Arts and Social Sciences Ethics Committee, University of Nottingham Malaysia on 18 December 2014 and 5 May 2015 respectively. Ethics approvals to conduct study one and study two (including pilot study) were granted on 9 February 2015 and 25 February 2016 respectively. All the approval letters obtained can be found in Appendix 1 and 2.

All studies have been designed and carried out by abiding to the Code and Research Conduct and Research Ethics (Version 4) published by University of Nottingham (University of Nottingham, 2013), Code of Human Research Ethics (The British Psychological Society, 2014), and Ethics Guidelines for Internet-mediated Research (The British Psychological Society, 2017) published by The British Psychological Society. Four specific areas within the ethical practices are outlined below.

3.7.1 Voluntary Nature of the Research

Potential participants were approached using official emails from their university websites. Interested participants were welcomed to participate in the studies voluntarily without incentives. Similarly, they were allowed to withdraw from the studies at any point without providing a reason as stated in the participant information sheet.

3.7.2 Anonymity and Confidentiality

For the qualitative studies, participants' names and other identifying information were set with a code to maintain anonymity. All data is confidential and can only be assessed by the researcher, hired transcribers (who had signed a confidentiality contract) and supervisors.

As for the quantitative studies, all participants were given a non-IP-tracking and anonymous link to participate in the studies without revealing their identity, in order to protect their anonymity. Participants were also reassured that any demographical data that was going to be collected from the survey would not be used to identify them.

All results and findings have been reported in a collective manner with no reference to the participant or any identifying information. All data collected from the participants is confidential and stored on a password-protected computer. Names and any identifying information of the participants will not be reported or mentioned in any publishable document or report.

3.7.3 Informed Consent

Prior to taking part in the individual face-to-face interview, all participants were given a participant information sheet that explained the purposes, procedures and the details of the study. They were required to sign a written informed consent to indicate their understanding

of the study and willingness to participate; only after that, they would proceed to the actual study.

As for the online survey, all participants were given a front page with the necessary information on the study (similar to a paper participant information sheet) for them to read. Before participating in the survey, they had to click the ‘proceed’ button as a replacement of a written agreement to indicate a valid consent to participate in the study.

3.7.4 Deception and Harm to Participants

Participants were given clear information on the studies' objectives and purposes, and no deception has been made when carrying out the studies. The studies did not contain any elements that could harm participants physically. Nevertheless, although the studies were not designed or aimed to discuss sensitive topics, there could have been chances that some participants would find it uncomfortable to discuss gender-related issues. Participants were reassured that the collected data was confidential, and they were allowed to stop at any point or withdraw from the study if they felt uncomfortable. One participant requested to pause the recording during the interview to not record certain content that might have been sensitive. The recording was paused until the interviewee agreed to continue voluntarily.

3.8 Chapter Summary

This chapter explained the rationale and philosophical assumptions for the research design and methodology in using MMDR, the rationale of participant selection in terms of sampling strategy and sample size requirements, data collection, the rationale of data analysis selection in using grounded theory and PROCESS, and ethical issues relating to the research. The next chapter reports the results from the first phase of the research.

CHAPTER 4 - QUALITATIVE PHASE (AN EXPLORATORY STUDY OF SUCCESS AMONGST SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS, AND MEDICINE WOMEN ACADEMICS)

4.1 Chapter Overview

This chapter presents the qualitative study, beginning with the method, which includes design and sampling method, description of participants, procedures, researcher as instrument, interview questions, and data analysis. This is then followed by presenting the findings and a short discussion.

4.2 Introduction

The qualitative phase is the first phase of the research (study one) in this thesis. It employed semi-structured interviews to address two research objectives (as stated in Section 1.5) amongst STEMM women academics from all RUs in Malaysia:

(a) To explore the meaning of success.

(b) To explore the psychological and organisational barriers and means of support in achieving career success.

4.3 Method

This section comprises of the research design, sampling method, description of the participants, procedures, the researcher as instrument, interview questions and data analysis.

4.3.1 Research Design and Sampling Method

A semi-structured interview approach was employed. This study employed purposive and snowballing sampling methods. The rationale of research design and sampling method selection can be found on Chapter 3 – Research Design and Methodology.

4.3.2 Description of Participants

A total of ten women academics from all RUs in Malaysia were recruited. Each university was represented by two participants (a senior lecturer and a professor). The key characteristics of the interviewees are outlined in Table 1 below:

Table 1

Interviewees' Characteristics

Interviewee	Age	Marital status	Number of children	Academic rank	Field
S1	37	Married	1	Senior lecturer	Chemistry
S2	33	Married	0	Senior lecturer	Biology
S3	29	Married	0	Senior lecturer	Engineering
S4	36	Married	1	Senior lecturer	Biology
S5	29	Married	3	Senior lecturer	Physic
P1	46	Married	2	Professor	Medicine
P2	60	Married	2	Professor	Biology
P3	52	Divorced	2	Professor	Medicine
P4	52	Married	4	Professor	Computing
P5	68	Married	2	Professor	Medicine

Note. S refers to senior lecturer, whereas P refers to professor.

For the participants who were senior lecturers, their average age was 32.80 years (SD = 3.77), ranging between 29 and 37 years old. All were married and were Malaysians. Two had no child, two had one child, while the remaining participants had three children. The average age of their children was 2.40 years (SD = 2.30). Their seniority in the present university ranged from less than one year up to 5 years (M = 3.20, SD = 1.64). All had obtained a doctorate degree between two and 11 years before the time of the interview.

As for the participants who were professors, their average age was 55.60 years (SD = 8.53), ranging between 46 and 68 years. All were married, except for one participant who was divorced. All participants were Malaysians, with the majority having two children (80%), and with one participant having four children. The average age of their children was 31.30 years (SD = 25.68). Their seniority in the present university ranged between 13 and 41 years (M = 25.80, SD = 10.90). All had obtained a doctorate degree between 13 to 33 years before the time of the interview.

4.3.3 Procedures

Initially, an email was sent to women academics inviting them to partake in the study. In fulfilling the criteria, they needed to be in a STEMM field and hold a senior lecturer or professor position from the five RUs. Once the potential participants responded to the email and agreed to participate in the study, fulfilling the criteria, an appointment was scheduled. The interviews were conducted in their university office or their home depending on the convenience and preference of the participants. The participants were provided with an information sheet along with an informed consent sheet to read and sign before the interviews. The participants were then required to complete a demographic profile form. The interview sessions were scheduled based on the interview question guide. Each interview was audio-recorded and later transcribed into verbatim form. The duration of each interview lasted between 1 and 2.75 hours.

4.3.4 Researcher as Instrument

The researcher, as the research instrument, conducted the interviews. At the time of interview, the researcher had conducted clinical interviews as a clinical psychologist for three years, as a counsellor for five years, and had undergone undergraduate and postgraduate

levels of qualitative research training. Dr Marshall Valencia, who served as the first supervisor from the outset, also attended some of the initial stage interviews to provide some corrective and reflective feedback.

As a female, the researcher was aware that her background would greatly affect her views and understanding of gender-related issues. Therefore, to reduce these impacts, the researcher held ongoing discussions with her supervisors (one male, and one female) and peers from both genders. The researcher maintained close awareness of her personal biases and values as well in order to prevent these from affecting the analysis of the data.

Furthermore, the researcher was also working as a part-time lecturer at a different institution from the five universities in this research during the time of data collection. Accordingly, this background also helped her to understand the various aspects of an academic's life, as well as their routine duties and tasks. Also, due to her identity as non-staff in the researched universities, the researcher viewed the interview content from an outsider's perspective without any initial perceptions and pre-judgment concerning the culture and values in those universities. This aspect enhanced the level of trust amongst the interviewees, who were willing to share personal stories with her in detail, without concern of the potential impact on their existing work environment.

4.3.5 Interview Questions

Based on Galletta (2013), semi-structured interview guide emphasises on open-ended and more theoretically driven questions. Thus, in this study, a semi-structured interview approach was employed beginning with an introductory question asked of the participants (i.e. 'Do you mind sharing your educational background? What about your family background?'). The introductory question focused on building rapport with the participant as well as understanding the background of the participants. By doing so, it encouraged a

generative narrative and created openings for the researcher to learn regarding the participants and their experience (Galletta, 2013).

Next, a general question related to the research topic (i.e. ‘What is your biggest achievement in life?’) was asked. As recommended by Galletta (2013), the beginning of interview question guide needs to create space in order to elicit the central story from the participants to develop direction and depth of the interview by using open-ended questions. Nonetheless, it is important to make sure that the focus of the questions is “very deliberate and carefully tied to your research topic” to allow rooms for narration of experiences by the participants (Galletta, 2013, p. 47). The term “achievement” was used instead of success as it is harder to visualise success as compared to achievement. By asking the participants regarding their achievement, they can relate to the actual things that they have done.

Lastly, Galletta (2013) advises to use the more theoretically shaped questions or questions of greater specificity to ensure that the narratives elicited from the participants are detailed, in-depth and of greater specificity, such as through using a series of probing questions. Hence, the interview question guide was followed by other probing questions mostly related to the main research question (e.g. ‘What are some of the challenges that you faced?’, and ‘What are some types of support that you had that time?’). A more detailed interview question guide is attached in Appendix 3 of this thesis.

4.3.6 Data Analysis

A grounded theory (GT; Glaser & Strauss, 1967) approach was employed to collect and analyse the data obtained from the interviews, assisted by using a software program called ‘NVivo 11’. By reading through the interviews verbatim, the quotations relevant to the research objectives of this study were identified and selected as ‘nodes’. Next, ‘nodes’ having similar features and characteristics were later classified into different ‘categories’ which were

named according to their features. After that, similar ‘categories’ were grouped into ‘themes’ which were given labels to represent their unique characteristics. Following that, the relationships or connections between categories were explored and integrated. A model was then established to elucidate the connections and relationships between the categories.

4.4 Findings for the Meaning of Success

Before proceeding to the findings of the study, please note that the findings are discussed briefly here (in Section 4.4 to 4.6) and will be later discussed more in detail in Section 4.7. This style of writing that incorporates brief discussion when reporting findings followed by more intense discussion after the outcomes are reported is commonly practised in qualitative studies (Hughes et al., 2017; Toffoletti & Starr, 2016).

Two types of success emerged from the interviews and were coded as *career success* and *family success*. Six interviewees (5 professors and 1 senior lecturer) described success as covering both family and career successes; whereas the remaining four interviewees (4 senior lecturers) believed that only career success met their definition of success. All of those who defined both types of successes had at least one child. Five were married and one was divorced.

For the interviewees, family success referred to having children, being able to raise their children, having a good family life and maintaining a family. Career success meant having a successful career, obtaining a Doctor of Philosophy (PhD) degree, obtaining awards, changing workplace to another university, and moving overseas to do a PhD or to attend postdoctoral training.

Senior leaders who are women from various working sectors also agreed that the definition of success should cover both work and family without compromising one or the other (Cheung & Halpern, 2010). Two interviewees who defined success as inclusive of

career and family summed up the meaning of success brilliantly as follows:

> Often, we are told that it has to be one or the other. If you have a successful career, your family somehow will be compromised. So, I think I would consider that as the most significant achievement: **being able to have a good family life while still being able to achieve things at work**. (P1)

> I always put **both family and career as equally important**... It is not about sacrificing one or the other. Both are equally important, so I have to excel in both. (P4)

As for those who perceived only career success as being successful, they were all married; one had a child, another had three children, and the remaining two had no children. Most of the interviewees recalled completing a doctoral degree as being a major success, followed by working as an academician as a career and having the ability to complete training or a degree overseas.

One interviewee referred to her PhD as “one of the biggest achievements”. She recalled:

> That was my first... **major steppingstone**... Yeah. BSc is very much like a testing ground... to see where my interest is, and what I want to do after that. So, during my BSc, I decided I wanted **to do my PhD**… and when I wanted to do my PhD… It is very single-minded... narrow-focussed... It is like everything that you do for that three or five years of your life right... It is on your own project. (S4)

For S5, her current career as being an academician came as a result of her “first interview and first job”, thus this achievement was significant for her. Conversely, P5 regarded herself as having “reached the top for the academic line” (referring to her leadership and professorial positions) as a proof of success in her chosen career.

For some interviewees, stepping out of their comfort zone, (i.e. changing the workplace and going overseas for doctoral or post-doctoral training), constituted a major success. One interviewee stated that:

> I would say, **completing my PhD,** and then having the guts to go to [a foreign country] ... and work there for one year [referring to her post-doctoral training]... a big turning point in my life... I am switching to a different system, a different language, a different country. It is also a different research field. So, it is like a 360-degree change…I think the second, biggest decision that I made, and a very right decision, was…**changing universities**, that was another big move… (S4)

4.5 Findings for the Barriers and Support in Achieving Career Success

Table 2 displays the identified themes and categories along with examples of quotations that arose from the interviews relating to the barriers and support to women academics in achieving career success. Generally, two themes emerged throughout the interviews: personal and psychological factors, and job demands and resources.

Table 2

Identified Themes and Categories with Quotation Examples

Theme	Category	Quotation
Personal and psychological factors	Relationship-related challenges and means of support	P2: *Women, you know, if you get married after your PhD, it's going to be difficult, you have to find somebody with that equal standing.* P4: *…my parents… my husband… my children have always been supportive… those are the important things that have allowed me to fly high.*
	Motherhood and childcare challenges, and means of support	P1: *The guilt of not spending enough time with them or… I wouldn't be able to because of the job… at least not to extend that I want.* P5: *… Family support is very important… for anything, we don't have to go outside to look for it, and we just spend on the family network.*
	Gender-related challenges and means of support	P2: *…women tend to be better teachers.* S4: *maybe it's because of the female's character also... We are not that type to talk about ourselves or... promote ourselves a lot.*
Job demands and resources	Family-friendly policies or facilities (poor or good)	P2: *I wish we could have money to have a nursery here in the faculty... But we don't have.* P5: *We make sure we have childcare facilities… They are one of the biggest… I think ours can house 600 kids… Yeah. It's subsidised.*
	Unprofessional workplace behaviours	P1: *It was very difficult la and then he [a problematic subordinate] came very, very aggressive and very argumentative towards me, and I felt that the reason for this was because he sees me as a woman, he sees me as being relatively young.*

Theme	Category	Quotation
Job demands and resources (continues)	Research, teaching and promotion-related barriers and means of support	S3: …*with the economic crisis, it's not easy to get a scholarship… So how are we going to do the research if we don't have students?* S5: *We have the lecturer course for teaching.* P1: …*we have a lot of clinical roles which somehow was not considered in the old criteria… we have to propose a new clinical sort of promotion criteria.*
	Recognition (with or without)	S2: …*they hardly give credit to people who help them; that's the sad part.* P5: *I think the V.C. recognised my ability to do this… I think I was already recognised as an academic leader.*
	Support from colleagues, supervisors and higher management (with or without)	P3: …*my boss is very supportive of me. So it is a very strong plus point and stuff. So I applied and then realised I have enough marks.* P2: *Women tend to pull the other person down instead of supporting each other… so I thought I really have to work hard to prove that I deserved it.*

4.5.1 Theme One: Personal and Psychological Factors

Under the personal and psychological factors theme, three categories of factors were identified:

(1) Relationship-related challenges and means of support,

(2) Motherhood and childcare challenges and means of support, and

(3) Gender-related challenges and means of support.

(1) Relationship-related challenges and means of support

Relationship-related challenges. The interviewees raised some relationship-related challenges and means of support. Marriage was one of the most significant relationship-related challenges raised by interviewees. Due to their highly educated and high salary background, some interviewees noticed that it was difficult for women academics to marry someone of equal standing. Instead, they needed to lower their expectations, especially if they chose to get married after their PhD. As shared by P2:

> Women, you know, if you **get married after your PhD, it's going to be difficult.** You have to find somebody having equal standing... And some of them can't... They may need to go and marry somebody with less education... Or who's doing something of less status... So that's hard as well... (P2)

The participants were pressured to get married and become pregnant by a certain age. The non-married participants were being labelled as "very independent tomboys" (P2). Some interviewees described their experience of being pressured to get married and to become pregnant mainly due to social norms and supposedly awareness due to their scientific background:

> I think of course there will be people around you… **friends, cousins, relatives... They will definitely ask**... of course the pressure is there… my immediate family didn't pressure me about it... I think they asked that after my PhD and after I started to work… I was twenty-six or seven… then they asked me about that. You have finished your study already... you need to settle down … with my Malay relatives... I think... **marriage, kids, family**, and it's almost like **a compulsory package**. (S4)

> Before I went overseas, I was a very different person. I was that kind of women who told my mum I **wanted to get married by 28**… I wanted to have kids by then, and I would **give up my job for my husband**... **I used to be that kind of women before I went**… because it was a very typical Asian mentality…that women **must have kids before 30**... My mum always tells me after 30, you get married and give birth, you going to have a **higher chance to get breast cancer**... which is true statistically la… If you have your first child after 30, the older you are, the higher risk there is… the risk of getting certain types of cancer. (S2)

With regards to the challenges of marriage, P2 shared that "marriage - it's not like a bed of roses, sometimes it goes on the rocks". One interviewee (P3) talked about her divorce experience, and how it affected her work and life to a great extent, and how a supportive supervisor could be a great form of support:

> I got divorced many, many years ago… that was the saddest part of my life also… I told him… Never mind, he took the kids, because he didn't want them growing up in [my city] … They were very young … **It was very, very depressing… I think after the divorce and all… I think I wasn't doing very well**… I was very skinny then (laugh)... I told my dean, I have to resign, I just have to get out of this place because of the memories and all … That's when he called [a different department under the same university that was located in a different city] and asked them whether they needed [her profession] … **he helped** and then he said okay, they need you. I said, thank God! So, once I came here, within like you know, one year, even my friends in [her city that time], said you look so much better. (P3)

Some interviewees had noticed how marriage had slowed down women's academic career progression, because they waited for their husbands to be promoted first, and only then would they consider applying for a promotion. Some interviewees were more like a follower; they left their career and reapplied in a new one when their husband decided to relocate. These are seen in the quotations below:

> I have to push them [referring to women academics] to apply for a promotion. I have to give them confidence. Sometimes they don't because their husband has not been promoted yet… **they will only ask for a promotion when their husband is promoted** because their husband is not happy if their wife gets promoted before them. (P4)

> One year before I was in [a non-RU], I'd been experiencing… a difference in terms of the atmosphere between [a non-RU] and [her existing RU] **because my husband is working here**… it was one year, and quite far... quite a distance apart… more than 100 km. In the beginning, my husband tried to travel every day, we went back and forth, but the total spending on mileage and petrol was quite high. It was almost RM 2k... (S3)

> I joined academia in [a public university] as a senior lecturer… But then **I transferred** to [her existing RU] after three and a half years **because I got married** to my husband, who is a [her existing RU] lecturer… So that's why I moved [to her existing RU] (P4)

Relationship-related means of support. In contrast, social support was indeed significant for the interviewees. The interviewees expressed the great support they received from their husbands, in-laws, own parents and children. Some excerpts are stated below:

> **They support, they help**. Generally, they don't interfere in my relationship with my husband, so I have been very, very fortunate in my husband, my in-laws and my parents because basically, they believe in what I do. They believe that it is for the greater good and they do what they can to support, you know. (P1)

> The family is always important; my parents have always been **supportive**. My husband has always been supportive. My children have always been supportive. So, I think those are the most… those are the most important things that have allowed me to fly high. (P4)

(2) Motherhood and childcare challenges, and means of support

Motherhood and childcare challenges. Being a mother and deeply involved in childcare were some of the most frequently raised themes presented by the interviewees. Confinement refers to the "period of convalescence immediately following childbirth" or "postnatal traditional birthing practices" that is commonly practised amongst Asians for a month after delivery due to the belief that "the body of a new mother needs to be nursed slowly back to its prenatal state of well-being" (Naser, 2015, p. 153). The interviewees mentioned that, beginning after delivery of a baby, they were required to follow the confinement rules, based on their ethnicity's general practices as mentioned next.

> Confinement period is actually 33 days for the Malay. But I'm half Chinese, so I follow the Chinese... **I break the rules… I didn't follow the rules** that much...During the confinement period… what the Malay culture advocates are that there are some diets that you should watch out for and things like that. Then you have to go through all these massages to make your blood flow better and all that... there are also some procedures on what to wear… it's like a corset … Just to make your waist smaller and all that... It makes no sense... I'm not going to do that! And the Chinese … it's more towards keeping yourself warm all the time because you don't want to have rheumatism and whatsoever. (S4)

Some interviewees admitted that they were not a baby type of person; thus, childcare became extremely challenging for them. P2 shared that "I found the most difficult time was probably after you give birth. Looking after the baby until they are old enough to go to school... Even schooling, I find looking after the children is…hard for me... **I'm not a baby person**."

Conversely, some interviewees had set an extremely high standard for the role of mother, which made them stressed and guilty.

> **The guilt of not spending enough time** with them or what we have been made to believe is the appropriate amount of time to spend with the children, you know if you look at parents these days, helicopter parenting thing is like a concern me and for a child... then I am not… I wouldn't be able to because of the job…**at least not to extend that I want**. (P1)

> The mother has to arrange everything, and then the father has to follow. Because she started nursery and everything... when she went out with all the preparations, you have to prepare food, drinks, clothes… everything… I don't know what the problem is. Just that I need to prepare… that's why maybe I say **I'm under stress... Because I need to do everything.** I never like it… let go of the work that I need to do to the father… sometimes… after he plans, then I don't agree. Then most of the time I plan…then he has to follow. (S1)

Entering into motherhood was like an entire life-changing event for some interviewees. One shared the following experience:

> I have got my life to be like, moved up one level, with the presence of my daughter… **She has changed me from… now in my mind, everything is her**. Whenever you go out, the whole bag is full of her things… There is just one of mine, which is my purse. Last time, everything is mine… Now everything when you have to eat, you have to give her food first… when you sleep, you also worry about her, and you are not worrying about yourself anymore. Whenever, wherever you are…you think of her, whether is she safe or not…you put her in the first place rather than yourself…Not even your husband. **If she's not well… Then I will have difficulties to attend work.** Last time, I mean before I had her, I could bring my work back and then do my work. Now …I have no time to do my work anymore at home. (S1)

For certain interviewees in the medicine field, expressing milk had become a particularly challenging task for them due to their long working hours.

> I would express milk at work, okay? **You just find time to do it.** Then I will store it in the ward la, in the on-call room because you have an on-call room where you sleep… I would express there, and then keep it in the fridge of the freezer. Then my husband would come every night and collect the bottle. (P1)

The geographically-bound condition of women academics (Kauffman & Perry, 1989), that can limit career progression due to gendered roles in the family, seems to worsen after having children. One interviewee explained that it was hard for her to consider any career development opportunities that required her to travel abroad, given her responsibilities as a mother:

> That's the thing about being a mother…**The child will, no matter what; they will always look for their mother..**. Although we try to create a bond between the father and the child, it's just different…if I were to decide to stay abroad for three months just to be attached to a lab, or to do a work project, I don't think I can put that decision right, into my parent's hand... for me… work is work, but… motherhood is forever, and it's not a contract... we bring a child into the world and it is not for us to let our parents' take care of the child. (S4)

Motherhood and childcare means of support. Nonetheless, childcare was well-supported by various parties, such as by the nursery (S5 and P2), maid or personal helper (P1, P2, P3, P4 and S5), baby sitter (P2), and extended family, such as the participants' own parents, husbands, in-laws, and relatives (P1, P2, P5 and S1). In relation to this, one participant stated:

> **I have a large family**. You see, for me, a family is very important. So I have 13 people in the family… there were a lot of people in the house, always, and we've always maintained this... family support is very important… for anything, we don't have to go outside to look for it, **we just rely on the family network** …The family is a whole team. And it's a big large extended family... [When P5 was pursuing her postgraduate study overseas] my cousin came with me. She was staying with us, and she was taking care of the children. (P5)

Some interviewees had integrated and combined work and life aspects so as not to compromise one another, which relates to the work-life interface concept proposed by Cheung and Halpern (2010). For example:

> And I always bring them [referring to her children] wherever I go, even if I have to go outstation, **I will bring them along**. If I have meetings at the office, the maid and I normally will bring them to the meeting. So, they are with me. (P4)

(3) Gender-related challenges and means of support

Gender-related challenges. When women pursue a career in a traditionally male-dominated field, they encounter significant challenges (Werber, 2015). The negative gender stereotypes of women tend to affect their career success, but positive gender stereotypes can assist them in achieving career success more easily.

In Asian cultures, women are expected to take care of their elders (Morley, 2014). P4 described her experience of being offered a promotion, but declining it due to her wish to take care of her parents and being involved in this role more than her male sibling:

> So I have always been called to interviews for vice-chancellor positions, several private universities have always recruited me…**each time I said no**…and, I always give the same reason that I do not want to leave my family…I said that because **I was taking care of my parents**, as both my parents live with me…I was also asked to be a vice-chancellor, but at that time, my mother was very, very sick in the hospital…I am the oldest of four siblings…only one boy [referring to her sibling]… I always put my family as number one… I always say that I don't need to be promoted because I have to take care of my parents…you can ask me to do the job…but don't give me the title. Compared to my brother, my only brother, he doesn't do a thing. (P4)

Due to the gendered roles in the family (Fox, 2010; Gilboa et al., 2008), women are expected to do be caretakers and also to do more household chores compared to men. As shared by one of the interviewees:

> Being a caretaker, I think it has a lot to do with us as a female and as a mother... I think it has been **embedded by their own upbringing**…Like when it comes to washing dishes... So, when the boys are finishing eating, then it's the girls that clean the dishes... So even a simple thing as laundry la... Okay, you just put your laundry in the basket, and then it is the girls who would, you know in the end... Yeah, settle the... (S4)

The interviewees also noticed that females were only attracted to certain areas in STEMM, such as computer science (P4), biology (S4), medicine (P3), chemistry (S1), but not so much attracted towards civil engineering (S3), engineering in general (P4, S4, S2) and

physics (S4). This finding is consistent with the official data reported by the Malaysian Higher Education (2017). One of the excerpts in regard to this is as follows:

> **Biology, we have more females**. Oh my god! ...I can count the males! I think because biology we look at details… Men, they don't really look at details….. men …tend to feel … a bit… I wouldn't say intimidating, a little bit troublesome... So, they don't want to go into those fields... But in physics and engineering…there will be a lot of boys in there, because of equations… I think they relate more to formulas, how to calculate it, and then how you get the right angle and things like that, even in architecture, you see a lot of males… But in biology, sometimes you don't have a lot of equations... It's all about... you know detailed info, so for them, it's like memorisation. (S4)

There also seemed to be a specific set of personality stereotypes observed amongst women, as shared by the interviewees; for example, females are emotionally unstable. A related quotation in this regard is:

> I'm quite a direct person… with females, I have to mix my words a little bit, so I don't hurt them so much... Because of the **emotional factor**... As females, one thing is that we rely on personal relationships... and if I were to work with them, I need to tell them, look this is what you have done wrong … and it's not very easy for me to tell them that... But, if let's say you switch that position to a male…even though if I'm close with that male, I can still say…look, David, I think this is where you screwed up... I think a male can take it…They [referring to females] … will be harder for them

to accept it. So, if you want to relay a message, sometimes negative messages come across, so you have to package it differently. (S4)

One interviewee attributed the low visibility of women scientists as being highly related to their personalities:

Not to say that females are doing less impactful work, but there are some out there that are doing very impactful work... it's just that their visibility is not enhanced… I think maybe it's because of the female's character... We are not of that type to talk about ourselves or promote ourselves a lot. Males, I think, they are good public speakers, they sell themselves more…females …**their personalities**... they have…this factor of being shy…they have been brought up not to be boastful, proud or whatsoever...females are always associated with being kind, being honest, being gentle, you know, all these things…Never about voicing out... (S4)

One of the interviewees realised that the Asian culture had been holding women back, such as in terms of not speaking one's mind or not being assertive in asking for their rights.

For women, **we hold our self back** and sometimes when I've talked about women…some of the men say that it's not just a women thing and so and so, it's an **Asian culture thing**. Sometimes our culture will hold ourselves back a lot…. will is not confident to say the things…Because we have been told since young, don't talk …with their elders present…Keep quiet, that's all, so our culture always stops us from speaking our minds or from being assertive. Asking for our rights…so these are

> all the values that seem to be western values rather than our cultural beliefs, so that's what stops us. (P4)

Some passive attitudes, like never say 'no', caused similar persons to be loaded with more tasks. As mentioned by one interviewee (P4), "I am always a person who won't say no, so then they ask me to do it."

The interviewees also noticed that they required different approaches to manage female and male student supervisees:

> **I have both males and females…different ways of managing**…For males, I just have to give them a guide…they will do it…For males, but I don't need to really guide them on how to do it. But for females, it's a lot of handholding. I think it's very challenging to guide them and to supervise females compared to males…female students are very emotional compared to males... Longer time to supervise female students compared to male students. (P4)

As suggested in the 'think manager-think male' metaphor (Schein, 1973, 1975), one interviewee also noticed that men had advantages when it came to the selection of leaders:

> Now I notice …as a **leader maybe they choose… they prefer males**. I am not sure maybe, maybe the female lecturer not really … I don't know because of the scope of the job. They have to attend so many meetings…Females cannot attend so many meetings. No, I mean because I think females actually have many more commitments … for the family…so the male lecturer not really… [having many] commitments, just like [females] …his work only. (S5)

According to Vongalis-Macrow (2016), female leaders often encounter conflicting assessments given by their subordinates, such as being labelled as weak (when practising communal and relational leadership qualities), controlling (when practising relational skills and consultative styles of decision making), being emotional (when practising empathetic and caring leadership styles). Whereas male leaders who used similar approaches would not receive such negative assessments. Two interviewees observed similar dynamics:

> I think there are **differences in how your action is perceived…**if the same action was performed by a male leader. It would be that he's firm, he's decisive… know what he's doing. When it comes to a female, it tends to have a slightly negative commendation. She is difficult, and she is dogmatic…she is a bitch, you know kind of thing…the feeling that you get, you know that maybe people think that you are not easy to work with. If you stand your ground, then you will seem as bossy, as dominate, whereas if a guy stands his ground then he's firm, you know what he's talking about…not being weak. (P1)

> When you have female figures that are very strong, like voicing out… that's why **you have terms like 'iron lady'... You don't have a term like 'iron-boy', 'ironman'** or whatever it is, for [male] bosses. (S4)

Some interviewees noticed that many women academics lacked the confidence to hold a leadership position. As shared by one interviewee:

> I counselled a lot, a lot of the women staff…when we wanted them, we want to give them the responsibility, administrative responsibility, some of them wanted to stay away, and I say no, this will help you in your career. A lot of them have no confidence…**they have the ability, but they lack the confidence to do it**. (P5)

Gender-related means of support. Compared to the negative gender-related stereotypes or challenges faced by women, there were relatively fewer positive stereotypes identified for women. Some of the positive stereotypes for women that emerged from the interviews included "generally, women are **attracted to academia**" (P1), "female students…**give more commitment**…compared to male student" (S5), and "women tend to **be better teachers**…they will guide the students". (P2).

4.5.2 Theme Two: Job Demands and Resources

Within this theme, the interviewees openly shared a few issues regarding job demands and resources, which included:

(1) Family-friendly policies or facilities,

(2) Unprofessional workplace behaviours,

(3) Research, teaching and promotion-related barriers and the means of support,

(4) Recognition (with or without), and

(5) Support from colleagues, supervisors and higher management (with or without).

(1) Family-friendly policies or facilities

Family-unfriendly policies or facilities. From what was shared by the interviewees, it appeared that RUs lacked support for women academics, especially in relation to pregnancy

and related situations. These issues were evident through poor family-friendly policies and/or facilities.

