科技部補助專題研究計畫報告

以生命歷程觀點檢視資訊科技業女性的職業發展(L07)

報 告 類 別 ： 成果報告
計 畫 類 別 ： 個別型計畫
計 畫 編 號 ： MOST 108-2629-E-426-001-
執 行 期 間 ： 108年08月01日至109年07月31日
執 行 單 位 ： 康寧學校財團法人康寧大學健康照護管理學系

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本研究具有政策應用參考價值：□否 ■是，建議提供機關勞動部,教育部
（勾選「是」者，請列舉建議可提供施政參考之業務主管機關）
本研究具影響公共利益之重大發現：■否 □是

中 華 民 國 109 年 10 月 28 日

中 文 摘 要 ： 過去研究指出，雖然女性進入臺灣勞動市場的比例上升，但性別區隔的現象仍存在，尤其在傳統以男性為主的科學、科技、工程、數學（STEM）職場更為明顯。為解釋性別區隔的背後原因，先前有不少研究嘗試從教育、家庭、工作環境等層面，探討影響女性進入此領域的因素，但少有研究以生命歷程的觀點檢視女性的整體職業發展路徑。有鑒於職業的選擇非一次抉擇、終身不變，加上國外文獻指出，相較男性，女性的職涯更常受因家庭職責而中斷，並呈現多元且分歧的面貌，因此針對女性的長期職涯發展進行分析，無論是在理論或實務層面上，都具有重要意涵。爲能在資料有限下，盡量呈現女性的整體職涯發展軌跡，本研究採用了三份資料進行分析，包括：1)臺灣教育長期追蹤資料庫後續調查2010年所收集的1981-1986出生樣本2001-2010年的回溯性職業資料，2)華人家庭動態資料庫中2009年起開始蒐集的1977-1983出生之主樣本2009-2018年的就業資料，及3)研究者運用自行設計問卷，透過網路所蒐集的資料。
分析結果發現，不同職涯階段的女性，STEM職場的處境明顯不同。初離開學校的女性，就迴歸與序列分析結果來看，相較男性，不僅更有可能在前幾年內續留職場，亦更有機會踏上STEM職涯路徑。然而隨著職涯進入中期，女性離開STEM職場的比例明顯攀升，並顯著高於男性。究其原因，除了文獻中通常指出的婚姻與育兒因素外，本研究發現，持續且明顯存在的職場性別差異應為重要原因。而比起新人，STEM職場老鳥感受到更為強烈的家庭工作衝突，與對女性的敵意，這亦突顯出不同職涯階段的女性，即便未做出不同的職業選擇，其對職場的觀察與意識也有所不同。
根據研究發現，本研究建議相關單位應同時從職場與教育兩端著手改善STEM性別失衡的現況。在職場方面，雖然性別工作平等法與性騷擾防治法行之有年，但本研究仍觀察到明顯的職場性別差異與敵意，研究建議相關單位應再次檢視現行之性別改善措施，並從鼓勵彈性工時與增加勞工性別教育來著手改善。在教育方面，基於本研究發現，性別失衡從教育階段即已發生，在大量相關研究討論外，本研究建議相關單位或可思考延後教育分流之可行性，以提供女性更多進入STEM領域的機會。

中文關鍵詞： 性別平等、性別差異、職業發展、職涯、序列分析

英 文 摘 要 ： Previous studies suggested that while the labor force participation rate of women in Taiwan has increased, gender segregation remains pronounced, particularly in the traditionally male-dominated STEM workforce. To elucidate the factors associated with the persisting gender segregation, ample studies have attempted investigations from the aspects in education, family, and work whereas a dearth of studies looking into the question from a life course perspective. As a career choice is not a static and singular moment of decision-making, moreover, according to the literature, women's career is more multifaceted and diverse as it is often interrupted due to family obligations, an empirical examination on women's career over a long-term career course has important implications in terms of both theories and practice. With data limits, to capture longer career trajectories, this study adopted three data sources, including 1.TEPS-B: the retrospective career status of the 1981-1986 birth cohort over the observation period from 2001 to 2010, 2. PSFD: the panel data of 1977-1983 birth cohorts collected since 2009 till 2018, 3. Data collected through an online survey administered by the researcher. The analysis based on these data found that women at different career stages had distinctively different career status in the STEM. Based on the regression and sequence analysis results, among those who just left the school, compared with men, women not only had a higher retention rate in the STEM workforce in the first few years, but also had a higher likelihood to step onto the STEM career path. However, as they moved along the course, women’s attrition increased as they became significantly less likely to hold onto the long-lasting STEM career path. To explain, apart from the influence of marriage and childbearing often suggested by the literature, this study found that the persisting and evident gender disparities in the workplace should be one of the fundamental causes. Moreover, compared with the newbies, the finding that women with years of work experiences felt a higher level of work-family conflicts and hostility towards women showed that women’s perceptions and understanding of the workforce changed even without apparent career choices reflected upon explicit actions.

Based on the findings, this study suggested that policymakers should work on improving the gender imbalance in STEM from both the areas of employment and education. In respect of employment, although the Act of Gender Equality in Employment and the Sexual Harassment Prevention Act have been implemented for years, the analysis still found evident gender disparities and hostility towards women. This report suggested that the government should review current gender policies and consider improving the workforce with flexible working hours and an enhanced gender equality education. In terms of education, as this study found that women’s attrition started from the education stage, whereas many scholars have dedicated to solving this problem, this study suggested that educators may consider the feasibility of retardant tracking to allow women more opportunities to enter the STEM field.

英文關鍵詞： gender equality, gender disparities, career development, career stage, sequence analysis

科技部補助專題研究計畫成果報告

（□期中進度報告/☑期末報告）

以生命歷程觀點檢視資訊科技業女性的職業發展(L07)

計畫類別：☑個別型計畫　　□整合型計畫

計畫編號：MOST 108-2629-E-426-001

執行期間： 108 年 8 月 1 日至 109 年 7 月 31 日

執行機構及系所：康寧學校財團法人康寧大學健康照護管理學系

計畫主持人：張詠菡

計畫參與人員：陳玠瑄、林紀宏

中　華　民　國 109 年 10 月 27 日

中文摘要

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根據研究發現，本研究建議相關單位應同時從職場與教育兩端著手改善 STEM 性別失衡的現況。在職場方面，雖然性別工作平等法與性騷擾防治法行之有年，但本研究仍觀察到明顯的職場性別差異與敵意，研究建議相關單位應再次檢視現行之性別改善措施，並從鼓勵彈性工時與增加勞工性別教育來著手改善。在教育方面，基於本研究發現，性別失衡從教育階段即已發生，在大量相關研究討論外，本研究建議相關單位或可思考延後教育分流之可行性，以提供女性更多進入 STEM 領域的機會。

關鍵字：性別平等、性別差異、職業發展、職涯、序列分析

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Previous studies suggested that while the labor force participation rate of women in Taiwan has increased, gender segregation remains pronounced, particularly in the traditionally male-dominated STEM workforce. To elucidate the factors associated with the persisting gender segregation, ample studies have attempted investigations from the aspects in education, family, and work whereas a dearth of studies looking into the question from a life course perspective. As a career choice is not a static and singular moment of decision-making, moreover, according to the literature, women’s career is more multifaceted and diverse as it is often interrupted due to family obligations, an empirical examination on women’s career over a long-term career course has important implications in terms of both theories and practice. With data limits, to capture longer career trajectories, this study adopted three data sources, including 1.TEPS-B: the retrospective career status of the 1981-1986 birth cohort over the observation period from 2001 to 2010, 2. PSFD: the panel data of 1977-1983 birth cohorts collected since 2009 till 2018, 3. Data collected through an online survey administered by the researcher. The analysis based on these data found that women at different career stages had distinctively different career status in the STEM. Based on the regression and sequence analysis results, among those who just left the school, compared with men, women not only had a higher retention rate in the STEM workforce in the first few years, but also had a higher likelihood to step onto the STEM career path. However, as they moved along the course, women’s attrition increased as they became significantly less likely to hold onto the long-lasting STEM career path. To explain, apart from the influence of marriage and childbearing often suggested by the literature, this study found that the persisting and evident gender disparities in the workplace should be one of the fundamental causes. Moreover, compared with the newbies, the finding that women with years of work experiences felt a higher level of work-family conflicts and hostility towards women showed that women’s perceptions and understanding of the workforce changed even without apparent career choices reflected upon explicit actions.

Based on the findings, this study suggested that policymakers should work on improving the gender imbalance in STEM from both the areas of employment and education. In respect of employment, although the Act of Gender Equality in Employment and the Sexual Harassment Prevention Act have been implemented for years, the analysis still found evident gender disparities and hostility towards women. This report suggested that the government should review current gender policies and consider improving the workforce with flexible working hours and an enhanced gender equality education. In terms of education, as this study found that women’s attrition started from the education stage, whereas many scholars have dedicated to solving this problem, this study suggested that educators may consider the feasibility of retardant tracking to allow women more opportunities to enter the STEM field.

Keywords: gender equality, gender disparities, career development, career stage, sequence analysis

I. Research background

As a small island, Taiwan has been proud of its development in the information technology (IT) industry for decades. However, although the country is the cradle of some famous technology companies, such as ASUS, ACER, HTC, and Foxconn Technology Group, the robust development of the IT industry in Taiwan has not been as gender-inclusive as expected given the persisting under-representation of women (Yan, 1998; Liao & Wu, 2018). While there has been continued growth in the Taiwanese female labor force participation since the 1960s (Kao & Chen, 1994; Chu, 2010), the persisting gender imbalance in the IT workforce, as well as in the traditional STEM field, is intriguing.

According to Taiwan's labor market statistics, the labor force participation rate of women aged 15 and above has reached 50% since 2012 (DGBAS, 2018). Nevertheless, according to the research on gender statistics, gender segregation still exists in many STEM workforces. In terms of Taiwan's IT field specifically, analyses based on the manpower survey (人力資源調查) indicated that the IT workforce is predominantly occupied by men, with men making up 80% of the workforce. A comparison of the statistics from 2011 to 2016 shows that the underrepresentation of women in the IT workforce has not seen much growth (Chang, 2018).

Whereas extensive studies have examined the factors affecting women's entries into male-dominated workforces (Korenman, 2001; Ahuja, 2002; Beise et al., 2003; Gallivan, 2003; Pande, 2006; Funk & Parker, 2018), previous studies rarely investigated this issue from a life course perspective. However, as women often experience career interruptions due to marriage or childbirth, their non-work experiences and multiple identities across different life stages may intersect with their employment and form a career path very different from man (Huang & Sverke, 2007). Moreover, career choices are not made once in a lifetime but constantly changing. A life-course perspective could help capture the dynamics of women's career development and its interactions with personal, family, and work environment factors. Specifically, at different life stages, determinants of women's persistence in a workforce may vary. Factors, such as math self-assessment, may be important in the high school stage, but not as significant for women who are already in the workforce (Cech et al., 2011). A life-course perspective could help examine various factors associated with women's career choices across different career stages.

Given that the persisting gender segregation in a male-dominated field, such as IT and STEM area in general, is not unique to Taiwan, literature in the global context (Blair-Loy, 1999; Cech , Rubineau, Silbey, & Seron, 2011; Joseph, Boh, Ang, & Slaughter, 2012) suggests an examination of women's career trajectories over the life courses is needed in understanding women' employment status and gender imbalance in the field. Thus this study aims to examine the career development of women in a traditionally male-dominated field with a holistic approach and a life-course perspective. By adopting sequence analysis, this study hopes to fill in the gaps in the literature by enhancing our understanding of women's career choices through the established career trajectories on the basis of sequence analysis results. The remainder of this report is structured as follows. The literature on gender disparities and career development are firstly discussed and followed by an introduction of the data and methods adopted in this study. After explaining the methods used and the solutions adopted by the researcher to tackle the problems encountered during the research process, the analysis results and preliminary findings are presented. This report concludes with the discussions on the results and the policy implications drawn from the findings.

