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## Leaky Pipeline Syndrome in Information and Communication Technology (ICT) Industry of Malaysia: A Conceptual Study on Female Career Barriers and Retention Management

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### Abstract

In Malaysia, women accounted more university enrolments than men in computer majors and occupy about half of the jobs in Science & Technology in Malaysia. While the number of women graduates has been increasing, their employment attrition rate compared women have been significantly higher in ICT industry, this problem has often been called the “leaky pipeline” syndrome. It is posited that given the current labor shortage in the ICT industry; it has become more important than ever to reduce sources of leakage in the ICT career paths of women. A model of barriers faced by women in the field of ICT is presented herein. Female career barriers such as work-family conflict, technostress and mentorship were identified and discussed in this paper. Subsequently, this paper suggested that these identified barriers tend to implicate psychological well-being, which is the key determinant for female talent’s retentiveness in ICT industry. The finding of the study able to provide appropriate patch for the leakage in the women’s ICT career pipeline.

**Keywords:** Leaky Pipeline Syndrome, Work-Family Conflict, Technostress, Mentorship, Psychological Well-Being and Retention

### Introduction

The Information Technology (IT) industry is now commonly known as the Information and Communications Technology (ICT) industry with the entry of the telecommunications sector (The National ICT Association of Malaysia, 2017). The rapid growth of the ICT sector, supported by the accelerated development of computing capacity and internet delivered goods and services, has seen

a steadily expanding body of research examining this sector and its workforce (Benner 2002, Hyde 2003, McKeown, Veenhof and Corman 2008, Niederman & Ferratt 2006, Ross 2009, Tremblay 2003, Valgaeren 2008). The ICT job market in Malaysia in 2017 showed improvement in salary growth and higher number of jobs compared to 2016. The overall average monthly salary of ICT Professionals grew to RM8,908 in 2017, a 5% growth from RM8,484 in 2016. This was a better growth compared to 4.6% in 2016. The number of advertised jobs for ICT professionals jumped by 35% to 15,197 in 2017 compared with 11,227 in 2016. These were among the findings in the 11th edition of the Pikom ICT Job Market Outlook in Malaysia 2018 launched on July, 2018. Despite the tremendous growth in ICT sector, a number of Human Resource Management (HRM) issues emerged as key themes in this research, including the issue of relatively high labor turnover rates. The National ICT Association of Malaysia (2017), reported the main 3 problems were foreseen in ICT industry in Malaysia which are 1) a lack of skilled professionals, 2) the drop-in women in the workforce and 3) the mismatch of talents has been long-standing issues for nearly two decades. This study going to evaluate further on the 2nd problem, which is drop in women talent in ICT sector.

TalentCorp Malaysia and The National ICT Association of Malaysia (2017) reported that the problem is not only in attracting women into ICT sector, but also in retaining them. Women remain severely underrepresented in the ICT profession globally. While the number of women graduates has been increasing, their employment attrition rate compared to men has been significantly higher in IT industry, this problem has often been called the “leaky pipeline” syndrome (Smith & Swamy, 2016). Female workers, who comprise half of Malaysia’s talent pool, are seen exiting the workforce in their late 20s to early 30s in the prime of their careers due to family commitments and do not typically return to the workforce in their later years, unlike peers in Japan and South Korean. According to World Bank research, the participation rate of Malaysian women in the workforce stands at 46%, considerably lower compared to its ASEAN peers and other countries like Japan and South Korean with similar development and income levels. While qualified women may join the workforce in larger numbers at the beginning of their careers, mid-path their numbers begin to decline as they quit formal employment (TalentCorp Malaysia & ACCA, 2013).

Women are nearly two and a half times more likely than men to leave the ICT labor force and reach a career ‘breaking point’ in their mid to late 30s which has resulted in 52% of highly qualified SET (Science, Engineering & Technology) women quitting their jobs (Trauth, Quesenberry, & Huang, 2006). The growth of information technology industry created the need of new skills, innovation and creativity hence talented women are leaving the sector, despite its apparent attractiveness. This conditions must be assessed within the context of Malaysian social values to determine the appropriate policy environment and incentives to retain a larger proportion of women in the labor force especially after marriage (Ahmad, 1998).

A search of the literature concerned with the retention of female ICT professionals in particular was carried out and a number of key factors identified by means of content analysis. Several factors that have an influence on retention have been identified by previous research (Kyndt, Dochy, Michielsen, & Moeyaert, 2009). However, according to Cardy and Lengnick-Hall (2011) there are “a myriad of other factors” that influence decisions to stay (p. 213). Therefore, the aim of this study is to identify

career barriers and factors that influence retention of female ICT professionals in Malaysia, hence gives fruitful impact in realizing nation goals in creating gender balanced labor force in technological field.