The interviewees reported discrimination towards pregnancy in the workplace, which obstructed their promotion opportunities and instilled within them the concern that they would be treated differently or unjustly. Some of them needed to prove these people wrong by pushing themselves to work much harder. Some of the relevant quotations with respect to this issue follow:

> Even my first job, when I had my first child… when I was doing my post-doc in [a foreign country's name], the professor **was not really impressed** with me when I told him **I was pregnant**. So, I needed to work really hard. (P2)

> I told my boss that if I am planning to get pregnant, don't treat me any differently because some people will say, okay, **she is pregnant, so we don't give her the post** because she will [be] on maternity leave… (S2)

The heavy workload expected of academics also made some women academics decide to delay their pregnancy plans. As shared by P1:

> He [referring to the interviewee's first child] was about 6 or 7 months old, and at that point and time, **the work was so heavy,** and I wanted to be at least able to focus on my son the rest of the time that I wasn't working, so it **didn't seem right to try for another child** at that point of time. (P1)

Notwithstanding, it is more challenging for pregnant women academics from the field of medicine, given their job scope does not only include teaching, research and administrative duties as academics in medicine also serve as clinicians. All these demands were predominantly difficult for them. As narrated by P5:

> Outpatients consisted of shifts…sometimes your shifts would be at night, and you would be there all alone in the hospital…and then when patients would come in, sometimes you have to do CPR [refers to cardiopulmonary resuscitation]... and **you are pregnant….and you are exposed to a lot of germs**… when people come... they cough. They are sick all the time. Yeah, it was difficult. (P5)

Although the Malaysia government had implemented the paid 90-day maternity leave for all government sectors (all RUs in Malaysia are under the government sector), it was reported by some of the interviewees that such leave was limited to only having three children, as for the fourth child they were only offered entitlement as per the standard 60-day maternity leave. The 2018 Malaysia budget has now attempted to improve the situation, declaring that the existing total maternity leave throughout the service for civil servants was increased from 300 days to 360 days (Mior, 2017), meaning that the 90-day maternity leave could apply to have four children. Another change made earlier by the 2015 Malaysia budget, is that all civil servants are now entitled to year-long childcare leave, but without pay (Boo, 2014). The latest 2020 Malaysia budget has expanded the 90-day maternity leave to private sectors (Mat Arif, 2019). However, for women academics holding leadership positions, it was difficult to take their rightful three-month maternity leave or the year-long childcare leave. The following excerpts highlight that:

> I think there is a rule with this maternity leave… you can choose to have three months of maternity leave for…I don't know how many times… Maybe if you have five kids, **you cannot have three months of maternity leave five times**. Maybe you can have three times only. So, the other two times, you can use one month or two months only. (S4)

> I think…**why people choose different durations** is maybe because of **the different expectations of the job from them.** Let's say you have a female who is a head of the department or a deputy dean or anything la, or accountable to the ministry. Sometimes you cannot afford to take three months, even though you want to because a lot of the decision making is with you… you cannot afford to be away from that job, for too long. (S4)

Other than poor pregnancy-related policies and policy implementations, the interviewees also pointed to family-unfriendly facilities. Some interviewees shared that the nursery in their university was shared by staff members from the entire university, which caused it to be always full. As shared by one interviewee:

> **I wish we could have money to have a nursery here in the faculty.** But we don't have. We have insufficient money to do that…we have one [referring to the main nursery for the entire university] …but it's really full... I think maybe…after-hour childcare or something…You know when you are experimenting halfway, you realise that there's something wrong, it's slow, then you can't finish on time. That's hard. (P2)

In most cases, in the participants' universities, although the rules did not explicitly state to avoid bringing children into the office, they did not support bringing children into the office either. Given the unavailability of slots or vacancies for keeping children during unavoidable events, such as teaching that was scheduled after office hours (which means the nursery's working time had also ended), delays in conducting experiments, children having school holidays, etc., the academics sometimes had no other option but to bring their children into the office. One excerpt from the interviews is described below:

> I don't see it stated to be allowed, but they also didn't mention we cannot bring…but…I mean to be strict, **it is not appropriate to bring kids to the lab**, especially this building…because it is full of labs…so, it is not so safe. But they don't have the rule that states that… I mean so far, I have not read the rule that you cannot bring a child to the university. (S1)

Failing to have a fully equipped nursing room was also an issue for breastfeeding mothers. As mentioned by S4:

> We have a fridge in the pantry…so some of them actually **store milk** in there…but before that, I think they had their own individual fridge, a very small one. I used an ice pack because on that floor, and we didn't have a pantry…or room also, and we didn't have a fridge. So, what I did was bringing a container and use a lot of those ice packs la. (S4)

In their existing working scheme, women academics did not have the alternative option to temporary opt-out from full-time work to a part-time working scheme, and the

options were either to endure it or to leave their job. P5 mentioned that “we don’t have such system [referring to part-time alternative option]. **You resign, that’s it**.”

The interviewees further shared that they were required to work outside of normal office hours, such as teaching night classes, attending meetings, giving talks, preparing presentations and proposals, etc. Some of the excerpts are described below:

> I cannot take care of my daughter if I have a class that ends at 8.30 pm. Then, I send my girl to **the nursery until 6.30 pm only**. I cannot pick her up on time. I also cannot let her go back early as nobody is going to take care of her. I cannot bring her to the office as nobody is going to take care of her if I attend the lecture…my husband is also working here… normally we both have to **lecture at night-time.** (S1)

> **I actually do a lot of work outside of office hours**. I attend a lot of meetings on weekends, on holidays, none of that is official, none of that is paid work…you move up a level, you get a title, you get slightly more pay, but I would say the responsibility and the working hours are more if you factor it in all these unofficial working hours. (P1)

Additionally, women academics in medicine were required to work long hours during their housemanship, as stated below:

> I think probably every working mother goes through this, not just myself… but obviously, there is pressure in the job, which increases the guilt level of not spending time with your family… **most people probably will not work 36 hours at a stretch,**

> **and most people would not probably spend 15 out of 13 days a month in the hospital…** or stay in the hospital at night or to attend training. (P1)

Family-friendly policies or facilities. In contrast, some of the interviewees also acknowledged the existence of some good family-friendly policies or facilities in the universities, such as paternity leave (P3), scholarship for staff's children (S1), respect for no-working-late practice by working mothers (P2), in-campus childcare centre (P5, S3, S4, S2, P3 and S1), pairing a pregnant lecturer with another colleague to co-teach a subject (S4), and the availability of an individual office room for lecturers that can be used for expressing (S4). As shared by P5:

> I think it [referring to the in-campus childcare centre] is pretty helpful. **We make sure we have childcare facilities**…to support them. They are one of the biggest. I built a new one, you know. We asked for funding... I think ours can house 600 kids… Yeah. It's subsidised. (P5)

(2) Unprofessional workplace behaviours

Various forms of unprofessional workplace behaviours were also reported by the interviewees, such as workplace bullying, discrimination and sexual harassment. This included being discriminated against for promotion due to gender, being treated aggressively due to holding the identity of a young woman leader, being treated rudely due to looking younger (like a student), being assigned to work but never being given credit, or being sexually harassed. Indeed, the participants were very often viewed as being less worthy despite performing well and showing their abilities. Moreover, they were taken advantage of

in the workplace. There was strong evidence of power distance in these conditions, some manifestations of which are expressed below:

> I was being nominated to be DVC [referring to deputy vice chancellor] …but I think **maybe my gender** was in the way I think. **I was not appointed as the DVC**… but they moved me out to the Ministry of [name of ministry] to do other work. (P5)

> It was very difficult… he [a problematic subordinate] came very, very aggressive and very argumentative with me, and I felt that the reason for this was because he **sees me as a woman**, he **sees me as being relatively young**… Not younger than him but still compared to most of the professors in that country, almost relatively young la…he told I was inexperienced, and I would back down if he were a bit aggressive. (P1)

> I was so annoyed by this because I had never heard this comment before I came back to Malaysia. Never! When I was in [a foreign country] when I was in [a world-class university] …I was a student, and nobody talked to me any differently, you know? And suddenly to come back here and being asked in a very rude manner… are you a student or what are you doing here. And **when they find out that you are an academician, their tone changed.** It kinds of irritates me because it shouldn't even be like that. I think that's the reason why I permed my hair…so that I looked older…I didn't look at the make-up option as sometimes it's just so difficult to just follow through all this nonsense. (S2)

> Nobody says you can't do this because you are women. Generally, as long as you can deliver, you know you can progress but as I move on, as I move up, you know I do

> come across sorts of **implicit discrimination**…if you go to meetings…often there is an **assumption that you are accompanying somebody else**… you are the spouse of one of the surgeons or you are a nurse of one of the surgeons…often at times, women in this sort of position, they are seen as the **workforce**… when there is something that needs to be done and delivered, you give it to the women but in terms of recognition often the recognition is given to whoever is the president or whomever it is la, you know? To me, it's like for how many years you want to make me just do the **groundwork**, you know? (P1)

Even though sexual harassment did not seem to occur often in the universities of the participants, one of the interviewees disclosed her unpleasant encounter with a foreign professional, in which she felt she was verbally harassed when she attended an external training conducted by him:

> When it comes to foreign professionals right? Sometimes, I think they do take advantage…they think that **being warm and nice and friendly, they take it the other way around**. Err... **easy to be hit on**. I have experienced a foreign professional that actually was quite bold, in making announces…verbal announces, not physical, in the training program… He sort of personally approached me…he emailed me again… more explicit as he said not everybody gets a personal invitation from me… you know that something is not right because he is giving you praises constantly and trying to sit with you during breaks or lunch or whatever and why is he not praising others. He made it clear that can I meet you if I come over here to Malaysia again … not to say it was disturbing but he sent emails you know, apologising… So clearly...he had some

> other intention … I just took it as a professional apology. That's it…**unwanted attention**. (S4)

Some interviewees also reported that they encountered gender discrimination. For S4, she encountered a sexist situation in which a male student refused to be under her supervision, given her gender:

> He's a post-graduate [student]… That was the only male I have had a problem with. He personally told…the research group leader, saying that he had a problem going under my supervision. Because to him, he said **females should not lead the males.** Ah, that was the only direct confrontation... call it remarks, sexist remarks or whatever, that is the direct thing. (S4)

As shared by one of the interviewees, some sexist remarks were also made by male colleagues, to imply that if she worked hard, her husband might look for someone else:

> When they said, I am **travelling overseas**…so **who's taking care of the children**? So, who is so… so this night I not slept much? And then sometimes implying also… Oh, **he might look for someone else** so whatever…Yes, they say…if you do that with your husband then he will go and look for someone else. I didn't, and I don't feel anything, I pity the person who said it…Men always give these kinds of remarks. (P4)

As reported by P4, women were not being taken seriously and were frequently being taken advantage of: "when I say something, **not being taken seriously**…or **being taken advantage of**…being given so many things to do but then **another person gets the credit**".

(3) Research, teaching and promotion related barriers and means of support

Research-related barriers. Even though a PhD scholarship encompasses three years, not everyone is able to finish it within three years given everyone has different types of research and different challenges in their doctoral programme. For S3, for instance:

> I changed both of my studies after one year because I kept on trying to do the preliminary study because my one was an experiment. After one year, we've been struggling and cannot get. So, I decided to change the topic, but it relates but to the main aim, and it's over four years. **My scholarship only covers three years**…because you know once you extend you cannot get…So you have to manage your life. If you want to get married, you have to manage it. If you manage to deliver at the same time to do your writing, then okay. But for me…I cannot. (S3)

Getting postgraduate students and obtaining research grants were some of the commonly repeated themes raised by the interviewees with regards to research. Some participants mentioned that they found it difficult to get postgraduate students, as the number of undergraduate students had reduced in all RUs. Also, the economic crisis had made access to scholarships or grants for postgraduate students more challenging, further complicating the process of attracting students to commit to postgraduate study. As predicted, lower research funding is one of the main obstructions of women's research productivity (Loan & Hussain, 2017).

> **When you are looking into research… 50% of the research… but you reduce the number of undergraduates**… the number of graduates this year for my class was

> only 20. Unlike in [referring to a non-RU]…for one class…about 60 to 70 students… But then again, when we talk about postgraduate, we have to think about the scholarship… along with the **economic crisis**, it's not really easy to get a scholarship. I'm quite frustrated because the number of students is few. So how are we going to do the research if we don't have students? … The grant is also quite an issue. Because for me, **a new lecturer, is not easy to get a grant**. Because a grant is normally based on experience, and have you experience in getting the grant before, and they are also looking into publications which are quite hard for us to get. (S3)

However, S3 shared that her university provided a one-off research grant of RM 20k for young researchers to apply for. In addition, transparency regarding the grant application system was also seen as great research support, as shared by S4:

> I think, here… **the system is more transparent**... if I were to apply for grants and everything... we know what the steps are… whatever proposal that we write our faculty members, our peers, will take a look at it. And then they will give you input so that you can improve on your proposal. But back in my former workplace, it is very open-ended... if your proposal gets accepted, you get accepted la. If you get rejected, you got rejected la… the input is not there, and it's not very transparent. (S4)

The impact of power distance regarding age and seniority also appeared to be quite prominent when the academics applied for research grants. The interviewees reported that, when they applied for grants as lecturers, they were required to add into the application names of senior colleagues, as the grant committee was not confident with younger lecturers.

> Our economy is not stable right now, right? So it's quite difficult for me, a young lecturer to get the grant so **we have to collaborate with others…the senior ones** …Yeah, because I have a comment…they said that, okay, I am not old enough, I am a younger lecturer… they want me to put against someone senior… I think they're not confident for young lecturers to conduct research. (S5)

> They will tell me that **I am too young, and I need to put in a Professor** or whatever who is not even related to your field, but you just need to put them in for the sake of putting them in. This is the problem I had, it is called sleeping collaborators, but then it is kind of common in Malaysia. Because they said that you are so young. You are not capable of managing the fund and running a project…. (S2)

A few interviewees mentioned that they became more sceptical with recruiting postgraduate students under their supervision, given the frequent encounters regarding the poor commitment from the students. For instance:

> I am still searching for a new student for a master or PhD student…**It's quite difficult to get the students now**… they [her colleagues] have one student... had just registered last month but, yesterday…he informed them, he cannot carry on because he is not…disciplined enough…lack commitment. And then, unfortunately, there are not many students because of the requirements... the pointer needs to over 2.7. Until now we only have a response, but none of them *yang betul-betul* [refers to 'really intended to' in Malay] study…they apply master because they still don't have a job offer … and then when they get the job and then they just run away. (S5)

> Now, when I get any female student, my question is “are you planning to get married?” I would ask “Are you planning to get pregnant?” I would also ask because of things in Malaysia… I realise that they give a lot of excuses and then I don’t like excuses for doing work… if you want the PhD, you have to earn it, I don’t do your work for you. So, **I cannot accept excuses**, you tell me if you are pregnant, everyday fainting here, tired, sick, and then you don’t come to work… so many already come and said yes, yes, yes and then after that, they just leave …They either go to industry to pursue a job and said that I need to earn money because my mum thinks it is time for me to earn money for the family … I don’t want this kind of student. (S2)

For some interviewees, their research area was saturated, and it was challenging for them to change to an entirely new area of research if their university had no facility for this. Nevertheless, mentoring seemed to be really helpful for the interviewees to overcome their fears of trying a new research area, as mentioned next:

> The research I was doing in [her previous university], **it is already saturated.** There are a lot of people working in that field... a lot of things have been investigated... the facilities are not there to support you... at that time, I talked to the mentor in [her previous university], I asked him whether it was a good time for me to switch or not. And **it was quite terrifying, because switching, means you have to start from scratch**... So, the advice given was that you are still young if you want to switch you better switch now rather than you wait until your retirement… So, I switch and then later on when I moved here... it’s easy for me just to integrate things. Because the system is there already. (S4)

One of the barriers that emerged regarded the availability of instruments and facilities. One of the participants was quite surprised that the university only provided her with a table, despite the university being categorised as a research university, as she had obtained a laptop and printer when she worked for a non-RU previously. S3 stated that "only tables…I had to buy [a laptop] myself. Like back in [her previous non-RU], I've been getting a laptop, and I've been getting printers." Another interviewee emphasised the importance of the research facilities in order to support her career progression.

> My career wasn't really flying at that time, you see…And it's only after I joined here, and I felt I could move forward easier…because of **the research facilities** here and everything. I think if I choose to stay back, I don't think…I'd move as fast as I have now… (S4)

Other interviewees mentioned the challenges faced due to experiencing long queues to use an instrument, expensive facilities that were spoilt, or being unable to pursue their area of research due to the lack of relevant facilities.

> We got…instrument maintenance, maybe sometimes the instrument… **service was down and then had to wait for a long time**…the queue is one more thing… we have many students…postgraduate students, so we have to take a queue. (S5)

> **…** a lot of expensive facilities are also expensive, and the sad part is that the students are not responsible…**they spoil the thing** … they don't even admit it, they don't even do anything, and then it takes so long for something to be repaired… many items and

> equipment become like… very lecturer-specific, only I can use it, you can use but if you want to use you have to pay… (S2)

> During my time, we didn't have a single thing, you know, **no lab**... we had to start creating things, so of course, it took a lot of lab time. (P2)

> For some reason, we **don't have certain facilities** … then we have to work on something else that may not be related to what we do…if you want to be a good scientist … you cannot keep changing a niche, and you have to be just better and better. (S2)

Some interviewees also expressed their concern regarding the overly high requirements for research in their universities. For example, P3 mentioned that her university expected them to publish in high ranking journals by saying "now they want Q1, Q2; they don't even want to count the ISI in the index and the other journals." Additionally, another interviewee, P1 shared that "tier 1 and tier 2 publications are usually against collaborative works".

Research-related means of support. On the other hand, some means of support for research as stated by the interviewees included having more new lecturers in order to ease the workload, increasing the women's age limit for grant applications (if part of the criteria are applicable) from 40 years to 45 years old, setting four years to complete a PhD for women instead of three years, helping young lecturers to plan their career goals, forbidding senior members of staff to load junior lecturers with too much work, and sharing information regarding research-related awards. Some relevant quotations in this area include the following:

> Certain international grants, they put a cap on for male applicants. They must be 40 years and below. But for females, they **raised the cap to 45 years** because they know that if you want to compare their CV, it would be different. (S4)

> In some countries, they even give **women an extra year to do their PhD**. That means you don't need to complete your PhD in three years. For women, you do an extra one year, that's four years. So, some ladies felt that, oh, are they going to be second class citizens? It's not… They want to get the women to understand a balanced career… to give them choices and chances... To give you a chance…to have a child. When you are doing your PhD, it's when you are of the child-bearing age... (P2)

> So, we do have this kind of training where young academics come, and we help them determine, in five years' time, where do you see yourself? And then, how do you move towards that goal? That is very helpful! When it starts, when they come in young…and [if] you're not careful, **the senior professors start loading them with a lot of work. So, we don't allow that.** (P5)

Teaching-related barriers. Some interviewees experienced teaching-related challenges. Professors, due to their other work commitments, sometimes needed to cancel their class.

> I have a problem…like, **clashing of diary, appointments**, you know? If I have to cancel my class, I dislike it. I really dislike that…or having students and then having to say, oh, can you come a little bit later or something like that. (P2)

Some of the senior lecturers mentioned that teaching a different group of students each semester was a major challenge.

> Teaching is more challenging… every semester, you will see **different students**. And then they will have a different reaction to whatever you teach…The students will show you that they don't understand which challenges you about how you make them understand, even though you used the same technique. Then you have to change yourself, to adapt to them. (S1)

For young lecturers, it was harder to teach students that were older than them, which suggests a potential influence from the high PDI.

> Maybe **I am still young**, not really young but compared to the other fellows, and I'm the younger one…Because they are mostly in thirty above…even my students [master, PhD, etc.] are older than me…I **lack confidence in teaching**, you know? Maybe for foundation undergraduates… I think it is okay…But for postgraduates, I feel you know when the student is older than me…They must be more expert than me. (S5)

Teaching-related means of support. On the other hand, in terms of teaching-related means of support, one of the universities had provided some teaching training to support young lecturers as mentioned by one of the interviewees:

> We got **the lecturer course for teaching**, offered by the *Pusat Siswazah* ['Centre of Graduate Studies' in Malay] - *kursus pembelajaraan and pengajaran* ['learning and

> teaching course' in Malay]. That one is compulsory for the lecturer too, to *sah jawatan* ['confirm position' in Malay]. We also have mock teaching, where they will give comments. One of the methods - blended learning they will use apps like telegram where they give you an assignment, quiz or all the quiz assignment in the system…they have a like a class in the telegram… instead of in the hall…so they use another method to attract the students. (S5)

Promotion-related barriers. In terms of promotion-related challenges, as shared by the interviewees from the medicine field, promotional criteria did not consider the heavy clinical practice, which made it really challenging for them to be promoted.

> It was very difficult because at that time… **the criteria for promotion** were the same, and it was **uniform** for the whole university, so we had to meet the criteria of somebody in the faculty of arts or somebody in the faculty of science had to meet…**we have a lot of clinical roles**… which somehow was not considered in the old criteria. So, we had to fight very, very hard, and we have to propose the new clinical sort of promotion criteria. (P1)

> At that time, it was a lot… like 30 something [referring to the number of publications in order to be promoted to full professorship]…which was very, very high for many of us who do **single consultant practice**, you know it's okay if you got a team like some of the other units and departments, sometimes they have already build up a team... But also, the **nature of the job**, okay? If you are in a field where there are not many emergencies, there is not much out of office work, clinical work, so you can use that

> time to do your paperwork, your research…writing papers. Whereas for us, **it's very unpredictable**. (P1)

A participant also raised the issue of inconsistent criteria being listed officially for promotion as compared to the hidden criteria that were unspoken.

> Even though you have experience here of 20 years, it's still quite hard for you to go to the next level…I don't know what the other criteria that they were looking into are, but I've been hearing some of the lecturers informing that they already followed whatever the requirements were but during the presentation, some of it is not really covered based on the criteria… **I've heard that different universities have different requirements**. But actually, we've been paid by the same amount. (S3)

Another participant mentioned that the promotion criteria were harsher than previously, especially regarding research publications and the supervision of students. She expressed her helplessness, especially since, in recent years, she could not even get one student:

> It is quite difficult for me too… to get promoted to associate *itu is jauh lagi* [refers to 'still far away' in Malay]. Because…**criteria to get promoted is quite strict** now, compared to previously. It's like…of course papers and then…should be…five students, at least four students…I think in previous years…I think within three to five years? They can promote to associate, but now I am not sure because of the strict criteria. I *nak dapat satu student pun susah sekarang* [refers to 'I want to get one student also difficult now' in Malay]. (S5)

Some interviewees also felt that promotion on merit was not really being practised in Malaysia, as mentioned in the quote below:

> I feel that…**promotion by merits is not as strong in Malaysia** as it is overseas. At least overseas it's very clear when they look at your CV, and you can negotiate your pay… according to your experience and according to your publications. But here literally… the government serves us, they follow a certain "*tangga*" [refers to 'rank' in Malay] … in a way, you can be a more high achieving person compared to another person, but… that doesn't translate to a higher position or paid higher in Malaysia. And also… a lot of them who graduate locally, it's so easy for them to just get to the next level because they already have people within the system who can recommend them …give them the link and opportunities. (S2)

Notably, some power distance issues relating to promotion were also raised by the interviewees, particularly regarding age and seniority:

> I am so used to all the smart people being so young and being respected at the same time. Young professors being respected, nothing to do with age… just when I came back here, suddenly **everything is something to do with age**. I just didn't get it… let's talk about science and don't look about, at how young or how old and how long I have served the university and then tell me because of certain years… eight years is time to become an associate professor, and it should not really be like that. (S2)

> If you have a senior colleague and somebody senior to you in terms of years of practice …having to…feed this back to the person and … try to get them to modify

> their behaviour… they don't accept it very well. Coming from someone they perceived to be their junior…Even though **I am actually quite senior already but…their perception is that I am junior**. Why should I listen to you? You are not respecting me, and I am senior, you know? (P1)

Interestingly, one interviewee disclosed that the challenges of being promoted did not mean they could relax afterwards as they were still required to work hard to keep the new rank:

> If somebody has been made a professor and they are not fulfilling what the faculty or the university feels is a requirement, **you can actually be demoted**… you can have other privileges taken away…Let's say you're entitled to sabbatical, and they can decide to turn down your application for sabbatical… Or let's say you attend a conference, you want to apply for financial support, they turn you down …or we will not give you a yearly increment. (P1)

As a result of implementing the Key Performance Indicators (KPI) in the universities, some interviewees reported their distinct dissatisfaction towards the inconsistency of the evaluation system. Another adverse effect of the KPI was felt to be the fact that they diverted people's focus from the quality of research to the mere quantity of publications.

> A lot of people **don't strike for quality in research, and they go for quantity**…just considering what's under the **KPI**…this is the sad part about research in Malaysia that you try to change the culture…should not be just publishing for the sake of

> publishing…It should be publishing and aiming to publish good papers because of who you are: the scientist. (S2)

The implementation and execution of the KPI system is not consistent for all academics from all public universities. The KPI for RUs and non-RUs (besides being increasingly harder in both types of institutions) are different. And even within the same type of university there are differences in KPI requirements. Each academic could set different KPI levels following discussion with their superior. For instance, academic A could aim to publish one paper per year, and academic B could aim to publish three papers per year. Obviously, the KPI for academic A is much more achievable than the KPI for academic B, but they would receive the same evaluation at the end of the day if they reached their target. Thus, the interviewees felt that the KPI system is inconsistent and unfair, as narrated below:

> Back in [a non-RU], the scheme is different, like I said **the KPI is different**. Like in [a non-RU] if you want to apply for the associate prof., you just need to get at least in-depth paper…One or two is enough. You need to graduate the master students at least three, and two is enough. Then you're entitled to be an associate professor. Very easy! But you come across here [her existing university] and it's very tough I mean there are so many requirements that you have to follow like you have to be in an internship also... have to experience one year on-site. (S3)

> Everything is very subjective, and it depends on the boss…I still not believe in KPI's…because KPI's are literally telling you that I have done this, check, check, check… I can be good, and you give me some shit KPI, and also, I cannot do anything. But I can achieve more things than other people and the person can get more

> KPI's than me. I don't understand this system, so I don't care about KPI's. I tell them that I don't believe that KPI's are a measure of telling me how good I am. Because **it's clearly not fair…you can play with the system, and you can be the system**. (S2)

(4) Recognition

Poor recognition. Issues regarding poor recognition at work were raised. Some interviewees were allocated to a non-official position or task, with no recognition given to them. For instance, S2 expressed her frustration in not receiving an acknowledgement from the work she helped other colleagues to perform: "they hardly give credit to people who help them, that's the sad part." Likewise, one other interviewee voiced her disappointment towards the poor recognition given to her regarding her unofficial position as the head of a division:

> The head of the department gets an allowance… I am not head of the department, I am head of all of the divisions of [name of a division]…the number [of divisions] that I have to manage is about half of the entire department numbers, and the amount of work that I do is actually quite a lot. And most of the things that previously were…the head of department has now been delicate to me, so **I am doing all this work**, but I am **not taking the allowances**, and that the title of head of the division is **not even acknowledged** as an official position. (P1)

Additionally, the interviewees also mentioned there was no recognition of previous work experience, postdoctoral training or overseas training. The value of sabbatical leave was also not recognised. S2 mentioned that her university did not recognise the value of

sabbatical leave; she said “Like here, you wait for it lah, you take time off even…go sabbatical…so you come back. After they’d say that…you have not done enough here and there… you have to catch up.” She further stressed that although the sabbatical leave came with pay by the university, it also came with an “extra bond”. Interestingly, it appeared that there was a tendency for the interviewees to link monetary reward with recognition. Thus, the salary was one of the often-used measurements pertaining to recognition for the interviewees. One pertinent excerpt from one interviewee is presented below:

> And after I finish my postdoc …even though I have more than one publication, two, three, four, five, it doesn’t matter anymore. **I still fit into that section**. Therefore, it’s nothing special anymore…It’s all the same, and I start from the lowest [referring to the entry salary level] because that’s what we do. (S2)

It was also difficult to receive recognition amongst colleagues. Despite winning an award, P2 felt that she needed to work even harder to prove to jealous colleagues that she deserved that award:

> … I won this [referring to a national level award] ... It was just in, by the [one of the ministries of government]. So, I had to **work harder**, because I had **to prove to my friends** that I deserved the award, you know? So, it’s not just hearsay, like oh she’s just lucky she got it. (P2)

P2 reported that postdoctoral training was not recognised during her time, but her university had started to recognise postdoctoral training in recent years: “Now it’s recognised

…the university even supports the students if they did their PhD here, locally... then they are able to go overseas on a scholarship… for a post-doc, one to two years, overseas…being sponsored by the university."

Having recognition. On the other hand, the participants also reported the experience of getting recognition. An interviewee disclosed that she was promoted to a higher leadership position in the university as her vice-chancellor recognised her leadership ability:

> I think I had my academic credentials already, but you know I was outside the university system when I was appointed. I was shifted into the ministry of [name of a ministry]. I think the **Vice Chancellor recognised my ability** to do this… So, he moved me up there to do all this for the university. I think I was already recognised as an academic leader, although I was doing work outside. (P5)

In other cases, even though recognition within one's university was poor, some interviewees were grateful that there were some local and international awards in recognising women scientists:

> L'Oréal-UNESCO is actually worldwide... in each country… They will award this award to women scientists. So, in Malaysia, every year, they will award three women scientists... that is one way actually to enhance the contribution and the visibility of women scientists… Because as far as I know, so far this is the **only award** that is specifically **dedicated to women**… (S4)

(5) Support from colleagues, supervisor and higher management

Poor support from colleagues, supervisor and higher management. Poor supervisor and higher management support issues were also mentioned as one of the issues by the interviewees. Both men and women can be poor or ineffective supervisors or managers to women academics. An interviewee spoke about her unsupportive PhD male supervisor that did not understand her additional role as a mother.

> **He doesn't understand me**...I have a family and because he is a male supervisor, so he does not really understand how I face…because…I have a family commitment. I have to divide my time for my family commitment and study... I had two babies at that time and still breastfed…It was quite stressful for me. (S5)

Another unsupportive supervisor example is shown by the following interviewee, in which she expected women to work late despite their role as a mother:

> Many of them [women] are trying to cope with married life, and it's hard for them to stay on after 5 o'clock or something because they've got to go and fetch their children from the nursery. Well, the thing is, I worked until very late…**So, I expect people to do that as well.** (P2)

Some interviewees raised the issues relating to the lack of mentorship, particularly women mentors, as well as having few women in higher leadership positions:

> Who will mentor you? Because everybody is doing it for the first time... Generally, I think it is a challenge for everybody, but I think the nature of the commitments that women have indicated are doubly difficult and the fact that there are **very few role**

> **models** makes it even more difficult…you can't even ask for advice. Most of my mentors have been men, okay so I can ask them about the professional things…But I can't ask them so how do you manage when you are breastfeeding your child, and you have to go on-call, can't ask them that because they won't have that experience. (P1)

> At the faculty, even when I moved to the centre was the dean who guided me. They are males and when I was appointed as the senate member…it was the vice-chancellor himself who saw my potential, and of course, they are all male. **There is never a female**. (P4)

Moreover, some interviewees noticed that their faculties lacked supporting staff members. Thus, they had to play additional administrative roles which could be performed by technicians, administrative and supporting staff members. For instance, P2 noticed that "We don't have enough technicians to go around". While P1 complained that "There is lots of clerical support for undergraduate [programmes] but not for postgraduate [programmes]." Whereas S5 pointed out that "Not so many staff *sokongan* [refers to 'supporting staff' in Malay] to…do all the *kerja* [refers to 'work' in Malay] la". S2 also highlighted that "At the university, when you want to enquire about something, they don't reply… I get so irritated sometimes because I don't have time to follow up with everything… sometimes I forget and then I have new things coming up". In terms of support from colleagues, some interviewees felt that their colleagues were not supportive enough. Some relevant excerpts are reported below:

> **They were not impressed at all** …I'm not surprised, because I find that many of us here... when the ladies go out for their maternity [leave]…it does give a mixed [feeling], the other people have to cover them…it's quite difficult, you know? (P2)
>
> **Women tend to pull the other person down** instead of supporting each other…so I thought I really have to work hard to prove that I deserved it…you hear people say, oh, did you know that she won the award... Maybe they feel that they deserve it, rather than me. (P2)

Furthermore, the interaction between colleagues was limited due to the single room policy for each lecturer as practised in S3's university. S3 stated that "you don't interact with other lecturers, because you have your own room, so I think I have that difficulty… in terms of the interaction". It further obstructed opportunities amongst the colleagues to develop a better understanding and support for other colleagues.

Good support from colleagues, supervisor and higher management. On the other hand, eight out of ten interviewees acknowledged that they had either received supervisor support or became the support to their subordinates, such as identifying their potential and supporting them for promotion, encouraging them and being empathetic and understanding about their issues and challenges. One interviewee described the support she offered to women academics with 'sticky floor' issues (Booth et al., 2003; Yap & Konrad, 2009):

> They were **not confident** about having to have even more responsibilities… they think they will not be able to do it …I know that they have the potential…I have to give confidence to them…They think they are not good enough. They don't think they desire promotion…maybe because they have their small children; they are planning to

> have a baby; they just delivered a baby… those who are not married, planning to get married. Their husband might not like it, so even things have not happened yet…But then you will give an excuse, and I said, you don't have a baby yet, do you see that? The baby is not even there yet… (P4)

Another interviewee finally gathered up her courage to apply for a promotion after receiving support from her immediate supervisor:

> And my **boss is very supportive of me**… it is very strong plus point and stuff…So I applied, and then, I realised that…I have enough points… luckily the evaluator's reports were good… (P3)

4.6 Model of Barriers and Means of Support in Achieving Career Success

By using the concept map in NVivo, all identified themes from both the first and second research objectives were displayed on the viewing pane of the software. Here, different shapes were assigned to different themes in order to distinguish the first and second research objectives. The first research objective's theme used a diamond shape, whereas the second research objective's themes used a standard rectangle shape. As the outcome of the barriers and support to women academics related to career success, an oval shape was created to represent career success.

By glancing through the interview transcripts and memos repeatedly, the presence of a strong collectivist culture and the phenomenon of power distance were noticed (Hofstede Insights, 2018). Thus, these were added into the concept map using a rounded rectangular shape. Moreover, different types of arrows were added to offer better visualisation of the relationship between these themes. A more primary relationship used a solid arrow line,

whereas a collateral relationship employed a dotted line. All shapes were rearranged to allow better visualisation. In the end, a model was generated to enable an overview to be provided, depicting the relationships between all the findings from the interviews (see Figure 6).