II. Literature Review

1. Gender segregations and women's career choices

Literature has often suggested that gender segregation at workplaces starts from education. Although studies showed that the segregation is in decline (England & Li, 2006; Bradley, 20000), it was found that the traditional division of labor and job segregation are still common in Taiwan (Yu, 2001; Chu, 2010). In order to explain the persistence of gender segregation, apart from the arguments offered by demand-side literature, many studies proposed models to investigate the mechanisms of women's career choices from the supply-side. One of them is the expectancy value model (Eccles, 1987; Eccles, Wigfield, Harold, & Blumenfeld, 1993; Eccles, 1994), which suggests that individuals' career choices are influenced by their interests, values, gender role beliefs, and cultural norms (Zarrett & Malanchuk, 2005)

To support such an argument with empirical evidence, Correll's studies (2001, 2004) examined the association between gender belief and biased self-assessment. Setting out to tackle the gender segregation problem from the supply-side, Correll argued that the supply-side approach could fill in a gap in the literature by accounting for the constraints embedded in the culture which affect individuals' preferences in developing their careers. According to Correll, although Pierre Bourdieu (1984) persuasively described how social class constrains individuals' choices, how choices are induced were not clearly specified. To understand how women's aspirations for career paths were affected by self-assessments, and how self-assessments were biased by gender beliefs, Correll proposed a model, which assumed individuals' preferences for a career were established on the foundation of their beliefs of having necessary abilities. Correll believed this model can offer empirical ground for Bourdieu's idea.

Through an experimental evaluation design, Correll found that being exposed to a gender belief that "men are better at a certain task", gender-differentiated self-assessments emerged when the participants joined the task. However, when the participants were exposed to a gender-neutral belief instead of a biased one, there were no gender differences (Correll, 2004).

In Taiwan, several studies drew on the mechanism found by Correll (2001, 2004) and found empirical support in the Taiwanese context. For example, Chen's study (2013) looked into the factors affecting Taiwanese senior high school students' selection of educational tracks (science track versus humanity track) and found that self-assessments had a significant influence on students' educational paths. Peng and Hsung's study (2011) on individuals' career choices discovered that the interactions in family, school, and workplaces shaped the gendered career culture belief. In particular, parents' gender appropriate belief was critical in terms of individuals' gender belief, which helps to sustain the gender segregation phenomenon in the labor market.

2. Professional role confidence

Cech et al. (2011) further explored the impact of gender belief. They contended that previous studies that paid attention to gender belief often failed to account for men and women's different levels of confidence in their abilities to fulfill their professional roles. Findings from studies in career psychology helped to shed some light on Cech et al.'s argument as they indicated that career self-efficacy may explain women's underrepresentation in traditional men's field. Whereas women were found having significantly lower levels of self-efficacy in male-dominated workforces

(Bandura et al., 2001; Betz & Hackett, 1981; Scherer, Brodzinski, & Wiebe, 1990), their career aspirations may be limited due to the lack of professional role confidence in certain fields (Wilson, Kickul, & Marlino, 2007).

According to Cech et al. (2011), professional role confidence is developed during the credentialing stage. It involves confidence in one's professional abilities, and confidence in playing the professional role properly. Cech et al.'s concept of professional role confidence consists of two dimensions: expertise confidence and career-fit confidence. Whereas "expertise confidence" refers to the confidence in the competencies required for a certain career, "career-fit confidence" connotes the confidence one has in enjoying and performing the professional role well.

Both expertise confidence and career-fit confidence are "contingent on successful professional socialization processes" (Cech et al., 2011, p. 647) which has been proven difficult for women in the male-dominated fields. According to previous studies, women often had a lower level of professional role confidence in male-dominated fields, such as IT, since they may face obstacles from gender stereotypes and render themselves unfit to perform the professional role (Charles & Bradley, 2009; Ridgeway, 2009). Cech et al.'s empirical analysis supported findings from previous studies and showed that professional role confidence was cultivated more successfully among men than women. Moreover, women with lower levels of professional role confidence are less likely to remain in engineering than men (Cech et al., 2011).

Cech et al.'s study suggested that the professional role confidence was closely associated with women's perceptions of the workforce. Adya and Kaiser's study (2005) also showed that teenage girls' perception of the IT based on gender stereotypes was a critical filter that blocks women from entering IT career. Hence women's level of professional role confidence was susceptible to the organization culture in the IT.

3. Organizational culture

Although organizational culture in the enterprises has long been conceived as gender neutral (Wilson, 1997), careful examination of the underlying implicit agreement and rules in organizational culture indicates that the gender power structure is influential. Through in-depth interviews, Cahusac and Kanji (2014) investigated the mothers who undertook professional or supervisor positions, and found that they were mostly challenged by the male work culture in the workplace, including working overtime and participating in social activities at night.

Taking technology industry as an example, according to Faulkner (2001), this IT industry is often associated with a masculine image, meaning it is tough, aggressive, rational (non-emotional), and authoritative (Wen, 2012; Hinze, 1999; Adams, 2000; Dryburgh, 1999). In their investigation of women who work in the IT industry, Crump and Logan (2000) discovered similar results. The female participants mostly suggested that the IT work culture is highly competitive, stressful, and aggressive, which are traits considerably associated with masculinity. In such an environment, jobs that required professional techniques, programmers or engineers, tended to be viewed as men's occupations; while administrative jobs, secretarial or clerical positions, were often assigned to women (Panteli, Stack, & Ramsey, 2001; Woodfield, 2002).

As masculinity is often seen as the dominant culture in technology, science, engineering, and mathematics occupations, women who work in these areas are often evaluated against masculine attributes (Van den Brink & Stobbe, 2009). However gender neutral the job requirements in these workforces may seem, studies have found that the standards of job requirements for employees tend to exhibit certain gender preferences (Peterson, 2007). Traditional masculine characteristics, such as being tough and ambitious, were valued; whereas conventional feminine characteristics, being careful and communicative, were degraded.

In Taiwan, one of the very few studies examining the gender imbalance in the IT workforce used the data collected from technology companies in The Hsinchu Science Park and found that women usually took administrative or skilled worker positions (Yan, 1998). Among all the employment categories in the technology companies, there were only very few women taking professional or managerial positions. In computer jobs (e.g. software developers, information systems managers and programmers), the percentage of women holding professional or managerial positions was even lower. Based on the findings, Yan (1998) suggested that the "technology industry is even more gendered than other industries" (1998, p. 191) in Taiwan. Yan argued that the gender imbalance found in her study was closely associated with the work environment. Socially-constructed gender relations were reinforced and strengthened through everyday practices in the workplace, which then renders "machines and computers masculine whereas repetitive and meaningless chores feminine" (Yan, 1998, p. 199).

When women enter such a "masculine" work field, their presence in the "men's field" could be viewed as a breach of the symbolic order of gender (Gherardi, 1994). Acting against the gendered prescript, women in the IT workforce are susceptible to criticism (Glicke & Fiske, 1996). They may easily encounter supervisors or clients questioning their job competence or discrimination from their colleagues (Demaiter & Adams, 2008; Funk & Parker, 2018). Consequently, women may start questioning themselves and losing faith in playing the pirofessional role successfully.

4. Women's career path

Previous studies on career development tend to view career progress as an ordered sequence of development within an occupation or an organization. The linear upward progression is usually presented with the analogy of "ladder-climbing" (Mavin, 2001; Joseph et al., 2012). Among all the studies focusing on the orderly fashion of the career, the status attainment theory is widely adopted in sociological research. The theory views occupational aspirations and attainment as integrated into the system of social stratification (Rojewki & Yang, 1997). Hence, individuals' promotions and demotions in an organization were deemed as indicators of upward or downward mobilities.

Nevertheless, more studies have found that individuals' career development is not always in sequential order (Arthur & Rousseau, 1996; Sullivan, 1999). Blair-Loy (1999) identified another type of career path which involves "disorderly career shifts between disparate fields and among several different organizations" (p.1362). Women, in particular, tend to have less orderly careers due to family responsibilities and workplace discrimination (Marshall, 1984). Moreover, in contrast to the traditional career studies, Super (1980) viewed career development in a new light by taking multidimensional life developments into account and underscored the necessity of understanding women's career from a life-span perspective as a career is the “combination and sequence of roles played by a person during the course of a lifetime” (1980, p. 282).

Whereas men and women’s career aspirations are gendered as discussed in the last section, their career developments are also different. Jacobs (1999), for instance, found that women’s career patterns were characterized by more interruptions, fewer returns to the workforce after interruptions than their male counterparts. Given that gender differences in career development patterns were pronounced in previous studies (Betz & Fitzgerad, 1987; Jacobs, 1999), Mavin (2001) argued that women who step into work often find themselves in disadvantaged positions as the prevalent working pattern is solely based on the typical working lives of men. Specifically, on the supply side, women’s career development is more easily interrupted by childbirth and domestic responsibilities; on the demand side, discriminations in the labor market could limit women’s opportunities and lead them to take an alternative path (Marshall, 1984; Larwood and Gutek, 1987; Heinz, 2003; Jacobs, 1999).

Drawing on the leaky pipeline theory to illustrate women’s attrition in the science career, previous studies have only partially explained how women opt out of the workforce during the process (Zarrett & Malanchuk, 2005). As diverse and complex as women’s working patterns are, Zimmerman and Clark (2016) have pointed out that the conventional linear career trajectory is obsolete and inappropriate in understanding women’s career experiences. Whereas decades ago, Super (1957) has already addressed the needs for a more inclusive and diverse career model and identified various career patterns which are more applicable in terms of modern women’s employment situations, including the doubletrack pattern, the interrupted career pattern, the unstable career pattern (women irregularly rotated between working and homemaking), and the multiple-trial career pattern; in recent years, to address the interruptions and non-work periods often experienced by women, scholars also developed several career models, one of them is the Kaleidoscope Career Model (KCM) (Sullivan & Mainiero, 2007). As a model developed with specific attention on gender differences, KCM incorporates the often-prescribed gender-role expectations on women, such as family commitments, into the model and proposed an analytical framework integrating women’s pursuit for a work-life balance and communal goals. Specifically, KCM argues that women in early, middle, and late stages may prioritize their desires differently. Whereas women at early career stages desire challenges, those who enter mid or late-career stages tend to be more motivated to pursue a balanced life and a career that could help others (authenticity). Studies on STEM careers have shown that for women at later stages of their careers, the inaccessibility of communion and authenticity may lead to women’s decision to opt out (Diekman, Brown, Johnston, & Clark, 2010).

Apparently, as complex and diverse as women’s career and work patterns are, no overarching model could fully explain women’s career decisions. However, KCM helps to shed lights on the current debates concerning women’s underrepresentation in a male-dominated field in a way that it “places the relational nature of women’s career values within the context of women’s changing work and personal lives (Zimmerman & Clark, p.607) and allows the current study to examine women’s career path with a more holistic view.

Given a scarcity of studies taking a holistic approach in this field, this study aims to contribute to the literature by examining women’s career trajectories on the basis of the analytical framework proposed by KCM. Although due to data availability, KCM served as an analytical guideline rather than a framework in most of the following analyses, the stage-differentiated perspective allows this study to discover some interesting results when addressing the following research questions:

1. How many women in STEM majors enter the STEM workforce?
2. Among those who enter the STEM workforce, how many of them drop out in the first three years?
3. Among those who remain in the STEM, how many of them become managers or supervisors?
4. What are the determinants of women's retention in the workforce?

III. Data and Methods

1. Data

One of the major problems that arose during the research process was the availability of the data. As the research proposal previously mentioned, each of the currently available data has some shortcomings in terms of addressing the question of women's career paths in the IT area. While the research focus bears distinct significance, a lack of suitable survey data has long impeded the progress in tackling the issue properly. Whereas this observation calls for more efforts from governments and academia in establishing large-scale data collection schemes, this study still attempts to address the research question with the best data available. By extending the focus from solely on IT to STEM[1] area, this study incorporated datasets from TEPS-B and PSFD, as well as data collected through an online survey administered by the author, to answer the research questions. (For an overview of the data used in this study, please see Table 1.)

With the adoption of this composite group of datasets, the research question was addressed with an analysis strategy guided by the KCM, which underscores the multi-faceted aspects of women's career developments at different stages. Correspondingly, the longitudinal data used in this study—TEPS-B and PSFD—focused on women at the early and mid-career stages, respectively.

[1] One of the hurdles in examining the STEM workforce is the definition of the "STEM" area, which becomes even more challenging when using large-scale datasets. Whereas it is relatively straightforward with TEPS-B data as data collected with 100% consistent occupation classification codings in the same year, it is much more complicated with the PSFD datasets as it adopts different versions of occupation classification standards in different years. To overcome the differences and avoid the inconsistency and incongruence of the analysis results due to inconsistent classifications of the STEM areas, the research team has spent a great amount of time to recode and reconstruct the occupational classifications. Detailed data processing and recoding are available upon request.