### **The Leaky Pipeline Syndrome in Malaysia ICT Industry**

A leaky pipeline is often cited as the cause for the underrepresentation of women in computer-related professions. At different stages in their education and entrance into the job market, women lose interest in these careers at a higher rate than do men, leaving the field after high school, during college, or before beginning a job in the field (Gurer & Camp, 2002; Woszczyński, Myers, & Beise, 2003). Proponents of the "leaky pipeline" theory generally assert that female interest in technology decreases through college student and early working years (Gurer & Camp, 2002). However, it seems that females might not be leaking from the pipeline at greater rates than males; instead, they might not be entering the pipeline at all. At each stage of advancement, fewer women succeed to the next position is analogous to the "leaks" in the pipeline (Campbell, 2015).

Sue Berryman's report *Who will do science? Minority and Female attainment of science and mathematics degrees: Trends and Causes* (1983) has made an important contribution to the theoretical and political debates in the UK about women's representation in science occupations. Berryman introduced the 'pipeline model', based on an empirical analysis of gender differences across the entire trajectory of training and employment rather than on discrete educational and career stages. By conceptualizing the scientific career as the sections of a narrowing pipeline, Sue Berryman's model concisely and visually describes where leakages of female scientists leaving the pipeline occur and the volume decreases leading to shortages in female supply (Berryman, 1983). Eventually the pipeline model has been used as foundation to study other technical fields as technology, engineering and mathematics (Lehr, 2001).

Ministry of Higher Education (MOHE) in 2010, conducted "Graduate Tracer Study" and stated that the overall ratio of female to male graduates for various Information & Communications Technology (ICT) fields at various public and private institutions of higher learning was 1.04:1. This means that there is nearly a 1-to-1 ratio in schools and in fact, the number of female ICT graduates is marginally more than that of male ICT graduates. In year 2014, Malaysia Digital Economy Corporation (MDEC) conducted a study of MSC Malaysia Talent Supply-Demand Study of 2010-2013. The study reveals that the number of male and female students across all the Institute of Higher learning (IHL) respondents are equally divided, with a higher proportion of females in IPTA (58%) while IPTS, polytechnic and community college have more male students (58%).

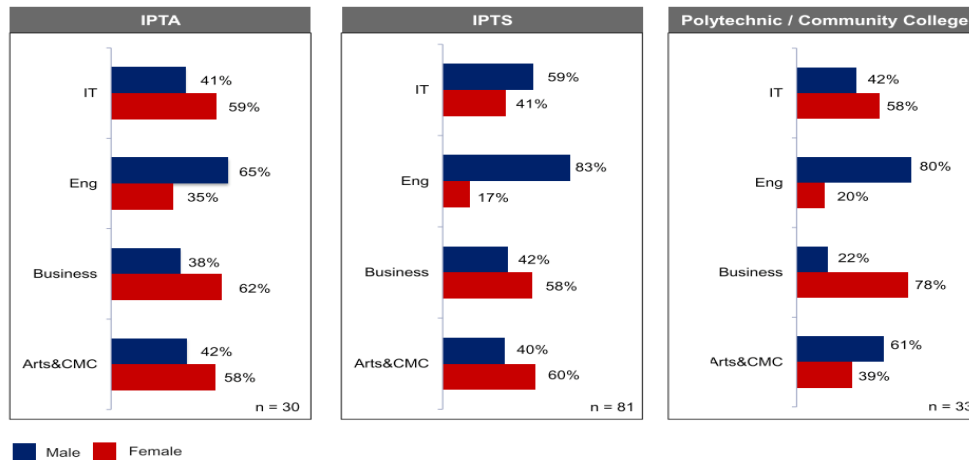
**Table 1. Gender Breakdown in IHL (2013-2017)**

| Institute Higher Learning         | Male | Female |
|-----------------------------------|------|--------|
| IPTA                              | 42%  | 58%    |
| IPTS                              | 58%  | 42%    |
| Polytechnic and community college | 57%  | 43%    |

*Source: Malaysia Digital Economy Corporation (MDEC)*

In terms of fields of study, there are more females taking up IT courses in IPTA and polytechnic / community college (~60%), while Engineering is dominated by male students across all IHLs.