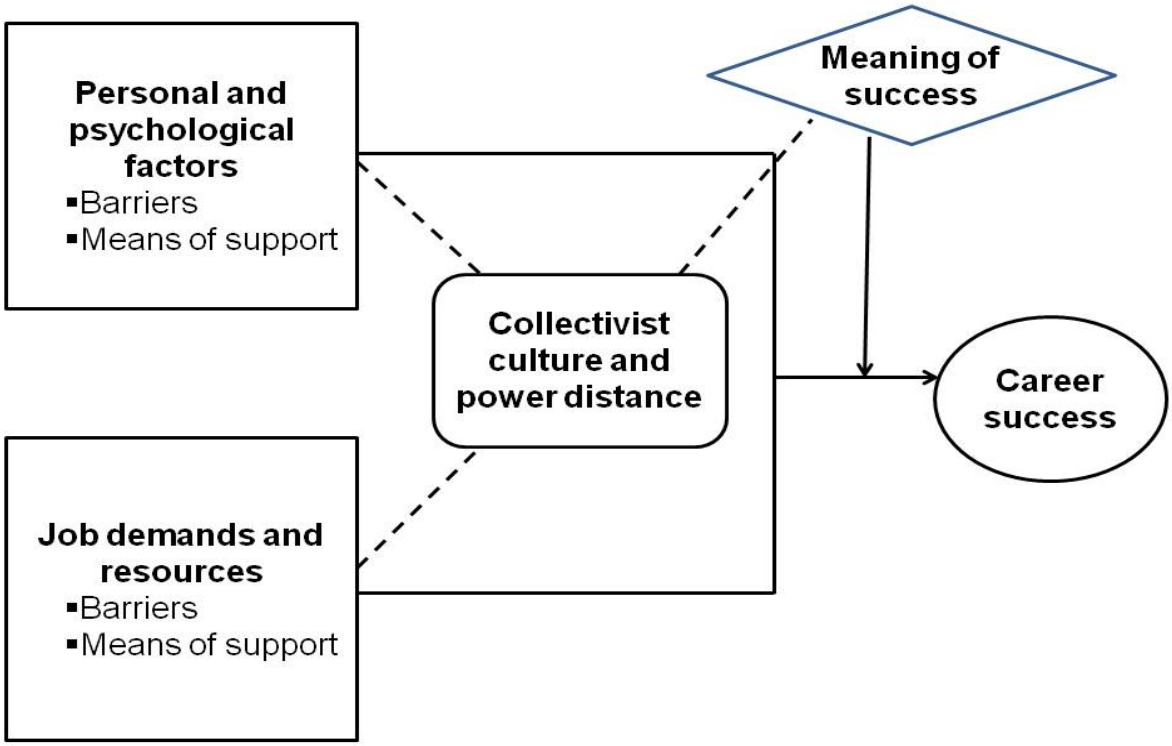


Figure 6. Model of Barriers and Means of Support in Achieving Career Success for STEMM Women Academics

The model generated was based on the two overarching themes: personal and psychological factors, and job demands and resources, to explain their relationships with career success amongst STEMM women academics in Malaysia (see Figure 6). All themes are divided into barriers and means of support. The dotted line indicates the collateral effect of the collectivist culture and power distance on all themes and their influences on the meaning of success. The solid line refers to the primary effect on career success.

Given the influence of collectivist culture and high PDI (Hofstede Insights, 2018), we can see a heightening level of the barriers or issues faced by women academics. In particular,

facing a greater challenge from gender stigma and the social norms governing gender roles and expectations, due to the pressure from the highly collectivist culture and high PDI in the traditionally male-dominated fields (i.e. STEMM).

However, offsetting this, is greater access to the means of support, through mentors, supervisors, superiors, extended family and other collectivist forms of social assistance. The meaning of success is also heavily grounded in the highly collectivist culture and high PDI. Similarly, personal and psychological factors, job demands and resources, and meaning of success, are all heavily influenced by the highly collectivist culture and high PDI, each affecting the career success of STEMM women academics in Malaysia.

4.7 A Short Discussion of the Qualitative Findings

The following subsections discuss the insights that arose when reflecting on the findings on the meaning of success and the barriers and means of support to STEMM women academics in achieving career success. This section is divided into four subsections, namely meaning of success, personal and psychological factors, and job demands and resources.

4.7.1 Meaning of Success

The majority of the interviewees (60%) perceived that success should cover both family and career successes. Amongst the interviewees, almost all were professors with only one being a senior lecturer. The interviewees were all married with only one having been divorced, and all had at least one child. Those who viewed that success should only cover career success (40% of the interviewees) were all senior lecturers.

Placing the household and childcare first as a priority remains a common gender schema (Bem & Bem, 1970) amongst STEMM women academics. It could be argued that the majority of interviewees were still holding their identity as gender-schematic people, while

the remaining 40% who defined success as career success were gender-aschematic people as described in GST (Bem, 1981a). The interviewees could have known that this study was more relevant to career success, thus all of them defined success should cover career success. However, for the gender-schematic women, on top of career success, they would still bring up family success as part of the definition of success and link the 'feminine' roles of the household and childcare in the family setting unconsciously to themselves (Bem & Bem, 1970).

Furthermore, we can also perceive the influence of the collectivist culture in this context. Malaysian women are expected to prioritise the family and place self-fulfilment behind family matters (Abdullah et al., 2008). Given Malaysia is a high collectivism country (Hofstede Insights, 2018) and a traditional country concerning gender roles (Hirschman, 2016; J. E. Williams & Best, 1990b, 1990a), one can see how women academics still view success from a more collectivist lens rather than from an individualistic lens. This finding is consistent with a study done amongst young female Malay academics in Malaysia, in which the participants were found to wish to commit to both family and career concurrently despite their identity as being a young, educated and modern woman (Osman, 2014).

Therefore, given such background, most of the interviewees perceived that success should not just be related to one's career, but they have to also be successful in the family context. The literature on gender roles in contexts with very similar indexes of collectivism, such as China, highlights this. Ji (2015, p. 1058) states that women are still being "valued in terms of their roles as wives and mothers, regardless of the impressive progress made in terms of gender equality in China" (Ji, 2015, p. 1058). Such meaning of success may have made them even more stressed compared to men as they need to target two areas of success. Whereas, men, on the other hand, might need to only focus on career success since they are considered as the main breadwinners from a traditional viewpoint (To, 2015). Even though

STEMM women academics might be successful in their chosen career, they are still judged based on success in family matters.

This double-meaning of success has definitely affected the subsequent layer of the research question, which referred to the barriers and support to STEMM women academics in achieving career success, as the additional effort required in balancing between career and family emerged.

4.7.2 Barriers and Support: Personal and Psychological Factors

Regarding the first theme (personal and psychological factors) on the barriers and support to STEMM women academics in achieving career success, we can see that relationship, motherhood and childcare, as well as gender-related challenges and means of support, were the main categories that emerged.

For relationship-related challenges, the interviewees highlighted the challenges in marrying someone of equal standing. Here, it appears that there is a form of gender schema (Bem, 1981a), in which women should marry someone who is better than them or of equal standing in terms of career or qualifications. In the Asian context, the concept of ‘compatible family background’, that refers to having similar educational attainments, is not an uncommon practice found amongst professional women when seeking for partners (Ji, 2015). Although more contemporary women accept men with lower education level or poorer financial ability, they are concerned that men’s pride would be challenged (Ji, 2015). The gender double standard in the marriage market is also prominent in the present study. For instance, a woman who holds a PhD, has money or has a good job is seen as a disadvantage in the marriage market, while the same set of characteristics are considered advantages for men (Ji, 2015).

The gender schemata also pressured women to get married and become pregnant by a certain age as “a compulsory package” (Bem, 1981a) under the collectivist culture (Hofstede, 2011), as relatives and friends were overly concerned regarding these topics. If not conforming, they were labelled harshly as “very independent tomboys”, as shared by one of the interviewees in this study. In the Asian context, single, educated women are castigated as ‘leftover’ women when they remain unmarried by their late 20s (Ji, 2015). Based on the interviewees, the scientific background had pushed them even further as they were well-aware of the health risk of getting pregnant at a later age. Notably, these increasing pressures and negative connotations associated with single women as well as women who may not have children were additional stressors or burdens placed on women, given they also needed to face challenges from having a career.

Those women who were married shared that marriage was sometimes challenging and would affect their career, especially when they experienced divorce. They often prioritised their husbands’ career plan over their own career. When women choose to make a career-related decision, such as changing jobs, having children, returning to school or relocating, by prioritising their husband’s career over their own, they are less likely to achieve subjective career success (Valcour & Ladge, 2008). While at the same time, social support from their supervisor, husband, in-laws, parents and their children was also evident given the highly collectivist country of Malaysia (Hofstede Insights, 2018). People in a high collectivist culture often emphasise on ‘we’ and belongingness, which leads to a strong and cohesive in-groups that provide support to each other (Hofstede, 2011). Hence, receiving social support is relatively common amongst STEMM women academics in Malaysia.

The next category that was highlighted was motherhood and childcare-related challenges and means of support. In the journey of achieving success, women are often pushed to make a selection between a baby or a briefcase (Cheung & Halpern, 2010). The

gendered responsibilities according to which women should focus on family and childcare (Fox, 2010) could be considered gender schemata that made STEMM women academics more stressed and feeling guilty. Some interviewees shared that being a mother, while they were not a baby person, had made childcare extremely challenging for them. Indeed, this condition could be particularly challenging for gender-aschematic women as described in the GST (Bem, 1981a), since they may not adopt the feminine-related roles (e.g. love childcare) as strongly as those who are gender-schematic.

Moreover, some interviewees shared that they were pressured with a high standard of childcare responsibility, were required to follow confinement rules, and needed to find time to express milk despite long working hours. These gendered schemas clearly influenced STEMM women academics in Malaysia at an early age due to societal practices (Bem, 1981a). Nevertheless, although there was strong gendered childcare responsibility, childcare was also well-supported by the extended family, husband, nursery, maid or personal helper and babysitter. This finding is consistent with a study that was conducted amongst Malay women academics in Malaysia (Osman et al., 2019). Due to the collectivist nature of Malaysia (Hofstede Insights, 2018), we can see strong support from extended family. As collectivism views that people are born and integrated into extended families that provide them protection in exchange for unquestioning loyalty (Hofstede, 2011), it is almost automatic that extended families, such as grandparents, uncles and aunts become one of the main sources of support when it comes to childcare. When it comes to maids or personal helpers, these are related to the relatively rapid economic growth and easy accessibility of domestic helpers in Malaysia (Orange et al., 2012). These means of support have provided great assistance to STEMM women academics, especially when they need more time in the ‘greedy institution of science’ (Fox, 2010; Grant et al., 2000).

As for the gender-related challenges and means of support, both negative and positive gender stereotypes themes emerged from the interviewees. Aside from childcare, women are expected to take care of their elders (Morley, 2014), especially under the influence of a collectivist culture in Malaysia (Hofstede Insights, 2018). Women are expected to play a caretaker role as this is considered a 'feminine' gender schema (Bem, 1981a; Hofstede Insights, 2018). For instance, one interviewee reported that she had to decline an offer of promotion in order to take care of her parents. As such, the universities in Malaysia should consider extending their support to employees by establishing an elder care service.

The strong gendered roles in household chores (Fox, 2010; Gilboa et al., 2008) have also projected that women should do more housework compared to men. Some interviewees felt that "it has been embedded by their own upbringing" that women should clean dishes and do laundry, playing a 'gender-appropriate' role as a woman (Bem, 1981a), thus they were heavily affected by the gendered roles in household chores.

Another gender stereotype observed was that females were only attracted to some areas in STEMM, but with little attraction to hard sciences. Interestingly, there is still a strong gender schema (Bem, 1981a) that women may not be suitable in STEMM fields, especially in the hard sciences field, given the strong association of 'science and math fields with males' (Hill, Corbett & Rose, 2010). However, many studies have proven that both genders can perform well in mathematics (Hyde et al., 2008; Lindberg et al., 2010; Lynn & Irwing, 2004).

Nonetheless, one positive stereotype was found for women, in which women were viewed as good teachers, and accordingly suitable in academia. However, this positive stereotype seems to have negative consequences too, as it can cause women to be loaded with more teaching thus affecting their performance in research (K. Kim & Choi, 2017; Xie & Shauman, 1998).

Notwithstanding, a further gender-related challenge was that the interviewees observed that women 'tended' to have a specific set of personalities (e.g. being emotionally unstable, sensitive, looking into detail, being kind and gentle), which could be embedded since early childhood due to their gender (Bem, 1983). These gendered schemata linked some of the attitudes or personalities that were considered as 'feminine' to all women in general (Bem, 1981a). Although, such gendered schemata are detrimental to women's career success.

Even when selecting leadership positions, the interviewees perceived that women had less advantages compared to men. The 'think manager-think male' metaphor suggested by Schein (Schein, 1973, 1975) emerged from the interviews. This situation could be due to the perception that that women cannot focus on a leadership role given their gendered role in the household and family (Fox, 2010; Gilboa et al., 2008). In relation to this, some interviewees noticed that many women academics lacked having the confidence to hold a leadership position. Moreover, it has been noted that even when women do have the confidence to become leaders, such confidence may be short-lived, given society endorsing gender-schematic concepts in that men should be leaders and that women are not good leader materials (Bem, 1983). The interviewees also reported that women leaders tended to be perceived more harshly and negatively (e.g. difficult, dogmatic, bitchy and bossy), even though male leaders performed the exact same actions and behaviour (but were instead being perceived as firm and decisive). This has been noticed in previous research as well (Vongalis-Macrow, (2016).

4.7.3 Barriers and Support: Job Demands and Resources

Regarding the second theme, which was related to job demands and resources, categories such as family-friendly policies or facilities, unprofessional workplace behaviours, research, teaching and promotion related barriers and means of support, recognition, and

support from colleagues, supervisors and higher management were highlighted and raised by the interviewees.

Founded on the interview results, RUs in Malaysia appeared to have inadequate family-friendly policies and/or facilities. The participants repeatedly reported facing discrimination with regards to pregnancy in the workplace, which hindered their opportunities for promotion and instilled in them the concern that they would be treated differently or unjustly. The heavy workload attributed to academia, in-turn, caused them to delay their plans for pregnancy.

Aside from inadequate maternity-related policies, the interviewees also pointed to family-unfriendly facilities, which included an insufficient nursery for staff members from one university, while at the same time there was no explicit rule allowing staff to bring children into the office (which would been useful especially in case of unavoidable events). Likewise, also highlighted was the lack of fully equipped nursing rooms or facilities, the lack of reasonable alternative arrangements for new mothers (such as temporarily opting out from full-time work to a part-time working scheme), and the requirement to work outside of normal office hours.

Nevertheless, the interviewees acknowledged the existence of some good family-friendly policies or facilities in some of the universities, such as having paternity leave, scholarships for staff's children, respect for no-working-late practice for working mothers, some good in-campus childcare centres, the practice of pairing a pregnant lecturer with another colleague to co-teach a subject, and the availability of individual office rooms that could be used for expressing milk. These good practices resonate with what has been put forward by Marican and Sabil (2017), who propose that there should be a set of good family-friendly policies and facilities for the support of women academics in Malaysia.

The next category under the job demands and resources theme related to unprofessional workplace behaviours, which consisted of workplace bullying, discrimination and sexual harassment due to their gender. Some of the findings from the interviews identified STEMM women academics as being discriminated or treated aggressively and rudely due to age and seniority. In most of these cases, the role played by power distance (Hofstede, 2011) is evident, especially in relation to the intersection of gender, age and seniority. It has been shown that female scientists and female university employees in general who encounter frequent gender discrimination and sexual harassment perform poorly at work (Schneider et al., 1997; Settles et al., 2006). This, together with the more obvious ethical reasons, should encourage universities to establish more comprehensive rules or guidelines to support STEMM women academics against workplace bullying, discrimination and sexual harassment.

A further category under the job demands and resources theme was research, teaching and promotion related barriers and means of support. Regarding research challenges, the interviewees revealed a series of challenges in their respective universities, such as PhD scholarships being limited to 3 years, difficulties in obtaining postgraduate students and obtaining research grants as a young lecturer, saturation in the existing research areas, poor research-related facilities, unnecessary administrative work, and excessive requirements for publications. Some means of support for research mentioned by the interviewees included good transparency in the grant application system in certain universities, having additional lecturers to ease the workload, and increasing the age limit of women for grant applications from 40 years to 45 years old. In addition, some universities set 4 years to complete a PhD for women instead of 3 years, would help young lecturers to plan their career goals, would proscribe senior academics from loading junior colleagues with too much work, and would share information about research-related awards. It has been shown that women academics

often receive less support for research (Franca & Padilla, 2017) and face gender bias in grant funding applications (R. van der Lee & Ellemers, 2015). At the same time, research demonstrates that support for research such as funds, facilities and equipment, reward and incentive system, and the scientific manpower of a laboratory are significantly and positively associated with research productivity, especially for STEMM fields (Cattaneo et al., 2016; Kumari et al., 2015; Minguillo & Thelwall, 2015; Miyaki & Okajima, 2018). Thus, it is essential to emphasise the importance of providing such means of support for STEMM women academics.

As for teaching-related challenges, the interviewees with a higher academic rank – professor expressed that they sometimes needed to cancel their scheduled class due to other work commitments, whereas the interviewees with a lower academic rank – senior lecturer needed to change their teaching style to suit different batches of students each semester, and that it was difficult to teach students that were older than them. Although some universities provided some teaching training to support junior lecturers, more teaching and mentoring support (including training) should be provided, as teaching training is associated with a better rating in teaching performance amongst academics (Arah et al., 2012).

With regards to challenges to promotion, differences in gender in career advancement amongst STEMM academics have been noted in several studies, where women tended to be promoted at a slower pace compared to men (Carr et al., 2003; Liu & Alexander, 2010; Sexton et al., 2012). Regarding promotion-related barriers, the interviewees from the medicine field shared that the promotion criteria did not consider their heavy clinical practice. Other interviewees also mentioned the inconsistent criteria being listed officially for promotion (as well as the hidden criteria), the fact that promotion criteria were becoming increasingly stricter, especially with regards to research publications and the supervision of students, and the fact that promotion on merit was not really practiced. Also, the participants

mentioned that being promoted required them to work harder in order to keep their new rank, and that the KPI evaluation system was inconsistent and unfair. More efforts are required to better address these issues.

Issues regarding inadequate recognition at work were raised, such as receiving no recognition based on an assigned non-official position or task, not receiving an acknowledgement from the work they helped other colleagues to undertake, and no recognition of previous working experience, postdoctoral training, overseas training and sabbatical leave. In contrast, some interviewees reported that some universities had begun to recognise postdoctoral training, with the male leader recognising their leadership abilities, and also recognising their local and international awards.

It seemed that STEMM women academics in Malaysia encountered a similar fate as STEMM women academics in the United States who have also been shown to receive significantly less recognition compared to their male counterparts (Fox, 2010). Moreover, poor recognition towards women scientists can also be seen from the low number of women winners of Nobel Prizes in Chemistry, Medicine, and Physics as well as the Fields Medal in Mathematics as compared to men (UNESCO Bangkok & Korean Women's Development Institute (KWDI), 2015).

Accordingly, the academics in Malaysia need to receive recognition in research, publications, teaching and services, as has also been pointed out by (Ismail & Mohd Rasdi, 2006a) from administrators, colleagues, students and parents (Fernet et al., 2016). Indeed, recognition can originate in various forms of affective, tangible or monetary rewards (Fernet et al., 2016). In this thesis, the interviewees expressed that they preferred recognition to be presented in the form of monetary reward. An informal appointment to them was not seen as proper recognition, given they were only being taken advantage of by doing more work,

while others may take the credit for their efforts. Some strategies to tackle these issues are needed.

Also rose as an issue was the support of poor supervisors, higher management and the support of colleagues. This included having an unsupportive PhD male supervisor that did not understand their additional role as a mother, the expectation from women leaders that women should work late despite their role as a mother, lack of mentorship, particularly women mentors, as well as having only a few women in higher leadership positions. Also, there were issues regarding the lack of supporting staff members, unwillingness from part of colleagues to cover for women during maternity leave and the limited interactions between lecturers. In contrast, though, the majority of interviewees mentioned that they had either received support from their supervisor or they became the support to their subordinates. Previous studies have also shown that support from supervisors and colleagues can affect career success favourably (K. Kim & Choi, 2017; Ng et al., 2005; Ng & Feldman, 2014). It is recommended that these issues are managed by providing more gender-sensitive training, formal mentoring, and networking opportunities.

4.8 Chapter Summary

This chapter presented and discussed the findings of the first phase of the research. The emerged meaning of success, based on the interviews conducted with STEMM women academics in Malaysia, was presented. In addition, the barriers and support encountered by the participants in achieving career success were also displayed. This was followed by a brief discussion of the findings. The findings of this study helped in identifying the theories and model on which the theoretical model of the quantitative phase was based as well as the variables and the relationships between variables to be measured in the next phase of the research.

CHAPTER 5 - PILOT STUDY OF THE QUANTITATIVE PHASE (EXAMINATIONS OF PSYCHOMETRIC PROPERTIES OF INSTRUMENTS)

5.1 Chapter Overview

This chapter starts by outlining the method of the pilot study of the quantitative phase, followed by reporting the findings on the psychometric properties of each instrument. The chapter ends with a summary of the changes that were applied to the instruments, based on the analyses conducted.

5.2 Introduction

As presented in Chapter 4, study one (qualitative phase) found two main themes that summarised the barriers and support encountered by the participants in achieving career success, namely personal and psychological factors as well as job demands and resources. These findings provide a novel insight in developing a quantiative study to test them among a bigger population. Building on the findings from study one (qualitative phase), the Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007; Demerouti et al., 2001), Social Cognitive Career Theory (SCCT; Lent et al., 1994) and Gender Schema Theory (GST; Bem, 1981a) were identified to be well-suited to provide theoretical grounds for the design of study two (quantitative phase).

The JD-R model was deemed as one of the most suitable theoretical foundations for study two as the model proposes that the conditions of work can be divided into two interacting categories: job demands and job resources and explaining their impacts on employees' well-being and performance (Bakker & Demerouti, 2007; Demerouti et al., 2001). This model was tally with the second main theme from study one.

Likewise, the SCCT addressed the first and second themes as it proposes that one's learning experiences are influenced by one's person inputs, which include gender, background contextual affordances or environmental variables (Lent et al., 1994, 2000, 2002). The person inputs were tally with the first theme - personal and psychological factors. The environmental variables were similar to the second theme – job demands and resources.

GST was also selected as one of the theoretical grounds, as this theory is a social-cognitive-based theory, containing features from both the cognitive-developmental and the social learning theories in explaining sex-typing (Bem, 1983). Thus, GST could help in explaining the impact of gender.

By linking the findings from study one and combining JD-R, SCCT and GST, study two developed a theoretical framework to be tested among STEMM academics from all RUs in Malaysia. The framework covers age and seniority as person variables that were raised under the personal and psychological factors, as well as job resources (i.e. recognition, supervisor support and feedback and support from colleagues) and job demands (i.e. work-family conflict and family-work conflict) as environmental variables that were raised under the job demands and resources from study one. As shown in study one, three main areas were noted to be the key areas of success in academe, which were research, teaching and promotion areas. Thus, all variables were designed to test in all three key areas of success. Three mediators were adopted from the SCCT to be used in study two, namely self-efficacy, outcome expectations and interest as they were deemed logical to explain the connection between independent variables and outcome variables.

Prior to moving on to test the proposed framework in study two, a quantitative pilot study was carried out to examine the psychometric properties of the relevant instruments. The following instruments were examined in this pilot study by using reliability testing, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA):

(a) Self-Efficacy Scale

(b) Outcome Expectations Questionnaire

(c) Interest Questionnaire

(d) Work-Family Conflict Scale

(e) Job Resources Questionnaire

5.3 Method

This section details the research design, sampling method, descriptions of participants, procedures, instruments, and data analyses for the pilot study of the quantitative phase of the present research.

5.3.1 Research Design and Sampling Method

A cross-sectional survey design was used in this study. Purposive sampling method was employed to recruit academics from a private university in Malaysia (for EFA) and academics from all RUs in Malaysia (for CFA).

5.3.2 Descriptions of Participants

As reported in Table 3, the study for EFA consisted of a total of 97 academics from a private university in Malaysia (53.6% women and 46.4% men). The majority of them was from STEMM fields (57.7%), Malaysians (53.6%), and were married (78.4%). Nearly all of them were full-time staff members (99.0%). Their average age was 40.28 years (SD = 7.92). The majority of them had less than 10-year seniority in the university (80.4%). They had one to two children (including child being expected) on average (M = 1.28, SD = 1.25). Most of them (59.8%) held assistant professor (equivalent to senior lecturer position in Malaysia's

public universities) positions, followed by associate professor (30.9%), and professor (9.3%) positions.

Table 3

Demographic Characteristics of Participants for the EFA Study

Category	*N*	%
Gender		
Female	52	53.6
Male	45	46.4
Total	97	100.0
Employment status		
Part-time	1	1.0
Full-time	96	99.0
Academic field		
Non-STEMM	41	42.3
STEMM	56	57.7
Nationality		
Non-Malaysian	45	46.4
Malaysian	52	53.6
Marital status		
Single	20	20.6
Married	76	78.4
Academic rank		
Assistant professor	58	59.8
Associate professor	30	30.9
Professor	9	9.3
Number of children (including child being expected)		
0	33	34.0
1	21	21.6
2	28	28.9
3	10	10.3
4	2	2.1
5	0	0.0
6	0	0.0
7	1	1.0
Age		
26-35	30	30.9
36-45	45	46.4
46-55	15	15.5
56-65	4	4.1
66-75	1	1.0
Seniority		
0-5	62	63.9
6-10	24	24.7
11-20	9	9.3
21-30	2	2.1

Table 4

Demographic Characteristics of Participants for the CFA Study

Demographic Characteristics	Non-STEMM		STEMM	
	N	%	*N*	%
Gender				
Female	134	62.0	194	58.3
Male	82	38.0	139	41.7
Total	216	100.0	333	100.0
Employment status				
Part-time	2	0.9	1	0.3
Full-time	214	99.1	332	99.7
Nationality				
Non-Malaysian	10	4.6	20	6.0
Malaysian	206	95.4	313	94.0
Marital status				
Single	35	16.2	61	18.3
Married	181	83.8	272	81.7
Academic rank				
Lecturer	21	9.7	37	11.1
Senior lecturer	132	61.1	183	55.0
Associate professor	46	21.3	78	23.4
Professor	17	7.9	35	10.5
Number of children (including the child being expected)				
0	43	19.9	75	22.5
1	28	13.0	53	15.9
2	55	25.5	86	25.8
3	35	16.2	58	17.4
4	39	18.1	30	9.0
5	10	4.6	19	5.7
6	3	1.4	5	1.5
7	2	0.9	2	0.6
8	1	0.5	5	1.5
Age				
26-35	32	14.8	110	33.0
36-45	81	37.5	141	42.3
46-55	81	37.5	55	16.5
56-65	22	10.2	27	8.1
Seniority				
0-5	42	19.4	103	30.9
6-10	40	18.5	78	23.4
11-20	69	31.9	112	33.6
21-30	54	25.0	22	6.6
31-40	11	5.1	18	5.4

As reported in Table 4, the data set for CFA consisted of 549 participants (60% females and 40% males) from all RUs in Malaysia. The majority of them was from STEMM

fields (60.7%), were married (82.5%), were full-time staff members (99.5%) and were Malaysians (94.5%). Their average age was 42.41 years (SD = 8.46). The majority of them had more than 10-year seniority in their current university (52.1%). They had two to three children (including child being expected) on average (M = 2.16, SD = 1.72). More than one-fifth of those who had children had at least one child who was below 6 years of age (22.74%). Most of them held senior lecturer positions (57.4%), followed by associate professor (22.6%), lecturer (10.6%), and professor (9.47%) positions.

5.3.3 Procedures

Academic staff members' email lists were obtained from the official website of the universities. An invitation email to participate in this study with an anonymous survey link was sent. The anonymous survey link led them to an online survey using Qualtrics. Reminders were sent between one to three times. A participant information sheet was displayed on the first page of the online survey, by pressing the 'proceed' button, the participants had agreed to give consent to participate in this study. Once the participants had completed the survey, a thank-you message was shown. Based on Section 15.5.3 in the Code and Research Conduct and Research Ethics (Version 4) published by University of Nottingham (University of Nottingham, 2013), Chapter 8 – Debriefing in the Code of Human Research Ethics (The British Psychological Society, 2014), and Chapter 4 Deception Section in the Ethics Guidelines for Internet-mediated Research (The British Psychological Society, 2017) published by The British Psychological Society, no debriefing was needed after the completion of the survey, because the real research objectives and details of the research were given to the participants on the first page of the Qualtrics survey.

5.3.4 Instruments

The psychometric properties of the following instruments were tested before deciding whether to use them in the actual study. Essential information about the instruments is reported below. More details about the instruments (i.e. information about the original instrument, reliability and validity of the original instrument, and changes made from the original instrument) can be found in Appendix 4.

(a) Self-Efficacy Scale

The Self-Efficacy Scale (SES) was developed to measure three types of self-efficacy in this study, namely research self-efficacy (RSE), teaching self-efficacy (TSE) and promotion self-efficacy (PSE). SES used a 5-point scale ranging from 1 (no confidence) to 5 (total confidence) to simplify the response selection process for all three types of self-efficacy.

The five items related to research self-efficacy in this study were a modified version of the Research Self-Efficacy Scale (RSES; Greeley et al., 1989) (item 1 - *Designing and conducting research*, item 2 - *Writing a research paper for journal publication*, and item 3 - *Developing proposals for research funding*).

In order to measure one's level of self-efficacy towards teaching, a two-item survey was developed (item 1 – *In getting excellent SET (student evaluation of teachers) marks*, and item 2 – *Delivering effective lectures*).

A two-item survey was developed to measure one's level of self-efficacy towards promotion (item 1 – *Becoming a full professor*, and item 2 – *Getting promoted to the next academic rank within 5 years since your last promotion*).

Thus, the variable self-efficacy was operationalised through the development of this measure. The higher the mean of the total score of SES's research self-efficacy subscale,

teaching self-efficacy sub-scale and promotion self-efficacy subscale, the higher the participant's self-efficacy in each respective area.

(b) Outcome Expectations Questionnaire

The Outcome Expectations Questionnaire (OEQ) was developed by adopting some items from the original Research Outcome Expectations Questionnaire (Bieschke & Bishop, 1994) and modifying some items from the Revised Research Outcome Expectations Questionnaire (Revised-ROEQ, Bieschke, 2000), to make the items more relatable and applicable to Malaysia's participants' context. The OEQ measures outcome expectations for research (ROE), outcome expectations for teaching (TOE) and outcome expectations for career advancement (CAOE). A similar 5-point Likert scale (from 1=strongly disagree to 5=strongly agree) was used for all three types of outcome expectations.

A four-item scale was formed to measure outcome expectations for research by modifying item 2 and 10 from revised-ROEQ and adopting item 11 and 13 from the original ROEQ (item 1 - *Doing research will increase my sense of self-worth,* item 2 - *Research involvement is valued by the important people in my life*, item 3 - *Being involved in research will contribute to my development as a professional*, and item 4 - *My involvement in research will lead to meaningful contributions to the field*).

Similar to the outcome expectations for research subscale, the same items from the original ROEQ and revised-ROEQ were modified to form the four-item outcome expectations for teaching subscale (item 1 - *Teaching will increase my sense of self-worth*, item 2 - *Teaching is valued by the important people in my life*, item 3 - *Teaching will contribute to my professional development*, and item 4 - *My involvement in teaching will lead to successful development of my students*).

As for the five-item outcome expectations for career advancement subscale, it was formed by modifying item 2 and 10 from the revised-ROEQ and item 11 from the original ROEQ (item 1 - *Achieving full professorship will increase my sense of self-worth*, item 2 - *Achieving full professorship is valued by the important people in my life*, item 3 - *Becoming a full professor will contribute to my professional development*, item 4 - *Taking on leadership position in the university will increase my sense of self-worth*, and item 5 - *Taking on leadership position in the university is valued by the important people in my life*).

Thus, the variable - outcome expectations was operationalised through the development of this measure. The higher the mean of the total score of the OEQ's for outcome expectations for research subscale, outcome expectations for teaching sub-scale and outcome expectations for career advancement subscale, the higher the participant's outcome expectations in each respective area.

(c) Interest Questionnaire

The Interest Questionnaire (INQ) was a tool developed to measure interest in research (IR), interest in teaching (IT) and interest in career advancement (ICA) in this study. It uses 5-point Likert scales from 1 (very disinterested) to 5 (very interested).