Table 1 Datasets used in this study

Survey/Data	Cohort	Obs. years	Advantages	Disadvantages
PSFD RI 2009 RR2010 RR2011 RR2012 RR2014 RR2016 RR2018	1977-1983	2009-2018	Continuous data collection Providing consistent and coherent information on respondents employment status, marital status High feasibility and suitability for sequence analysis Sequence analysis→capturing trajectories Small sample size→insufficient statistical power in modelling	Insufficient STEM sample size Data attrition Lack of detailed work environment information Lack of women's personal attitudes and self- assessments
TEPS TEPS-B 2010	1981-1986 (Panel 1 SH)	2001-2010	Large sample size Data reliability and credibility problem (as work history data is collected retrospectively and not always collected from respondents themselves.)	Lack of detailed work environment information Lack of women's personal attitudes and self- assessments
Career stage online survey (self-designed questionnaire)		Undefined/ Depending on respondents' tenures	Providing pertinent work environment information, women's personal attitudes and self-assessments.	Snowballing/purposive sampling Small sample size

Note: For the distributions of respondents' genders and career status of the TEPS-B and PSFD data sets, please see Appendix 1.

1.1 TEPS-B

Previous studies (e.g. Chen, 2013) of students' gender belief and curriculum track selection used the longitudinal data from Taiwan Educational Panel Surveys (臺灣教育長期追蹤資料庫), which first collected data in 2000 with a sample of 20000 junior high school students and 2000 senior high school students. Since 2009, a series of follow-up surveys (TEPS-B) started collecting the data from the same samples who turned into grown-ups. TEPS has the advantages of large sample size and providing retrospective work history information. In this study, data from the TEPS-B, the follow-up survey conducted through face-to-face interviews in the year 2010 was adopted, which contains a total sample size of 3815.

1.2 PSFD

The Panel Study of Family Dynamics started in the year 1999. The data collection was conducted through face-to-face interviews with randomly sampled respondents born in 1953-64. Since then, the follow-up surveys were conducted every year before 2012. After 2012, the follow-up surveys were conducted every two years. Starting from 2000, children of the adult samples were also interviewed with a separate questionnaire and re-interviewed in the follow-up surveys. Since 2004, children who reach the age of 25 are included in the adult sample for follow-ups. PSFD has the advantages of containing information on both education and employment (i.e. work sector and position). Moreover, the data is continuously collected without gaps. As this research attempts to investigate women's career trajectories from a life-course perspective, it is preferable to acquire the data which covers the whole life-career span. However, in reality, it is not possible. Given the limits in data, PSFD has provided the longest span in terms of time by comparison to other datasets. In this study, data of the main respondents of birth cohort 1977-1983 who joined the survey since 2009 was used. Data collected in 2009 and the follow-up data collected from 2010 to 2018 were adopted in the analysis.

1.3 Career stage online survey

Apart from the above two datasets, the research also administered an online survey with a self-designed questionnaire. As mentioned in the above discussions, the currently available data was limited in providing the information on the work environment, but it still offers valuable results with randomly sampled large-scale data. With the restraints of time and resources, though not ideal, the researcher distributed the questionnaires through snowballing and purposive sampling, which obviously undermined the representativeness of the sample and the extent of the generalization based on the results. Notwithstanding, the survey may still offer some valuable insights on women's work status in STEM by incorporating questions concerning the following aspects: 1.Personal attitudes, including respondents' gender role attitudes, self-assessment, work engagement, and professional role conflicts, 2. Family pull, including work-family conflicts, 3. Work push, including observed work environment hostility, perceived gender identity threats, 4. KCM scales (i.e. the authenticity, balance, and challenge scales) designed by Sullivan et al. (2009), which were then translated by the researcher into mandarin Chinese and used in the survey.

To assess the reliability and validity of the survey, a pre-test was run with a sample of 30 respondents. After that, revisions were made and the final version of the questionnaire was created (see Appendix 2) and distributed. Eventually, after removing the invalid questionnaires, a sample of 165 respondents was used in the analysis.

2. Methods

2.1 Sequence analysis

In order to investigate the dynamic career development of women in the IT workforce, this study plans to adopt sequence analysis to track the changes at different career stages. Sequence analysis is not a new research approach in social science. Many studies have used other research methods and attempted to tackle the problems with cause and effect and the order of time sequences (Abbott, 1995). Nonetheless, the said sequence analysis in this research proposal is originated in informatics and widely used in biology for DNA sequence alignment, and later adopted by social scientists for the sequence analysis of social events (Abbott & Forrest, 1986; Abbott & Hrycak, 1990; Abbott, 1995, 2001; Abbott & Tsay, 2000). Sequence analysis not only could depict the trajectories of individuals' career status over time and hence establish a life-course development sequence, but also measure the distances between different sequences with the optimal matching method.

Optimal matching was introduced in 1986 to help disentangle the sequence alignment problems encountered by social scientists when dealing with complex and sometimes even chaotic social and life events. The method has since been used in life courses, career trajectories, and language analyses. Optimal matching algorithms run with simple algebras which generate the matrix of distances between sequences. The metric distances are calculated based on the cost of substitution, insertion or deletion (indel). The distances between sequences are calculated based on the minimum cost of substitution and indel cost required to transform one sequence into another (Abbott & Tsay, 2000). Following the results of optimal matching, cluster analysis would be applied to group sequences into different types of career developmental paths.

Many sequence analyses were conducted using the software R or Stata. This study used the SADI package developed by Halpin (2017) to carry out the analysis. In practice, when using sequence analysis, there are some data requirements. One of them concerns the handling of missing data. Ideally, data of samples should be continuously collected throughout the years without missing (Halpin, 2017). Although some studies managed to include the missing data into analysis by treating "missing" as a status, this raised potential problems, such as the calculation of the cost (Piccarreta & Studer, 2019). To minimize confusion, this study excluded respondents without complete spells from all sequence analyses. The procedures of sequence analysis and cluster analysis for each dataset are explained respectively in the following sections of analysis.

IV. Analysis results

By incorporating three different datasets, this section contains a great amount of data. To increase readability and avoid complicating the matter further, this section is structured into three parts. Each part contains a section introducing the analytical procedures, which is followed by the presentation and discussions of the results. To confine the discussions within the research focus, only the results pertinent to research questions are presented while a lot of preliminary analysis results are omitted or available in the appendix.

Before getting into the details, note that the analysis results of each section correspond to respondents at different life stages. Therefore, these analyses are not repeated and meaningless efforts, but a strategic attempt to address the research question with the available data and feasible methods. Specifically, section 1 looks into respondents in their early 20s, who are most likely those at the early career stage. As suggested by KCM, they are probably those desire more challenges and less affected by demands for work-life balances. Section 2 examines respondents in their late 20s to early 40s. These respondents are likely to be at their middle career stage with a higher desire for balance and authenticity. Section 3 focuses on mapping the KCM model on respondents across early, mid and late career stages. Although with small sample size, the analysis results based on the online survey still shed some light on women's situations in STEM.

1. TEPS

To answer the research questions with the advantages of the large sample size of TEPS-B, this study has pursued three analysis steps. First, this study conducted a descriptive analysis and provided an overview of respondents' employment and work history in STEM workforce. By doing so, the first research questions were also addressed. Second, this study adopted a statistical modeling approach and ran a logistic regression analysis to elicit the factors associated with the entrance and retention in the STEM. Third, career paths were established with the adoption of a sequence analysis. The characteristics of respondents across distinct career paths were discussed.

1.1 Descriptive analysis

The descriptive analysis first looks into the retention rate of STEM talents from the education stage to the employment stage, two variables in the TEPS-B were used. The first variable used is the occupational area of respondents' first job, and the second one is respondents' occupational status in STEM—ever entered and never entered STEM, which accounts for their employment information throughout 2001-2010.

The results in Table 2 show that, of those with a STEM educational background, 6.5% of women entered STEM workforce at their 1st jobs whereas 19.8% of men did. The gender difference was distinct. Nonetheless, in terms of the percentages of respondents who "ever-entered" STEM workforce (Table 3), the gender gap was evidently small. Moreover, a comparison with Table 4 shows that when the sample was limited to those with STEM educational qualifications, there is no significant differences across genders. However, when the data was no longer capped with a STEM educational background, gender differences become distinct with men apparently more likely being in STEM than women.

Table 2 Occupational areas of the 1st job for respondents with a STEM educational background by genders (percentage by row)

	Occupational areas		
	Non-STEM	STEM	N
Gender			
Men	80.2	19.8	1846
Women	93.5	6.5	1969
All	12.4	38.1	3815

Pearson chi2(1) = 0.1336 Pr = 0.715

Table 3 Percentages of respondents with a STEM educational background ever entered STEM workforce by genders (percentage by row)

	Occupational areas		
	Never entered STEM	Currently or was in STEM	N
Gender			
Men	69.0	31.0	1016
Women	70.2	29.8	245
All	69.2	30.8	1261

Pearson chi2(1) = 0.1352 Pr = 0.713

Table 4 Percentages of All Respondents ever entered STEM workforce by genders (percentage by row)

	Occupational areas		
	Never entered STEM	Currently or was in STEM	N
Gender			
Men	80.2	19.8	1846
Women	93.5	6.5	1969
All	97.1	12.9	3815

Pearson chi2(1) = 151.5032 Pr = 0.000

The analysis then examines STEM employees' attrition rate in the first three years. Table 5 shows the results. Surprisingly, of those ever entered the STEM workforce, after three years, women, though fewer in numbers, were more likely than men to stay in the workforce. Table 6 presents another unexpected result. By taking respondents' employment information across years into account, this study calculated the percentages of women ever in the managerial position in the STEM workforce by tracing respondents' yearly occupational positions from 2001 to 2010. The results showed that, of women who ever-entered STEM workforce, regardless of their educational background, 10% of them had been in a managerial position at least once during their 2001-2010 career. This percentage, although was slightly lower than it was for men, the difference was not as distinctive as expected.

Table 5 Percentages of respondents' drop-out of STEM workforce after 3 years in STEM occupations by gender (percentage by row)

	Drop-out or stay in STEM after 3 years		
	Drop-out	Stay	N
Gender			
Men	94.0	6.0	366
Women	77.2	22.8	127
All	89.7	10.3	493

Pearson chi2(1) = 28.7729 Pr = 0.000

Table 6 Percentages of Women and Men holding managerial positions in the STEM

	employee	Supervisors/ managers	Total in STEM	% in managerial position
Women	114	13	127	10.23
Men	327	39	366	10.65

Whereas the descriptive analysis concerning the first three research questions delineate a rather positive picture of a gender-balanced STEM work environment, there remains an essential puzzle unsolved—how to explain the relatively small number of women in the field? To answer this question, this study then looks into the determinants of women's retention in the workforce.

In comparison with the above three questions, this question is probably the most complex and difficult one as it addresses an issue, which by its essence, is entangled with multiple aspects and various factors. To explain why women stay or leave a workforce is no easy task. Accordingly, one cannot presume to find an easy answer.

1.2 Logistic regression analysis

In light of the career development literature, it is argued that at different stages, a woman's career decision, including staying or leaving an organization, a work area, or even the labor market, was affected by different factors.

For those newly joined the labor market, and this is probably the case for most respondents in the TEPS-B data, a stable work environment, including proper employee welfare and stable income might matter more than their chances of getting promoted; whereas for those with 2 or 3 years of work experiences, future career prospects, such as pay raises, may become significant. Having said this, however, there was generally a lack of proper data on the work environment, organizational culture in particular. Fortunately, TEPS-B collected data on respondents' wages, working hours, numbers of staff at each job. Nonetheless, data on the promotion system, gender ratio, or relationships with supervisors were not collected. Eventually, given the available information in the TEPS-B, other than using respondents' employment status as a dependent variable, the following analysis also used information of respondents' education, gender beliefs, working hours, salaries, and number of colleagues at STEM jobs, and their parents' education and occupations. In order to tackle this research question, before conducting a sequence analysis, this study first adopted regression analysis, which generated some interesting results.

To elucidate the relationships between independent variables and respondents' entrance or retention in the STEM, in the regression analysis this study used four groups of samples: 1. All respondents (including male and female with all educational backgrounds), 2. Respondents with a STEM educational background, 3. Respondents with STEM work history, 4.Female respondents.

Table 7 shows the results of all respondents' likelihood of "ever entered" STEM workforce by comparison with "never entered". The logit regression analysis found that although there was significant gender difference when other factors were not accounted for, once controlling for educational levels and areas, the significant effect disappeared. Moreover, parents' education, occupational areas[2], as well as respondents' gender belief were not significantly related whereas respondents' educational levels and areas were highly significant throughout the four logit models.