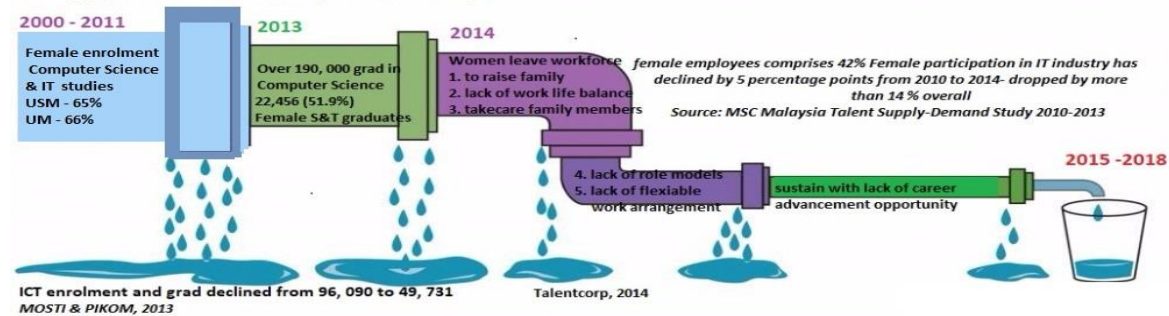
Figure 2.2 Gender breakdown in IHL (2013-2017)



Source: Malaysia Digital Economy Corporation (MDEC)

Although female enrollments and graduation in ICT courses is marginally higher than male, however female workforce in ICT industry is severely underrepresented as reported by Graduate Tracer Study (2016), by Ministry of Higher Education (MOHE), where total of 10,816 male employee and total of 9,645 female employee currently employed in ICT field in Malaysia. Overall out of 60% of female ICT enrolment only 3.3% women are in scientific and technological careers stated by Ministry of Women, Family and Community Development Malaysia (2013).

A Leaky pipeline model: IT Industry in case of Malaysia



In total women employed, only 3.3% are in scientific and technological careers (Statistics On Women, Family and Community 2013, Malaysia).

By 2018, - total demand for ICT professionals is projected to be 134,438  
In 2014 - talent shortage of 5,800 computer science (CS) and IT talent workforce against the demand of 13,300  
PIKOM, 2015

Figure 1. Leaky pipeline in model: ICT industry of Malaysia

Adapted from www.businessandeducation.org

Vitalari & Dell (1998) have reported that the cost of filling a vacancy is as high as 120% of the yearly salary for the position. In this environment, 'women may prove to be a key resource of skilled technology workers for international IT markets' (Maitland, 2001, p 9). However, despite a host of efforts to attract and keep women and minorities in computing, their retention continues to be a significant challenge in computer-related disciplines (Pfleeger & Mertz, 1995). As a result, more and more companies are reassessing practices that may lead to turnover, including those related to balancing family and work life (Goff, 2000). Under these circumstances, it has become more important than ever to identify factors affecting women in ICT careers that may act as sources of leakage in the pipeline of ICT career paths. Once identified, these barriers can be addressed with appropriate intervention.

### **Self-Determination Theory (SDT)**

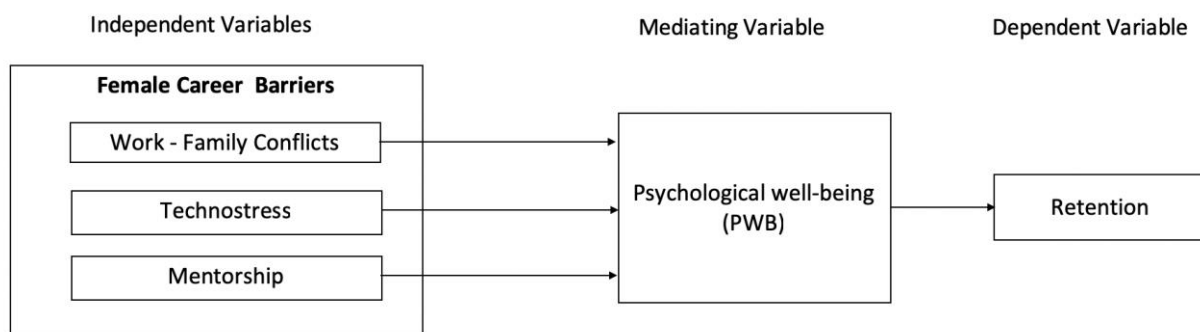
Self-Determination Theory (SDT) is an evidence-based theory of motivation created by Edward Deci and Richard Ryan and developed by researchers worldwide. It posits that there are two main types of motivations as intrinsic and extrinsic, that both are powerful forces in shaping who we are and how we behave (Deci & Ryan, 2008). According to self-determination theory (SDT), there are three fundamental, intrinsic psychological needs that are required for optimal functioning and well-being (Gagne & Deci, 2005). These needs are autonomy, competence, and relatedness (See table 4.3). Autonomy refers to the perception that the individual has choice with regard to his/her own behavior and decisions; competence refers to engagement in challenging experiences and the belief that the individual can bring about desired outcomes; and relatedness refers to the experience of connection and belonging with others (Gagne & Deci, 2005; Howell, Chenot, Hill, & Howell, 2011). Importantly, SDT posits that the experience of autonomy, competence, and relatedness are "universal necessities" (p. 337, (Gagne & Deci, 2005) and that satisfaction of these needs improves psychological health while thwarting these needs can be harmful. Indeed, past research on psychological need fulfillment supports such a mediation model. For example, need fulfillment has been shown to mediate the relationship between perceptions of organizational and supervisor support with both subjective well-being (SWB) and psychological well-being (PWB) (Gillet, Fouquereau, Forest, Brunault, & Colombat, 2012) . It is suggested in the present study that the extent to which these needs are met would motivate female ICT professionals in order to mitigate career barriers, gain positive psychological well-being and achieve retention in technological career for long run.