Item 3, 5, 6, 11 and 13 were selected from the initial 16-item Interest in Research Questionnaire (IRQ, Bishop & Bieschke, 1994) to measure interest in research for the present study (item 1 – *Conceptualising a research study*, item 2 – *Developing funding proposals*, item 3 – *Having research activities as part of every workweek*, item 4 – *Analysing data*, and item 5 – *Writing for publication/presentation*), as these items are more relevant to the research context in Malaysia.

A three-item subscale was developed for this study to measure one's degree of interest in teaching-related activities (item 1 – *Preparing teaching materials*, item 2 –

Delivering lectures, item 3 – *Teaching in general*). Similarly, another three-item subscale was developed for this study to measure one's degree of interest in activities related to career advancement (item 1 – *Getting promoted to the next academic rank*, item 2 – *Taking on leadership position*, and item 3 – *Heading any committee*).

Thus, the variable interest was operationalised through the development of this measure. The higher the mean of the total score of the INQ's interest in research subscale, interest in teaching sub-scale and interest in career advancement subscale, the higher the participant's interest in each respective area.

(d) Work-Family Conflict and Family-Work Conflict

The Work-Family Conflict Scale (WAFCS, Haslam et al., 2015) is a ten-item questionnaire that was developed to measure work-to-family (five items) and family-to-work (five items) conflict. The original questionnaire was adopted into this study. It uses a 7-point Likert scale that ranges from 1 (very strongly disagree) to 7 (very strongly agree).

Thus, the variable work-family conflict and the variable family-work conflict were operationalised through the adoption of this scale. The higher the mean of the total score of the WAFCS's work-to-family subscale and family-to-work subscale, the higher the participant's perceived conflict in each area.

(e) Job Resources Questionnaire

The Job Resources Questionnaire (JRQ) is an instrument that aims to measure the psychological climate or attributed meanings in relation to one's job, co-workers, performance, and workplace practices. It covers three dimensions, namely recognition (two items), supervisor support and feedback (four items) and support from colleagues (four

items). Each dimension was either adopted from existing tools or developed for this study. It is assessed by using a 6-point scale ranging from 1 (strongly disagree) to 6 (strongly agree).

The variable *recognition* was operationalised through a two-item subscale developed by adopting item 3 from the recognition subscale of Psychological Climate (S. P. Brown & Leigh, 1996) (item 1 – *The organisation recognises the significance of the contributions I make*) and developing one item (item 2 – *I get recognition for the work I do from my superiors (immediate supervisor and upper university management*). It aims to measure the level of perceived recognition from the organisation and the superiors. The higher the mean of the total score of the 2-item recognition subscale, the higher the level of perceived recognition from part of a participant.

Social support in the workplace comprises of the four-item *supervisor support and feedback* subscale (item 1 – *My immediate supervisor gives me help and support,* item 2 – *My immediate supervisor treats me and my work colleagues fairly*, item 3 – *I get sufficient feedback from my immediate supervisor regarding my performance,* and item 4 – *I receive feedback specific enough to be useful for improving my performance*) and the four-item *support from colleagues* subscale (item 1 – *I can count on my co-employees when I face difficulties at work,* item 2 – *My co-employee show concern and courtesy towards me*, item 3 – *I have good working relationship with my co-employees,* and item 4 – *There is a feeling of cooperation in my workgroup*). The items for measuring these two variables were developed for this study in order to measure the degree of social support in the workplace. The higher the mean of the total score of each subscale, the higher the level of perceived support from part of a participant (from the supervisors or from colleagues).

(f) Demographic Variables

Demographic data was collected through items asking participants about their gender, employment status, academic field, age, nationality, marital status, academic rank, seniority, and number of children including child being expected.

5.3.5 Data Analyses

Data cleaning was done prior to working on the analyses by removing outliers using the standardised score approach (cut-off at 3.29) and deleting cases or variables that had missing data (Tabachnick & Fidell, 2013).

Data analyses for the quantitative pilot study covered descriptive analysis, reliability testing, Exploratory Factor Analysis (EFA) and bivariate Pearson correlation by using the IBM SPSS Statistics version 24 and Confirmatory Factor Analysis (CFA) by using IBM SPSS Amos version 24.

Demographic data were analysed using descriptive analysis.

Reliability was tested using Cronbach's alpha reliability testing (Cronbach, 1951) and interpreted using the guideline set by George and Mallery (2003), in which alpha coefficients above .7, .8 and .9 are considered acceptable, good and excellent respectively. Analyses for Cronbach's alphas if item deleted were computed to examine whether deletion of any item could increase the reliability of the scale.

EFA was conducted to examine the psychometric values of the instruments. For self-developed or modified instruments, an exploratory factor analysis (EFA) using principal axis factoring (PAF) extraction method (varimax rotation) was conducted separately for all subscales to identify and compute composite scores for the factors underlying each subscale. Then, the same analysis was used for the entire scale to determine whether each subscale could be deemed to be correlated (oblique) or uncorrelated (orthogonal). As for the existing

scale (i.e. Work-Family Conflict Scale), a principal component (PC) extraction method was conducted separately for all subscales to identify and compute composite scores for the factors underlying each subscale. This was then followed by the same analysis for the entire scale to determine which items to remove in order to reduce the total number of items of each subscale. The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) should be above the commonly recommended value of .60 (Coakes, 2012) to verify the sampling adequacy to run the analysis. The Bartlett's Test of Sphericity (χ^2) should also be significant to show that correlations between items are large enough for the analysis (Field, 2013). The two tests were performed.

To confirm the factor structure and model fit of the instruments, a CFA was conducted on the data set from study two. The selected estimation method of CFA was Generalised Least Square (GLS). This is because GLS can provide optimal performance for sample size below 500, whereas the commonly used Maximum Likelihood (ML) would have been more suitable for sample size above 500 (Tabachnick & Fidell, 2013). Other than removing the outliers using the standardised score approach, additional 9 outliers that were detected using the Mahalanobis distance were removed, as suggested by the CFA outcome, in order to provide a better fit to the tested models. To determine the goodness-of-fit, the recommended fit indices reported in Table 5 were used:

Table 5

Fit Indices and Acceptable Threshold Levels

Fit Index	Acceptable Threshold Levels	References
Absolute Fit Indices		
Chi-square χ^2	Low χ^2 relative to the degree of freedom with an insignificant p-value ($p>.05$)	(Hooper et al., 2008)
Relative χ^2 (χ^2/df)	A value below 2 up to 5 is acceptable	(Tabachnick & Fidell, 2013; Wheaton et al., 1977)
Goodness-of-fit index (GFI)	At least .90 is adequate, values >.95 is excellent	(Hair et al., 2010)
Adjusted goodness-of-fit index (AGFI)	At least .90 is adequate, values >.95 is excellent	(Bollen, 1990; Hooper et al., 2008)
Root Mean Square Error of Approximation (RMSEA)	A value less than .05 is excellent, a value less than .06 is good, a value between .08 to .10 is a mediocre fit	(Hu & Bentler, 1999; MacCallum et al., 1996; Steiger, 2007)
Incremental Fit Indices		
Comparative fit index (CFI)	At least .90 is adequate, values >.95 is excellent	(Hu & Bentler, 1999)
Normed fit index (NFI)	At least .90 is adequate, values >.95 is excellent	(Hu & Bentler, 1999)

5.4 Results

The results on the psychometric properties of each instrument are reported below:

5.4.1 Self-Efficacy Scale

As can be seen in Table 6, all three subscales under Self-Efficacy Scale had acceptable to good internal consistency coefficients ranging from .73 to .86 (George & Mallery, 2003). The internal consistencies for each item were lower than the full subscale's internal consistency, except for item 5, with a relatively little variation of .02. No Cronbach's

alphas with each item deleted can be conducted for teaching and promotion self-efficacy, as each subscale had less than 3 items.

Table 6

Cronbach's Alpha, Item-to-Total Scale Correlations, and Factor Loadings for Self-Efficacy Scale

Subscale	Cronbach's alpha	Item number	Cronbach's alpha if item deleted	Item loadings (subscale based on eigenvalue)	Item loadings (scale based on eigenvalue)		Item loadings (scale based on fixed factors)		
					1	2	1	2	3
Research self-efficacy	.845	1	.804	.746	.758		.716		
		2	.785	.867	.829		.887		
		3	.814	.728	.710		.689		
		4	.790	.839	.805		.797		
		5	.869	.476	.490		.431		
Teaching self-efficacy	.731	1	-	.760		.949			.794
		2	-	.760		.552			.703
Promotion self-efficacy	.855	1	-	.863	.625	.308	.437	.658	
		2	-	.863	.516	.409		.917	

Note. Item loadings (subscale) were results from the component matrix. Item loadings (scale based on eigenvalue or fixed factors) were results from the rotated component matrix.

An exploratory factor analysis (EFA) using principal axis factoring (PAF) extraction method (varimax rotation) based on eigenvalue was conducted separately for all subscales to identify and compute composite scores for the factors underlying each subscale. The 5-item research self-efficacy subscale had factor loadings ranging from .48 to .87 and accounted for 63.23% of the variance. The KMO was .83, above the commonly recommended value of .60 (Coakes, 2012), and Bartlett's Test of Sphericity was significant (χ^2 (10) = 217.51, p<.001). The eigenvalue for the first factor was 3.16, with the remaining eigenvalues smaller than 1. The 2-item teaching self-efficacy subscale had high factor loadings of .76 and accounted for

78.89% of the variance (KMO = .50; χ^2 (1) = 38.40, p<.001). The eigenvalue for the first factor was 1.58, with the remaining eigenvalue smaller than 1. The 2-item promotion self-efficacy subscale had high factor loadings of .86 and accounted for 87.32% of the variance (KMO = .50; χ^2 (1) = 76.13, p<.001). The eigenvalue for the first factor was 1.75, with the remaining eigenvalue smaller than 1. Results from the separate EFA for each subscale proved that each subscale was unidimensional.

Subsequently, a PAF analysis (varimax rotation) based on eigenvalue was computed for all subscales to determine whether each subscale could be deemed to be correlated (oblique) or uncorrelated (orthogonal). Results showed that the full scale had factor loadings ranging from .31to .95 and accounted for 62.51% of the variance from the two factors with eigenvalues of 4.15 and 1.48 respectively (KMO = .79; χ^2 (36) = 395.99, p<.001). The third component had an eigenvalue of .97, which is closer to 1 eigenvalue.

Based on the existing design and model (which has three factors, namely research self-efficacy, teaching self-efficacy and promotion self-efficacy), another PAF analysis (varimax rotation) based on fixed factors was computed for all subscales to test whether there were three factors. The three components had factor loadings ranging from .43 to .92 and accounted for 73.23% of the variance (KMO = .79; χ^2 (36) = 395.99, p<.001). The eigenvalues for the first, second and third factors were 4.15, 1.48 and .97 respectively. The 5-item research self-efficacy had factor loadings higher than .4 under the first factor. As for the 2-item teaching self-efficacy, it had factor loadings higher than .7 under the third factor without any cross-loading. The 2-item promotion self-efficacy had factor loadings higher than .6 under the second factor, except for the first item, that had a cross-loading of .44 which can be ignored as the primary loading of .66 was strong. These outcomes supported the 3-factor design of the full scale.

Next, a CFA using GLS was conducted (see Figure 7). The 3-factor model provided an excellent fit, with χ^2 (19) =27.704, p>.05, χ^2/df=1.458, GFI=.985, AGFI=.965, CFI=.980, NFI=.942, RMSEA=.033. Specifically, the chi-square value had an insignificant p-value; the relative chi-square was below 2, which suggested very good fit; GFI, AGFI, CFI were above .95, which indicated excellent fit; NFI was above .90, which indicated adequate fit; and RMSEA was below .05, which indicated excellent fit.

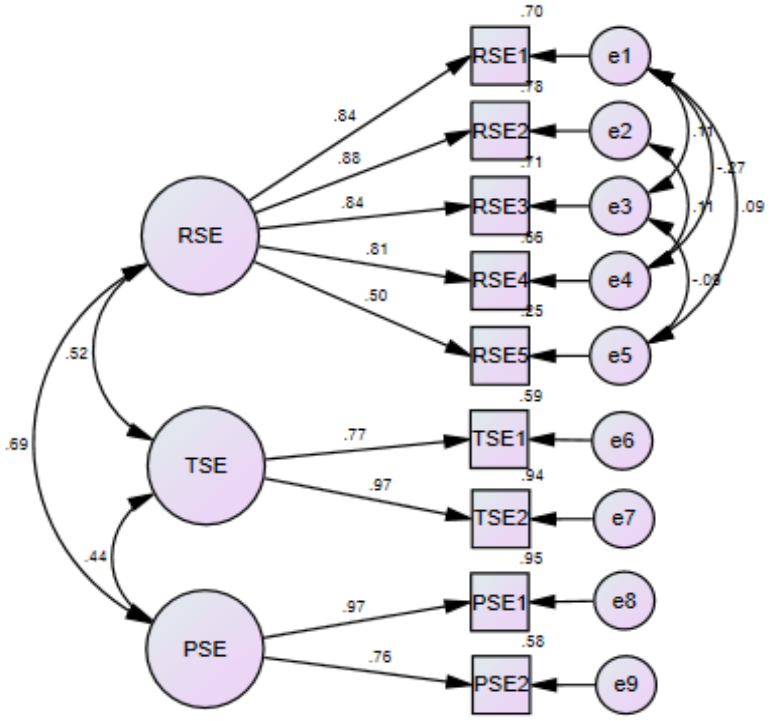


Figure 7. CFA model of Self-Efficacy Scale

5.4.2 Outcome Expectations Questionnaire

As can be seen in Table 7, all three subscales under Outcome Expectations Questionnaire had good to excellent internal consistency coefficients ranging from .83 to .93 (George & Mallery, 2003). The internal consistencies for each item under outcome expectations for research, teaching and career advancement were lower than the full subscale's internal consistency, except for item 4 in outcome expectations for teaching, with a relatively little variation of .02.

Table 7

Cronbach's Alpha, Item-to-Total Scale Correlations, and Factor Loadings for Outcome Expectations Questionnaire

Subscale	Cronbach's alpha	Item number	Cronbach's alpha if item deleted	Item loadings (subscale based on eigenvalue)	Item loadings (scale based on eigenvalue)		
					1	2	3
Outcome expectations for research	.825	1	.741	.804	.312	.697	
		2	.820	.663		.531	
		3	.771	.810		.835	
		4	.790	.743		.766	
Outcome expectations for teaching	.846	1	.763	.878			.854
		2	.801	.767			.747
		3	.777	.828			.833
		4	.861	.572			.530
Outcome expectations for career advancement	.925	1	.897	.915	.836	.336	
		2	.898	.905	.819	.367	
		3	.919	.791	.689	.448	
		4	.915	.794	.786		
		5	.909	.829	.814		

Note. Item loadings (subscale) were results from the component matrix. Item loadings (scale based on eigenvalue) were results from the rotated component matrix.

Based on the PAF analysis using eigenvalue on all subscales separately, the 4-item outcome expectations for research subscale had high factor loadings ranging from .66 to .81 and accounted for 67.75% of the variance (KMO = .75; χ^2 (6) = 162.52, p<.001). The eigenvalue for the first factor was 2.71, with the remaining eigenvalues smaller than 1. The 4-item outcome expectations for teaching subscale had high factor loadings ranging from .57 to .88 and accounted for 68.54% of the variance (KMO = .77; χ^2 (6) = 172.51, p<.001). The eigenvalue for the first factor was 2.74, with the remaining eigenvalues smaller than 1. The 5-item outcome expectations for career advancement subscale had high factor loadings ranging from .79 to .92 and accounted for 77.40% of the variance (KMO = .77; χ^2 (10) = 446.82, p<.001). The eigenvalue for the first factor was 3.87, with the remaining eigenvalues smaller

than 1. Results from the separate EFA for each subscale proved that each subscale was unidimensional.

Next, the PAF (varimax rotation) based on eigenvalue for the full scale showed it had factor loadings ranging from .31 to .85 and accounted for 73.49% of the variance from the three factors with eigenvalues of 5.84, 2.19 and 1.53 respectively (KMO = .79; χ^2 (78) = 915.17, p<.001). The 4-item outcome expectations for research had factor loadings higher than .5 under the second factor, with only the first item having a poor cross-loading of .31 under the first factor. The 4-item outcome expectations for teaching had factor loadings higher than .5 under the third factor. As for the 5-item outcome expectations for career advancement, it had factor loadings higher than .6 under the first factor. Though the first three items had cross-loadings ranging from .34 to .45 under the second factor, their primary loadings on the first factor were very strong. These outcomes supported the 3-factor design of the full scale.

Next, based on the CFA result (see Figure 8), the 3-factor model provided an adequate fit, with χ^2 (49) =152.527, p<.001, χ^2/df=3.113, GFI=.944, AGFI=.896, CFI=.846, NFI=.796, RMSEA=.071. Specifically, the relative chi-square was below 5, which suggested an acceptable fit; GFI was above .90, which indicated adequate fit; and RMSEA was below .08, which indicated adequate fit.

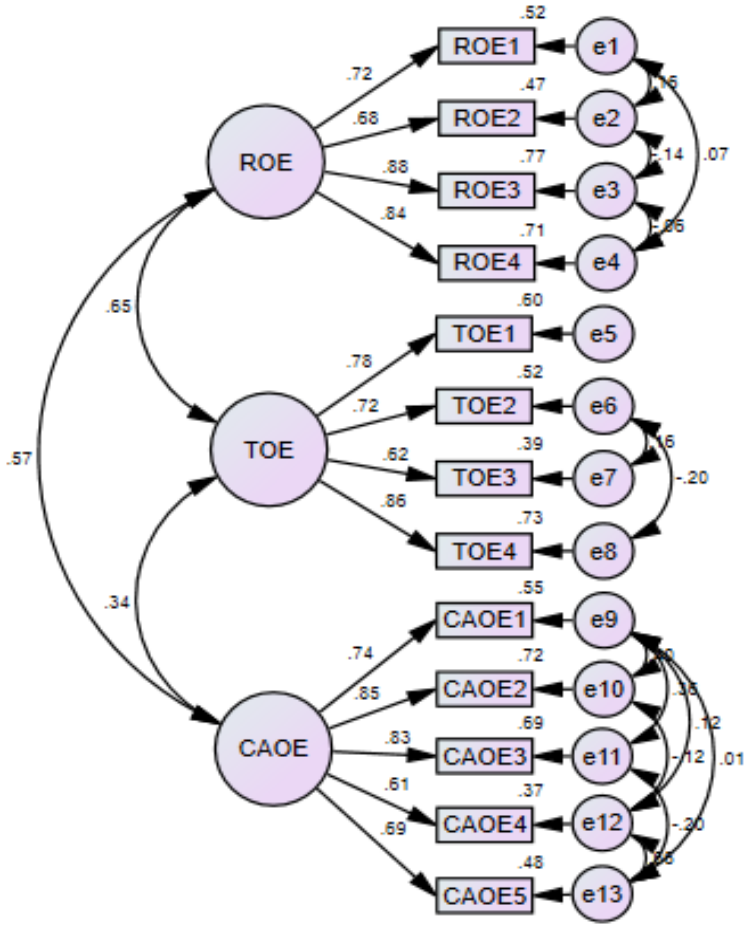


Figure 8. CFA model of Outcome Expectations Questionnaire

5.4.3 Interest Questionnaire

As can be seen in Table 8, all three subscales under Interest Questionnaire had good internal consistency coefficients ranging from .84 to .90 (George & Mallery, 2003). The internal consistencies for each item under interest in research, teaching and career advancement were lower than the full subscale's internal consistency, except for item 1 in interest in career advancement, with a relatively little variation of .05.

Table 8

Cronbach's Alpha, Item-to-Total Scale Correlations, and Factor Loadings for Interest Questionnaire

Subscale	Cronbach's alpha	Item number	Cronbach's alpha if item deleted	Item loadings (subscale based on eigenvalue)	Item loadings (scale based on eigenvalue)		
					1	2	3
Interest in research	.838	1	.781	.827	.786		
		2	.811	.722	.678		
		3	.797	.787	.799		
		4	.828	.620	.658		
		5	.811	.676	.664		
Interest in teaching	.896	1	.868	.836		.856	
		2	.856	.854		.857	
		3	.832	.903		.882	
Interest in career advancement	.847	1	.892	.629	.328		.574
		2	.727	.873			.883
		3	.704	.924			.896

Note. Item loadings (subscale) were results from the component matrix. Item loadings (scale based on eigenvalue) were results from the rotated component matrix.

The PAF analysis based on eigenvalue for all subscales separately showed that the 5-item interest in research subscale had high factor loadings ranging from .62 to .83 and accounted for 62.31% of the variance (KMO = .79; χ^2 (10) = 201.02, p<.001).The eigenvalue for the first factor was 3.12, with the remaining eigenvalues smaller than 1. The 3-item interest in teaching subscale had high factor loadings ranging from .84 to .90 and accounted for 83.14% of the variance (KMO = .75; χ^2 (3) = 174.65, p<.001). The eigenvalue for the first factor was 2.49, with the remaining eigenvalues smaller than 1. The 3-item interest in career advancement subscale had high factor loadings ranging from .63 to .92 and accounted for 76.62% of the variance (KMO = .68; χ^2 (3) = 139.18, p<.001). The eigenvalue for the first factor was 2.30, with the remaining eigenvalues smaller than 1. Results from the separate EFA for each subscale proved that each subscale was unidimensional.

Next, the PAF (varimax rotation) based on eigenvalue for the full scale showed the full scale had factor loadings ranging from .33 to .90 and accounted for 73.36% of the variance from the three factors with eigenvalues of 3.79, 2.60 and 1.68 respectively (KMO = .78; χ^2 (55) = 546.24, p<.001). The 5-item interest in research had factor loadings higher than .6 under the first factor. The 3-item interest in teaching had factor loadings higher than .8 under the second factor. As for the 3-item interest in career advancement had factor loadings higher than .5 under the third factor, only item 1 had a poor cross-loading of .33 under the first factor. These outcomes supported the 3-factor design of the full scale.

The CFA results (see Figure 9) showed that the 3-factor model provided an adequate fit, with χ^2 (38) =95.169, p<.001, χ^2/df=2.504, GFI=.959, AGFI=.928, CFI=.892, NFI=.837, RMSEA=.060. Specifically, the relative chi-square was below 5, which suggested acceptable fit; GFI was above .95, which indicated excellent fit; AGFI was above .90, which indicated adequate fit; and RMSEA indicated a good fit.

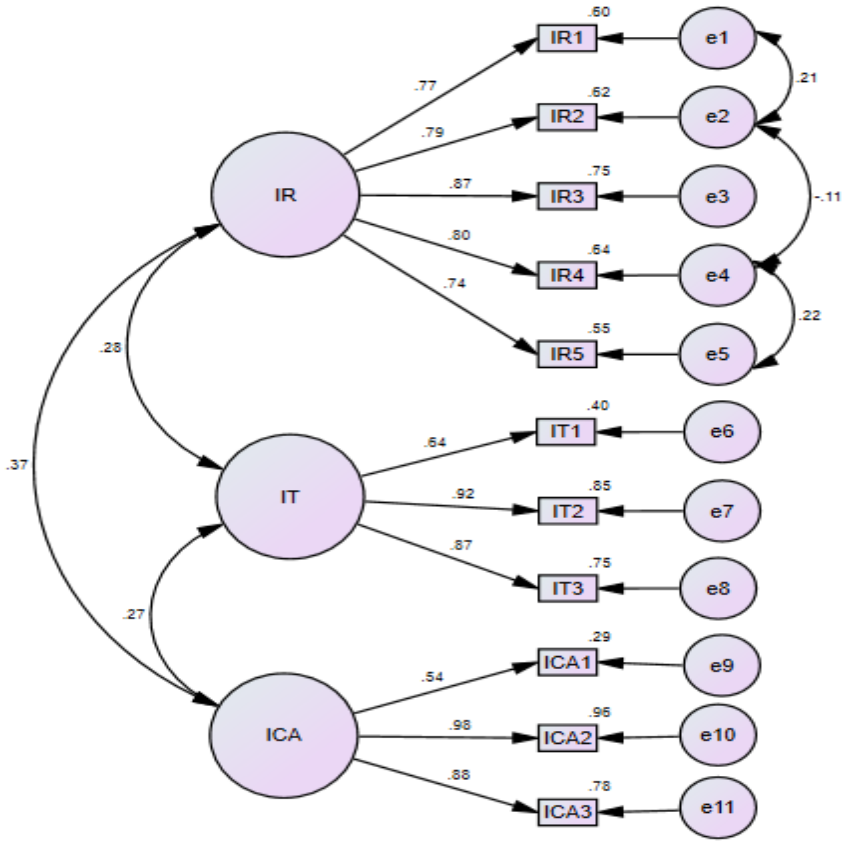


Figure 9. CFA model of Interest Questionnaire

5.4.4 Work-Family Conflict Scale

As can be seen in Table 9, all two subscales under Work-Family Conflict Scale had good internal consistency coefficients higher than .8 (George & Mallery, 2003). Cronbach's alphas for all items under the two subscales were lower if items were deleted, except item 5 under work-to-family conflict, with little variation of .02, as well as item 3 under family-to-work conflict, with little variation of .004.

Table 9

Cronbach's Alpha, Item-to-Total Scale Correlations, and Factor Loadings for Work-Family Conflict Scale

Subscale	Cronbach's alpha	Item number	Cronbach's alpha if item deleted	Item loadings (subscale based on eigenvalue)	Item loadings (scale based on eigenvalue)	
					1	2
Work-to-family conflict	.890	1	.833	.938	.928	
		2	.884	.786	.780	
		3	.842	.920	.905	
		4	.853	.884	.865	
		5	.914	.656	.653	
Family-to-work conflict	.888	1	.863	.840		.818
		2	.860	.847		.843
		3	.892	.755		.747
		4	.851	.871		.857
		5	.854	.868		.876

Note. Item loadings (subscale based on eigenvalue) were results from the component matrix. Item loadings (scale based on eigenvalue) were results from the rotated component matrix.

A principal component (PC) extraction method based on eigenvalue was conducted separately for all subscales to identify and compute composite scores for the factors underlying each subscale. The 5-item work-to-family conflict had high factor loadings ranging from .66 to .94 and accounted for 71.12% of the variance (KMO = .82; χ^2 (10) = 352.12, p<.001). The eigenvalue for the first factor was 3.56, with the remaining eigenvalues

smaller than 1. The 5-item family-to-work conflict had factor loadings ranging from .76 to .87 and accounted for 70.10% of the variance (KMO = .52; χ^2 (10) = 283.39, p<.001). The eigenvalue for the first factor was 3.51, with the remaining eigenvalues smaller than 1. Results from the separate PC analysis for each subscale proved that all two subscales were unidimensional.

Next, a PC analysis based on eigenvalue was computed for all subscales to determine which items to remove in order to reduce the total number of items of each subscale. Results showed the full scale had factor loadings ranging from .65 to .93 and accounted for 70.80% of the variance from the two factors with eigenvalues of 4.53 and 2.55 respectively (KMO = .83; χ^2 (45) = 649.09, p<.001). The 5-item in the work-to-family conflict had factor loadings higher than .6 under the first factor, whereas the 5-item in the family-to-work conflict had factor loadings higher than .7 under the second factor. These outcomes supported the 2-factor design of the full scale.

In order to reduce the number of items for the convenience of participants, item 2 and 5 in the work-to-family conflict were removed from the actual study, as these two items had the lowest item loadings and would increase the reliability of the full subscale if deleted. Work-to-family conflict's internal consistency increased to .93. For family-to-work conflict, item 3 was removed as it had the lowest item loading and would increase the reliability of the subscale if deleted. Next, item 2 instead of item 1 was chosen to be removed, although item 1 had the second-lowest item loading. Item 1 covers both components of personal and family commitment which are not covered under the remaining family-to-work items. Item 2 and 1 had only very little variations of .003 and .007 under Cronbach's alpha if item deleted and item loadings respectively. Thus, item 3 and 2 were removed from the actual study. Family-to-work conflict's internal consistency increased to .93.

The CFA results (see Figure 10) showed the 2-factor model provided an adequate fit, with χ^2 (8) =33.144, p<.001, χ^2/df=4.143, GFI=.974, AGFI=.931, CFI=.928, NFI=.909, RMSEA=.087. Specifically, although RMSEA was between .08 to .10, which indicated mediocre fit, the relative chi-square was below 5, which suggested acceptable fit; GFI was above .95, which indicated excellent fit; AGFI, CFI and NFI were above .90, which indicated adequate fit.

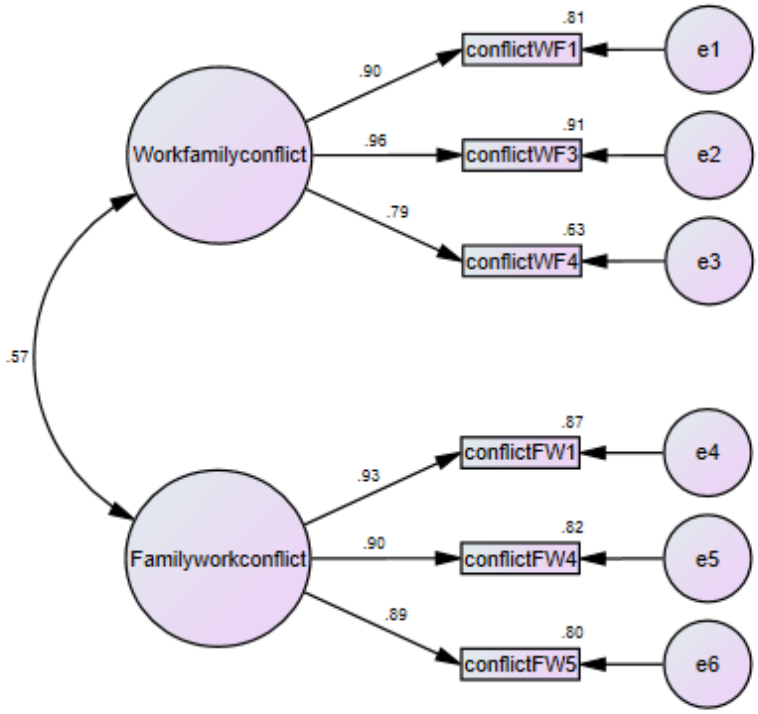


Figure 10. CFA model of Work-Family Conflict Scale

5.4.5 Job Resources Questionnaire

As can be seen in Table 10, all three subscales under Job Resources Questionnaire had good to excellent internal consistency coefficients ranging from .87 to .92 (George & Mallery, 2003). Cronbach's alphas for all subscales were lower if items were deleted. Only the 2-item recognition could not generate Cronbach's alphas if items deleted due to having less than 3 items.

Table 10

Cronbach's Alpha, Item-to-Total Scale Correlations, and Factor Loadings for Job Resources Questionnaire

Subscale	Cronbach's alpha	Item number	Cronbach's alpha if item deleted	Item loadings (subscale based on eigenvalue)	Item loadings (scale based on eigenvalue)		Item loadings (scale based on fixed factor)		
					1	2	1	2	3
Recognition	.907	1	-	.912	.678				.820
		2	-	.912	.796		.455		.776
Supervisor support and feedback	.920	1	.881	.913	.832		.849		
		2	.908	.823	.717	.336	.772	.319	
		3	.884	.904	.876		.780		.406
		4	.912	.811	.833		.648		.502
Support from colleagues	.868	1	.811	.857		.826		.828	
		2	.812	.848		.826		.817	
		3	.837	.807		.783		.777	
		4	.864	.689	.419	.599	.440	.596	

Note. Item loadings (subscale) were results from the component matrix. Item loadings (scale based on eigenvalue or fixed factor) were results from the rotated component matrix.

A PAF analysis (varimax rotation) based on eigenvalue was conducted separately for all subscales. The 2-item recognition had high factor loadings of .9 and accounted for 91.65% of the variance (KMO = .50; χ^2 (1) = 111.85, p<.001). The eigenvalue for the first factor was 1.83, with the remaining eigenvalue smaller than 1. The 4-item supervisor support and feedback had factor loadings above .7 and accounted for 80.82% of the variance (KMO = .79; χ^2 (6) = 307.76, p<.001). The eigenvalue for the first factor was 3.23, with the remaining eigenvalues smaller than 1. The 4-item support from colleagues had factor loadings above .6 and accounted for 73.04% of the variance (KMO = .82; χ^2 (6) = 197.43, p<.001). The eigenvalue for the first factor was 2.92, with the remaining eigenvalues smaller than 1. Results from the separate EFA for each subscale proved that each subscale was unidimensional.

Next, the results from the PAF analysis (varimax rotation) based on eigenvalue on all subscales showed the full scale had factor loadings ranging from .34 to .88 and accounted for 73.98% of the variance from the two factors with eigenvalues of 5.73 and 1.67 respectively (KMO = .87; χ^2 (45) = 750.51, p<.001). The 2-item recognition had factor loadings higher than .6 under the first factor. The 4-item supervisor support and feedback had factor loadings higher than .7 under the first factor, but item 2 had a cross-loading of .34 under the second factor. The 4-item support from colleagues had factor loading higher than .5 under the second factor, but item 4 had a cross-loading of .42 under the first factor.