Table 7 Logit regression analysis results of all respondents entered STEM (contrasts with "never entered STEM workforce")

	1	2	3	4
Sex(Men=ref)				
Women	-1.27***	- 0.143	- 0.101	- 0.140
Education(Junior College=ref)				
University		1.019***	0.99***	0.97***
Post-graduate		1.638***	1.616***	1.574***
Education areas (non-STEM=ref)				
Science		1.620***	1.626***	1.626***
T/E/M		2.408***	2.423***	2.452***
Father's education (Junior high and Lower=ref)				
Higher sec			- 0.166	- 0.172
Junior College			0.020	- 0.009
Tertiary			0.033	0.007
Father's occupational area (non-STEM=ref)				
STEM			0.115	0.105
Gender Belief 1—Disagreement to Gendered division of labor				0.116
Gender Belief 2—Disagreement to Science is for men				0.023
Constant	- 1.397***	-4.092***	- 4.047***	- 4.507***
Log likelihood	- 1390.2215	-1168.1614	-1129.134	-1126.7682
Chi-square	156.45***	600.57***	581.51***	585.4***
N	3815	3815	3671	3668

* p < 0.05; ** p < 0.01; *** p < 0.001

Table 8 shows the results of respondents with a STEM educational background and their likelihood of entering STEM workforce. As the respondents were limited to those with a STEM educational background, the results were expected to be, and

[2] In the presented results, the father's education and occupational areas were adopted in the analysis. However, in the analysis, I have also looked into the father's educational areas, mother's education and occupation. But as they were found without any significant relationships with respondents' STEM careers throughout the whole analysis across different samples. There were not presented in the final report here.

indeed, different from that in Table 7. Gender difference was not found in model 1, but becoming significant after controlling for father's education and occupation in model 3 with a surprising higher likelihood of women entering the STEM workforce than men. In model 4, for the very first time that gender belief was found significantly related to respondents' entrance into the STEM workforce in a way that respondents with stronger disagreement to the gendered division of labor (i.e. men are breadwinners whereas women are housekeepers) were more likely to enter the STEM workforce. The significant relationship with women with a STEM educational background entering the STEM workforce than their male counterparts shows that the current gendered workforce may be considerably attributed to the gender imbalance at the education stage. In other words, to improve the gender disparities at workplaces, the governments and educators should endeavor to fix the gender imbalance at the education stage as the primary and the most significant selection process might have already taken its toll during school years.

Table 8 Logit regression analysis results of respondents with educational background entered STEM (contrasts with "never entered STEM workforce")

	1	2	3	4
Sex(Men=ref)				
Women	-0.057	0.337	0.434*	0.378*
Education(Junior College=ref)				
University		1.288***	1.278***	1.238***
Post-graduate		1.935***	1.917***	1.849***
Education areas (Science=ref)				
T/E/M		0.954***	0.998***	1.035***
Father's education (Junior high and Lower=ref)				
Higher sec			- 0.095	- 0.103
Junior College			0.118	0.076
Tertiary			0.298	0.254
Father's occupational area (non-STEM=ref)				
STEM			0.141	0.108
Gender Belief 1—Disagreement to Gendered division of labor				0.191**
Gender Belief 2—Disagreement to Science is for men				- 0.038
Constant	-0.800***	-2.946***	- 3.014***	- 3.521***
Log likelihood	-778.273	-731.175	-699.339	-695.780
Chi-square	0.14	94.33***	98.64***	105.76***
N	1261	1261	1209	1209

* p < 0.05; ** p < 0.01; *** p < 0.001

Table 9 focuses on respondents with STEM work history. That is, those who ever entered the STEM workforce during 2001-2010. Among them, two groups of models were constructed to examine the factors affecting their likelihood of staying for more than 1 year and 2 years, respectively. In line with the results found in the descriptive analysis, instead of men, women were found more likely to stay longer in the STEM. This result contradicts the literature as the literature generally suggests that women are more likely to leave STEM workforce due to masculine organizational culture, biased evaluation or promotion systems associated with gendered stereotypes. However, despite a contradictory finding, the gendered work environment described in the literature was still very likely to be the case with these respondents as the current observation based on the TEPS-B data may be affected by some factors specifically pertinent in the Taiwanese context. One of the factors particularly associated with the 20-something respondents in the TEPS-B, was that most male respondents probably experienced employment gaps due to military service. The military service obligation might contribute to men's temporary leaves from the STEM workforce or their relatively shorter stay at the STEM. In comparison, women were not obligated to carry out the military service, which probably gave them a longer career path after graduation.

Moreover, the results in Models 6-8 showed that respondents with post-graduate educational qualifications were less likely to stay in the STEM workforce for more than 2 years. Whereas this relationship between higher education and lower STEM retention seems unexpected, the fact that many respondents in the TEPS-B were still at the stage of education advancement may help to explain. Specifically, this significant relationship with post-graduate educational level is most likely due to the late entrance into the labor market among those highly-educated respondents, or a higher likelihood of STEM employees interrupting their career for education advancement.

Table 9 Logit regression analysis results of respondents with STEM work history

	Likelihood of respondents stayed for more than 1 year (contrasts with "leaving within 1 year")				Likelihood of respondents stayed for more than 2 years (contrasts with "leaving within 2 years")			
	1	2	3	4	5	6	7	8
Sex(Men=ref)								
Women	0.553**	0.629**	0.665**	0.670**	1.295***	1.319***	1.348***	1.325***
Education(Junior College=ref)								
University		0.592	0.532	0.468		- 0.038	- 0.101	- 0.076
Post-graduate		- 0.218	- 0.297	- 0.368		- 1.678**	- 1.730**	- 1.700**
Education areas (non-STEM=ref)								
Science		0.298	0.284	0.274		0.364	0.512	0.515
T/E/M		0.446	0.520*	0.492		0.321	0.443	0.466
Father's education (Junior high and Lower=ref)								
Higher sec			- 0.252	- 0.234			- 0.788**	- 0.803**
Junior College			- 0.094	- 0.102			- 0.073	- 0.100
Tertiary			- 0.037	- 0.048			- 0.451	- 0.457
Father's occupational area (non-STEM=ref)								
STEM			0.195	0.169			- 0.468	- 0.476
Gender Belief 1—Disagreement to Gendered division of labor				0.065				- 0.004
Gender Belief 2—Disagreement to Science is for men				- 0.107				0.090
Constant	-0.055	-0.689	-0.568	- 0.364	-1.533***	-1.361**	- 1.058*	- 1.402
Log likelihood	-337.762	-327.877	-316.446	-315.732	-258.330	-239.880	-228.783	-228.459
Chi-square	7.02**	26.79***	28.34***	29.77**	32.8***	69.70***	78.92***	79.57***
N	493	493	478	478	493	493	478	478

Whereas logit regression analyses on samples containing both men and women offer a footing for gender comparisons, Table 10 focuses on female respondents in an attempt to further elicit the factors associated with women's entrance and stay in the STEM. Among the female respondents, two subgroups of samples were used: 1. All female respondents (Models 1-3 in Table 10), 2. Female respondents with STEM work history (Models 4-9).

In the model containing female respondents of all educational backgrounds, as expected, those with STEM educational backgrounds were more likely to enter the STEM workforce and so were those with post-graduate qualifications. Moreover, female respondents with stronger gender beliefs that science is not just for men, were also found significantly more likely to enter the STEM workforce.

Whereas the results in Models 1-3 were pretty much in line with the literature, the analysis in Models 4-9 generated some tricky discoveries. While most of the independent variables were found not significantly related to women's entrance or stay in the STEM, respondents' educational qualifications and father's educational levels were significantly related. While the former significant relationship could be explained by the afore-mentioned mechanism of education advancement, the association between respondents' lower likelihood of staying in the STEM for more than 1 or 2 years and father's junior college education was not easily explained. Combining this results with the finding related to respondents' personal educational qualifications, one speculation is that respondents with fathers obtaining junior college educational qualifications were probably more likely to pursue education advancement and subsequently more likely to have shorter career paths. However, as the sample size was rather small, both the analysis results and the interpretations are limited and to be treated with care.

Table 10 Logit regression analysis results of female respondents

	Respondents entered STEM workforce / Sample with a STEM educational background (contrasts with “never entered STEM workforce”)			(Respondents stayed for more than 1 year / Sample=ever entered STEM workforce (contrasts with “leaving within 1 year”)			Respondents stayed for more than 2 years / Sample=ever entered STEM workforce (contrasts with “leaving within 2 years”)		
	1	2	3	4	5	6	7	8	9
Education(Junior College=ref)									
University	0.596	0.561	0.563	1.001	1.314	1.279	2.016	2.226*	2.259*
Post-graduate	0.955*	1.048*	1.041*	0.033	0.527	0.529	- 0.279	- 0.110	- 0.070
Education areas (non-STEM=ref)									
Science	1.959***	1.990***	1.992***	0.459	0.514	0.526	0.400	0.460	0.460
T/E/M	3.359***	3.438***	3.489***	- 0.005	0.328	0.368	0.058	0.320	0.366
Father’s education (Junior high and Lower=ref)									
Higher sec		- 0.222	- 0.249		- 0.661	- 0.642		-0.665	- 0.687
Junior College		- 0.450	- 0.510		- 2.536***	- 2.586***		-2.117*	- 2.128*
Tertiary		- 0.423	- 0.451		- 0.905	- 0.912		0.172	0.198
Father’s occupational area (non-STEM=ref)									
STEM		0.098	0.190		0.492	0.505		-0.602	- 0.639
Gender Belief 1—Disagreement to Gendered division of labor			- 0.007			0.055			- 0.081
Gender Belief 2—Disagreement to Science is for men			0.253*			0.129			0.197
Constant	-4.037***	-3.830***	-4.688***	-0.286	-0.111	-0.784	-1.808	-1.662	-2.102
Log likelihood	-374.725	-360.867	-357.975	-80.647	-71.202	-70.963	-74.480	-68.248	-67.905
Chi-square	192.41***	193.92***	199.29***	7.12	21.14**	21.62*	25.32***	33.82***	34.51***
N	1969	1893	1890	127	124	124	127	124	124

Based on the findings above, given a limited sample size of respondents with STEM work history, this study attempted to look into the impact of organizational factors by comparing the means in the number of staffs, monthly wages, and weekly working hours at STEM jobs between the "STEM stayers" and "STEM leavers".

Table 11 shows the means of the three organizational factors of female respondents who joined STEM workforce and then left within 1 year and those who stayed for more than 1 year. Judging from the numbers presented in the table, those who stayed in the STEM seemed to have higher monthly wages and longer working hours. However, while this helps to offer a glimpse of their work environments, none of these differences was statistically significant, which may be partially due to small sample size. Moreover, the comparison in Table 11 did not account for those who returned to the STEM workforce after gaps (e.g. Respondent A in Table 12), but only those with continuing STEM employment history (e.g. Respondent B in Table 12). The various STEM career paths, such as the different paths listed in Table 12, highlight the necessities of an examination from a holistic approach, which helps to capture the career trajectories for a longer period of time.

Table 11 Means of number of staffs, monthly wages, weekly working hours of female respondents with STEM work history

	Stayers	Leavers	T-test (Stayer-Leaver) (P-Value)
Number of staffs/ organization scale	300-499 6.01 (0.26)	300-499 6.55 (.35)	-1.25 (p=0.21)
N	69	45	
Monthly wages	30362.34	27587.39	1.69 (p=0.093)
N	77	46	
Weekly working hours	46.05	45.94	0.059 (p=0.95)
N	78	48	

Note: The variable "number of staffs" contains 13 missing values while "monthly wages" and "weekly working hours" contains 4 and 1 missing values, respectively.

Table 12 An example of work sequences of respondents between 2001-2010

Respondent	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
A	U	U	U	S	N	N	N	S	S	S
B	U	U	U	U	U	U	U	S	S	S

Note: U=unemployed, S=STEM job, N=Non-STEM job

1.3 Sequence analysis

As a follow-up survey to TEPS, TEPS-B collects respondents' status after they reached adulthood and entered the labor market. Although TEPS-B is a longitudinal-based dataset, it does not track the status of respondents annually. However, in 2010, through face-to-face interviews, TEPS-B surveyed respondents and collected their employment status in retrospective since the year 2001. Based on the details of respondents' yearly employment information, employment sequences were constructed. For proper analysis and comparisons, in the section of sequence analysis, this study chose to use respondents' age, instead of years, as the horizontal axis indicating the progression of time and confined the sample within those with a STEM educational background (i.e. STEM majors, minors, or double-majors since college level). Given the insufficient observation length with samples born in 1982, 1986, and 1987, this study limited the sample to those born in 1983, 1984, and 1985 and established their career paths from age 18 to 25 (please see Table 13). As "career" pertains to multiple aspects in life, based on the age frame of the TEPS-B respondents, this study incorporated the information of respondents' employment and education and constructed the "education-employment status" variable, which classified respondents' career status from age 18 to 25 with four categories: 1. Studying[3], 2. Unemployed (i.e. neither studying nor working), 3. Working at non-STEM job, 4. Working at STEM job.