### **Female Career Barriers Model**

Igbaria & Baroudi (1995), given call for future researchers to explore the potential barriers to promotability among women have aspiration to excel in ICT career path. Hence, discovering the reason for such barriers existed and possible way to overcome them is biggest contribution for the literature. In conjunction to that, this study identified the most prevalent female career barriers such as work-family conflict, technostress and mentorship which are highly impact psychological well-being of female employees in ICT professions. Female career barriers often implicate psychological well-being of female employees (Martire et al., 2000). Withstanding to that, this study going to answer what is the level of female employee's psychological well-being in Malaysian society and how

they could handle these foreseen barriers in vital way in order to archive job retention in technological field for long run.

This paper proposes a model of barriers faced by women that affect their entry and performance in the ICT field. The model examines effects of barriers on women's psychological well-being and its influence on job retention in ICT careers. It is suggested that each of these barriers can serve as a source of leakage in the pipeline, and make a cumulative contribution to the ICT labor shortage. It is suggested that it is not sufficient to examine these factors in isolation from one another, as the ICT literature on gender has done so far. In order to develop a rich understanding of ICT careers, it is crucial that inter- actions among these factors be considered.



**Figure 1. Conceptual Framework**

### Work - Family Conflict

Work–family conflict has been defined as “a form of inter-role conflict in which the role pressures from the work and family domains are mutually incompatible in some respect” (Greenhaus & Beutell, 1985, p. 77). Research on work–family conflict has found that this variable influences a number of outcomes including psychological distress, job satisfaction, organization commitment, turnover, and life satisfaction (Frone, Russell, & Cooper, 1992; Higgins, Duxbury, & Irving, 1992; O’Driscoll, Brough, & Kalliath, (2004); Parasuraman, Greenhaus, Rabinowitz, Bedeian, & Mossholder, 1989). Thus, work–family conflict has become a much-investigated topic in today’s organizational behavior research.

Work-family interface studies involves varied structural and psychological aspects of work and family life which determine the outcome for the domains namely work, family, and individual (Karimi, 2009). Henceforth, increase research understanding of this interface is essential (Eagle, Miles, & Icenogle, 1997) due to drastic increase of women participation in labor force globally (Powell & Graves, 2003). The non-synchronicity in certain aspects of the demand and duties of the work and family roles arises work-family conflict (Greenhaus & Beutell, 1985). Recent demographic changes in labor force, such as the greater involvement of women and parents in the workplace have led to a proliferation of studies that negative effects of the work-family interface arise due to rising demands on the individuals’ time (Aryee, Srinivas, & Tan, 2005). Over the past century there has been drastic increase of employee turnover rates (Haar, 2004) due to these negative effects. In this thesis, the researcher focuses and accentuate on two domains of the work-family interfaces, which are work-family conflict, and family-work conflict. Many researchers believed that psychological distress induced by work-

family conflicts tend to compromise well-being and lead poor retention rate in careers. Paying attention to the work family conflict by focuses on the methods that increase the level of psychological well-being among female employees, to improve their career sustainability, decrease job quitting rate is aim of this study.