Due to the design of this scale (which supports three factors, namely recognition, supervisor support and feedback, and support from colleagues), another PAF analysis (varimax rotation) based on fixed factor was computed for all subscales to test whether there were three factors. The three components had factor loadings ranging from .32 to .85 and accounted for 81.83% of the variance (KMO = .87; χ^2 (45) = 750.51, p<.001). The eigenvalues for the three factors were 5.73, 1.67 and .79 respectively. The 2-item recognition had factor loadings higher than .7 under the third factor; however, item 2 had poor cross-loading of .46 under the first factor. The 4-item supervisor support and feedback had primary loadings higher than .6 under the first factor. Item 2 had a cross-loading of .32 under the second factor. Item 3 and 4 had a cross-loading of .41 and .50 under the third factor respectively. The 4-item support from colleagues had factor loadings higher than .5 under the second factor, except for item 4, which had a poor cross-loading of .44 under the first factor. These outcomes supported the three-factor design of the scale.

The CFA results (see Figure 11) showed that the 3-factor model was an adequate fit for the data, with χ^2 (30) =80.414, p<.001, χ^2/df=2.680, GFI=.962, AGFI=.929, CFI=.893, NFI=.845, RMSEA=.063. Specifically, RMSEA was less than .08, which indicated a

mediocre fit, but the relative chi-square was below 5, which suggested an acceptable fit; and GFI and AGFI were above .90, which indicated adequate fit.

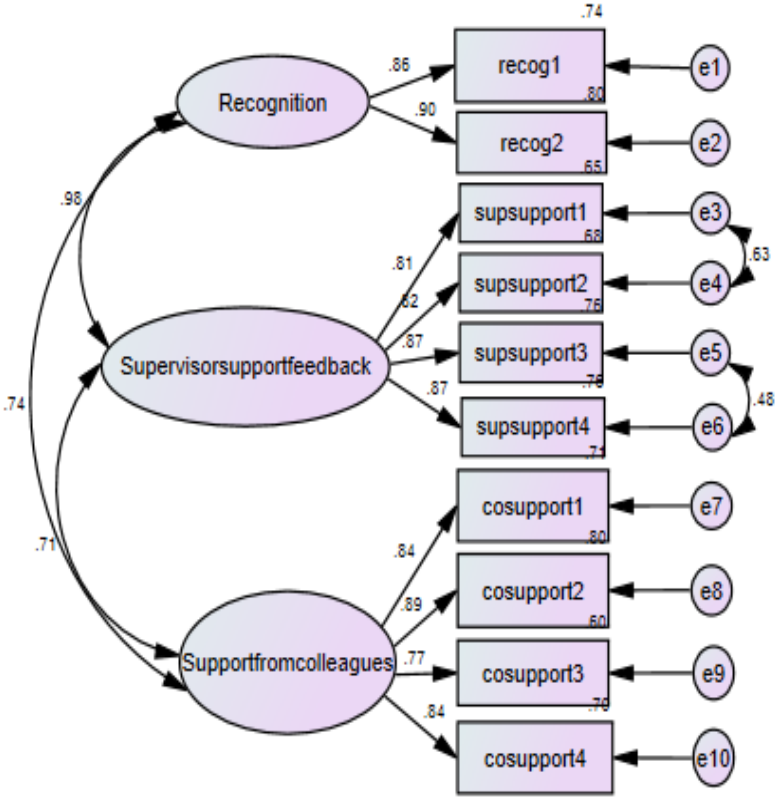


Figure 11. CFA Model of Job Resources Questionnaire

5.5 Application to Actual Study

Based on the psychometric analyses, the only modification made was to the Work-Family Conflict Scale. The remaining instruments remained the same. Table 11 summarises the findings from the pilot study and modification made to the instrument.

Table 11

Psychometric Properties and Modification to the Instruments (Pilot Study)

Instrument	Psychometric properties		Modification to the instrument
	Cronbach's alpha	EFA/PC and CFA	
Self-efficacy Scale	Research subscale (5 items): α= .85 Teaching subscale (2 items): α= .73 Promotion subscale (2 items): α= .86	The 3-factor model showed excellent fit.	-No modification
Outcome Expectations Questionnaire	Research subscale (4 items): α= .83 Teaching subscale (4 items): α= .85 Career advancement subscale (5 items): α= .93	The 3-factor model showed an adequate fit.	-No modification
Interest Questionnaire	Research subscale (5 items): α= .84 Teaching subscale (3 items): α= .90 Career advancement subscale (3 items): α= .85	The 3-factor model showed an adequate fit.	-No modification
Work-Family Conflict Scale	Work-to-family conflict (5 items): α= .89 Family-to-work conflict (5 items): α= .89	The 2-factor model showed an adequate fit.	-Item 2 and 5 in the work-to-family conflict were removed -Item 2 and 3 in the family-to-work conflict were removed
Job Resources Questionnaire	Recognition (2 items): α= .91 Supervisor support and feedback (4 items): α= .92 Support from colleagues (4 items): α= .87	The 3-factor model showed an adequate fit.	-No modification

5.6 Chapter Summary

The present chapter reported the pilot study's method, results, and how the results were applied to the actual study based on the outcomes of each instrument's reliability testing, Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). All five instruments (i.e. Self-efficacy Scale, Outcome Expectations Questionnaire, Interest

Questionnaire, Work-Family Conflict Scale and Job Resources Questionnaire) have shown adequate psychometric properties to be used amongst academics in Malaysia.

The internal consistencies of the Self-Efficacy Scale ranged from .73 to .86, which indicates acceptable to good reliability (George & Mallery, 2003). The internal consistencies of Outcome Expectations Questionnaire, Interest Questionnaire and Job Resources Questionnaire were above .8 (ranged from .83 to .93), which imply good to excellent reliability (George & Mallery, 2003). The 3-factor model in the Self-Efficacy Scale showed an excellent fit, whereas the models in the other three instruments showed an adequate fit. No modification had been made for the previous four instruments. In the alpha coefficients of Work-Family Conflict Scale were above .8, which indicates good reliability (George & Mallery, 2003). However, item 2 and 5 in work-to-family conflict and item 2 and 3 in the family-to-work conflict were removed based on the evaluation from the reliability testing and factor loadings, in order to make the instrument more parsimonious for the participants' convenience. The 2-factor model (after item removal) showed an adequate fit.

Subsequently, the thesis proceeds with study two – the quantitative study.

CHAPTER 6 - QUANTITATIVE PHASE (DETERMINANTS OF SUCCESS IN RESEARCH, TEACHING AND CAREER ADVANCEMENT AMONGST SCIENCE, TECHNOLOGY, ENGINEERING, MATHEMATICS, AND MEDICINE WOMEN ACADEMICS)

6.1 Chapter Overview

This chapter details the second phase of the research (study two), including method, analyses from tests of assumptions, results from preliminary and psychometric analyses, and results from inferential analyses. It ends with a short discussion of the findings.

6.2 Introduction

This study is the main study under the quantitative phase. To recap from Section 1.5, the purposes of this study are:

(a) To examine the mediating roles of self-efficacy (in research, teaching and promotion), outcome expectations (for research, teaching and career advancement) and interest (in research, teaching and career advancement) in the relationship between the predictors (person and environment variables), and outcome variables (research productivity, teaching performance, and career advancement) amongst a sample of STEMM academics in Malaysia.

(b) To examine the moderating role of gender in the mediated relationship between the person and environment variables, and interest (in research, teaching and career advancement) amongst a sample of STEMM academics in Malaysia when self-efficacy (in terms of research, teaching and promotion) and outcome expectations (for research, teaching and career advancement) are the mediators.

6.3 Method

In this section, research design, sampling method, descriptions of participants, procedures, instruments and data analyses of study two are covered.

6.3.1 Research Design and Sampling Method

This study employed a cross-sectional survey design. Purposive sampling method was used in this study to recruit STEMM academics from all RUs in Malaysia. More details on research design and sampling method can be found in Chapter 3.

6.3.2 Descriptions of Participants

As reported in Table 12, a total of 333 academic staff members from STEMM fields participated in this study. The majority of them were women (58.3%). Nearly all of them were full-time staff members (99.7%), Malaysians (94.0%), and were married (81.7%). Their average age was 40.71 years (SD=8.31). More than half of them had less than 10-year seniority in their current university (54.3%). They had two to three children (including child being expected) on average (M=2.10, SD=1.74). Most of them held senior lecturer (55.0%) positions, followed by associate professor (23.4%), lecturer (11.1%) and professor (10.5%) positions.

Table 12

Demographic Characteristics of Participants for Study Two

Demographic Characteristics	Participants	
	N	%
Gender		
Female	194	58.3
Male	139	41.7
Total	333	100.0
Employment status		
Part-time	1	0.3
Full-time	332	99.7
Nationality		
Non-Malaysian	20	6.0
Malaysian	313	94.0
Marital status		
Single	61	18.3
Married	272	81.7
Academic rank		
Lecturer	37	11.1
Senior lecturer	183	55.0
Associate professor	78	23.4
Professor	35	10.5
Number of children (including the child being expected)		
0	75	22.5
1	53	15.9
2	86	25.8
3	58	17.4
4	30	9.0
5	19	5.7
6	5	1.5
7	2	0.6
8	5	1.5
Age		
26-35	110	33.0
36-45	141	42.3
46-55	55	16.5
56-65	27	8.1
Seniority		
0-5	103	30.9
6-10	78	23.4
11-20	112	33.6
21-30	22	6.6
31-40	18	5.4

6.3.3 Procedures

Academic staff members' email lists were obtained from the official website of the university from all RUs in Malaysia. An invitation email to participate in this study with an anonymous survey link was sent. The anonymous survey link led them to an online survey using Qualtrics. Reminders were sent between 1 to 3 times. A participant information sheet was displayed on the first page of the online survey, by pressing the 'proceed' button, the participants had agreed to give consent to participate in this study. Once the participants had completed the survey, a thank-you message was shown. No debriefing was needed after the completion of the survey, because the real research objectives and details of the research were given to the participants on the first page of the Qualtrics survey.

6.3.4 Instruments

The instruments (i.e. Self-Efficacy Scale, Outcome Expectations Questionnaire, Interest Questionnaire, Work-Family Conflict Scale and Job Resources Questionnaire) described in Chapter 5 (Pilot Study of the Quantitative Phase) were used in this study. More details of these instruments can be found in Appendix 4. In addition to administering the instruments described in Chapter 5, the following tools were also used:

(a) Research Productivity Questionnaire

The Research Productivity Questionnaire (RPQ) is a single item instrument that is intended to measure academician's scholarly output or research productivity. The item was obtained from the nine-item Scholarly Activity Scale (SAS, Kahn & Scott, 1997). Additional information about this instrument, including information about the original instrument, reliability and validity of the original instrument, and changes made from the original instrument can be found in Appendix 4.

Research productivity was measured through the following item. Thus, the variable research productivity was operationalised through the adoption of an item from SAS (i.e. *published manuscripts in a refereed journal (entire career)* [RP]). The higher the exact number of published manuscripts in a referred journal in entire career, the higher the participant's research productivity.

(b) Teaching Performance Inventory

A two-item Teaching Performance Inventory (TPI) was developed to measure one's perceived teaching performance (TP) for the past two years. One item is used to evaluate one's self-perceived teaching performance (item 1 – *In the past 2 years, how would you rate your teaching performance*), while another item aims to examine one's perceived teaching performance by comparing with other colleagues (item 2 – *In the past 2 years, compared to your colleagues, how would you rate your teaching performance*). A 7-point Likert scale ranging from 1: poor to 7: excellent is used. This scale was not tested in the pilot study as the items were very direct. However, this psychometric value of the scale was tested in this study before proceeding to apply in the inferential analysis. The variable teaching performance was operationalised through the development of this measure. The higher the mean of the total score of the TPI, the higher the participant's perceived teaching performance.

(c) Career Advancement in Academia Inventory

Career advancement was measured through the self-developed Career Advancement in Academia Inventory (CAAI). Two types of career advancement related items were covered, such as years spent to be promoted from senior lecturer to professor (CA1), and years spent staying at senior lecturer or lecturer position without being promoted (CA2). No

reliability coefficient is generated as each item refers to an independent dimension of career advancement.

Thus, the variable career advancement was operationalised through the development of this measure. The operational definition of years spent to be promoted from senior lecturer to professor (CA1) is the self-report years taken to be promoted from senior lecturer to professor. The more years the participants took to be promoted from senior lecturer to professor, the slower their career advancement. As for years spent staying at senior lecturer or lecturer position without being promoted (CA2), it was measured by using the deduction of the year of the survey being filled up to the year of the participant joined their existing university. Similarly, the more years the participants spent staying at senior lecturer or lecturer position without being promoted, the slower their career advancement.

(d) Demographic Variables

Demographic data was collected through items asking participants about their gender, employment status, academic field, age, nationality, marital status, academic rank, seniority, and number of children including the child being expected.

Age in the present study refers to the actual biological age of the participant, as self-reported by the participant.

Based on the interview result, previous working experience in other universities was not taken into account when the participants joined their current university. Hence, seniority measured in the present study was deduced from the year the participant started serving in their current university compared to the year they filled up the survey.

Work hours per week for research and teaching were obtained through two items (‘Please indicate the estimated percentage of your total working hours per week that you

spend for research' and 'Please indicate the estimated percentage of your total working hours per week that you spend for teaching').

6.3.5 Data Analyses

Data cleaning was done prior to working on the analyses by removing outliers using the standardised score approach (cut-off at 3.29) and deleting cases or variables that had missing data (Tabachnick & Fidell, 2013). Descriptive analysis was used to analyse the demographic data of the participants. In this section, the tests of assumptions, as well as the tests used for the preliminary and psychometric analyses and for the inferential analyses will be described.

(a) Tests of assumptions

Tests of assumptions were done to fulfil the assumptions that need to be met for correlational analysis, independent t-test and ordinary least squares (OLS) regression using IBM SPSS Statistics version 24 and PROCESS v2.16.

Before conducting correlational analysis, Coakes (2012) recommends to test the data for several assumptions: (1) data must be from related pairs, (2) scale of measurement should be either interval or ratio, (3) there should be normality for each variable, (4) there should be linearity, and (5) there should be homoscedasticity. Normality was assessed by using the normal probability plots (p-p plots). The p-p plots were used instead of the Kolmogorov-Smirnov test and the Shapiro-Wilk test, as these tests often give significant results in large samples, which suggest normality is violated (Field, 2013). Assumptions of linearity and homoscedasticity were done by using a bivariate scatterplot. Violations of assumptions were handled by changing the regular Pearson's correlation (Pearson, 1894) testing to Spearman's correlation (Spearman, 1910) testing.

As for independent-groups t-test, Coakes (2012) recommends for five assumptions to be met: (1) scale of measurement should be either interval or ratio measurement, (2) data should be randomly sampled, (3) there should be normality for each variable, (4) there should be independence of groups and (5) there should be homogeneity of variance. For assumption 2, as described in Chapter 3, the non-probability sampling method was used instead of probability sampling due to the feasibility of data collection, representation of sample and strategy to increase the response rate. The survey link was sent to all academics (the whole population) and the collected data were from those who were willing to fill up the survey. It is not uncommon for t-test to be applied on non-probability samples by researchers (e.g. Goodman & Blum, 1996; Selvaganapathy, Rajappan, & Tham, 2017; Valerio et al., 2016). Normality (assumption 3) was assessed by using the normal probability plots (p-p plots). Assumption 5 (homogeneity of variance) was automatically tested in t-test by using Levene's test (Levene, 1960). Violation of normality was handled using the Mann-Whitney U test (Mann & Whitney, 1947).

A. F. Hayes (2013) suggests four key assumptions to be satisfied before performing OLS regression: (1) linearity, (2) normality on the outcome variable, (3) homoscedasticity and (4) independence. Normality was assessed on all dependent variables by using the normal probability plots (p-p plots). Nevertheless, A. F. Hayes (2013) states that normality is one of the least important assumptions in linear regression analysis unless the studies have a relatively small sample size. Natural logarithm (Ln (X_i + 1) was selected to transform the non-normally distributed dependent variables due to zeros in the data (Field, 2013).

Assumptions of linearity and homoscedasticity were done by using a bivariate scatterplot. Linearity and homoscedasticity are the two imperative and key assumptions in ordinary least squares (OLS) regression that cannot be violated (A. F. Hayes, 2013; A. F. Hayes & Cai, 2007). Hence, A. F. Hayes (2017, p. 2) proposed two hacks to use PROCESS

(model 1 or 2) to estimate and probe a linear moderation of quadratic or non-linear effects and quadratic or curvilinear moderation of linear effects to resolve issues of non-linearity, however he stated that “the hack is easy to describe, understanding what it is doing and how to interpret the results is considerably more complex”. In addition, the visualisation of the moderation has to be done manually, unlike the readily available excel templates that can generate simple slopes for common linear moderation interpretations – referring to Dawson (n.d.).

Violation of linearity was corrected using logarithmic transformation, as this approach is generally used to “handle situations where a non-linear relationship exists between the independent and dependent variables” (Beniot, 2011, p. 2). The same transformation should be applied to all variables (Field, 2013). Thus, natural logarithm (Ln (X_i + 1) was applied to non-linear variables.

A heteroscedasticity-consistent standard error (HCSE) estimator of OLS parameter estimates (specifically HC3) was used to resolve heteroscedasticity. Several researchers favoured the use of HC3 instead of the other four HC methods (HC0, HC1, HC2 and HC4), because HC3 does not affect the power too much regardless the existence of heteroscedasticity issue or not (Cribari-Neto et al., 2005; Long & Ervin, 2000). HC3 was readily available in PROCESS v2.16 (A. F. Hayes, 2013; A. F. Hayes & Cai, 2007).

(b) Preliminary and Psychometric Analyses

The preliminary and psychometric analyses were done by using the IBM SPSS Statistics version 24.

A bivariate Pearson correlation or Spearman’s correlation was conducted to run preliminary analysis to examine the relationship between key variables as a step before

proceeding to the main analyses. Cronbach's alpha test (Cronbach, 1951) was used to assess the internal consistency of each measure.

(c) Inferential Analyses

The inferential analyses for OLS regression were done by using the additionally installed plug-in of PROCESS v2.16 (A. F. Hayes, 2012) in the IBM SPSS Statistics version 24. All conditional process analyses (sequential mediation and moderated mediation analyses) were run separately using model 6 and model 7 respectively in PROCESS v2.16 (A. F. Hayes, 2012). All the path coefficients and indirect effects in the sequential mediation analyses, the conditional indirect effects and indexes of moderated mediation were generated based on 95% bias-corrected bootstrapping technique that was constructed using 10000 resamples.

In the sequential mediation analysis, all the path coefficients were estimated, simultaneously controlling for university (4 dummy coding for 5 university), employment status (0 as part-time and 1 as full-time), nationality (0 as non-Malaysian and 1 as Malaysian), work hours for research per week (only for hypotheses that have research productivity as outcome variable), work hours for teaching per week (only for hypotheses that have teaching performance as outcome variable), academic rank (1 as lecturer, 2 as senior lecturer, 3 as associate professor and 4 as professor), marital status (0 as single and 1 as married), age, seniority (not for hypotheses that have years spent staying at senior lecturer or lecturer position without being promoted as outcome variable as they were the similar variables), number of children including child being expected, number of children below 6 years of age, outcome expectations (when running for self-efficacy) and self-efficacy (when running for outcome expectations). The total effect between each predictor and outcome variable (research productivity, teaching performance and years spent to be promoted from

senior lecturer to professor and years spent staying at senior lecturer or lecturer position without being promoted) was tested to isolate the indirect effects from both mediators while controlling the same control variables. Then, a three-path mediated effect was tested. All sequential mediation tables and figures used in this thesis were developed based on the relevant tables and figures proposed by van Jaarsveld, Walker and Skarlicki (2010) and Hayes, Preacher and Myers (2011). Total effect and model summary values were added into the tables.

University, employment status, nationality, work hours for research per week (for hypotheses that have research-related variables), work hours for teaching per week (for hypotheses that have teaching-related variables), academic rank, marital status, age, seniority, number of children including child being expected and number of children below 6 years of age were included as covariates in all moderated mediation analysis. All moderated mediation tables incorporate the typical regression table format and the moderated mediation tables used in several published articles (Berndt et al., 2013; Dicke et al., 2014) (*Note.* DV in the tables refers to dependent variable). All moderated mediation figures and result write-ups followed the advice of reporting conditional process modelling from Hayes's (2013) and an article that was endorsed by him: Berndt and associates' article (2013). A post-hoc simple slope was done for all the significant moderation analyses by using the two-way with binary moderator interactions excel template created by Dawson (n.d.), as recommended in his article (Dawson, 2014) for better viewing and interpreting of the results.

Data from the respondents that were recruited from different universities could be considered nested data, which refers to the fact that when data is "collected from multiple individuals in a group, the individual data are considered nested within that group" (O'Dwyer & Parker, 2014, p. 2). To avoid the influence of nested data in the main analyses, the

university was recorded as dummy coded variable (4 dummy coding for 5 universities) and was controlled as a covariate in all main analyses.

6.4 Tests of assumptions

For correlational analysis, assumptions 1 (data must be from related pairs) and 2 (scale of measurement should be either interval or ratio) are related to the research design and were met in accordance to research design. Assumption 3 (normality) was separately tested for research productivity, teaching performance, and career advancement. Normality for research productivity was met for RSE. AG, SN, WF, FW and RP were negatively skewed. RC, SC and IR had positive kurtosis. SS and ROE were positively skewed. Normality for teaching performance was met for TSE and TP. SN, WF and FW were negatively skewed. AG had negative kurtosis. RC, SS, TOE and IT were positively skewed. SC had positive kurtosis. For career advancement, the p-p plot of AG and SN showed negative kurtosis, whereas SC displayed positive kurtosis. CA1, CA2 and FW were negatively skewed, while PSE, CAOE, RC and SS were positively skewed. The remaining dependent variable (ICA) and predictor (WF) displayed normal distributions. The normally distributed variables were assessed for linearity (assumption 4) and homoscedasticity (assumption 5). The relationships between TSE and TP were non-linear and heteroscedastic. For variables that violated assumptions, Spearman's correlation was used instead of Pearson's correlation.

In comparison between means analysis, assumptions 1 (scale of measurement should be either interval or ratio), 2 (randomly sampled), 4 (independence of groups) are related to the research design. Assumption 1 and 4 were met in accordance with the research design. As for assumption 2, a non-probability sampling method was used. Thus, the assumption was not met, but this was justifiable as explained in the previous section. Assumption 3 (normality) was tested during tests of assumptions prior to correlational analyses. Only the normally

distributed RSE, TSE, TP, ICA and WF used the independent t-test, while the remaining variables used the Mann-Whitney U test. Assumption 5 (homogeneity of variance) was automatically tested in t-test by using Levene's test (Levene, 1960).

For OLS regression, assumption 4 (independence) is related to the research design and was satisfied in accordance with the research design. For assumption 2 (normality for the dependent variable), RP was negatively skewed in the p-p plots, whereas RSE, ROE and IR were normally distributed. RP was transformed using natural logarithm (Ln (X_i + 1). The transformed RP displayed a normal distribution. Linearity and homoscedasticity were tested on all paths of the models. AG and SN were found to violate assumption 3 (homoscedasticity). As for the remaining variables, assumptions 1 (linearity) and 3 (homoscedasticity) were satisfied. For variables that violated homoscedasticity, analyses were conducted by using HC3.

For assumption 2 (normality) for teaching performance, all dependent variables (TP, TSE, TOE and IT) showed normal distributions in the p-p plots. Linearity and homoscedasticity were tested on all paths of the model. The relationship between all predictors and all dependent variables were found to be linear, thus fulfilled assumption 1 (linearity). The relationships between all predictors and either some or all dependent variables were found to violate assumption 3 (homoscedasticity).

Assumption 2 (normality) for career advancement was tested on all mediators (PSE, CAOE and ICA) and outcome variables (CA1 and CA2). Only CA1 displayed negative skewness. CA1 was transformed using natural logarithm (Ln (X_i) and showed normal distribution after transformation. The transformed CA1 was used in the subsequent analyses. Assumption 1 (linearity) and 3 (homoscedasticity) were tested. AG, SN, RC, SS, SC and FW were found to be heteroscedastic with the dependent variables (CA1, CA2, PSE, CAOE, and ICA). For variables that violate homoscedasticity, analyses were conducted by using HC3.

6.5 Results of Preliminary and Psychometric Analyses

The results of preliminary and psychometrics analyses are reported based on the order of outcome variables, starting from research productivity, and followed by teaching performance and career advancement.

6.5.1 Research Productivity

A Spearman's correlation was performed to have a preliminary view on the relationship between predictors, mediators (RSE: research self-efficacy, ROE: outcome expectations for research and IR: interest in research) and research productivity (RP). Based on Table 13, we can conclude that there were significant relationships between the person variables (age and seniority) and mediators (RSE and IR) and RP (r_s= .11 to .46, p<.05), but there were no significant relationships with ROE. There were significant relationships between all environment variables (recognition, supervisor support and feedback, support from colleagues, work-family conflict and family-work conflict) and mediators (RSE, ROE and IR) and RP (r_s=-.26 to .29, p<.05). These results supported further regression analyses. All instruments showed acceptable to excellent reliabilities, ranging from .79 to .92.

6.5.2 Teaching Performance

A Spearman's correlation was performed to have a preliminary view on the relationship between predictors and mediators (TSE: teaching self-efficacy, TOE: outcome expectations for teaching and IT: interest in teaching) and teaching performance (TP). Based on Table 14, we can conclude that there were significant relationships between the person variables (age and seniority) and mediators (TSE and IT) and TP (r_s= .20 to .35, p<.01), but there was no significant relationship with TOE. There were significant relationships between all environment variables (recognition, supervisor support and feedback, support from

colleagues, work-family conflict and family-work conflict) and mediators (TSE, TOE and IT) and TP (r_s=-.29 to .32, p<.05). These results supported further regression analyses using PROCESS v2.16. All instruments showed acceptable to excellent reliabilities, ranging from .77 to .92.

Table 13

Correlation, Means, Standard Deviations and Cronbach's Alpha of Predictors, Mediators and Research Productivity

Variables	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Age	42.41	8.46	-	-									
2. Seniority	12.47	8.81	-	-	-								
3. Recognition	4.32	1.07	.84	-	-	-							
4. Supervisor support and feedback	4.22	1.08	.90	-	-	-	-						
5. Support from colleagues	4.75	0.82	.90	-	-	-	-	-					
6. Work-family conflict	3.29	1.55	.90	-	-	-	-	-	-				
7. Family-work conflict	2.53	1.45	.92	-	-	-	-	-	-	-			
8. Research self-efficacy	3.97	0.66	.86	.17***	.16***	.23***	.21***	.25***	-.19***	-.26***	-		
9. Outcome expectations for research	4.38	0.58	.80	-.02	.02	.29***	.26***	.27***	-.16***	-.16***	.39***	-	
10. Interest in research	4.10	0.67	.89	.11**	.11*	.22***	.21***	.27***	-.18***	-.23***	.65***	.50***	-
11. Research productivity	25.84	29.33	-	.46***	.42***	.16***	.09*	.15***	-.10*	-.19***	.43***	.13**	.28***

Note. All coefficients refer to Spearman's correlation, ***p<.001, **p<.01, *p<.05.

Table 14

Correlation, Means, Standard Deviations and Cronbach's Alpha of Predictors, Mediators and Teaching Performance

Variables	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Age	43.68	8.67	-	-									
2. Seniority	13.75	9.17	-	-	-								
3. Recognition	4.42	1.09	.84	-	-	-							
4. Supervisor support and feedback	4.30	1.12	.92	-	-	-	-						
5. Support from colleagues	4.81	0.86	.90	-	-	-	-	-					
6. Work-family conflict	3.25	1.53	.90	-	-	-	-	-	-				
7. Family-work conflict	2.51	1.46	.93	-	-	-	-	-	-	-			
8. Teaching self-efficacy	4.34	0.62	.86	.23***	.21***	.25***	.20***	.25***	-.19***	-.29***	-		
9. Outcome expectations for teaching	4.49	0.54	.80	.02	.05	.25***	.25***	.32***	-.22***	-.25***	.30***	-	
10. Interest in teaching	4.33	0.57	.84	.22***	.20***	.17**	.15**	.30***	-.19***	-.24***	.48***	.470***	-
11. Teaching performance	5.13	.70	.78	.35***	.28***	.17**	.14**	.20***	-.12*	-.22***	.62***	.28***	.45***

Note. All coefficients refer to Spearman's correlation, ***p<.001, **p<.01.

6.5.3 Career Advancement

A bivariate Pearson correlation or Spearman's correlation was performed to have a preliminary view on the relationship between predictors and mediators (PSE: promotion self-efficacy, CAOE: outcome expectations for career advancement and ICA: interest in career advancement) and career advancement (CA1: years spent to be promoted from senior lecturer to professor and CA2: years spent staying at senior lecturer or lecturer position without being promoted). Based on Table 15, we can conclude that there were significant relationships between most of the person variables and mediators (PSE, CAOE and ICA) and career advancement (CA1 and CA2) (r_s=.10 to .69, p<.05). There were significant relationships between most of the environment variables and mediators (PSE, CAOE and ICA) and CA1 (r/r_s=-.24 to .39, p<.05), but there were no significant relationships with CA2. These results supported further regression analyses using PROCESS v2.16. All instruments showed good to excellent reliabilities, ranging from .81 to .91.

Table 15

Correlation, Means, Standard Deviations and Cronbach's Alpha of Predictors, Mediators and Career Advancement

Variables	M	SD	α	1	2	3	4	5	6	7	8	9	10
1. Age	43.76	8.98	-	-									
2. Seniority	13.67	9.50	-	-	-								
3. Recognition	4.43	1.09	.85	-	-	-	-						
4. Supervisor support and feedback	4.30	1.10	.90	-	-	-	-	-					
5. Support from colleagues	4.81	0.82	.89										
6. Work-family conflict	3.23	1.53	.90	-	-								
7. Family-work conflict	2.42	1.38	.92	-	-								
8. Promotion self-efficacy	3.75	1.07	.83	.15**	.18***	.39***	.32***	.33***	-.11*	-.24***	-		
9. Outcome expectations for career advancement	4.08	0.80	.88	.11*	.15**	.30***	.31***	.30***	-.13**	-.11*	.45***	-	
10. Interest in career advancement	3.66	0.90	.82	.07	.10*	.28***	.24***	.30***	**-.14****	-.16**	.48***	.63***	-
11. Years spent to be promoted from senior lecturer to professor	13.28	5.60	-	.54***	.46***	.12	.26*	.15	-.13	-.09	-.19	.28*	.13
12. Years spent staying at senior lecturer or lecturer position without being promoted	5.17	2.97	-	.57***	.69***	.02	-.05	-.01	.11	.10	-.03	-.07	-.11

Note. Bold coefficients refer to Pearson's correlation, the remaining coefficients refer to Spearman's correlation, ***p<.001, **p<.01, *p<.05

6.6 Results of Inferential Analyses

Results of inferential analyses are reported based on the order of each predictor. For each predictor, reports start with results relating to research-related variables, followed by teaching and career advancement-related variables. A list of abbreviations and acronyms regarding the variable names can be found in Appendix 5.

6.6.1 Age (AG)

(a) Research

Neither pairs of sequential mediators (1: RSE and IR and 2: ROE and IR) sequentially mediated the relationship between AG and RP amongst STEMM participants. Also, when RSE and ROE were mediators, gender did not moderate the mediated relationship between AG and IR. With regard to research, H1 H2, and H3 were not supported amongst the participants.

(b) Teaching

Neither pairs of sequential mediators (1: TSE and IT and 2: TOE and IT) sequentially mediated the relationship between AG and TP amongst STEMM participants. Also, when TSE and TOE were mediators, gender did not moderate the mediated relationship between AG and IT. With regard to teaching, H1 H2, and H3 were not supported amongst the participants.

(c) Career advancement

Neither pairs of sequential mediators (1: PSE and ICA and 2: CAOE and ICA) sequentially mediated the relationship between AG and CA1, and the relationship between AG and CA2 amongst STEMM participants. Also, when PSE and CAOE were mediators,

gender did not moderate the mediated relationship between AG and ICA. With regard to career advancement, H1 H2, and H3 were not supported amongst the participants.

6.6.2 Seniority (SN)

(a) Research

Neither pairs of sequential mediators (1: RSE and IR and 2: ROE and IR) sequentially mediated the relationship between SN and RP amongst STEMM participants. When RSE and ROE were mediators, gender did not moderate the mediated relationship between SN and IR. With regard to research, H4, H5, and H6 were not supported amongst the participants.

(b) Teaching

Neither pairs of sequential mediators (1: TSE and IT and 2: TOE and IT) sequentially mediated the relationship between SN and TP amongst STEMM participants. Also, when TSE and TOE were mediators, gender did not moderate the mediated relationship between SN and IT. With regard to teaching, H4, H5, and H6 were not supported amongst the participants.