Table 13

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	N
1983	18	19	20	21	22	23	24	25	26	27	49
1984	17	18	19	20	21	22	23	24	25	26	1204
1985	16	17	18	19	20	21	22	23	24	25	2536

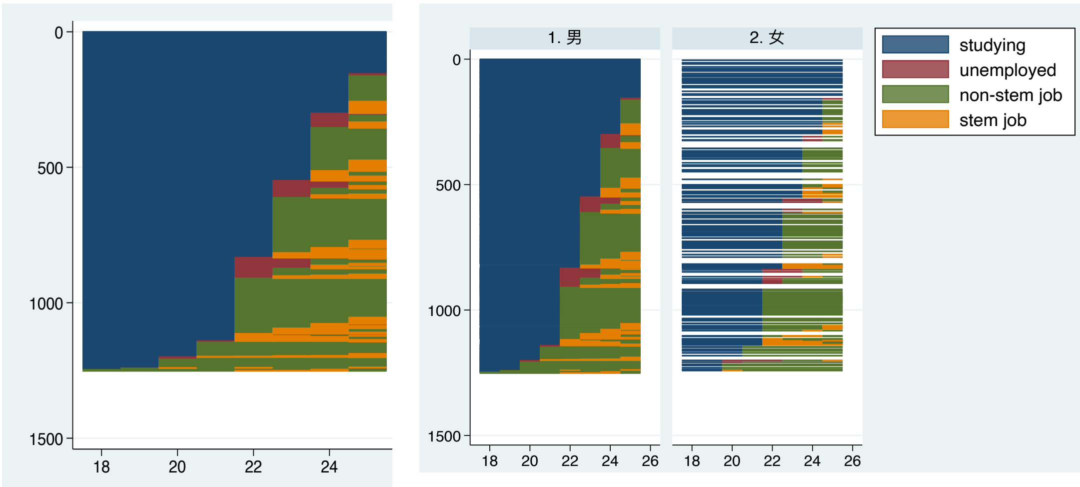
As explained earlier, the sequence analysis method is adopted to capture the dynamics of career trajectories over time. Instead of examining single transitions or changes at a singular point in time, sequence analysis is used to discover the distinct career paths from a holistic perspective. This study used the SADI package of STATA developed by Halpin (2017) to carry out the analysis. After aligning the sequence of individuals' yearly career status over 8 years, the optimal matching method, with the adoption of the Needleman–Wunsch algorithm, was employed to compare the distances between different sequences. The distances between sequences were calculated based on the minimum cost of substitution and indel (insertion and deletion) cost required to transform one sequence into another (Abbott & Tsay, 2000). Whereas there is no definite and perfect substitution and indel cost settings, previous studies on career paths have come out with various standards as to how to verify the validity of the settings. After experimenting with various settings, including the often-adopted transition-based substitution cost, this study eventually follows the literature and adopted the approach of combining theories and data, and generated a substitution cost based on the inversed-coefficients. With indel cost set as 1, this substation cost was adopted since this setting generated a result most pertinent to the research focus.

Following the results of optimal matching, cluster analysis was applied with Ward's method to group sequences into different clusters of housing transitions. After comparing different cluster solutions with dendrogram, Calinksi and Harabasz's F-statistic and the R^2 which measures the amount of heterogeneity within the whole sample accounted for by the clusters, different cluster solutions were also examined

[3] In the original dataset, some respondents reported they were studying and working within the same year. While it is true in many cases that full-time job employees may pursue higher degrees as part-time students, an examination of the original data showed that most of these cases self-reported as full-time students. Thus, for a clearer examination with minimized overlapping confusions, this study classified those stated themselves as still in education and holding employment positions simultaneously as "studying".

visually. Eventually, the 6 cluster result was selected as it offers a richer picture of the dynamic housing trajectories in relation to the research focus.

Figure 1 shows the index plot of the career path of all sample and men vs women and demonstrates the diverse career path from education to the workforce as some experienced unemployment whereas the others entered into STEM workforce straightaway. To examine the gender differences of the traversed career paths, a comparison of the average lengths of each career status was also generated (see Table 14).



(a) (b)

Figure 1 Sequence index plots of all respondents (a); and of male and female respondents (b)

Table 14 Average number of elements, episodes, and lengths of each career status by genders

	Ave. no. of elements	**Ave. no. of episodes**	**studying**	**unemployed**	**Non-stem job**	**Stem job**
Sex						
Men (1009)	2.23	2.26	5.37	0.28	1.95	0.40
Women (242)	2.17	2.19	5.16	0.12	2.2	0.52

Generally, as Table 14 shows, women worked longer and spent a shorter time in education than men. The gender difference in education length may be associated with the traditional gender role expectation of men obtaining higher educational qualifications than women. Whereas this gender role ideology might also contribute to the differences in the employment length as women left education earlier, it could also be attributed to the military service obligations on men. Overall, the gender difference was persistent and evident in their traversed career paths.

Following the preliminary examination on the career path, a cluster analysis was conducted and 6 distinct career pathways were found (see Figure 2).

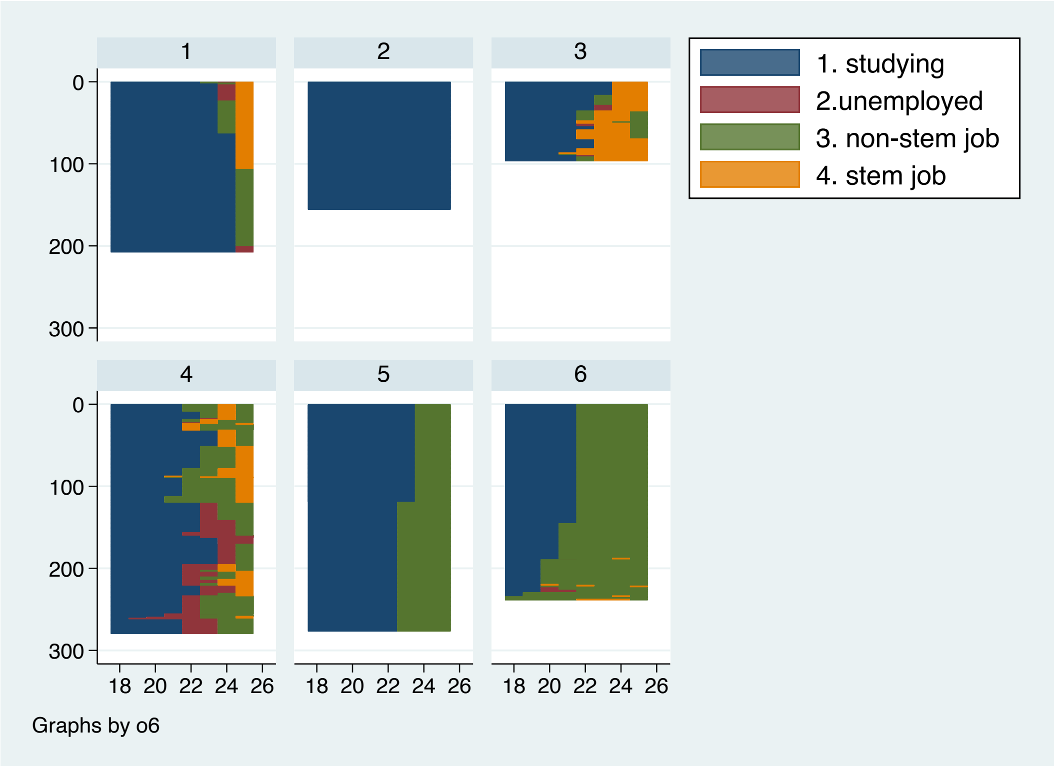


Figure 2 Cluster analysis results—6 career pathways.

Apart from respondents in the Cluster 2—the student path, most respondents already entered the labor market by the age of 25. Among all, Cluster 1 (early career path) contains respondents at their earliest career stage as most of the respondents in Cluster 1were in education before age 23. As they were still at the dawn of their career, there was rarely any transition observed in this cluster.

Clusters 5 and 6 contain respondents who entered non-STEM workforces. These two non-STEM pathways are very much alike with merely a difference in respondents' ages of entering employment. Whereas respondents in Cluster 5 left education and entered non-STEM employment around age 22, respondents in Cluster pursued non-STEM careers earlier from around age 18.

In contrast, Clusters 3 and 4 consist of respondents who entered the STEM workforces. With a relatively evident STEM employment concentration, Cluster 3—the STEM career path—is the cluster most pertinent to the research focus in TEPS-B data as it shows a most evident path of leaving STEM education field and entering STEM employment. However, given a small proportion of respondents being grouped into this cluster, it suggests that a transition from STEM education into a STEM career is not as frequent or common as a transition from STEM education to a non-STEM career found with clusters 5 and 6.

The traversed trajectories of Cluster 4—the career transition path—are the most diverse. While respondents in this cluster were similar to their counterparts of other clusters and stayed in education before age 22, their paths parted after leaving education with more than 50% of them experienced unemployment for the first few years. The uncertainty of the career path demonstrated in this cluster is most characteristics among young career seekers with nearly a quarter of the sample embarking on this path.

To summarize, of respondents with STEM educational backgrounds, the above analysis found that less than half of the respondents embarked on the STEM career path before age 25. Whereas respondents in Clusters 1, 3, 4 entered the STEM workforce after education, those in Clusters, 2, 5, 6 seemed to drift away from the STEM field.

The analysis then set out to elucidate the factors associated with respondents' probabilities of embarking on a certain career path by firstly comparing the differences of respondents' characteristics across 6 clusters.

Table 15 shows the distribution of respondents in 6 clusters by their characteristics. As expected, there are distinct differences in respondents' likelihood of entering different career paths across genders and educational levels and areas. However, some results are not as straightforward as the results in the previous section. **For example, chi^2 test in the cross-tabs finds that, by comparison with men, women seemed to be more likely to enter Cluster 3, but less likely to enter Clusters 1 and 4. This demonstrates the distinctions between the analyses focusing on single transitions and the analyses taking the whole trajectories into account. While single transitions are already intertwined with multiple levels of factors, trajectories are susceptible to static and dynamic factors at the same time.** The different directions of associations between genders and Clusters 3 and 4 show that women's entrance or retention in the STEM is probably complicated by their education path and personal life course development. Whereas respondents in Cluster 4 entered the labor market later than those in Cluster 3, it is speculated that those in Cluster 4 spent a longer time pursing higher educational qualifications while those in Cluster 3 probably entered the STEM workforce soon after graduating from college or university. Thus the gender difference observed in Table 15 may be largely due to educational differences.

Table 15 Distribution of respondents across 6 career pathway cluster by individual characteristics (% by row)

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	N
Sex***							
Men	17.64	12.78	**6.24**	23.79	21.61	17.94	1009
Women	11.98	10.74	**13.64**	16.12	23.97	23.55	242
Education***							
Junior College	1.52	3.03	**1.52**	15.15	9.85	68.94	132
University	9.17	4.65	**10.05**	29.52	28.14	18.47	796
Post-graduate	40.87	35.29	**4.33**	7.43	12.07	0.00	323
Educational area***							
Science	13.51	14.05	**5.14**	17.30	29.73	20.27	370
T/E/M	17.82	11.69	**8.74**	24.40	18.84	18.50	881
Father's education***							
Non-lower sec	14.20	8.56	**9.19**	20.04	22.13	25.89	479
Higher sec	19.41	10.57	**6.63**	23.34	24.08	15.97	407
college	13.61	20.71	**8.28**	19.53	21.30	16.57	169
Tertiary	19.86	19.18	**6.85**	30.14	15.75	8.22	146
Mother's education***							
Non-lower sec	13.75	9.00	**9.17**	19.35	22.92	25.81	589
Higher sec	19.39	13.55	**7.71**	24.07	22.90	12.38	428
college	24.74	21.65	**2.06**	18.56	16.49	16.49	97
Tertiary	16.90	19.72	**7.04**	30.99	19.72	5.63	71
Father's education area*							
Non-STEM	16.68	11.64	**7.56**	21.89	22.68	19.55	1151
STEM	15.00	21.00	**9.00**	27.00	15.00	13.00	100
Father's occupational area							
Non-STEM	16.28	12.19	**7.59**	22.25	22.34	19.35	1173
STEM	20.51	15.38	**8.97**	23.08	17.95	14.10	78
Occupational area at 1st job***							
Non-STEM	15.16	12.51	**4.75**	21.28	24.66	21.64	1095
STEM	26.28	11.54	**28.21**	29.49	3.85	0.64	156
Average monthly wages 2001-2010***	25303.04	19236.67	**29182.48**	26455.23	22215.07	22780.41	1226
Average weekly working hours 2001-2010***	41.55	38.23	**44.41**	45.80	43.10	48.87	1244
Gender Belief 1—Gendered division of labor							
agree	14.10	12.78	**4.85**	18.94	26.87	22.47	227
Neutral	16.12	12.09	**7.33**	26.37	16.48	21.61	273
disagree	17.44	12.38	**8.66**	21.84	22.64	17.04	751
Gender Belief 2—Science is for men***							
agree	20.69	16.30	**10.03**	22.88	16.61	13.48	319
neutral	13.81	7.84	**5.60**	24.25	23.51	25.00	268
disagree	15.66	12.35	**7.38**	21.23	24.10	19.28	664
Marital status							
18-25 unpartnered	17.0	12.8	**7.1**	22.3	22.0	18.8	1168
18-25 married/cohab*	9.6	6.0	**15.7**	22.9	22.9	22.9	83

* p<0.05; ** p<0.01; *** p<0.001

This study then narrows down the analytical lens to focusing on female respondents only. Table 16 shows the distribution of respondents in 6 clusters by their characteristics. The association between a higher percentages of female respondents in the Cluster 3 and a lower educational qualification signals a possibility that, in the TEPS-B data, women who entered STEM workforce probably left education relatively early, which in turn led to a longer career path. However, lower educational qualifications might also lead to lower income and occupational positions. This might help to explain why for women, as shown in Table 16, those in Cluster 3 did not enjoy a higher income as demonstrated in Table 15. The following logit regression analysis further examined the above observations.