### **Technostress**

Technostress is a problem of adaptation that an individual experience when he or she is unable to cope with or get used to ICTs. In the organizational context, technostress is caused by individuals' attempts and struggles to deal with constantly evolving ICTs and the changing physical, social, and cognitive requirements related to their use (Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan, 2007). Scholar Nagarajah (2016) conducted study examining personal factors on technostress and the data analysis demonstrated women experienced significantly higher levels of technostress. The research found that (a) men are more sensitive to achievement stress, (b) women are more sensitive to social rejection stress, and (c) men show higher levels of stress than women in cases of computer malfunction and network breakdowns (Riedl, Kindermann, Auinger, & Javor, 2013). Further research by Tarafdar, Tu, Ragu-Nathan, & Ragu-Nathan (2011) on the relation of gender to IT demonstrated that when the use of IT was voluntary, men were more inclined to use IT than women to accomplish a task, even the exact same task. Both Riedl et al.'s (2013) and Tarafdar et al.'s (2011) studies concluded that professional men or women with greater IT confidence experienced less technostress because of their confidence in their ability to understand and handle ICT issues effectively, thereby avoiding situations that create technostress. In addition to age, gender can also potentially influence technostress.

The psychological well-being level based on the impact that technostress has induced on attitudes, thoughts, and behaviors (Nimrod, 2017) of female employees, highly influence their decision of retaining or withdrawing from the IT industry. To the best of the author's knowledge, none of the technostress-related studies have examined technostress impact on psychological well-being of female employees which lead to leaky pipeline syndrome. Herein this study attempted to fill the gap by examining the relationship between technostress and psychological well-being of female talents which lead to leaky pipeline syndrome in Malaysia.

### **Mentorship**

Ahuja (2002) points to the absence of mentoring as key among the barriers to women's retention in the IT field. By the same token, Soe & Yakura (2008) emphasis that while mentoring is important, in order to be effective at addressing the retention of women in the IT field, mentoring programs need to be part of a broader goal of changing organizational culture and assumptions about women and technology work. In the absence of this wider change, they warn, there is a danger that negative stereotypes could be reinforced. Higgins & Kram (2001) assert that the outcomes of mentoring programs are affected by both work environment and individual level factors. Scholars argue that a proactive facilitation of mentorships may be beneficial for development and advancement of women in IT careers.



A group of scholars Allen, Eby, Poteet, Lentz, & Lima (2004) and Underhill (2006) found significant relationships between workplace mentoring and career attitudes, work attitudes, and some career outcomes. Reviews of youth (D. L. DuBois, Holloway, Valentine, & Cooper, 2002) and academic (Sambunjak et al., 2006) mentoring found an association between mentoring and both career and employment outcomes. There are also reviews linking youth (DuBois et al., 2002), academic (Dorsey & Baker, 2004; Sambunjak, Straus, & Marusic, 2006), and workplace (Underhill, 2006) mentoring to psychological outcomes such as positive self-image, emotional adjustment, and psychological well-being, although similar to our findings, several of these reviews found small effect sizes. Mentorship beneficial as research has repeatedly shown that when one's social partner and environment provides them with autonomy-support, their intrinsic motivation, quality and persistence of performance, and psychological well-being are all increased.

### **Psychological Well-Being**

Ryff and Singer's (1996; 2006) model of Psychological well-being is one of the models that come closest to explaining why physical activity can facilitate well-being. This model proposes that there are six distinct components of positive psychological functioning. In combination, these dimensions encompass a breadth of wellness that includes positive evaluations of oneself and one's past life (Self-Acceptance), a sense of continued growth and development as a person (Personal Growth), the belief that one's life is purposeful and meaningful (Purpose in Life), the possession of quality relations with others (Positive Relations With Others), the capacity to manage effectively one's life and surrounding world (Environmental Mastery), and a sense of self-determination (Autonomy).

A research by Martire et al. (2000) has shown that psychological well-being is affected by age, which is itself under the effect of increasing women's social role. A woman's family and professional responsibilities can represent an important overload if they are considered simultaneously. The traditional role of a woman as a caregiver of children, the elderly and the ill, contributes to this overload in family environment. Such responsibilities that develop in family are considered as important determinants of psychological well-being (Kowal et al., 2002; Wright & Cropanzano, 2000). Scholar Vandenberg and Nelson (1999) explained organizational commitment, job satisfaction, and well-being at work as a predictor of the emergence of turnover intentions. Employees who have fulfilled their well-being in the workplace are more productive, contributing to the organization's goals, and low of intentions to leave (Harter, Schmidt, & Hayes, 2002). Scholar Samad (2006) also stated the process of identifying factors influence of turnover intentions becomes important to be considered in turn lower of turnover rate in the company. Robertson and Cooper (2011) suggested employee well-being contributed towards increase of productivity and organizational performance. It will increase service to customers, profitability, and reduced employee turnover and absenteeism.