(c) Career advancement

Neither pairs of sequential mediators (1: PSE and ICA and 2: CAOE and ICA) sequentially mediated the relationship between SN and CA1, and the relationship between SN and CA2 amongst STEMM participants. Also, when PSE and CAOE were mediators, gender did not moderate the mediated relationship between SN and ICA. With regard to career advancement, H4, H5, and H6 were not supported amongst the participants.

6.6.3 Recognition (RC)

(a) Research

Neither pairs of sequential mediators (1: RSE and IR and 2: ROE and IR) sequentially mediated the relationship between RC and RP amongst STEMM participants. However, we can see that gender moderated the mediated relationship between RC and IR when RSE was a mediator (B=.07, SE=.03, 95% CI=.01 to .14), as reported in Table 16. The indirect effect of RC on IR through RSE for men was positive (B=.09, SE=.03, 95% CI=.04 to .15), as depicted in Figure 12 (where men are represented by the solid line). Higher RC led to higher RSE, which in turn led to higher IR only amongst men. The indirect effect for women was not significantly different from zero (B=.02, SE=.02, 95% CI=-.02 to .07). But, when ROE was mediator, gender did not moderate the mediated relationship between RC and IR. With regard to research, H7 and H8 were not supported amongst the participants, but H9 was partially supported, when RSE was mediator.

Table 16

Conditional Indirect Effects of Recognition (RC) on Interest in Research (IR) via Research Self-Efficacy (RSE) or Outcome Expectations for Research (ROE)

Effects	B	SE	*t*	*p*	95% CI
DV: RSE					
RC	.044	.041	1.058	.291	
Gender	-.507	.278	-1.825	.069	
RC x Gender	.147	.063	2.342	.020	
Conditional indirect effect					
Female	.021	.021			-.019, .065
Male	.092	.027			.043, .151
Moderated mediation	.071	.034			.009, .143
Model Summary: R^2=.235, F=6.069, *df1*=16, *df2*=317, p<.001					
DV: IR					
RSE	.484	.048	10.093	<.001	
ROE	.293	.049	5.930	<.001	
Model Summary: R^2=.507, F=20.411, *df1*=16, *df2*=317, p<.001					

Note. Control variables: please refer to 6.3.5 (c).

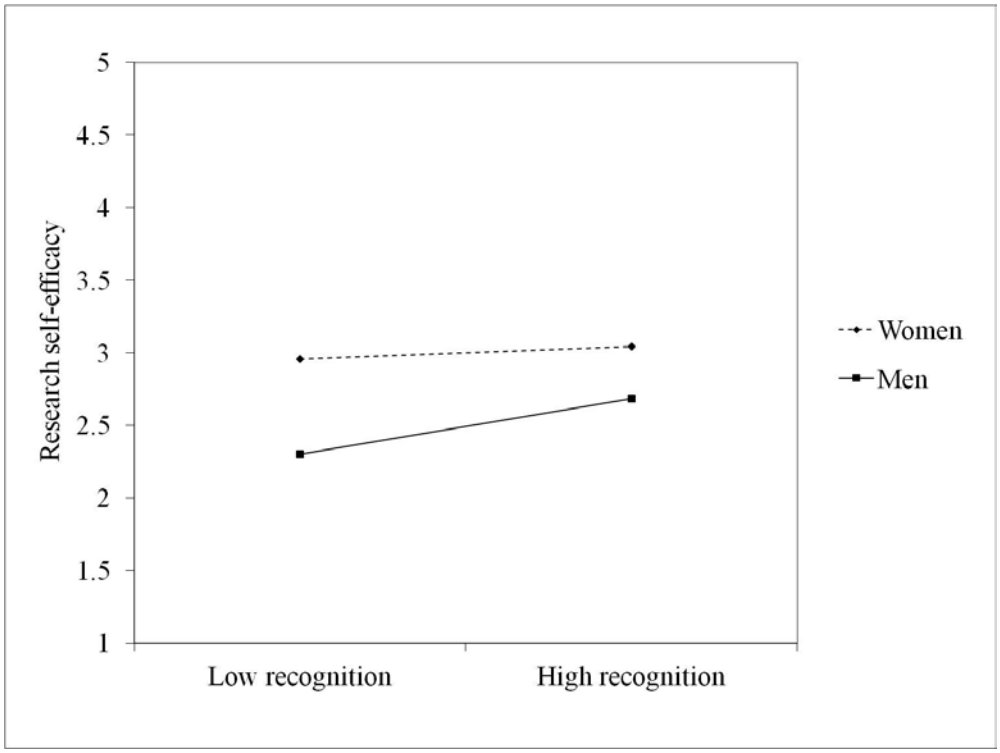


Figure 12. Moderating effect of gender on the recognition-research self-efficacy relationship

(b) Teaching

Neither pairs of sequential mediators (1: TSE and IT and 2: TOE and IT) sequentially mediated the relationship between RC and TP amongst STEMM participants. Also, when TSE and TOE were mediators, gender did not moderate the mediated relationship between RC and IT. With regard to teaching, H7, H8, and H9 were not supported amongst the participants.

(c) Career advancement

Neither pairs of sequential mediators (1: PSE and ICA and 2: CAOE and ICA) sequentially mediated the relationship between RC and CA1 amongst STEMM participants. However, PSE and ICA sequentially mediated the relationship between RC and CA2 (B=-.01, SE=.01, 95% CI=-.07 to -.00004), as reported in Table 17. The smaller negative indirect effect of RC on CA2 through PSE and ICA indicates that there was a suppression

effect from the two mediators (PSE and ICA) towards the larger positive direct effect (B=.41, SE=.25), based on the interpretation from MacKinnon and colleagues (2000). Higher RC led to higher PSE, which in turn led to higher ICA, which in turn led to lower CA2. Contrary to the outcome of direct effect, which suggests that higher RC would lead to higher CA2, we can see that higher RC led to lower CA2 due to the suppressive effect from PSE and ICA, as illustrated by Figure 13. But CAOE and ICA did not sequentially mediate the relationship between RC and CA2. Also, when PSE and CAOE were mediators, gender did not moderate the mediated relationship between RC and ICA. With regard to career advancement, H8 and H9 were not supported amongst the participants, but H7 was partially supported, when CA2 was outcome variable.

Table 17

Path Coefficients and Indirect Effects for Mediation Models of Recognition (RC) on Years Spent Staying at Senior Lecturer or Lecturer Position without Being Promoted (CA2)

	Path Coefficients			Indirect Effects	
				Estimate	95% CI
	to CA2	to PSE	to ICA		
RC	.41 (.25)	.21* (.09)	-.03 (.06)		
PSE	-.02 (.38)		.13 (.07)		
ICA	-.52 (.36)				
Total				-.004 (.08)	-.17, .18
RC→PSE→CA2				-.004 (.08)	-.14, .17
RC→ICA→CA2				.01 (.04)	-.04, .13
RC→PSE→ICA→CA2				-.01 (.01)	-.07, -.00004
Total effect (RC→CA2)=.41 (.25)					
Model summary	R^2=.43, F(15,116) =3.56, p<.001	R^2=.26, F(13,118) =3.00, p<.001	R^2=.43, F(14,117) =6.54, p<.001		

Note. Standard error in parentheses. Control variables: please refer to 6.3.5 (c). All standard errors are based on the HC3 estimator.

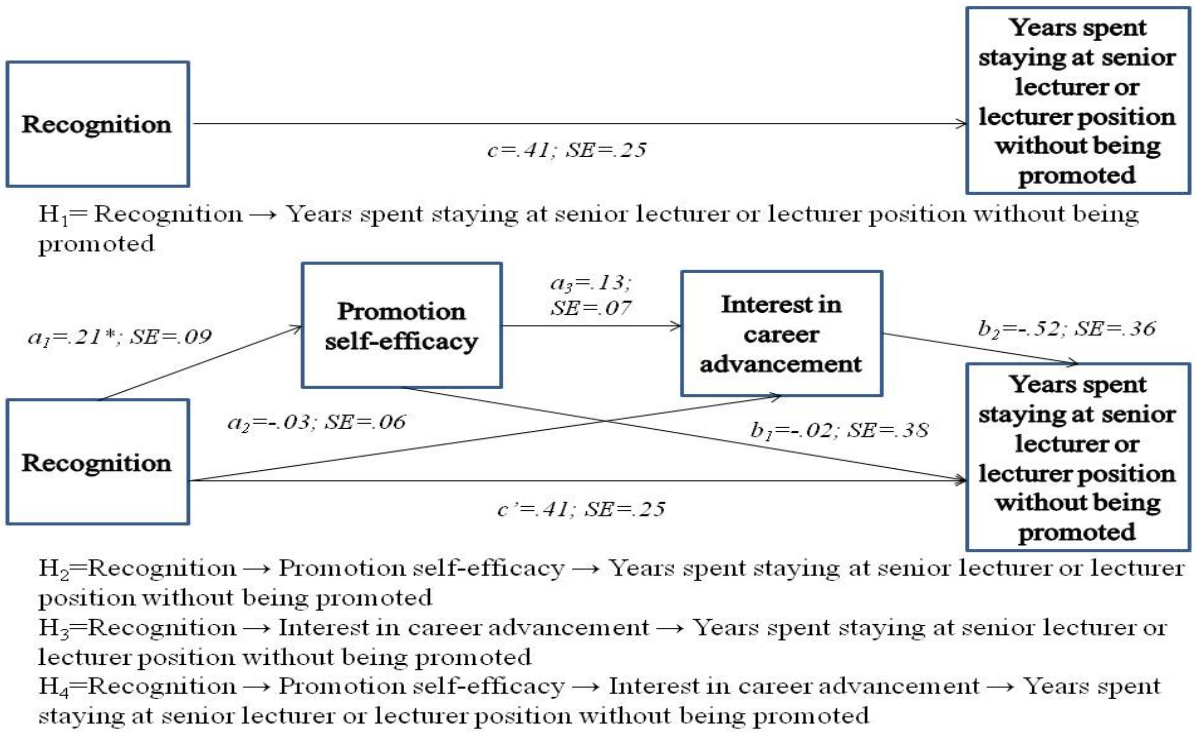


Figure 13. Sequential mediation model of recognition on years spent staying at senior lecturer or lecturer position without being promoted through promotion self-efficacy and interest in career advancement

Note. Indirect effect of the sequential mediation: B=-.01, SE=.01, 95% CI=-.07 to -.00004

6.6.4 Supervisor Support and Feedback (SS)

(a) Research

Neither pairs of sequential mediators (1: RSE and IR and 2: ROE and IR) sequentially mediated the relationship between SS and RP amongst STEMM participants. However, as can be seen in Table 18, gender moderated the relationship between SS and IR, when RSE (B=.10, SE=.03, 95% CI=.04 to .17) and ROE (B=.05, SE=.02, 95% CI=.01 to .09) were mediators in STEMM. The indirect effect of SS on IR through RSE for men was positive (B=.10, SE=.03, 95% CI=.05 to .16), as depicted in Figure 14 (where men are represented by the solid line). Higher SS led to higher RSE, which in turn led to higher IR only amongst men. The indirect effect for women was not significantly different from zero (B=-.001, SE=.02, 95% CI=-.04 to .04).

Table 18

Conditional Indirect Effects of Supervisor Support and Feedback (SS) on Interest in Research (IR) via Research Self-Efficacy (RSE) or Outcome Expectations for Research (ROE)

Effects	B	SE	*t*	*p*	95% CI
DV: RSE					
SS	-.002	.039	-.060	.952	
Gender	-.752	.269	-2.800	.005	
SS x Gender	.204	.062	3.318	.001	
Conditional indirect effect					
Female	-.001	.019			-.038, .037
Male	.097	.027			.049, .156
Moderated mediation	.098	.033			.039, .170
Model Summary: R^2=.236, F=6.122, *df1*=16, *df2*=317, p<.001					
DV: ROE					
SS	.045	.038	1.186	.237	
Gender	-.703	.263	-2.672	.008	
SS x Gender	.155	.060	2.570	.011	
Conditional indirect effect					
Female	.013	.012			-.008, .039
Male	.058	.018			.028, .098
Moderated mediation	.045	.020			.012, .092
Model Summary: R^2=.169, F=4.015, *df1*=16, *df2*=317, p<.001					
DV: IR					
RSE	.482	.048	10.103	<.001	
ROE	.289	.049	5.876	<.001	
Model Summary: R^2=.509, F=20.534, *df1*=16, *df2*=317, p<.001					

Note. Control variables: please refer to 6.3.5 (c).

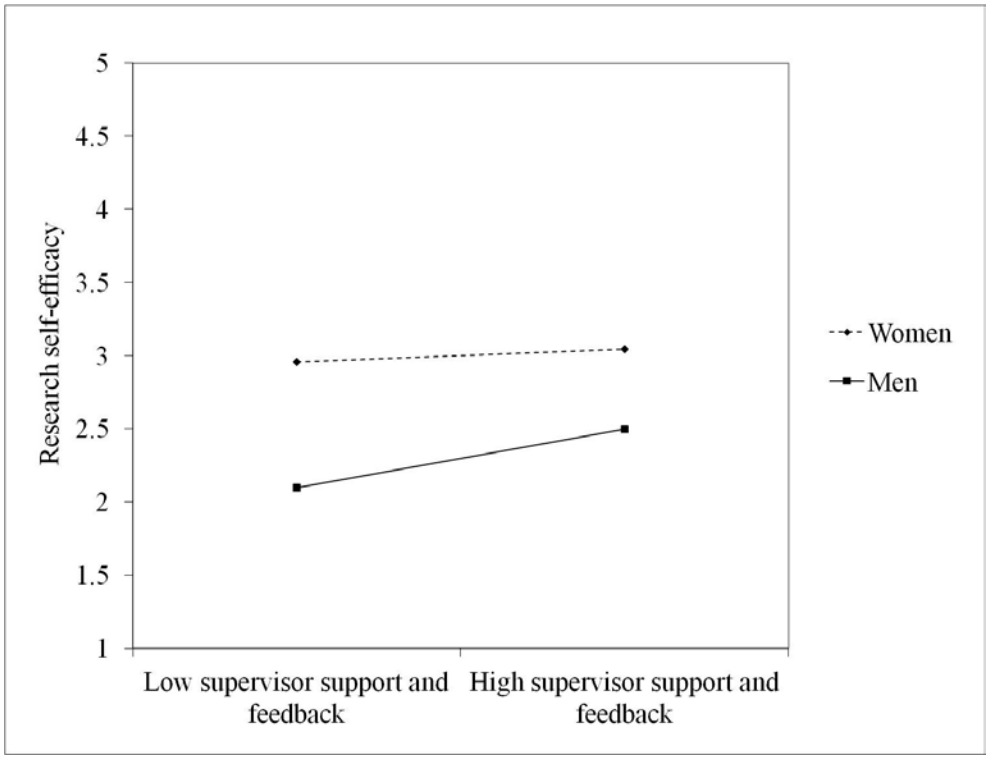


Figure 14. Moderating effect of gender on the supervisor support and feedback-research self-efficacy relationship

Additionally, the indirect effect of SS on IR through ROE for men was positive (B=.06, SE=.02, 95% CI=.03 to .10), as depicted in Figure 15 (where men are represented by the solid line). Higher SS led to higher ROE, which in turn led to higher IR only amongst men. The indirect effect for women was not significantly different from zero (B=.01, SE=.01, 95% CI=-.01 to .04). With regard to research, H10 and H11 were not supported amongst the participants, but H12 was supported.

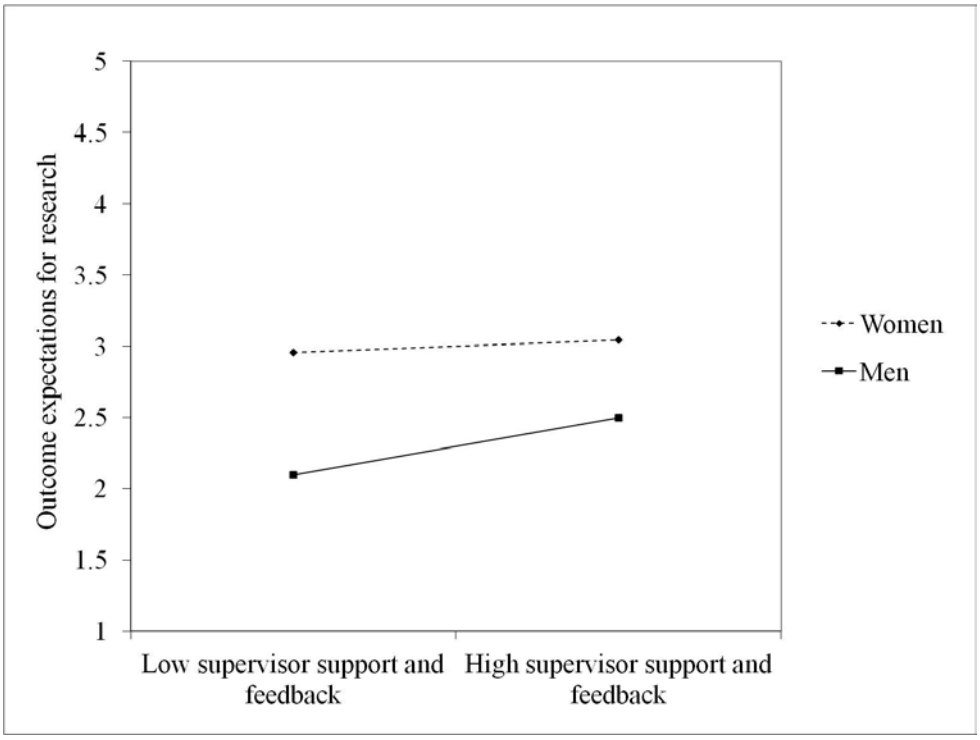


Figure 15. Moderating effect of gender on the supervisor support and feedback-outcome expectations for research relationship

(b) Teaching

Neither pairs of sequential mediators (1: TSE and IT and 2: TOE and IT) sequentially mediated the relationship between SS and TP amongst STEMM participants. Also, when TSE and TOE were mediators, gender did not moderate the mediated relationship between SS and IT. With regard to research, H10, H11, and H12 were not supported amongst the participants.

(c) Career advancement

Neither pairs of sequential mediators (1: PSE and ICA and 2: CAOE and ICA) sequentially mediated the relationship between SS and CA1, and the relationship between SS and CA2 amongst STEMM participants. And, when PSE and CAOE were mediators, gender did not moderate the mediated relationship between SS and ICA. With regard to career advancement, H10, H11, and H12 were not supported amongst the participants.

6.6.5 Support from Colleagues (SC)

(a) Research

Neither pairs of sequential mediators (1: RSE and IR and 2: ROE and IR) sequentially mediated the relationship between SC and RP amongst STEMM participants. However, it is worth noting that RSE alone mediated the relationship between SC and RP (B=.04, SE=.02, 95% CI=.01 to .09), as reported in Table 19. According to MacKinnon and colleagues (2000), the larger positive indirect effect of SC on RP through RSE indicates that there was a mediation towards the smaller positive direct effect (B=.03, SE=.06). Higher SC led to higher RP through RSE. When RSE and ROE were mediators, gender did not moderate the mediated relationship between SC and IR. With regard to research, H13, H14, and H15 were not supported amongst the participants.

Table 19

Path Coefficients and Indirect Effects for Mediation Models of Support from Colleagues (SC) on Research Productivity (RP)

	Path Coefficients			Indirect Effects	
	to RP	to RSE	to IR	Estimate	95% CI
SC	.03 (.06)	.13** (.04)	.11** (.04)		
RSE	.31** (.09)		.46*** (.05)		
IR	-.07 (.09)				
Total				.03 (.02)	-.002, .07
SC→RSE→RP				.04 (.02)	.01, .09
SC→IR→RP				-.01 (.01)	-.03, .01
SC→RSE→IR→RP				-.004 (.01)	-.02, .01
Total effect (SC→RP)=.06 (.06)					
Model summary	R^2=.58, F(17,315)= 25.68, p<.001	R^2=.29, F(15,317)= 8.71, p<.001	R^2=.52, F(16,316)=21.55, p<.001		

Note. Standard error in parentheses. Control variables: please refer to 6.3.5 (c).

(b) Teaching

Neither pairs of sequential mediators (1: TSE and IT and 2: TOE and IT) sequentially mediated the relationship between SC and TP amongst STEMM participants. Also, when TSE and TOE were mediators, gender did not moderate the mediated relationship between SC and IT. With regard to teaching, H13, H14, and H15 were not supported amongst the participants.

(c) Career advancement

Neither pairs of sequential mediators (1: PSE and ICA and 2: CAOE and ICA) sequentially mediated the relationship between SC and CA1, and the relationship between SC and CA2 amongst STEMM participants. Also, when PSE and CAOE were mediators, gender did not moderate the mediated relationship between SC and ICA. With regard to career advancement, H13, H14, and H15 were not supported amongst the participants.

6.6.6 Work-Family Conflict (WF)

(a) Research

Neither pairs of sequential mediators (1: RSE and IR and 2: ROE and IR) sequentially mediated the relationship between WF and RP amongst STEMM participants. Also, when RSE and ROE were mediators, gender did not moderate the mediated relationship between WF and IR. With regard to research, H16, H17, and H18 were not supported amongst the participants.

(b) Teaching

Neither pairs of sequential mediators (1: TSE and IT and 2: TOE and IT) sequentially mediated the relationship between WF and TP amongst STEMM participants. However, from

Table 20, we can see that gender moderated the mediated relationship between WF and IT, when TOE was mediator (B=.05, SE=.02, 95% CI=.01 to .10). The indirect effect of WF on IT through TOE for women was negative (B=-.04, SE=.02, 95% CI=-.07 to -.01), as illustrated in Figure 16 (where women are represented by the dotted line). Higher WF led to lower TOE, which in turn led to lower IT, only amongst women. The indirect effect for men was not significantly different from zero (B=.01, SE=.02, 95% CI=-.02 to .04) (as shown by the solid line). When TSE was mediator, gender did not moderate the mediated relationship between WF and IT. With regard to teaching, H16 and H17 were not supported amongst the participants, but H18 was partially supported, when TOE was mediator.

Table 20

Conditional Indirect Effects of Work-Family Conflict (WF) on Interest in Teaching (IT) via Teaching Self-Efficacy (TSE) or Outcome Expectations for Teaching (TOE)

Effects	B	SE	*t*	*p*	95% CI
DV: TOE					
WF	-.098	.032	-3.035	.003	
Gender	-.391	.206	-1.897	.059	
WF x Gender	.123	.055	2.261	.025	
Conditional indirect effect					
Female	-.036	.015			-.072, -.013
Male	.010	.015			-.019, .041
Moderated mediation	.046	.022			.009, .098
Model Summary: R^2=.123, F=2.087, *df1*=16, *df2*=182, p=.011					
DV: IT					
TSE	.329	.065	5.077	<.001	
TOE	.371	.072	5.138	<.001	
Model Summary: R^2=.400, F=11.633, *df1*=16, *df2*=182, p<.001					

Note. Control variables: please refer to 6.3.5 (c). All standard errors are based on the HC3 estimator.

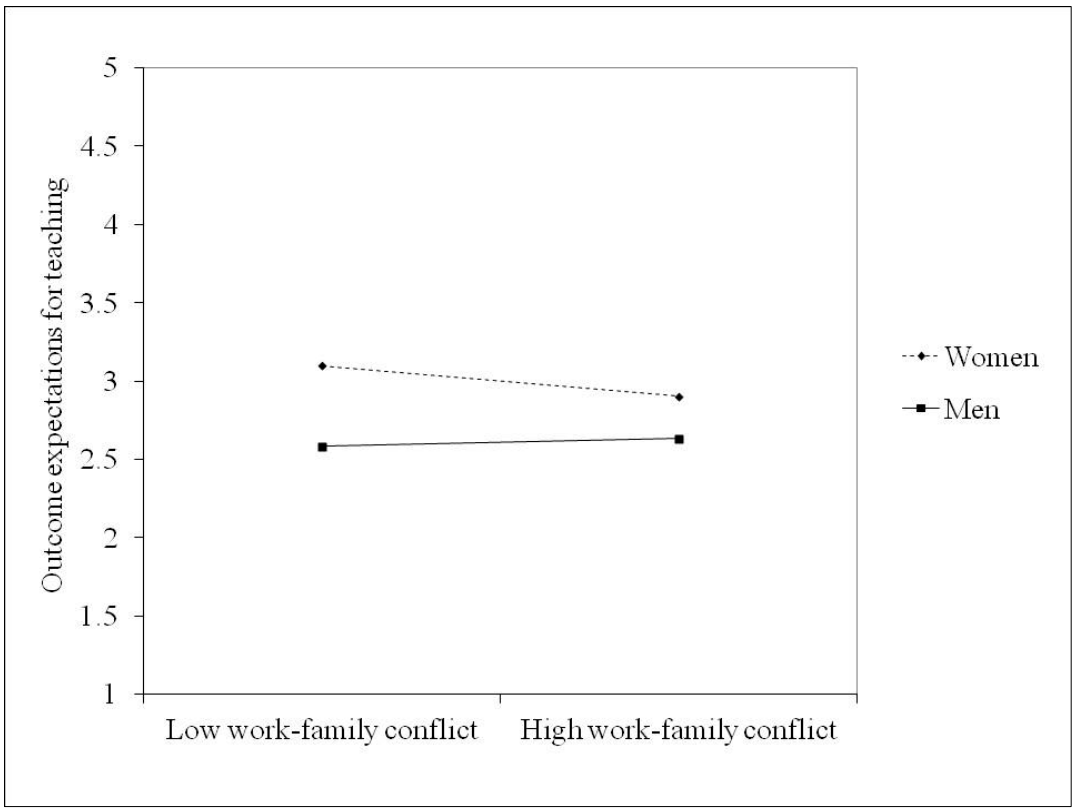


Figure 16. Moderating effect of gender on the work-family conflict-outcome expectations for teaching relationship

(c) Career advancement

Neither pairs of sequential mediators (1: PSE and ICA and 2: CAOE and ICA) sequentially mediated the relationship between WF and CA1, and the relationship between WF and CA2 amongst STEMM participants. Also, when PSE and CAOE were mediators, gender did not moderate the mediated relationship between WF and ICA. With regard to career advancement, H16, H17, and H18 were not supported amongst the participants.

6.6.7 Family-Work Conflict (FW)

(a) Research

Neither pairs of sequential mediators (1: RSE and IR and 2: ROE and IR) sequentially mediated the relationship between FW and RP amongst STEMM participants. Also, when RSE and ROE were mediators, gender did not moderate the mediated relationship between FW and IR. With regard to research, H19, H20, and H21 were not supported amongst the participants.

(b) Teaching

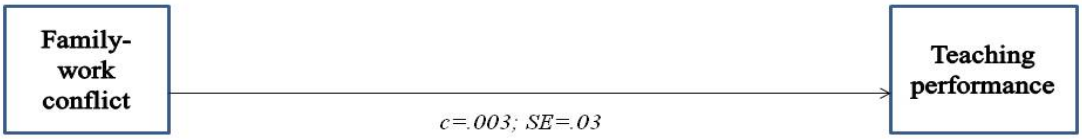
TSE and IT did not sequentially mediate the relationship between FW and TP amongst STEMM participants. However, TOE and IT sequentially mediated the relationship between FW and TP (B=-.005, SE=.004, 95% CI=-.02 to -.0002), as reported in Table 21. The smaller negative indirect effect of FW on TP through TOE and IT indicates that there was a suppression effect from the two mediators (TOE and IT) towards the larger positive direct effect (B=.01, SE=.03). Lower FW led to higher TOE, which in turn led to higher IT, which resulted in higher TP, as illustrated in Figure 17.

Table 21

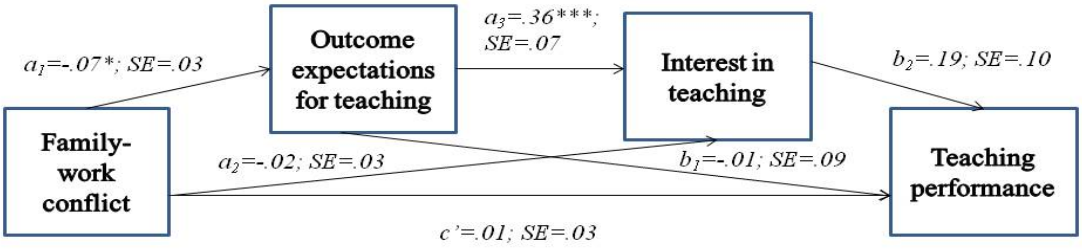
Path Coefficients and Indirect Effects for Mediation Models of Support from Colleagues (SC) on Teaching Performance (TP)

	Path Coefficients			Indirect Effects	
	to TP	to TOE	to IT	Estimate	95% CI
FW	.01 (.03)	-.07* (.03)	-.02 (.03)		
TOE	-.01 (.09)		.36*** (.07)		
IT	.19 (.10)				
Total				-.01 (.01)	-.03, .01
FW→TOE→TP				.001 (.01)	-.01, .01
FW→IT→TP				-.004 (.01)	-.02, .003
FW→TOE→IT →TP				-.005 (.004)	-.02, -.0002
Total effect (FW→TP)=.003 (.03)					
Model summary	R^2=.46, F(17,181)= 8.26, p<.001	R^2=.14, F(15,183)= 2.91, p<.001	R^2=.40, F(16,182)=1 1.63, p<.001		

Note. Standard error in parentheses. Control variables: please refer to 6.3.5 (c). All standard errors are based on the HC3 estimator. [a] Possible by chance due to sampling variability (not the valid significant result).



H_1= Family-work conflict → Teaching performance



H_2=Family-work conflict → Outcome expectations for teaching → Teaching performance
H_3=Family-work conflict → Interest in teaching → Teaching performance
H_4=Family-work conflict → Outcome expectations for teaching → Interest in teaching → Teaching performance

Figure 17. Sequential mediation model of family-work conflict on teaching performance through outcome expectations for teaching and interest in teaching

Note. Indirect effect of the sequential mediation: B=-.005, SE=.004, 95% CI=-.02 to -.0002

Interestingly, from Table 22, we can see that gender moderated the mediated relationship between FW and IT, when TOE was mediator (B=.05, SE=.02, 95% CI=.01 to .10). The indirect effect of FW on IT through TOE for women was negative (B=-.04, SE=.02, 95% CI=-.08 to -.02), as illustrated in Figure 18 (where women are represented by the dotted line). Higher FW led to lower TOE, which in turn led to lower IT, only amongst women. The indirect effect for men was not significantly different from zero (B=.002, SE=.02, 95% CI=-.03 to .03) (as shown by the solid line). When TSE was mediator, gender did not moderate the mediated relationship between FW and IT. With regard to teaching, H19 was not supported amongst the participants, but H20 was supported, and H21 was partially supported, when TOE was mediator.

Table 22

Conditional Indirect Effects of Family-Work Conflict on Interest in Teaching (IT) via Teaching Self-Efficacy (TSE) or Outcome Expectations for Teaching (TOE)

Effects	B	SE	*t*	*P*	95% CI
DV: TOE					
FW	-.121	.036	-3.408	.001	
Gender	-.320	.159	-2.008	.046	
FW x Gender	.126	.054	2.325	.021	
Conditional indirect effect					
Female	-.044	.015			-.081, -.020
Male	.002	.015			-.030, .029
Moderated mediation	.046	.021			.011, .095
Model Summary: R^2=.145, F=2.491, *df1*=16, *df2*=182, p=.002					
DV: IT					
TSE	.325	.065	5.003	<.001	
TOE	.364	.072	5.067	<.001	
Model Summary: R^2=.402, F=11.633, *df1*=16, *df2*=182, p<.001					

Note. Control variables: please refer to 6.3.5 (c). All standard errors are based on the HC3 estimator.