Table 16 Distribution of **female** respondents across 6 career pathway cluster by individual characteristics (% by row)

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	N
Education***							
Junior College	5.26	0.00	**0.00**	5.26	10.53	78.95	19
University	4.76	4.17	**18.45**	19.64	27.98	25.00	168
Post-graduate	36.36	34.55	**3.64**	9.09	16.36	0.00	55
Educational area***							
Science	9.03	9.68	**9.03**	12.90	30.97	28.39	155
T/E/M	17.24	12.64	**21.84**	21.84	11.49	14.94	87
Father's education							
Non-lower sec	9.38	8.33	**16.67**	14.58	20.83	30.21	96
Higher sec	13.89	8.33	**18.06**	16.67	26.39	16.67	72
college	13.33	13.33	**3.33**	13.33	30.00	26.67	30
Tertiary	17.24	13.79	**10.34**	20.69	20.69	17.24	29
Mother's education†							
Non-lower sec	7.56	8.4	**17.65**	15.13	21.01	30.25	119
Higher sec	16.88	14.29	**12.99**	12.99	28.57	14.29	77
college	15.00	10.00	**0.00**	25.00	15.00	35.00	20
Tertiary	25.00	12.50	**12.50**	25.00	18.75	6.25	16
Father's education area							
Non-STEM	11.50	9.73	**14.16**	16.37	25.22	23.01	226
STEM	18.75	25.00	**6.25**	12.50	6.25	31.25	16
Father's occupational area							
Non-STEM	11.89	10.57	**13.22**	16.74	24.23	23.35	227
STEM	13.33	13.33	**20.00**	6.67	20.00	26.67	15
Occupational area at 1st job***							
Non-STEM	11.90	11.90	**8.10**	13.33	27.62	27.14	210
STEM	12.50	3.12	**50.00**	34.38	0.00	0.00	32
Average monthly wages 2001-2010***	27217.28	20135.82	**26975.09**	27633.05	22830.65	20821.63	237
Average weekly working hours 2001-2010	42.40	38.60	**42.51**	44.73	43.10	44.50	241
Gender Belief 1—Gendered division of labor							
agree	5.56	16.67	**16.67**	16.67	27.78	16.67	18
Neutral	15.38	0.00	**15.38**	7.69	30.77	30.77	26
disagree	12.12	11.62	**13.13**	17.17	22.73	23.23	198
Gender Belief 2—Science is for men							
agree	15.38	13.46	**11.54**	23.08	13.46	23.08	52
neutral	10.87	6.52	**10.87**	15.22	26.09	30.42	46
disagree	11.11	11.11	**15.28**	13.89	27.08	21.53	144
Marital status							
18-25 yrs unpartnered	12.2	11.3	**13.1**	16.2	23.4	23.9	222
18-25 married/cohab	10.0	5.0	**20.0**	15.0	30.0	20.0	20

†p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Tables 17 and 18 present the results of logit regression analysis on Clusters 1, 3, and 4 for all respondents and female respondents, respectively. In each set of the models, the likelihood of respondents embarking on a certain career pathway was compared against all the other clusters. **The results in the logit regression models corroborate the above observations with women, instead of men, being significantly more likely to embark on the STEM career path (Cluster 3)**. Moreover, by focusing on women only, the negative and significant relationship of women with post-graduate educational qualifications belonging to Cluster 3 also aligns with results in the cross-tabs. On a more positive note, the significant and positive association between income and women's likelihood of embarking on a STEM career path in Table 18 suggest that women in this path might at least enjoy the perks of a better wage than women who did not enter this path, which also aligns with the wage difference observed in Table 11. Nonetheless, a comparison of the average income in Tables 15 and 16 suggest that women were generally paid less than men.

To sum up, analysis results based on the TEPS-B data generated two primary findings:

1) Gender imbalance in the STEMs still exists, but the current study suggests that attrition at the employment stage does not contribute much to the gender imbalance in the workforce. Instead, the persisting gender disparities mostly originated from women's underrepresentation at the education stage.
2) In terms of the transition from education to employment, an unexpected result was found in the current analysis. For those with a STEM educational background in their early 20s, women, instead of men, were more likely to stay in the STEM workforce in the first few years (Table 9). From a holistic approach, women, instead of men, were also more likely to embark on the STEM career path (Table 17). Nonetheless, analysis of the TEPS-B data does not find an overly positive picture of women's work environment as they were found paid less than men. Thus as far as the data could tell, the factors attracting women's entrance and stay in the workforce were not evident.

Whereas the findings based on the TEPS-B data were mostly concerned with respondents at their early career stage and accordingly limited in a way that they were not yet entering a stable employment status and form a steady and long-term career path, the following section hopes to shed some light with the adoption of the data—PSFD, which contains respondents at their late 20s to early 40s.

Table 17 Logit regression analysis on Clusters 1, 3, 4 (sample with a STEM educational background / birth cohort=1983-1985)

	Cluster 1			Cluster 3			Cluster 4		
	1	2	3	4	5	6	7	8	9
Sex (men=ref)									
Women	-0.453*	- 0.354	- 0.225	0.863***	1.277***	1.382***	-0.485*	- 0.415*	- 0.377
Education(Junior College=ref)									
University		1.932**	1.608*		2.011**	2.526*		0.938***	0.845**
Post-graduate		3.842***	3.653*		1.075	1.243		- 0.764*	- 1.188**
Education areas (Science=ref)									
T/E/M		0.230	0.155		1.181***	1.120***		0.422*	0.389*
Father's education (Junior high and Lower=ref)									
Higher sec			0.064			- 0.327			0.190
Junior College			- 0.727*			0.336			- 0.081
Tertiary			- 0.536			- 0.078			0.522
Mother's education (Junior high and Lower=ref)									
Higher sec			0.282			- 0.203			0.233
Junior College			0.644			- 1.740*			0.114
Tertiary			0.186			- 0.600			0.564
Gender Belief 2—Disagreement to Science is for men			- 0.065			- 0.029			- 0.045
Average monthly wages			0.000			0.000***			0.000***
Average working hours			- 0.005			- 0.022			- 0.006
Constant	-1.541***	-4.323***	-4.010***	-2.709***	-5.408***	- 6.313***	-1.164***	-2.026***	- 2.681***
Log likelihood	-558.818	-470.131	-409.404	-332.116	-312.727	-273.868	-660.400	-616.547	-533.927
Chi-square	4.83*	182.20***	187.16***	13.13***	51.91***	95.76***	7.03**	94.73***	123.91***
N	1251	1251	1135	1251	1251	1135	1251	1251	1135

Note: marital status was not presented here due to the non-significant results.
* p<0.05; ** p<0.01; *** p<0.001

Table 18 Logit regression analysis on Clusters 1, 3, 4 (Female sample with a STEM educational background / birth cohort=1983-1985)

	Cluster 1		Cluster 3		Cluster 4	
	1	2	3	4	5	6
Education(College/Uni=ref)						
Post-graduate	2.391**	2.984***	- 1.828*	- 2.164*	- 0.883	- 1.043
Education areas (Science=ref)						
T/E/M	0.626	1.015*	1.162**	1.300**	0.700	0.383
Father's education (Junior high and Lower=ref)						
Higher sec		- 1.055		0.169		0.165
Junior College		- 1.682		- 1.072		- 0.104
Tertiary		- 2.374*		0.463		- 0.045
Mother's education (Junior high and Lower=ref)						
Higher sec		1.102		- 0.315		- 0.332
Junior College/tertiary		2.274*		- 1.383		0.891
Gender Belief 2— Disagreement to Science is for men		- 0.009		0.375		- 0.193
Average monthly wages		0.000		0.000**		0.000*
Average working hours		0.015		- 0.036		0.009
Constant	-3.237***	-4.257**	-2.110****	-3.563*	-1.775***	- 3.015*
Log likelihood	-71.116	-57.024	-88.079	-75.574	-103.521	-89.442
Chi-square	35.20***	45.04***	16.62***	33.86***	6.68*	16.12
N	242	217	242	217	242	217

* $p<0.05$; ** $p<0.01$; *** $p<0.001$

Note: marital status was not presented here due to the non-significant results.

2. PSFD

As discussed above, TEPS-B mostly focused on respondents in their 20s, which is a stage where education and military service probably affected their career paths most. In contrast, the data drawn from the PSFD included respondents in their late 20s to 40s. For an appropriate analysis with better sample size and higher statistical power, this study adopted the survey sample in the PSFD collected since 2009, which contains respondents born between1977-1983. The first wave survey was conducted in 2009 and the follow-up surveys were conducted annually before 2012. After 2012, the data collection was conducted biennially.

To address the research question, in terms of providing consistent longitudinal information on respondents, PSFD is probably the best data available. However, as the panel data often suffers data collection and attrition problems, the sample size of the 1977-1983 birth-cohort in the PSFD survey (2182 at 1st wave) could only provide a very limited number of respondents working in the IT field (58 males and 15 females at 1st wave). Accordingly, this study has extended the research focus and changed the research target to respondents in the STEM field. Data collected in 2009 and the follow-up data collected from 2010 to 2018 were adopted in the analysis. In order to properly establish the career sequences of respondents, to avoid the confusion, this study excluded samples without complete spells between 2009 to 2018 from the analysis, which generated a total sample size of 1215[4].

In line with the analysis with TEPS-B data, the analysis of PSFD data also pursued three steps and started the examination with a descriptive analysis, which is followed by logistic regression analysis before investigating their career paths.

2.1 Descriptive analysis

To best utilize the data, this study pursued the following analysis with two groups of samples: 1. All respondents (including male and female respondents regardless of their educational backgrounds), 2. Respondents with a STEM educational background (including those majoring in the STEM areas at universities or postgraduate degrees).

Regarding the percentage of respondents with STEM background entering STEM workforce, Tables 19 and 20 present the cross-tabs of the percentages of respondents entered the STEM workforce during the observation period by genders for two samples, respectively. Results in Table 19 show that, among female respondents with a STEM educational background, 35.7% of them ever entered the STEM workforce during the observation period whereas 65.5% of their male counterparts did. The gender difference was drastic to the extent that men were nearly twice more likely than women to enter the STEM workforce. This gender difference was even more staggering for the sample including all respondents with the percentage of men ever entered the STEM workforce being nearly triple the percentage for women (see Table 20).

[4] In order to capture the career sequences of respondents as many as possible, for those without complete spells, the researcher managed to use the retrospective information provided by them in the following years and reconstructed their status in the skipped years. Eventually, there were 1215 respondents included in the analysis.