### **Retention**

Employee retention is a process of encouraging employee to remain in the organization for long term or until a project completion (Akila, 2012). Scholar Frank, Finnegan, and Taylor, (2004, p. 13) define retention and turnover as "the effort by an employer to keep desirable workers in order to meet business objectives and turnover as the unplanned loss of workers who voluntarily leave and whom employers would prefer to keep". Employees in ICT often have long working hours, rigorous work,

incessant pressure and pressing deadlines, which collectively challenge their work-life balance on a daily basis (Nanjamari, 2013). A review of seminal empirical studies on employee retention in ICT industry for past decades still left a need for the clarity of employee perception of antecedents of employee retention based on gender (Goy et al., 2017), psychological well-being (George, 2015), generational cohort, extrinsic, and intrinsic benefits (Babich, 2014). Therefore, this study will focus specifically on female professionals' career barriers and retention management within Malaysian ICT industry.

### **Psychological Well-Being Mediating Variable**

Psychological well-being at work represents indicators of an individual's self- assessment of their entire work experience. It has often been depicted to represent an individual's affective state at work including experiences of work-related depression, anxiety, self-esteem, job satisfaction (Van Horn, Taris, Schaufeli, & Schreurs, 2004). The past research of Wright and Bonett, in 2007 has proposed a link between psychological well-being and various positive workplace outcomes such as lower turnover and organizational citizenship behavior (OCB), which are extra role behaviors by the employee that benefit either the organization or an individual within the organization (Griffeth, Hom, & Gaertner, 2000; Smith, Organ, & Near, 1983). Psychological well-being is a complex concept that covers a range of emotional, affective and attitudinal factors that capture the overall mental health of individuals in various contexts, and measures overall psychological functioning (Wright and Cropanzano, 2000). To the best of the author's knowledge, there has been no published study to date that empirically examined psychological well-being as mediators in the relationship between female career barriers (work-family conflicts, technostress and mentorship) and job retention. The present study advances a conceptual model in which psychological well-being acts as a key mediating mechanism to examine leaky pipeline syndrome in ICT industry in Malaysia.

### **Discussion**

This paper emphasis psychological well-being is one of the employee's need that must be met and accredited to be the best motivational factor. Positive psychological well-being can be the enablers to mitigate career barriers and to be retained in technical field for the long run. In fact, self-determination theory has shown how its motivational "laws" predict important organizational outcomes such as well-being (Gagné & Deci, 2005; Vansteenkiste et al., 2007) and talent retention (Bock, 2015; Fowler, 2014) and among other critical performance indicators. Henceforth for this study, the focus is on basic psychological needs fulfilment provides a practical basis for leveraging positive change in achieving goal of female talent retention.

This paper seeks to explain the development of theoretical foundation to women psychological well-being literature which identified as hindrance of women career progression in technological field. The finding of the study will be important for future researchers and future job holders as it provide more knowledge and guidelines on women psychological well-being that affect women career progression especially for skill workers, professionals and managers; the ways to shatter those barriers ; as a referential material for their studies, policy makers; in creating and improving existing policies in organizations and government authorities with regard to female professionals retention in technological industry.

Furthermore, our nation's current state of affairs, the "Envisioning Malaysia 2050: Foresight Initiative" was conceived as a guiding framework for the bold journey between Malaysia's status quo and its future destination 33 years from now. Academy of Sciences Malaysia (ASM) along with the Foresight Alliance brings experts from a myriad of subject areas to assist in building the scenarios that are plausible for Malaysia by 2050. For our desired future, it is envisioned that in 2050, Malaysia will be living in "smart communities", where we are able to live in a harmonious, sustainable and prosperous milieu. The vision will be realized by addressing three fundamental drivers: governance, wealth creation, and well-being (Academy of Sciences Malaysia, 2017). Professor Datuk Dr. Asma Ismail the president of the Academy of Sciences Malaysia, propelled that knowledge in STEM is the fuel for the future economy and enhancement of societal well-being too. In conjunction to that, this study investigates female career barriers and provide an overview of its impact on the psychological health and well-being of female professionals, with a specific focus on maintaining and enhancing their psychological balance with technology related jobs for long run.

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