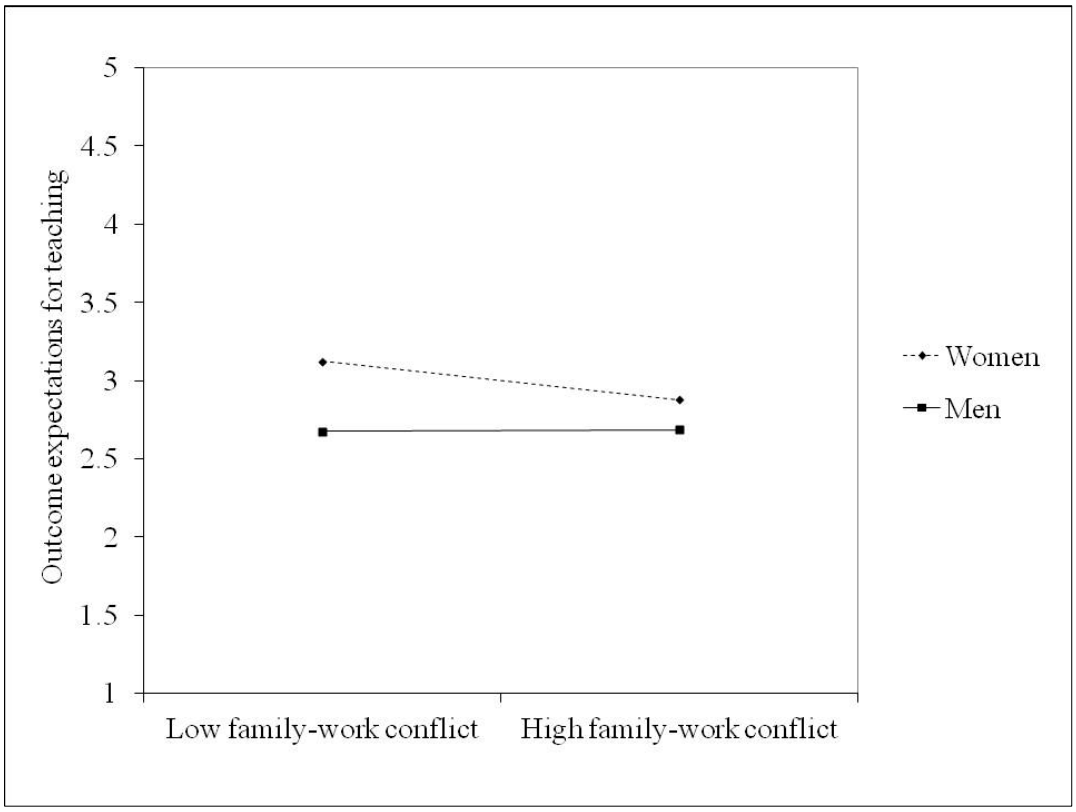


Figure 18. Moderating effect of gender on the family-work conflict-outcome expectations for teaching relationship

(c) Career advancement

Neither pairs of sequential mediators (1: PSE and ICA and 2: CAOE and ICA) sequentially mediated the relationship between FW and CA1, the relationship between FW and CA2 amongst STEMM participants. Also, when PSE and CAOE were mediators, gender did not moderate the mediated relationship between FW and ICA. With regard to career advancement, H19, H20 and H21 were not supported amongst the participants.

6.7 A Short Discussion of the Quantitative Findings

The sections below discuss the significant results that pertain to STEMM women academics, followed by some reflections on determinants that also apply to STEMM men, and determinants that were expected to contribute to STEMM women's career success but do not. When it comes to interest in teaching, both work-family conflict and family-work

conflict affect STEMM women negatively. Women with higher work-family conflict and family-work conflict have lower outcome expectations for teaching and interest in teaching. When it comes to research-related outcomes, the main determinant is support from colleagues. However, this factor seems to equally help men academics, and thus does not represent a mean of support specific to STEMM women academics only. On the other hand, one of the important determinants of career advancement-related outcomes is recognition; this antecedent, however, plays an important role also amongst STEMM men. The findings for this phase are summarised in Table 23.

Table 23

Summary of Findings from Quantitative Phase

Independent Variables	Sequential Mediation Findings	Moderated Mediation Findings
Age	No significant results.	No significant results.
Seniority	No significant results.	No significant results.
Recognition	Higher recognition led to higher promotion self-efficacy, which in turn led to higher interest in career advancement, which in turn led to lesser years spent staying at senior lecturer or lecturer position without being promoted.	Higher recognition led to higher research self-efficacy, which in turn led to higher interest in research only amongst men.
Supervisor Support and feedback	No significant results.	Higher supervisor support and feedback led to higher research self-efficacy, which in turn led to higher interest in research only amongst men. Higher supervisor support and feedback led to higher outcome expectations for research, which in turn led to higher interest in research only amongst men.
Support from colleagues	Higher support from colleagues led to higher research productivity through research self-efficacy.	No significant results.
Work-family conflict	No significant results.	Higher work-family conflict led to lower outcome expectations for teaching, which in turn led to lower interest in teaching, only amongst women.
Family-work conflict	Lower family-work conflict led to higher outcome expectations for teaching, which in turn led to higher interest in teaching, which resulted in higher teaching performance	Higher family-work conflict led to lower outcome expectations for teaching, which in turn led to lower interest in teaching, only amongst women.

6.7.1 Work-Family Conflict and Family-Work Conflict Affect Teaching amongst STEMM Women Academics

Higher family-work conflict and work-family conflict led to lower outcome expectations for teaching, which in turn led to lower interest in teaching, only amongst STEMM women academics (not amongst men). Women academics' career success is affected when they cannot balance work and family life (Achour, Grine, & Mohd Nor, 2015; Stack, 2004).

These results are supported by several studies, in which increased family-work conflict or work-family conflict affects job performance negatively (Ajala, 2017; Fox, 2010; Karatepe & Sokmen, 2006; Stack, 2004). Same goes for Fox's study (2010), that showed that STEMM women academics experience a significantly higher level of work-family conflict and family-work conflict than men. The claim of 'science as a greedy institution' (Fox, 2010) in Malaysia's research universities context is confirmed. STEMM women academics in Malaysia are still significantly more affected by the gendered roles on household and family than men, which appears to be similar in the United States samples too (Fox, 2010).

Family-friendly policies should be proposed to reduce family-work and work-family conflict (Marican & Sabil, 2017), as these can reduce the impact of these conflicts on teaching related outcomes.

6.7.2 Predictors of Research and Career Advancement-Related Outcomes in Both STEMM Men and Women

The success of STEMM women is also determined by some factors that are relevant to STEMM men too, including support from colleagues and recognition. STEMM academics can have higher research productivity when their research self-efficacy is enhanced after receiving support from colleagues. At the same time, receiving recognition is important in

improving promotion self-efficacy and interest in career advancement STEMM academics, as these can reduce years spent staying at senior lecturer or lecturer position without being promoted.

Higher support from colleagues led to higher research self-efficacy, which in turn led to higher research productivity amongst both genders in STEMM. This is consistent with the result of a study in which support from colleagues has been positively associated with self-reported total publications (K. Kim & Choi, 2017). Research self-efficacy alone serves as a significant mediator in the present study, and this is supported by another empirical study in which research self-efficacy was shown to lead to higher total research productivity amongst academics (Pasupathy & Siwatu, 2014). This can also explain the non-significant results of all sequential mediation analyses amongst STEMM academics. Interest in research did not improve research productivity, but higher research self-efficacy could lead to higher research productivity directly. Thus, support from colleagues and research self-efficacy are more important than interest in research to improve STEMM academics' research productivity.

The results of the present study also suggest that recognising STEMM academics can lead to an increase in promotion self-efficacy, interest in career advancement and a reduction of years spent without being promoted from senior lecturer or lecturer position. While this result is applicable to both men and women in STEMM, particularly for women, it could be because recognition can help them to fight 'impostor syndrome' (Clance & Imes, 1978) with regards to career advancement. Women's ability and competency in STEMM fields are often being judged as lesser than men, as the common belief assumes that men are stronger in mathematical skills (Hill et al., 2010). Higher recognition can help STEMM women academics to enhance their promotion self-efficacy, which in turn can increase their interest in career advancement, and can overcome the 'sticky floor' phenomenon (staying at lower rank without being promoted) (Booth et al., 2003; Yap & Konrad, 2009). Recognition gives a

message to them that STEMM fields are not ‘masculine’ fields that do not suit women. As described in GST, individuals are taught from a young age to partake in ‘gender-appropriate’ activities and perceive that other individuals should only do ‘gender-appropriate’ activities too (Bem, 1983). However, such sex-typing can be unlearned (Bem, 1983) if STEMM women academics are being recognised that they too can be successful in STEMM.

6.7.3 Explanations for Other Findings That Are Not Applicable to STEMM Women Academics

Most of the job resources (i.e. recognition and supervisor support and feedback) were found to help only STEMM men academics towards research outcomes. Such findings had, again, confirmed STEMM women do encounter more challenges (Werber, 2015), especially in research.

As supported by Sax and colleagues (2002), recognition can predict research productivity only amongst men, while women might be more driven to direct societal impact instead of recognition in research. In the present study, higher recognition led to higher research self-efficacy, which in turn led to higher interest in research only amongst STEMM men academics. The ‘imposter phenomenon’ (Clance & Imes, 1978) is stronger amongst women academics (Fotaki, 2013), and this might be linked to the fact that recognition alone did not improve research self-efficacy and interest in research amongst the STEMM women academics of the present research’s sample. In addition, the fact that women scientists often receive significantly lesser recognition than their male counterparts (Fox, 2010; UNESCO Bangkok & Korean Women’s Development Institute (KWDI), 2015) could explains why STEMM women academics could be troubled by the ‘imposter phenomenon’ (Clance & Imes, 1978), shaping them to feel inferior to men in terms of research. Thus, despite

receiving recognition, they might minimise it to mere luck or to the fact that they were just a ‘token’ (Kamberidou, 2010), instead of being truly deserving it.

The supervisors for STEMM women academics could be ‘gender-schematic’ individuals as described by Bem (1981a), and might not be so supportive of women for success in research. Supervisor support and feedback are not enough to improve research self-efficacy and interest in research amongst STEMM women. Again, it could be due to the ‘imposter phenomenon’ (Clance & Imes, 1978). Hence, supervisor support and feedback can only improve research self-efficacy, outcome expectations for research and interest in research amongst STEMM men. The gendered perception of ‘think professor-think male’ (Tharenou, 1994) might have caused STEMM women academics to think that research is more ‘masculine’ and ‘gender-inappropriate’ for women (Bem, 1983) and that they are not as competent as their male counterparts to perform well in their research area. Furthermore, their supervisors might be mainly men given they were in the male-dominated fields. Thus, without the exposure to a gender-sensitive training, they might not be able to truly understand how to better support STEMM women academics in research, given the complexity of gendered roles of women in household and childcare (Fox, 2010) in the lens of GST (Bem, 1981a). These gendered concepts should be unlearned through more gender-aware training.

In addition, in relation to teaching, given that none of the tested job resources was able to improve the teaching-related variables of STEMM women, further testing on more job resources is encouraged in future research to identify other job resources that may help in improving teaching-related variables.

It is crucial to explore how job resources can help STEMM academics, particularly women academics, in terms of research, teaching and career advancement.

6.8 Chapter Summary

This chapter reported the method and findings of study two. In terms of research, almost all predictors were not applicable to STEMM women academics, except support from colleagues (which was applicable to STEMM men too). As for teaching, the predictors of STEMM women participants were centred only on job demands (i.e. family-work conflict and work-family conflict). In terms of career advancement, the predictors of STEMM women participants covered only one job resource (i.e. recognition, which was applicable to STEMM men too). The model proposed for this thesis (based on a combination of JD-R model and SCCT) can be considered a good fit for the STEMM academics in Malaysia. Gender was found to be a significant moderator amongst STEMM academics in Malaysia.

The next and last chapter contains a general discussion and conclusion for the research of this thesis.

CHAPTER 7 - GENERAL DISCUSSION AND CONCLUSIONS

7.1 Chapter Overview

This chapter begins by summarising the findings from the two phases of research (qualitative phase and quantitative phase). Then, it proceeds with the theoretical and practical contributions of the research through a general discussion of the findings by integrating the two phases of research. Subsequently, the chapter includes limitations of the research, future research suggestions, and a conclusion of the research.

7.2 Introduction

This chapter is the final chapter of the thesis. It aims to provide a general discussion of the findings from the two phases of research to address the impact of psychological and organisational determinants on the career success (research productivity, teaching performance, and career advancement) of STEMM women academics in Malaysia. The discussion will be organised accordingly based on the theoretical and practical contributions as stated in Chapter 1:

(a) The development of a model of barriers and means of support in achieving career success.

(b) The development and testing of a new combination of JD-R and SCCT.

(c) The testing of the applicability of the combined version of JD-R with SCCT amongst STEMM academics in Malaysia.

(c) An understanding of the impact of gender on the combined version of JD-R and SCCT amongst STEMM academics in Malaysia.

(d) The development and validation of instruments relating to academic self-efficacy, outcome expectations, interest, research productivity, teaching performance,

career advancement in academia, work-family conflict, and job resources within STEMM academic population in Malaysia.

(e) A contribution to the United Nations' third Millennium Development Goal – to promote gender equality and empower women (United Nations, 2000), fifth Sustainable Development Goal – to achieve gender equality and empower all women and girls (United Nations, 2015) and one of the six strategic thrusts of Eleventh Malaysia Plan -to enhance inclusiveness towards an equitable society (Economic Planning Unit, 2015) through the development of a set of recommendations to design, develop practical plans, policies and solutions to help STEMM women academics in Malaysia.

7.3 Summary of Research Findings

The following sections will focus on the key determinants of career success amongst STEMM women academics from the two phases of research. The findings of phase one and two of the research are summarised below in Section 7.3.1 and 7.3.2 respectively.

7.3.1 First Phase of the Research – Result Summary

Study one explored the meanings of success, while also exploring the psychological and organisational barriers and means of support in achieving career success amongst STEMM women academics in Malaysia.

From the viewpoint of most interviewees (60%), the meaning of success should include both family and career successes. This dual notion of success affected the subsequent layer of the research questions, which explored the barriers and support to STEMM women academics in achieving career success.

Based on the qualitative findings, it can be summarised that the key determinants that can support STEMM women academics in achieving career success are personal and psychological factors (having support from various relationships, support in terms of motherhood and childcare, and positive gender stereotypes) and job resources (good family-friendly policies or facilities, having support in research, teaching and promotion, receiving recognition, and having support from colleagues, supervisors or higher management).

In contrast, the following factors hindered them from achieving career success: personal and psychological factors (having relationship-related challenges, motherhood and childcare challenges, and negative gender stereotypes), and job demands (poor family-friendly policies or facilities, unprofessional workplace behaviours, and facing barriers in research, teaching and promotion, poor recognition and support from colleagues, supervisors or higher management).

Across all the themes emerging from study one, one consistently sees the impact from the high collectivist culture and high power distance index (PDI) in the country (Hofstede Insights, 2018) and its detrimental effects on STEMM women academics. This leads to the dual notion of success in career and family as well as an increasing number of barriers faced by the participants, particularly due to gender stigmata and the social norms governing gender roles and expectations. However, at the same time, the collectivist culture and the high PDI levels (Hofstede Insights, 2018) also seemed to enhance the means of support for STEMM women academics. There appeared to be greater access to certain means of support, through supervisors, mentors, extended family and other collectivist forms of social assistance.

7.3.2 Second Phase of the Research – Result Summary

Study two examined the determinants of career success amongst STEMM women academics in Malaysia through the testing of a theoretical model that combines JD-R and SCCT.

In terms of psychological determinants, self-efficacy in research and promotion, outcome expectations for teaching, and interest in teaching and career advancement were identified as key factors that affect career success amongst STEMM women. Certain tested job resources (i.e. support from colleagues and recognition) and all tested job demands (work-family conflict and family-work conflict) were found to serve as key organisational determinants in affecting interest and career success.

As expected, higher job demands (i.e. work-family conflict and family-work conflict) led to lower outcome expectations for teaching, which in turn led to lower interest in teaching, only amongst STEMM women. The following determinants resulted to be relevant for both women and men in STEMM: support from colleagues, which affected research productivity positively via research self-efficacy; and recognition, which led to higher promotion self-efficacy, which in turn led to higher interest in career advancement, which resulted in lower years spent staying at senior lecturer or lecturer position without being promoted.

Some results were only applicable to STEMM men. For examples: recognition affected research self-efficacy and interest in research positively, and supervisor support and feedback influenced research self-efficacy, outcome expectations for research and interest in research positively only for men.

It can be concluded that the proposed combined model of JD-R and SCCT can fit STEMM academics in Malaysia. Gender was found to be a significant moderator amongst STEMM academics in Malaysia.

7.4 Theoretical Contributions

In line with the key contributions listed under Section 1.7, the following section will discuss the theoretical contributions of the research (the first four contributions). It starts with how the present research has contributed to the development of a model of barriers and means of support in achieving career success, the development and testing of a new combination of JD-R and SCCT, the testing of the applicability of the combined version of JD-R with SCCT amongst academics in Malaysia and an understanding of the impact of gender on the combined version of JD-R and SCCT amongst academics in Malaysia. Then, this section ends with a contribution to the development and validation of instruments relating to academic self-efficacy, outcome expectations, interest, research productivity, teaching performance, career advancement in academia, work-family conflict and job resources within an academic population in Malaysia).

The Development of a Model of Barriers and Means of Support in Achieving Career Success

One of the main contributions of study one in the present thesis is the development of a theoretical model using grounded theory approach to explain the barriers and means of support in achieving career success for STEMM women academics in Malaysia. This model has showcased personal and psychological factors, and job demands and resources as the key determinants of career success, that are heavily influenced by collectivist culture and high power distance (Hofstede Insights, 2018) as well as perceived meaning of success.

Most interviewees from study one described that success should consist of both family and career successes, they still hold the identity of ‘gender-schematic’ people by linking the ‘feminine’ roles of household and childcare to themselves (Bem & Bem, 1970). There seems to be a heavy influence from the collectivist culture and gender schema that

place the household and childcare as a priority (Bem & Bem, 1970; Hofstede Insights, 2018) amongst STEMM women academics. Such dual-meaning of success is perceived to place more challenges to women as they need to target on both areas of successes. STEMM women often face more inter-role conflict due to their multiple roles (L. T. Thomas & Ganster, 1995) as wives, daughters, mothers, daughters-in-law and as academics (on top of the multiple roles embedded in the nature of the job, such as researchers, teachers and administrators) in a male-dominated area. Hence, it is easy to understand the reasons why personal and psychological factors, and job demands and resources were the key determinants of career success for STEMM women academics. It is also fascinating that how the high collectivist culture and high power distance index (PDI) in Malaysia (Hofstede Insights, 2018) can play both detrimental and beneficial effects on the barriers and means of support for STEMM women academics.

The Development and Testing of a New Combination of JD-R and SCCT

By referring to the outcomes from study one, a new combination of JD-R model and SCCT was proposed as they resemble the theoretical model generated from study one. For instances, ‘job demands and resources’ from the model are similar to ‘job demands’ and ‘job resources’ in the JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and ‘environment variables’ in the SCCT (Lent et al., 1994); and ‘person and psychological factors’ from the model and the ‘person input’ in SCCT (Lent et al., 1994) are quite alike. On top of that, three mediators from SCCT (Lent et al., 1994) were identified to be added into the new combination of framework, namely self-efficacy, outcome expectations and interest. These three mediators were expected to be able to explain the relationship between person and environment variables, and career success better.

By using this new combination of JD-R model and SCCT, it can help to test the qualitative findings from study one using a quantitative approach amongst a group of bigger samples. The transition from study one to study two has allowed the constructivist principles been employed to first view from different perspectives and acquire in-depth understanding and followed by a postpositivist philosophical stance to exercise multiple worldviews (Creswell & Clark, 2018).

The present research (both study one and two) provides theoretical contributions to the field by proposing an innovative combination of the JD-R Model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and the SCCT (Lent et al., 1994).

The Testing of the Applicability of the Combined Version of JD-R with SCCT Amongst STEMM Academics in Malaysia

The second phase of the study has tested the applicability of the combined version of JD-R with SCCT amongst STEMM academics in Malaysia. Despite both the JD-R model and SCCT have separately demonstrated their applicability amongst academics (Barkhuizen et al., 2014; Boyd et al., 2010; Wang et al., 2007), the present research has shown that the combined version of JD-R with SCCT is applicable amongst STEMM academics in Malaysia.

There were three significant sequential mediation findings in study two. For instances, a higher level of recognition can lead to lesser years spent staying at senior lecturer or lecturer position without being promoted via promotion self-efficacy and interest in career advancement. Also, lower family-work conflict can improve teaching performance through outcome expectations for teaching and interest in teaching. In addition, there is an interesting finding that highlights that higher support from colleagues can increase research productivity

via research self-efficacy, without needing interest in research. These results show that this newly developed model is applicable for STEMM academics in Malaysia.

For STEMM academics (both women and men), higher recognition led to higher promotion self-efficacy, which - as a result - led to higher interest in career advancement. This higher interest in career advancement then led to more chances of being promoted and reducing years staying at senior lecturer or lecturer position without being promoted. The following discussion focuses specifically to only how recognition can help STEMM women academics. One way in which STEMM women academics can combat the imposter syndrome (Clance & Imes, 1978) is through the recognition of those in the 'sticky floor' situation (staying at lower rank without being promoted) (Booth et al., 2003; Yap & Konrad, 2009). Recognition also instils confidence in STEMM women academics by showing them that STEMM is not an exclusively masculine field. As described earlier in this thesis, although individuals are gendered from a very young age to conceive of participating in 'gender-appropriate' activities (Bem, 1983), the gendered concepts such as 'think manager-think male' (Schein, 1973, 1975), 'think professor-think male' (Tharenou, 1994) and 'think vice chancellor-think male' (Tilbrook, 1998) can be unlearned (Bem, 1983). As suggested by the results in this thesis, this can be achieved if STEMM women academics are given the due recognition that they deserve, by promoting them at the right time, through increasing their promotion self-efficacy and interest in career advancement.

As mentioned earlier, support from colleagues can improve research productivity through self-efficacy. The unique aspect of this result is that when support from colleagues serves as a predictor, research self-efficacy alone leads to research productivity, and that interest in research is not required to serve as a mediator. This result is consistent with empirical findings by different researchers (Garnasih et al., 2018; Pasupathy & Siwatu, 2014; Sawitri et al., 2018). Even though this finding applies to both men and women in STEMM, it

helps shading light on the importance of collegial support for STEMM women. Generally, women are found to be more interested in teaching than in research (Edmunds et al., 2016). By looking into the result from this thesis, we can see that regardless of whether STEMM women academics have interest in research or not, they can produce a high number of publications through the support from colleagues (that enhances their research self-efficacy). Support from colleagues is particularly important for STEMM women, as they are in the male-dominated fields of STEMM (Hill et al., 2010). Additionally, given that research is often being viewed as work exclusively for men (Armenti, 2004), having support from colleagues can serve as an acknowledgement that STEMM women academics also have the research-related capabilities and can perform in research publication as well as their male colleagues.

The impact of family-work conflict will be discussed in the following section.

An Understanding of The Impact of Gender on The Combined Version of JD-R and SCCT amongst STEMM academics in Malaysia

Overall, STEMM academics displayed gender differences in some of the mediated relationship between the predictors and interest through the mediators (i.e. self-efficacy and outcome expectations) with five significant moderated mediation results.

When the predictors were job resources (i.e. recognition, supervisor support, and feedback and support from colleagues), gender differences were found (three significant moderated mediation results), in which the results were only applicable to STEMM men academics. When examining job demands (i.e. work-family conflict and family-work conflict), gender differences were found (two significant moderated mediation results), in which the findings were only applicable to STEMM women academics. Thus, such results

confirm the gendered roles in household and childcare amongst STEMM women academics (Bem, 1981a; Fox, 2010).

The Impact of Work-Family Conflict and Family-Work Conflict. In this thesis, the most salient results regarding challenges for STEMM women academics are related to family-work conflict, work-family conflict, and their impact on teaching-related variables (outcome expectations for teaching and interest in teaching). An inability to balance work and family life has been a constant factor which influences the performance of a woman's profession (Stack, 2004), including Malaysia's women academics (Achour, Grine, Mohd Nor, et al., 2015). In the present quantitative study's sample, it is evident that higher family-work conflict (overspill from personal and family issues to work) and work-family conflict (overspill from work issues to personal and family life) negatively affected STEMM women academics' interest in teaching via outcome expectations for teaching. This was only evident amongst STEMM women, and not amongst men.

Another important note to the importance of outcome expectations for teaching and interest in teaching is that the two mediators suppressed the larger positive effect between family-work conflict and teaching performance. In another word, initially, higher family-work conflict led to better teaching performance, but with the two mediators that suppressed this effect, higher family-work conflict led to poorer teaching performance. Outcome expectations for teaching and interest in teaching seemed to play an important role amongst STEMM women, but not amongst men. Previous studies found that women are more often being assigned to a teaching role compared to men (Armenti, 2004), and they tend to spend a significantly higher amount of time on teaching activities (Aiston & Jung, 2015). In such a context, women can relate to their teaching outcome better than men. Hence, women have a greater interest in teaching compared to research (Edmunds et al., 2016). Additionally, women are perceived as better teachers in Malaysia context (Chua & Kho, 2015, 2013). This

also indicates that ‘teaching’ is seen as a ‘gender-appropriate’ career that is suitable for women in Malaysia (Bem, 1983). These might be the reasons at the basis of the stronger effect of outcome expectations for teaching amongst STEMM women than amongst men.

As described in the Gender Schema Theory (Bem, 1981a), individuals become gendered due to cultural gender schemata, and women traditionally are expected to play more active roles in child-rearing and household chores (Bem & Bem, 1970). STEMM women academics are negatively affected by the aforementioned gender schemata, as also shown in study one’s findings, in which motherhood and childcare are one of the most frequently raised themes. STEMM women academics, who score higher in family-work conflict, could possibly be women who were high achievers in the first place, but then felt entrapped by the burdening family commitments. This is a prime example of women who face the ‘glass ceiling’ (Barreto et al., 2009), meaning that they aspire to be successful yet they encounter barriers which obstruct them from their progress.

Based on study one, one can see the impact from work-family conflict (poor family-friendly policies or facilities, unprofessional workplace behaviours, and without support from colleagues, supervisors and higher management) and family-work conflict (relationship-related challenges, motherhood and childcare challenges, and gender-related challenges).

Ideally, as shared by one of the interviewees who was a professor, both family and career can coexist, and success does not mean sacrificing one or the other. According to Paustian-Underdahl and colleagues (2013), family involvement may not always lead to negative outcome such as a greater work-family conflict. Instead, family life can improve the prospects of one’s career by applying lessons learned at home (i.e. positive affect, skills, knowledge and abilities) to the workplace. Cheung and Halpern (2010) also propose the concept of the work-family interface, which is defined as the integration of work and family and how one role can enhance the other. This can be done by creating links between work

and family life, such as taking children along on work trips, working after children sleep, and always being home for dinner time, as suggested by the interviewees in the present research.

The Impact of Recognition and Supervisor Support and Feedback. In this thesis, it is also worth to note that some of the results apply to STEMM men academics, but not necessarily to women academics. For instances, higher recognition and supervisor support and feedback led to higher research self-efficacy or outcome expectations for research, which in turn led to higher interest in research only amongst STEMM men academics. However, this does not mean that these predictors cannot assist women academics in the STEMM field. It is important to know how such predictors can be modified to suit the unique needs of STEMM women academics.

For recognition, based on study one, STEMM women academics in Malaysia seemed to prefer more monetary forms of recognitions. Universities in Malaysia should thus reconsider how they recognise STEMM women academics. They can do this is by providing research funds, monetary-based awards, and increasing salaries or allowances. In addition, recognition can also be provided by recognising direct societal impact (Sax et al., 2002) of the research.

The more pragmatic nature of STEMM (Leach, 2013) might seem dismissive to the needs of women academics, and rather more utilitarian in its straight-to-the-point approaches which result in less supportive outcomes. And such dismissiveness can come from both men and women. Nonetheless, mentoring is a method shown to empower and support women in a male-dominated workplace (Jones, 2017). STEMM women's supervisors might be mainly men and not understanding of how to better support STEMM women academics in research. Women who have broken through the 'glass ceiling', particularly, would be good mentors or role models for other women (Silvestri, 2003). As supported by the findings from study one, STEMM women academics shared that although they do receive good advice and guidance

from their men mentors, the men mentors are still unable to provide support or advice regarding work-life balance, pregnancy, and family-related guidance. From women supervisor's angle, one of the interviewees stated that she is not able to accept 'excuses' related to pregnancy, such as morning sickness, from her PhD students. To summarise from study one, having unsupportive supervisors and colleagues, regardless their genders, who do not understand women's challenges as mothers, wives, and other roles outside of work make it harder for women to achieve success in her field.

It is pertinent for researchers to further explore the JD-R model so as to discover the various challenges, as well as modes of support, for STEMM women academics. This can be done by incorporating more theories to the JD-R model.

The Development and Validation of Instruments

This research also theoretically contributes to the field through the development and validation of instruments relating to academic self-efficacy, outcome expectations, interest, research productivity, teaching performance, career advancement in academia, work-family conflict, and job resources within the STEMM academic population in Malaysia.

By using reliability testing, EFA and CFA, five instruments (i.e. Self-efficacy Scale, Outcome Expectations Questionnaire, Interest Questionnaire, Work-Family Conflict Scale and Job Resources Questionnaire) have been validated and show adequate psychometric properties to be in use amongst STEMM academics in Malaysia. Furthermore, the single item Research Productivity Questionnaire (RPQ) that was adapted from the 9-item Scholarly Activity Scale (SAS, Kahn & Scott, 1997) also shows its suitability to be used to examine research productivity amongst STEMM academics in Malaysia. The self-developed two-item Teaching Performance Inventory (TPI) and the two-item Career Advancement in Academia

Inventory also provide evidence to be useful in examining teaching performances and career advancement amongst STEMM academics in Malaysia.

Since such tools are validated using STEMM academics in Malaysia, future studies can use them as one possible tool to measure academic self-efficacy, outcome expectations, interest, research productivity, teaching performance, career advancement in academia, work-family conflict and job resources. These tools encourage further studies to be explored using the proposed combination of JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and SCCT (Lent et al., 1994).

7.5 Practical Contributions

The last key contribution as listed under Section 1.7, which is a practical contribution, will be discussed below. The present research also contributes to the United Nations' third Millennium Development Goal (to promote gender equality and empower women) (United Nations, 2000), fifth Sustainable Development Goal (to achieve gender equality and empower all women and girls) (United Nations, 2015), and one of the six strategic thrusts of the Eleventh Malaysia Plan (to enhance inclusiveness towards an equitable society) (Economic Planning Unit, 2015), through the development of a set of recommendations to design, develop practical plans, policies and solutions to help STEMM women academics in Malaysia.

The Malaysian government targets to ensure all citizens regardless of gender can participate in and benefit from the country's prosperity before 2020 - the final year of National Transformation Policy 2011-2020 (Economic Planning Unit, 2015). The inclusion of women is able to bring diversity into STEMM fields (Aguirre, 2000). By understanding the meaning of success, barriers, and means of support for STEMM women academics in achieving career success (first phase of the research) and examining the determinants of

career success amongst STEMM women academics in Malaysia through the development of a combination of the Job-Demands-Resources Model and the SCCT (second phase of the research), the present research is able to make helpful contributions regarding gender equality, inclusiveness, and empowerment amongst STEMM academics, specifically women, in Malaysia.

The present research shows the importance of raising awareness regarding the unique challenges faced particularly by STEMM women academics in Malaysia. Many people are not aware that there are still gender-related challenges amongst STEMM women academics in Malaysia. Perhaps they are not aware because they go through a 'gender fatigue' - a loss of energy and lack of interest, or awareness, to tackle issues related to gender (Kelan, 2010). The findings from the two phases of research show that there are still significant gender inequality issues encountered by STEMM women academics in Malaysia. However, there is little attention regarding such situations, and also little efforts to improve the situation.

By referring to the GST (Bem, 1981a), several gender schemata were identified in study one, such as gendered roles in household and childcare (Fox, 2010), the idea that women should prioritise family and place self-fulfilment behind family matters (Abdullah et al., 2008), the idea that the priority should always be given to the husband's career (Bem & Bem, 1970), and the 'think manager-think male' (Schein, 1973, 1975), 'think crisis-think female' (Ryan et al., 2011), 'think professor-think male' (Tharenou, 1994) and 'think vice chancellor-think male' (Tilbrook, 1998) stereotypes. These, of course, causes more gender discrimination and gender-related challenges amongst STEMM women.

The detailed recommendations to design and develop practical plans, policies and solutions to help STEMM women academics in Malaysia are discussed below. The findings of this thesis can help inform the new Millennium Development Goal and Sustainable Development Goal, as well as future action plans to encourage gender equality and women

empowerment in STEMM. Similarly, the Malaysian government can also utilise the outcomes to draft the next Malaysia Plan that supports STEMM women academics in Malaysia.

Evaluation of the existing promotional scheme

According to Carr and colleagues (2003), the hierarchical structure in academia estranges STEMM women, given that there are so few women at the top level. When gender discrimination occurs, women academics may perceive that nothing much can be done to tackle such issues. Hence, they propose that the universities should play a more proactive role in assessing the gender climate periodically, as well as providing a fair scrutiny of promotion and salary decision and transparent information. The present research also supports such an idea.

As mentioned in study one in this thesis, the interviewees reported the existing promotional scheme was particularly challenging to them, the universities in Malaysia should evaluate the existing promotional scheme. Some interviewees revealed that the promotion criteria are stricter than in the past, and some of them are hidden and unspoken. Specifically, the academics from the medical field shared during the interviews that their heavy clinical practice is not taken into consideration for promotion. The universities should adopt the meritocracy system to acknowledge individual merits in both talent and effort (Hughes et al., 2017). The promotional scheme should be similar across different universities in Malaysia to provide a fair appointment to qualified candidates. Simultaneously, the promotional scheme should consider the unique nature of each field, such as fields with clinical practice, fields with more teaching but fewer research opportunities and so on. There should also be a revisit regarding the requirements of publications, in order to accept a wider range of types of publications. At the same time, precise procedures should consistently be put in place to

ensure that impact factor, quality of the journals and other parameters are taken into account to avoid focussing on the number of publications rather than the quality of published works.