Table 19 Percentages of respondents with a STEM educational background ever entered STEM workforce by genders (percentage by row)

	Occupational areas		
	Never entered STEM	Currently or was in STEM	N
Gender			
Men	34.5	65.5	278
Women	64.3	35.7	56
All	39.5	60.5	334

Pearson chi2(1) = 17.2634 Pr = 0.000

Table 20 Percentages of All Respondents ever entered STEM workforce by genders (percentage by row)

	Occupational areas		
	Never entered STEM	Currently or was in STEM	N
Gender			
Men	62.8	37.2	683
Women	86.1	13.9	532
All	73.0	27.0	1215

Pearson chi2(1) = 82.2325 Pr = 0.000

Table 21 then addresses the question of women's attrition rate in the STEM workforce by showing the percentages of respondents' retention or attrition from STEM workforce after 3 years by genders. As it shows, for women who have entered the STEM workforce, 52.7% of them opted out after three years. In contrast, for their male counterparts, 38.2% of them left the workforce after three years. In comparison with the result found with TEPS-B respondents, the difference is distinct. To explain, it is probably associated with the different life stages of respondents of these two surveys. While TEPS-B respondents were still in the transition from education to employment with men shouldering military service commitments, most of the PSFD respondents already entered the labor market for a period of time. Moreover, given the age and life stage differences, while most of the TEPS-B respondents were in their early 20s and unmarried, PSFD respondents were at the family formation stage with marriage and childcare responsibilities.

Table 21 Percentages of respondents' drop-out of STEM workforce after 3 years in STEM occupations by gender (percentage by row)

	Drop-out or stay in STEM after 3 years		
	Drop-out	Stay	N
Gender			
Men	38.2	61.8	254
Women	52.7	47.3	74
All	41.5	58.5	328

Pearson chi2(1) = 4.9734 Pr = 0.026

In respect to the question—how many women in the STEM became managers or supervisors, Table 22 presents the percentage of respondents ever holding a managerial position in the STEM during the observation period and shows that 9.5%

of women in the STEM had ever become managers or supervisors in the workforce, which contradicts to the previous expectation that men were more likely to become supervisors or managers in the STEM. As it turns out, although women were the minorities in the workforce, they were more likely to hold managerial positions than their male counterparts.

Table 22 Percentages of Women and Men holding managerial positions in the STEM

	Employee	Supervisors	Total in STEM	% in managerial position
Women	66	7	74	9.5%
Men	239	15	254	5.9%

2.2. Logistic regression analysis

Based on the above descriptive analyses, by firstly examining the associated factors with regression analysis, this study then moves on to the core research question of this study—what are the determinants of women's retention in the workforce?

With a limited sample size, Tables 23 and 24 only presented part of the analysis results as most of the variables were found with a non-significant relationship with respondents' entrance or retention in the workforce. Whereas the results may be a bit tricky due to small sample size, the significant effect of educational areas found in Tables 23 and 24 were pretty much in line with the results based on the TEPS-B data. Nonetheless, whereas in the TEPS-B data, the positive relationship between educational level and the likelihood of staying in the STEM was often not significant, it is significant in the PSFD data.

Table 23 PSFD Logit regression analysis results

	Respondents ever entered STEM workforce / All Sample (contrasts with "never entered STEM workforce")		Respondents staying for more than 1 year / Sample ever entered STEM workforce (contrasts with "leaving within 1 year")		Respondents staying for more than 2 years / Sample ever entered STEM workforce (contrasts with "leaving within 2 years")	
	1	2	3	4	5	6
Sex(Men=ref)						
Women	-1.30***	- 0.82***	- 0.30	0.24	-0.49	0.23
Educational level		0.246**		0.50*		0.54***
Education areas						
(non-STEM=ref)						
Science		0.867*				
T/E/M		1.809***		1.167*		1.42***
Constant	-0.524***	- 2.162***	2.407***	0.071	1.047***	-1.806***
Log likelihood	-655.3155	- 568.3524	-97.8040	-85.5028	-194.0708	-159.0573
Chi-square	86.59***	280.51***	0.44	25.04***	3.01	73.03
N	1215	1215	328	328	328	328

Notes:

1. Although the author analyzed the effects of parents' education, parents' occupational areas, and respondents' gender beliefs, the results were not included in the table due to non-significant effects.
2. For models 4 and 6, education areas—science and T/E/M—were merged into one category as all respondents in the area of "science" stayed in the STEM for more than 1 year, which led to a problem of "predicting failure perfectly" when running the logit regression.
3. * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 23 (continued)

	Respondents entered STEM workforce / Sample with a STEM educational background (contrasts with "never entered STEM workforce")	
	7	8
Sex(Men=ref)		
Women	- 1.23***	- 1.20***
Educational level		1.14***
Education areas		
(Science=ref)		
T/E/M		1.37**
Constant	0.640***	- 5.214***
Log likelihood	- 215.6703	- 194.6067
Chi-square	16.9***	59.03***
N	334	334

Table 24 PSFD Logit regression analysis results for **female** respondents

	Respondents ever entered STEM workforce / All female sample (contrasts with "never entered STEM workforce")	Respondents staying for more than 1 year / All female sample (contrasts with "leaving within 1 year")	Respondents staying for more than 2 years / All female sample (contrasts with "leaving within 2 years")
	1	2	3
Educational level (Sec & lower=ref)			
College/University	- 0.23	0.07	0.40
Postgraduate	0.69	1.08*	1.58**
Education areas (non-STEM=ref)			
Science	0.25	0.32	0.75
T/E/M	1.59***	1.68***	2.07***
Constant	- 1.99***	- 2.41***	- 3.25***
Log likelihood	- 201.3225	- 183.4853	- 137.2769
Chi-square	26.49***	31.96***	43.26***
N	532	532	532

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

On the other hand, the analysis results here contradict the findings obtained from the TEPS-B data by showing that female respondents with a STEM educational background in the PSFD data were significantly **less likely** to enter the STEM workforce whereas women in the TEPS-B were **more likely** to enter the STEM career path. Apparently, life stages and birth cohort differences between respondents of these two surveys may account for these differences in the results. Interestingly, although TEPS-B data has a better sample size and accordingly a higher statistical power, the results generated with the PSFD were more in line with the literature.

By all accounts, the paradoxical and contradicting findings presented here highlight the importance of further examinations. Moreover, it also lends support to the argument that women's careers should be examined from a life-course perspective as different life stages pertain to different personal and structural factors, which leads us to the discussions on career paths in the following section.

2.3 Sequence analysis

On the basis of the research incentives, the analysis aims primarily to examine the career paths of women. In order to achieve this, this study adopted a holistic approach and used the sequence analysis method. By establishing the career sequences of respondents, instead of focusing on single transitions, such as entrance or leaving the workforce, this study also accounts for respondents' retention in STEM by capturing their career trajectories. Again, when establishing the career sequences, this study confined the sample to those with STEM educational backgrounds. After running the sequence analysis with various substitution cost settings and algorithms, the optimal matching method and the transition-based substitution cost were adopted as this combination generated a richer picture of career paths in relation to the research focus.

Conceptually, one's "career status" concerns the occupational areas, employment status, as well as their job positions in the company. The fact that PSFD provides detailed information on the above helps the researcher to construct a 5-category career status variable, which was used to establish respondents' career paths. Of this variable, the 5 mutually exclusive career status are: 1. Studying/training, 2.unemployed, 3. Non-STEM job, 4. STEM job, 5.Family Care.

After calculating the distances among sequences consisting of the 5-category career status, the cluster analysis was applied with Ward's method to group sequences into different clusters of housing transitions. After comparing different cluster solutions with dendrogram, Calinksi and Harabasz's F-statistic and the R^2, different cluster solutions were also examined visually. Eventually, the 7 cluster solution was selected (see Figure 3). The resulting 7 distinct career paths are distinctively different from the 6 career paths of TEPS-B respondents.

Whereas the clusters of career paths found with TEPS-B data were mostly clouded with the status of "studying" with prolonging or intermittent education advancements, the career paths of PSFD respondents were evidently more stable and longer with **Cluster 2 embodying the long-lasting STEM career path and Cluster 5 representing a consistent non-STEM career path**.

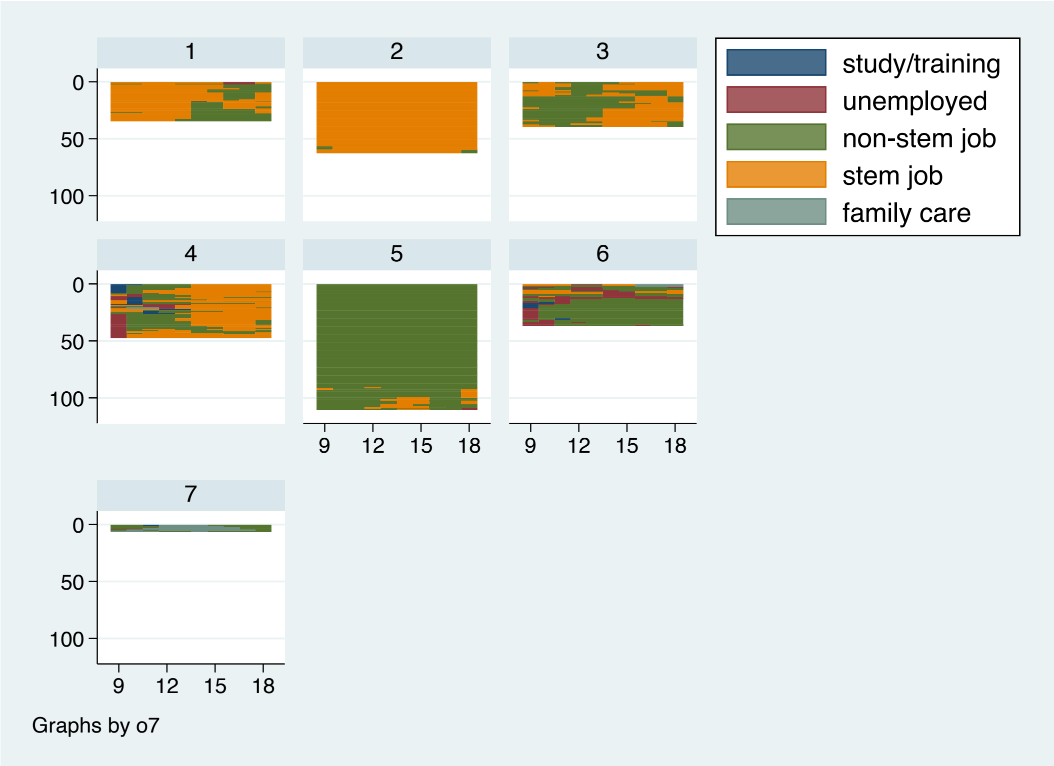


Figure 3 Cluster analysis results—7 career pathways (PSFD).

Tables 25 and 26 present the distribution of the 7 clusters by respondents' individual characteristics for all respondents and female respondents, respectively. Preliminary results from the cross-tabulations indicated that there were significant differences among respondents' probabilities of embarking on different career paths due to differences in sex, educational levels, average monthly wages, the marital status between 2009-2018, and father's occupational areas. In contrast, there were no significant differences found associated with gender beliefs or educational areas, which is very different from what was found with TEPS-B data. However, note that **the percentages of respondents with a STEM educational background entering the STEM workforce were fundamentally different with a drastic discrepancy between 30.8% (TEPS-B) and 60.5%(PSFD)**, which probably helps to explain the non-significant differences in career paths undertaken by respondents with a STEM educational background in the PSFD data as more than half of them had entered STEM workforce with only the differences in the timing of entrances and lengths of staying.