The Key Performance Indicators (KPI) system should also be re-evaluated. It is recommended that there should be a customised and tailored KPI evaluation system for women academics. By taking pregnancy into consideration, there should be more time to be given in fulfilling the requirements. The Ministry of Education (MOE) should facilitate in the re-evaluation of the KPI evaluation system, leading to an equitable, transparent and consistent set of evaluation criteria across all universities. The Ministry of Education should thus monitor the promotional criteria and schemes to avoid the potential misuse of power amongst universities. In particular, this addresses potential gender discrimination and potential unfair appointment based on age and seniority instead of meritocracy. Transparent information regarding the promotion and salary decisions should be opened for access by everyone, to ensure that the decisions are made fairly.

Evaluation of Recognition Approach

STEMM women receive significant lesser recognition than men (Fox, 2010; UNESCO Bangkok & Korean Women's Development Institute (KWDI), 2015). In study one, the interviews revealed the issues of poor recognition for non-official positions or tasks or other work that the participants helped other colleagues do, as well as no recognition regarding previous working experience, postdoctoral training, overseas training and sabbatical leave. As for study two, recognition affected research and career advancement positively amongst STEMM academics, although the first result was only applicable to STEMM men.

Recognition can be done through "an affective, a tangible, or a monetary reward" (Fernet et al., 2016, p. 483) in order to increase "the perceived meaningfulness of work" (S.

P. Brown & Leigh, 1996, p. 360). When applying this to academia, one can recognise STEMM women academics' research, publications, teaching and services (Ismail & Mohd Rasdi, 2006a). Based on the interviewees, there was a preference for a monetary form of recognition. The universities should evaluate any misuse of power in the appointment of academics to a non-official position or task. Formal appointments, together with a monetary allowance, should be offered to individuals who are holding any position, especially when the responsibilities linked to a role are time-consuming.

Formal working experience, postdoctoral training, and overseas training should be properly recognised by universities and reflected in academics' salaries, avoiding the mere use of a standard salary scheme alone. Likewise, universities should also acknowledge the advantages of taking sabbatical leave to enable researchers to have more flexible working conditions in whichever areas they wish, which is related to research, publications, family or other areas. By offering such support, academics will return to the university having better working conditions. These proposed strategies are believed to increase the "perceived meaningfulness of work" (S. P. Brown & Leigh, 1996, p. 360) amongst STEMM women academics in Malaysia.

Awards relating to research, teaching, and career advancement should be given as a means of acknowledging STEMM women academics. Since women are more driven to direct societal impact, rather than merely receive research related recognition (Sax et al., 2002), universities can acknowledge this through university bulletins, newspapers, social media, and media coverage. These means should provide visibility for the linkages between STEMM women academics' research and local direct societal impact projects, as this will help recognise the beneficial work of the academics.

Other than these suggestions, as highlighted in the interviews in study one, recognition by colleagues was also seen as important, as recognition can improve the

individual's psychological health and well-being (Fernet et al., 2016). However, the promotion of STEMM women academics whether in the form of receiving awards or being promoted to a specific position or role could be viewed as 'tokenism' rather than due to their actual capability (Alpay et al., 2010). Moreover, other women academics might view the more successful women academics as competitors and hence, may perceive that only one 'token' is acknowledged. In the context of this study, when other STEMM women academics were promoted, the participants thought that they would have even fewer opportunities to be recognised, which led to signs of jealousy. Therefore, in addressing this issue, universities should provide workshops to educate academics to avoid competition, especially for women academics and how they should be more supportive of one another rather than downgrading others.

Gender-sensitive/Gender-aware training

All staff members, regardless of gender, should undergo gender-sensitive or gender-aware training to learn about gender-related challenges and how to reduce, amongst other issues, the problem of pregnancy discrimination. As suggested by Allana, Asad and Sherali (2010), this type of training is highly important in academic settings as it allows one to learn how to transmit gender equality values to their students too. Additionally, attending gender-sensitive training is also effective in reducing or nullifying sexist-related content (2010) as well as promoting institutional change and learning about gender-related issues in the workplace (McNutt & Beland, 2015).

Based on the results from study one, the content of the training shall include, but not limit itself to, understanding the kind of social interactions that might be considered sexual harassment due to cultural differences, the importance of paternity leave, implicit biases that one might have about each gender, understanding of common gender-related work-life issues,

and common gender schemata. This type of training can better equip academics with a stronger collegial support system in the context of challenging gender insensitive actions or comments. The training will inevitably enhance women's career advancement as well as their inclusion and diversity at work (A. M. Valerio & Sawyer, 2016). Such training shall also play a role in encouraging the concept of 'psychological androgyny' (Bem, 1974) - a psychological state that has "both stereotypically feminine and masculine attributes within the same individual" (Dean & Tate, 2017, p. 643). By doing so, it can help people to unlearn sex-typing, reduce gender schemata, and also decrease gender polarisation (Golden & McHugh, 2017).

Stand-alone Department for Complaints Regarding Workplace Bullying or Workplace Sexual Harassment

Due to the challenges of a traditionally Asian collectivist culture that that encourages the suppression of emotional conflicts, and discourages the full expression of emotions (Hofstede, 2011; B. S. Kim et al., 2001; Uba, 1994), universities should have a stand-alone department or centre that handles complaints regarding workplace bullying or sexual harassment, allowing academics to submit complaints, especially when these are involving their direct manager, using a simple and confidential method to protect the complainant. Accordingly, this can be achieved by establishing a 'dignity at work policy' to manage complaints regarding these issues.

The discrimination or bullying due to age and seniority, whether regarding research grant applications, career advancement, or teaching should be handled professionally under the stand-alone department. Academics should also undergo regular workshops to understand related policies and the actions to be undertaken when experiencing such situations. Other than that, some awareness training workshops regarding what constitutes workplace bullying

and sexual harassment should be conducted from time to time, especially for new staff members and newly appointed leaders.

Acts to Address Gender Discrimination Issues

It is reported that although the Malaysian government has planned to adopt a Gender Equality Act since 2006, there is still no formal act on such matters up to now (Zainal, 2019). Such legislation is proposed to address gender discrimination and gender inequality issues, in which the existing legal framework is still inadequate to protect women in Malaysia from discrimination (Zainal, 2019). The Women's Aid Organisation (WAO) and the Joint Action Group for Gender Equality (JAG) have played an important role in pushing for this act and helping to identify the gaps in gender equality (Joint Action Group for Gender Equality, 2017; Zainal, 2019).

As STEMM women academics often face gender discrimination in the workplace (Carapinha et al., 2017; Carr et al., 2003; Edmunds et al., 2016; Settles et al., 2006), the present research also supports the notion that the government should formally draft and enact an act to address gender discrimination against women academics, which includes pregnancy discrimination.

In terms of pregnancy discrimination, this act or policy would be related specifically to the verbal and non-verbal behaviour of the employer (university), superior (high management of the university or supervisor), other employees (colleagues) or other parties (students) that are discriminative towards pregnant individuals. The faculty or department should also reconsider the existing workload and tasks of pregnant academics, check if it is in-line with occupational health and safety guidelines so as to rearrange their work and tasks accordingly. For instance, those in medicine, civil engineering, chemical engineering,

chemistry fields are at higher risk given they are more exposed to risky working locations, such as hospitals, construction sites, laboratories and so on.

Any promotional bias based on gender should also be handled accordingly under this act. As reported by the interviewees from study one, they have encountered gender discrimination when it comes to leadership selection and career advancement. It is foreseeable that the proposed gender equality act in Malaysia will greatly reduce such issues, and also allow women academics to have a formal guide to address these issues through legal actions.

Family-Friendly Policies

As reported in the interviews from study one, STEMM women academics in Malaysia face lots of pregnancy discriminations, such as receiving doubts regarding their work performance and rejection from colleagues to cover for them during maternity leave. The respective departments or schools should be given a sufficient budget to bring in part-time lecturers to replace academics that are taking maternity leave, and not impose the added workload on other academic staff members. More administrators should be hired to perform the administrative related work that is being done by the lecturers (Kumari et al., 2015). These means of support can help prevent mothers from leaving the workplace. Studies conducted in the United States show that it costs the organisations an average of 20% if an employer needs to replace a staff member (Anderson, 2014). These costs include productivity loss if someone resigns, and the costs related to hiring and training new staff members (Anderson, 2014). The amount of loss could be higher given that a minimum of USD 1,000,000 needs to be invested into STEMM education, training, and hiring of a STEMM academics (Association for Women in Science, 2013). The cost to hire and train another suitable candidate is undoubtedly even higher.

Additionally, universities should introduce a part-time working scheme (Shollen et al., 2009) for existing staff members who prefer to prioritise other areas in their life for a certain period and allow transferring back to a full-time working scheme once they decide to return to the workplace. Such support can help them to return to the academe without much bureaucratic effort, as they do not need to go through the usual hiring procedures.

In terms of maternity leave, the 90-day paid maternity leave based on the 2018 Malaysia budget was limited to only all government sectors only (Mior, 2017). The 2020 Malaysia budget (Mat Arif, 2019) proposes that the 90-day paid maternity leave should be applied in all universities in Malaysia and not just universities under the government sector. Currently, the limit of the paid maternity leave is four children with a maximum of 360 days and the 2020 Malaysia budget did not address this regulation. There should be no restriction on the number of children as it disregards the personal choice of working women in wanting more children and set a limit to them in terms of family planning. The year-long childcare leave (Boo, 2014) is also encouraged to be applied in all universities (not only limit to public universities that are under government sector), and not limited to only women academics. Men academics can also utilise such leave to parent their children. All university leadership positions should be supported by a succession plan that can help replace these positions, especially when women leaders become aware of their pregnancy. Such an effort can allow them to take their rightful 90-day paid maternity leave.

Since women are perceived as the primary caregivers of children (Man, 2014), it is crucial to have appropriate in-campus childcare support and childcare-related workplace policies to help STEMM women academics to overcome work-family conflict and family-work conflict (Marican & Sabil, 2017). Marican and Sabil (2017) propose that a good family-friendly policy should consist of a childcare centre, lactation room and flexible working conditions.

As such, universities should establish one nursery for each faculty in order to accommodate more staff members. Other than these measures, these centres should allow for after-hour childcare services and should accept ad-hoc cases in case of emergencies (Shollen et al., 2009), such as children becoming sick, and women needing extra childcare due to night classes or delay in conducting an experiment.

Several universities or institutions have recently introduced policies that constitute good examples of the aforementioned suggestions. These include: the provision of an allowance or academic childcare benefit (University of Alberta, 2019) to those not able to secure a place for their children in the in-campus childcare service; the setting up of dedicated parking lots (The Star Online, 2017) for expectant mothers and parents who arrive to campus late due to the school run; allowing academics to have their children in their office as long as it does not disturb others (Jenkin, 2016); and setting up fully equipped lactation rooms (Marican & Sabil, 2017) in each building to support breastfeeding mothers. Implementing flexible working hours can also help in reducing conflict that may arise from work and family matters as well as balancing work and family; with the advancement of technology, many tasks in the workplace can be completed virtually without needing to be in the office (Marican & Sabil, 2017). Notably, if the academics are required to work outside of the official working hours (e.g. weekends), the university should acknowledge these efforts in a monetary form or compensation through additional replacement leave.

Other than childcare, universities should extend their family-friendly facilities to elders too (Shollen et al., 2009). As noted in study one in this thesis, STEMM women academics in Malaysia are viewed as responsible to take care of elders. This, as a result, heavily affects their research (Morley, 2014). In another study, there seems to be an expectation for women who are single and without children to play a more prominent role in elder care than those with children (Cummins, 2005). Other than the more commonly known

gender schema in which women should take care of children, the expectation that women should be a caretaker for elders is also a form of gender schema (Bem, 1981a). Some supportive universities in the United States and Canada have initiated and extended their facilities to eldercare (Carr et al., 2017; University of Alberta, 2019). By providing an affordable elderly care with healthcare professionals' support, such facilities can help women academics to have a better concentration on work-related matters while knowing that their elders are under good care.

The results suggest that developing and implementing similar policies in the Malaysia's academic context can be beneficial for women academics, especially those in STEMM fields, who appear to be more affected by family-work and work-family conflict. Other than supporting women academics, these policies can also benefit men academics.

Mentoring and Career Development Support

As reported by the interviewees in study one, early-career women academics are calling for leadership and mentoring related to career development from fellow female professors. This, partially, maybe due to the Asian cultural values related to deference to authority figures (B. S. Kim et al., 2001); female professors are expected to have expertise and knowledge about their field and life. Therefore, young female academics are willing to ask them for guidance in the field.

Mentoring can provide empowerment and support to women in a male-dominated workplace setting (Jones, 2017). Hirayama and Fernando (2018) emphasise the importance of promoting female mentors in the male-dominated organizational culture in order to provide support to female surgeons in facing workplace-related challenges and life-related issues. Moreover, it is recommended to provide a formal research mentor for all academics (Minguillo & Thelwall, 2015). As such, there should be more formal mentors assigned to

support STEMM women academics, especially women mentors. Even though male mentors are still required, they may perform their role better if they are exposed to gender-sensitive training.

Universities should ensure that the development programmes for academics tailor themselves to suit the needs of all academics from different academic ranks, even for professors. For example, professors can be trained on how to become mentors to junior lecturers; at the same time, new lecturers should be given more training in developing their skills in teaching, and also on how to balance between family and work. For young lecturers, they can also be trained to obtain various research-related skills and techniques, such as networking, collaborations, organising journal clubs, and breaking into the 'old-boys networks'. More networking opportunities should be provided to enable greater interactions amongst academics in the form of formal or informal activities (e.g. meetings, gatherings, family day, research meetings, and a journal club). Leadership training, additionally, amongst newly appointed women leaders can also target potential negative gender schemata on women leaders and how to handle them.

All these efforts can be great strategies to counter the effect of gender schemata as described in GST (Bem, 1981a). These efforts can ensure that STEMM women academics receive gender-tailored feedback and support from their mentors and supervisors, as well as a career development plan that is suitable for them.

Other Policies to Support Women

Based on study one in this thesis, it is recommended that the PhD scholarship programme for female students is set at 4 years rather than 3 years to allow for family planning. Furthermore, STEMM women academics should be given more opportunities to

have more networking with other non-RUs, given they have more undergraduate students than RUs that might be interested in becoming postgraduate students.

Other than that, the set-up of more research grants (Miyaki & Okajima, 2018) specifically targeted to young lecturers or that require senior researchers to include young researchers and vice versa is encouraged. More funds should be provided in purchasing required research-related facilities (Minguillo & Thelwall, 2015). In line with that, to better maintain the facilities, universities should have more technicians in monitoring these facilities and labs (Kumari et al., 2015); this would allow women academics to focus on conducting research, instead of also playing a role in doing maintenance for the facilities or labs.

Career Counselling for Women in STEMM

By looking at the significant relationships between predictors and career success through the mediators, we can utilise these findings to design and implement effective support for women academia in STEMM. It is not a new attempt for researchers to design frameworks for SCCT to be applied in career counselling, especially on women (Chronister & McWhirter, 2003) to modify their faulty self-efficacy beliefs and assist them to fully utilise their vocational potentials (S. P. Brown & Leigh, 1996).

It is important to note that the negative impact on STEMM women is primarily due to the strong effect of the unsupportive environment that might not believe in the potential of women. Encouraging STEMM women to undergo career counselling would not imply that they are the ones with problems. The aim of career counselling should focus on altering the impact of the unsupportive environments that might have shaped the faulty beliefs and gender schemata amongst STEMM women academics.

SCCT can be applied in career counselling for women (Chronister & McWhirter, 2003). In the counselling process, faulty self-efficacy beliefs can be modified and assistance

can be given to fully utilise vocational potentials (S. P. Brown & Leigh, 1996). The present research identified that STEMM women academics in Malaysia have faulty self-efficacy in research and promotion as well as faulty outcome expectations for teaching, which affect their interest in teaching and career advancement as well as career success negatively.

In GST, it is believed that sex-typing can be unlearned too (Bem, 1983). We noticed strong association of 'science and math with males' (Hill et al., 2010), the gendered roles in household and childcare (Fox, 2010) as well as impact from age and seniority, due to the extremely high power distance index and high collectivist culture (Hofstede Insights, 2018). Such gender schemata and perception work against STEMM women.

By attending career counselling, STEMM women academics can be more aware of these unconscious influences from various factors and situations and can work on modifying their impact and influences on their career decisions. The impostor syndrome (Clance & Imes, 1978) might also be challenged so as to allow STEMM women to overcome it.

7.6 Limitations and Future Research Suggestions

While this thesis had generated several significant contributions, there were a few limitations in the present research. First, the research employed a cross-sectional design. This means that such a design can only collect a sample at a specific point of time (Gorard, 2017). Thus, it does not measure the progression of research productivity, teaching performance, and career advancement in the long term and the interactions of various factors in affecting the changes of these career success-related outcomes. At the same time, due to the cross-sectional design and regression based-study, the present research is unable to provide evidence for a causal-effect relationship. However, the present research focuses on a specific population and context, STEMM women academics in RUs in Malaysia, thus it would not have been easily feasible to conduct it using an experimental design or longitudinal study

given time constraint and the nature of the population. For example, the participants might leave their workplaces during the research, which would reduce considerably the sample size in a longitudinal study; or a lot of experimental designs are required to address all the variables that were measured in the present research. Ideally, for future research, it is recommended to employ a longitudinal study so as to examine the progression of research productivity, teaching performance, and career advancement. It is also suggested to use an experimental design to obtain better evidence of causal-effect relationships.

Second, one common method bias issue may occur given the data are self-report in nature, the findings have higher risk of single-source bias (Podsakoff et al., 2003). In order to protect the anonymity of the respondents, the self-report design using a single source was chosen as the ideal design in the present study. Nonetheless, this issue is lessened by using different response formats, in which some instruments require an actual number of publications, whereas some instruments use five-point Likert Scale, while some may employ seven-point Likert Scale. The ambiguity of the items is also clarified by ensuring that the items are short and simple. The verbatim in the qualitative study is also checked. Future studies should employ a multi-sample design. For instance, teaching performance can be measured using self-report by academics and also through student evaluations. The comparison of means between two sources of data could help lessen the effects of common method bias.

Third, study two was unable to employ random sampling method, which may violate the t-test's tests of assumptions' criterion. As recommended by Coakes (2012), the second assumption for independent-groups t-test is that the data should be randomly sampled. However, it is not uncommon for t-test to be applied onto non-probability samples by researchers (e.g. Goodman & Blum, 1996; Selvaganapathy, Rajappan, & Tham, 2017; Valerio et al., 2016). It is worth noting that study two reached all collected emails of all

academics from all RUs in Malaysia, which are the entire sample population. Then the data was collected from those who were willing to fill up the survey. T-test was also used as a preliminary analysis only and not the main analysis approach for the study. Nonetheless, random sampling is the best standard of strategies given its unbiasedness (van Hoeven et al., 2015), hence it is recommended that future research should try to employ random sampling approach as the first choice of sampling approach.

Fourth, this research can only be generalised amongst STEMM academics from the RUs in Malaysia. Generalisability refers to "the range of situations or units of study to which findings or methods from elsewhere can be applied" (Øvretveit et al., 2011, p. i88). Given that the samples of the research were limited to STEMM academics from the five RUs only, the qualitative and quantitative results can only be generalised to them, but not to academics from private sectors or other non-research-universities. Hence, it is advised to recruit academics from non-research-universities in Malaysia to increase the generalisation of the findings. A comparison study for RUs and non-RUs is also welcomed, as it would be interesting to investigate whether the same factors amongst STEMM women academics from different university types would yield different results or not.

Lastly, the selected software - PROCESS v2.16 was unable to measure moderated mediation with more than one sequential mediator (A. F. Hayes, 2012), hence the present research was not able to include the full proposed model to be tested. However, due to none of the research in this thesis has a sample size over 500, which was recommended by Hu, Bentler and Kano (1992), for SEM to be used, the PROCESS v2.16 was selected as it can measure sample size below 500. Although some scholars would have argued that SEM is better, PROCESS was chosen over structural equation modelling (SEM) for the present research for several reasons. Some scholars prefer PROCESS over SEM, because PROCESS and SEM are substantively the same in the case of bigger samples, but PROCESS is

relatively easier to use, and has a set of pre-programmed models that can run complicated analyses automatically compared to any SEM programme (A. F. Hayes et al., 2017). However, in the future research, the researcher can consider targeting at increasing the number of participants to more than 500, in order to allow SEM to be used.

Future studies can look into the impact of age and seniority on grant application and student recruitment specifically as well as the impact of age and seniority in teaching younger students and older students separately. Further testing on more job resources on research productivity, teaching performance and career advancement is encouraged too. More theories should be explored to be incorporated into the model to explore other supporting or hindering factors to STEMM women academics' career success. More validation studies should be conducted amongst different populations by using the validated tools in the present study, which include measures for academic self-efficacy, outcome expectations, interest, research productivity, teaching performance, career advancement in academia, work-family conflict and job resources. These validated tools can examine the proposed model that combines JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) and SCCT (Lent et al., 1994).

7.7 Conclusions

This thesis examined the psychological and organisational determinants which impact STEMM women academics' career success (research productivity, teaching performance, and career advancement) in Malaysia using two phases of research.

The first phase of the research employed a qualitative approach and generated a model to address the research questions using the interview data. The model contained themes such as personal and psychological related themes, and job resources, and demands related themes. Power distance and a collectivist culture appeared to cut across these themes.

Drawing the qualitative findings from the first phase of the research , the second phase developed a new model based on a combination of the JD-R model and the SCCT, as they resembled the key themes emerged from the first phase of the research (in which the job demands and resources themes resembled the JD-R model's job demands and job resources, whereas the personal and psychological themes and job demands and resources themes resembled the person inputs and environmental variables in the SCCT respectively), and tested it on STEMM academics of RUs in Malaysia. Results indicated that STEMM participants show a good fit of the combination of the JD-R model and SCCT in some of the tested relationships. The role of gender was also prominent amongst STEMM participants, especially when the independent variables were work-family conflict and family-work conflict for women on teaching-related variables, and when the independent variables were recognition and supervisor support and feedback for men on research-related variables.

Overall, this thesis discussed various theoretical and practical implications within the research field, policy arena, and possible interventions. While this research may have its limitations, some future directions were also proposed in terms of variations in research design and wider population coverage.

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Appendix 1: Ethics Approval for Study One

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

Ms Lim Hooi Shan
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9th February 2015

Dear Ms Lim,

FASS Research Ethics Committee Review

Thank you for submitting your proposal on ***An Exploratory Study of Work-Life Issues among Female Academic Staff***. This proposal has now been reviewed by the FASS Research Ethics Committee to the extent that it is described in your submission.

I am happy to tell you that the Committee has found no problems with your proposal and able to give approval.

If there are any significant changes or developments in the methods, treatment of data or debriefing of participants, then you are obliged to seek further ethical approval for these changes.

We would remind all researchers of their ethical responsibilities to research participants. If you have any concerns whatsoever during the conduct of your research then you should consult those Codes of Practice relevant to your discipline and contact the FASS Research Ethics Committee.

Independently of the Committee procedures, there are also responsibilities for staff and student safety during projects. Some information can be found in the Safety Office pages of the University web site. Particularly relevant may be:

Section 6 of the *Safety Handbook*, which deal with working away from the University, http://www.nottingham.ac.uk/safety/handbook/general-precautions.aspx
Specific safety guidance on:
Fieldwork http://www.nottingham.ac.uk/safety/documents/fieldwork-policy.pdf
Lone working http://www.nottingham.ac.uk/safety/documents/lone-working.pdf
Overseas travel/work http://www.nottingham.ac.uk/safety/documents/overseas-travel.pdf
Risk management http://www.nottingham.ac.uk/safety/policies-and-guidance/guides-and-support.aspx

Responsibility for compliance with the University/National Data Protection Policy and Guidance also lies with the principal investigator or project supervisor.

The FASS Research Ethics Committee approval does not alter, replace or remove those responsibilities, nor does it certify that they have been met.

Sincerely

Angeli Santos

Angeli Santos, PhD
On behalf of the FASS Research Ethics Committee

Appendix 2: Ethics Approval for Study Two

Ms Lim Hooi Shan
Department of Applied Psychology

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

25 February 2016

Faculty of Arts and Social Sciences
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43500 Semenyih
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Dear Ms Lim,

FASS Research Ethics Committee Review

Thank you for submitting your proposal on ***Social Cognitive Analysis of Women in STEM: Performance in Research, Teaching and Administration***. This proposal has now been reviewed by the FASS Research Ethics Committee to the extent that it is described in your submission.

I am happy to tell you that the Committee has found no problems with your proposal and able to give approval.

If there are any significant changes or developments in the methods, treatment of data or debriefing of participants, then you are obliged to seek further ethical approval for these changes.

We would remind all researchers of their ethical responsibilities to research participants. If you have any concerns whatsoever during the conduct of your research then you should consult those Codes of Practice relevant to your discipline and contact the FASS Research Ethics Committee.

Independently of the Committee procedures, there are also responsibilities for staff and student safety during projects. Some information can be found in the Safety Office pages of the University web site. Particularly relevant may be:

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http://www.nottingham.ac.uk/safety/handbook/general-precautions.aspx
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Lone working http://www.nottingham.ac.uk/safety/documents/lone-working.pdf
Overseas travel/work http://www.nottingham.ac.uk/safety/documents/overseas-travel.pdf
Risk management http://www.nottingham.ac.uk/safety/policies-and-guidance/guides-and-support.aspx

Responsibility for compliance with the University/National Data Protection Policy and Guidance also lies with the principal investigator or project supervisor.

The FASS Research Ethics Committee approval does not alter, replace or remove those responsibilities, nor does it certify that they have been met.

Sincerely

Ken Kyid Yeoh

Ken Kyid Yeoh, PhD
On behalf of the FASS Research Ethics Committee

Appendix 3: Interview Question Guide

Introductory questions

- Do you mind to share your educational background?
- What about your family background?

General questions related to the research topic

- What is your biggest achievement in life?
- What are some of the challenges that you faced?
- What support did you receive at that time?

Supporting questions

- How did you overcome that?
- Can you elaborate more on that?
- What did you do at that time?
- Any specific person that has supported your journey?
- How come you can overcome that?
- What exactly happened at that time?
- What kind of support or help would you suggest that can help STEMM women academics?
- In terms of university, did you receive any support?
- In terms of family, did you receive any support?
- How come you can make it this far?
- What difficulties did you encounter that time?
- Is there any university's policy or rule that supports your condition / makes your situation worst that time?
- What advice will you give to young women academics? (when asking the professors)

Appendix 4: Additional Details about the Instruments

Instrument / Subscale used in the present research	Original Instrument / Subscale	Reliability and validity of the original instrument/subscale	Modification made for the present research
The five-item Research self-efficacy subscale in the Self-Efficacy Scale (SES)	Research Self-Efficacy Scale (RSES, Greeley et al., 1989) - 38 items - to measure the perceived ability to perform a research-related behaviour - 100-point scale from 0 (no confidence) to 100 (complete confidence)	- excellent internal consistency of .96 (Bieschke et al., 1995) - has evidence of construct validity that was found in factor analysis of the RSES (Bieschke et al., 1996)	Item 1 - "Designing and conducting research" was a combination of several items from the original scale, such as item 22 - "Choose an appropriate research design", item 28 – "Obtain appropriate participants/general supplies/equipment", item 29 – " Train assistants to collect data", and item 30 – "Perform experimental procedures". Item 2 – "Writing a research paper for journal publication", item 4 – "Publishing in top journals in your field" and item 5 – "Publishing in lower-ranked journals in your field" were modified from the original item 19 – "Effectively edit your writing to make it logical and succinct", item 20 – "Present your research idea orally or in written form to an advisor or group" and item 21 – "Utilise criticism from reviews of your idea", with added publication emphasis that is heavily emphasised in the academia. Item 3 – "Developing proposals for research funding" was modified from the original item 18 – "Organise your proposed research ideas in writing" and added with the funding component to cover the current expectation for an academic in a university. All items used a 5-point scale ranging from 1 (no confidence) to 5 (total confidence) instead of the original point scale.

Outcome Expectations Questionnaire (OEQ)	Research Outcome Expectations Questionnaire (ROEQ, Bieschke & Bishop, 1994) - 18 items - to evaluate professional and personal outcomes that might occur from involvement in research - 5-point Likert scale (from 1=strongly disagree to 5=strongly agree)	- high coefficient alpha of .89 (Bieschke & Bishop, 1994) - the one-factor model showed an acceptable fit in a Confirmatory Factor Analysis (Bieschke, 2000).	Item 2 (People I respect will approve of my involvement in research) and 10 (Research involvement will lead to a sense of satisfaction) from the revised-ROEQ were modified into item 2 (Research involvement is valued by the important people in my life) and item 1 (Doing research will increase my sense of self-worth) in the present study. Item 11 (Being involved in research will contribute to my development as a professional) and 13 (My involvement in research will lead to meaningful contributions to the field) were selected from the original questionnaire together with the two modified items to form a 4-item questionnaire for this study to measure research outcome expectations. Item 2 and 10 from the revised-ROEQ and item 11 and 13 from the original ROEQ were modified into teaching related items in the present research.
	Revised Research Outcome Expectations Questionnaire (Revised-ROEQ, Bieschke, 2000) - 8 items - to measure outcomes that one might expect from participating in research activities - 5-point Likert scale (from 1=strongly disagree to 5=strongly agree)	- high internal consistency reliability of .90 (Bieschke, 2000). - In terms of its predictive validity, Revised-ROEQ accounted for 60% of the variance in predicting research interest in the original study (Bieschke, 2000).	Item 2 and 10 from the revised-ROEQ and item 11 from the original ROEQ were adapted into career advancement related items in the present study.

The five-item interest in research subscale from the Interest Questionnaire (INQ)	Interest in Research Questionnaire (IRQ, Bishop & Bieschke, 1994) - 16 items - to measures one's degree of interest in research-oriented activities - 5-point Likert scales from 1 (very disinterested) to 5 (very interested)	- high internal consistency of .89 (Bishop & Bieschke, 1994). - The total score of IRQ showed a significant positive correlation (r = .29) with the Investigative scale of the Vocational Preference Inventory (Bieschke et al., 1995)	Item 3, 5, 6, 11 and 13 were selected from the initial 16-item Interest in Research Questionnaire (IRQ, Bishop & Bieschke, 1994)
Work-Family Conflict Scale (WAFCS)	Work-Family Conflict Scale (WAFCS, Haslam et al., 2015) - 10 items - to measure work-to-family (5 items) and family-to-work (5 items) conflict - 7-point Likert scale from 1 (very strongly disagree) to 7 (very strongly agree)	- excellent internal consistency of .91 for the work-to-family and .91 for family-to-work conflict subscales (Haslam et al., 2015). - Both subscales have good concurrent validity with the Frone's work-to-family(r=.82) and family-to-work (r=.73) conflict subscales respectively (Haslam et al., 2015).	No modification to the original items.

The two-item recognition subscale from the Job Resources Questionnaire (JRQ)	The three-item recognition subscale in the Psychological Climate (S. P. Brown & Leigh, 1996) - 3 items - to measure the level of recognition from the organisation - 7-point Likert-type scales (strongly agree and strongly disagree)	- acceptable reliability of .76 and .70. - adequate fit by using CFA (S. P. Brown & Leigh, 1996).	Item 1 in Recognition subscale was measured by adopting item 3 (The organisation recognises the significance of the contributions I make) from the recognition subscale of Psychological Climate (S. P. Brown & Leigh, 1996)
Research Productivity Questionnaire (RPQ)	Scholarly Activity Scale (SAS, Kahn & Scott, 1997) - 9 items - to measure students' past and current involvement in research activities - composite scores from 0 to 9 (higher scores indicating higher involvement in research activities)	- adequate internal consistency (K-R 20 alpha coefficient .68). - - Its convergent validity has been evidenced in the form of positive Pearson correlations with research self-efficacy, research interests, science-relatedness of career goals, perceptions of the research training environment as well as years in the doctoral programme (Hollingsworth & Fassinger, 2002; Kahn, 2001; Kahn & Scott, 1997)	The present research adopted item 1 from the SAS to form the single-item questionnaire. Instead of following the composite scores in SAS, item 1 in the questionnaire requires the participants to report the actual scholarly outputs figure in their entire career.

Appendix 5: Abbreviations and Acronyms for Variables

Variable Categories	Variables	Abbreviations
Predictors	Age	AG
	Seniority	SN
	Recognition	RC
	Supervisor support and feedback	SS
	Support from colleagues	SC
	Work-family conflict	WF
	Family-work conflict	FW
Mediators	Research self-efficacy	RSE
	Teaching self-efficacy	TSE
	Promotion self-efficacy	PSE
	Outcome expectations for research	ROE
	Outcome expectations for teaching	TOE
	Outcome expectations for career advancement	CAOE
	Interest in research	IR
	Interest in teaching	IT
	Interest in career advancement	ICA
Outcome variables	Research productivity	RP
	Teaching performance	TP
	Career advancement	CA
	Years spent to be promoted from senior lecturer to professor	CA1
	Years spent staying at senior lecturer or lecturer position without being promoted	CA2