Table 25 Distribution of respondents across 7 career pathway cluster by individual characteristics (% by row)

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	N
Sex***								
Men	11.5	19.8	11.9	15.8	31.7	9.4	0.0	278
Women	3.6	12.5	10.7	5.4	39.3	17.9	10.7	56
Education***								
Junior College	3.1	6.2	20.0	4.6	47.7	12.3	6.2	65
University	9.5	19.0	8.4	10.6	39.7	11.7	1.1	179
Post-graduate	16.7	26.7	12.2	27.8	8.9	7.8	0.0	90
Educational area								
Science	11.1	7.4	7.4	11.1	55.6	7.4	0.0	27
T/E/M	10.1	19.5	12.1	14.3	30.9	11.1	2.0	307
Father's education								
Non-lower sec	9.5	19.0	14.0	11.8	31.9	11.2	2.8	179
Higher sec	9.5	17.9	7.4	14.7	39.0	10.5	1.1	95
college	11.1	22.2	14.8	7.4	29.6	14.8	0.0	27
Tertiary	16.1	16.1	9.7	29.0	22.6	6.5	0.0	31
Mother's education								
Non-lower sec	11.2	19.3	12.6	11.7	32.3	11.2	1.8	223
Higher sec	7.4	19.8	11.1	18.5	29.6	11.1	2.5	81
college	0.0	14.3	7.1	21.4	42.9	14.3	0.0	14
Tertiary	21.4	7.1	7.1	21.4	42.9	0.0	0.0	14
Father's occupational area*								
Non-STEM	10.4	18.1	11.0	13.3	34.3	11.3	1.6	309
STEM	0.0	38.5	30.8	23.1	7.7	0.0	0.0	13
Average weekly working hours 2009-2018	46.0	46.9	45.6	45.4	47.6	47.2	41.5	333
Average monthly wages 2009-2018**	56270.5	61012.1	51519.6	53855.0	51445.7	39844.9	20505.5	333
Gender Belief 1-disagreement level to 'gendered division of labor'	2.7	2.8	2.9	2.5	2.8	3.1	3.3	334
Gender Belief 2—disagreement level to 'sons carry on family line'	2.8	2.7	3.1	2.7	2.8	2.9	3.3	334
Marita Status 2009-2018***								
Unpartnered 09-18	3.9	9.7	14.6	19.4	35.0	17.5	0.0	103
Married/Cohab at 09	17.1	19.7	11.8	6.6	34.2	4.0	6.6	76
Married/Cohab during 10-18	11.0	23.9	9.7	14.2	31.0	9.7	0.7	155

* p<0.05; ** p<0.01; *** p<0.001

Table 26 Distribution of **female** respondents across 7 career pathway cluster by individual characteristics (% by row)

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	N
Education								
Junior College	0.0	8.3	8.3	0.0	33.3	16.7	33.3	12
University	2.9	11.8	5.9	5.9	50.0	17.7	5.9	34
Post-graduate	10.0	20.0	30.0	10.0	10.0	20.0	0.0	10
Educational area								
Science	0.0	16.7	0.0	0.0	66.7	16.7	0.0	7
T/E/M	4.0	12.0	12.0	6.0	36.0	18.0	12.0	50
Father's education†								
Non-lower sec	2.6	13.2	10.5	2.6	36.9	21.1	13.2	38
Higher sec	0.0	18.2	0.0	9.1	54.6	9.1	9.1	11
college	25.0	0.0	50.0	0.0	25.0	0.0	0.0	4
Tertiary	0.0	0.0	0.0	50.0	0.0	50.0	0.0	2
Mother's education†								
Non-lower sec	4.9	12.2	12.2	2.4	39.0	19.5	9.8	41
Higher sec	0.0	14.3	7.1	7.1	42.9	14.3	14.3	14
Tertiary	0.0	0.0	0.0	100.0	0.0	0.0	0.0	1
Father's occupational area								
Non-STEM	1.9	11.5	9.6	5.8	42.3	19.2	9.6	52
STEM	0.0	50.0	50.0	0.0	0.0	0.0	0.0	2
Average weekly working hours 2009-2018	42.6	43.7	42.8	43.3	42.1	46.0	41.5	56
Average monthly wages 2009-2018**	63642.9	53060.6	43144.7	51848.0	39226.6	33303.2	20505.5	56
Gender Belief 1- disagreement level to 'gendered division of labor'	2	3.9	3.3	3.3	2.9	3.7	3.3	56
Gender Belief 2— disagreement level to 'sons carry on family line'	2	3.1	3.3	3.3	4.3	2.8	3.4	56
Marita Status 2009-2018								
Unpartnered 09-18	0.0	7.1	14.3	7.1	35.7	35.7	0.0	14
Married/Cohab at 09	9.1	9.1	4.6	4.6	40.9	9.1	22.7	22
Married/Cohab during 10-18	0.0	20.0	15.0	5.0	40.0	15.0	5.0	20

† p<0.1; * p<0.05; ** p<0.01; *** p<0.001

On the other hand, arguably given the age range, most of the PSFD respondents were probably at the life stage of family formation and raising kids, the effect of education was likely to be weaker while the influence of marital status was stronger. However, a preliminary examination with logit regression analyses on respondents' marital status already hinted that the effect of marital status was not as strong as expected.[5] The following logit regression analysis on respondents' likelihood of stepping onto the career path of Clusters 5 and 2 against all the other clusters respectively corroborated this observation (see Tables 27 and 28). Notwithstanding, the logit regressions analysis on the **long-lasting STEM career path** (Cluster 2) did find a mild significant effects of marital status on respondents' likelihood of embarking on this long-lasting STEM career path with those married or cohabited during 2009-2018 more likely to stay long in the STEM than their single or earlier-married counterparts. Unfortunately, probably due to small sample size, this significant association was not observed with female respondents in Table 28.

Moreover, though non-significant, a negative association between female respondents' educational levels and their probabilities of staying on the STEM career path was found in Table 28, which coincided with the finding with TEPS-B in a way that highly-educated female respondents in TEPS-B data were found significantly less likely to enter the STEM career pathway (Cluster 3 in TEPS-B data). Whereas education advancement may be a good explanation to highly-educated respondents' shorter career paths in the TEPS-B data, what led to female respondents' lower probabilities of having a lengthy STEM career in the PSFD data still requires further examinations. Having said that, however, combining the results we see here and the results obtained with TEPS-B data, there seemed to be a negative association between women's educational level and their career lengths in STEM workforce for those in their 20s to early 40s. While this argument requires more empirical support, it drew our attention to the fact that women's status in the STEM might need more detailed differentiations as women with different educational levels entering the workforce with various career prospects. However, given the limits of the current data, this study could speculate that, averagely, women embarking on the STEM career path in the TEPS-B and PSFD data, were often with lower educational qualifications than their male counterparts and concomitantly, very likely, being paid less with lower occupational status in the workforce. Gender comparison in Table 29 somehow offers a fair empirical ground for this argument.

[5] The analysis results are not presented here, but available upon request.

Table 27 Logit regression analysis on Clusters 2, 5 (Respondents with STEM educational backgrounds)

	Cluster 2	Cluster 5
	1	2
Sex (men=ref)		
Women	- 0.39	0.29
Educational Level	0.62**	- 1.21***
Education areas (Science=ref)		
T/E/M	1.25	- 1.56***
Average monthly wages 09-18	0.00	0.00
Marita Status 2009-2018 (Unpartnered 09-18=ref)		
Married/Cohab at 09	0.82	- 0.15
Married/Cohab during 10-18	0.87*	0.03
Constant	- 6.18**	5.23***
Log likelihood	-147.9198	-188.6530
Chi-square	24.27***	45.21***
N	333	333

Note: "Average monthly income" contains one missing value.

Table 28 Logit regression analysis on Clusters 2, 5 (**Female respondents** with STEM educational backgrounds)

	Cluster 2	Cluster 5
	1	2
Educational Level	- 0.34	- 0.71
Education areas (Science=ref)		
T/E/M	0.57	- 1.74
Average monthly wages 09-18	0.00*	- 0.00
Marita Status 2009-2018 (Unpartnered 09-18=ref)		
Married/Cohab at 09	- 0.07	0.40
Married/Cohab during 10-18	1.18	0.65
Constant	- 4.47	3.52
Log likelihood	- 17.7328	-35.2729
Chi-square	6.73	4.50
N	56	56

Moreover, by comparing the results based on the analysis of the female sample (Tables 26 and 28) and of the overall sample (Tables 25 and 27), gender disparities apparently remained in workplaces. Hence, Table 29 further compares the characteristics of men and women on the STEM career path (Cluster 2).

Although the sample size was small, it still helps to offer a glimpse into the current status of a gendered workforce. Whereas the narratives on gender inequalities often surrounded disparities in wages, the comparison here also shows evident differences in working hours with men working longer than women by nearly 4 hours; and a higher percentage of men obtaining postgraduate qualifications. These differences somehow seemed to justify the gendered discrepancies in pay. But in tracing the roots of these disparities, the differences in educational levels and working hours were often intertwined with social norms and social expectations. While education was often a result of personal aspirations, parents' expectations and investments, individual working hours were related to time allocations across various commitments, such as household chores and childcare. The outcome of higher weekly working hours among men and the significantly higher likelihood of married respondents ended up on the STEM career path as shown in Table 27 suggested that a mechanism of the division of labor might still function in Taiwan's family today. Sadly, career-wise, as far as the analysis goes, women in the PSFD data did not seem to enjoy the perks of the labor division at home. On the contrary, although our data did not offer direct evidence, arguably, a speculation based on the literature was that women's careers probably suffered because of the division of labor.

Table 29 Gender comparisons on **Cluster 2** by individual characteristics (% by column)

	Men	Women
% of clusters	19.8	12.5
Education		
Junior College	5.5	14.3
University	54.6	57.1
Post-graduate	**40.0**	**28.6**
Educational area		
Science	1.8	14.3
T/E/M	98.2	85.7
Average monthly wages 2009-2018**	**62024.1**	**53060.6**
Average weekly working hours 2009-2018**	**47.4**	**43.7**
Gender Belief 1-disagreement level to 'gendered division of labor'	**2.7**	**3.9**
Gender Belief 2—disagreement level to 'sons carry on family line'	**2.7**	**3.1**
Marita Status 2009-2018		
Unpartnered 09-18	16.4	14.3
Married/Cohab at 09	23.6	28.6
Married/Cohab during 10-18	60.0	57.1
N	55	7

To sum up, the analysis of the PSFD data generated the following findings:

1) In contrast to the upside brought by the TEPS-B analysis result that women with a STEM educational background were more likely to embark on a STEM career path with a higher retention rate, the analysis on PSFD respondents found that women were less likely to enter the STEM workforce and more likely to drop out after 3 years if entered.
2) The differences in the analysis results on TEPS-B and PSFD data verified the need to examine women's career from a life-course perspective as drastic distinctions were found between the 6 career paths of respondents in their 20s (TEPS-B) and the 7 career paths of respondents from the 20s to early 40s (PSFD). Moreover, the analysis found that whereas marital status was not significantly related to respondents' career paths in the TEPS-B data, it had a moderately significant

relationship with PSFD respondents' likelihood of embarking on the long-lasting STEM career paths. This again shows that different factors might account for the career status of women at different life stages.

3) Gender comparisons on PSFD respondents embarking on the long-lasting STEM career path (Cluster 2) provided evidence on gender disparities in the workforce. While more examination required to pass the judgments on what determined the differences in pay and working hours, the persisting underrepresentation of women was very likely attributed to these gender disparities.

Apart from the above findings, throughout the analysis of both TEPS-B and PSFD data, there was generally a lack of examination on the impact of women's personal attitudes on their careers. Whereas the above analysis on the gender role beliefs presented some mild significance and interesting results, data limits had long impeded a proper investigation into the relationship between women's career development and their personal attitudes, such as self-passements or professional role conflicts. To fill this gap, the following analysis attempted an examination of women's personal attitudes and their quitting intention with the data collected through a self-designed online survey.

3. Career stage online survey

As aforementioned, to address the lack of information on women's personal attitudes and work environment in the STEM in the currently available data, this study collected data through an online survey with a self-designed questionnaire. With the limits in time and resources, although the data was generated with snowballing and purposive samplings, it still contributes to the current study in a way that the information provided by respondents helps to shed some light on the aspects less covered and detailed in large-scale datasets. Moreover, given that the sample was apparently selective, as the initial incentive of this study aimed to address women's careers in IT, in the online survey, the majority of the respondents with STEM work experiences had worked in the IT workforce (see Table 30). Of the 165 respondents in the analysis, 20.6 % of them are currently working in the STEM workforce whereas 1.8% had previously worked in the workforce, which results in a total number of 37 respondents with STEM job experiences.

As the scale of the data was relatively small, the following analysis consists mainly of the descriptive analysis on the work environment experienced by respondents. The analysis primarily aims to complement the current study by addressing two issues: 1. As currently available data lacks information on women's work environment, the following analysis utilizes the workplace information provided by the respondents and focused on exploring the "gender differences" experienced by them; 2. Although KCM model and career stage theories served as the foundation of an analytical framework in this study, due to data availability, the KCM model was not actually mapped onto the data. With the questions of KCM scale (i.e. authenticity, balance, and challenge scales) proposed by Sullivan et al. (2009) incorporated into the self-designed questionnaire, and distributed and collected through the online survey, the following analysis used the data to classify respondents' career stage and analyzed their work conditions from the career-stage perspective.

On the basis of the above two objectives, the following analysis is structured into two sections. Section 1 focuses on the gender differences presented in the online survey; and section 2 attempts to enhance our understanding of women's career development with the mapping of the KCM model.

3.1 Gender differences

Table 30 offers an overview of the characteristics of the respondents. Unlike the samples in the TEPS-B or PSFD surveys, the sample collected through the online survey has certain distinct characteristics. While a wider age range and job tenures of the online sample made it feasible to attempt to map the KCM model on the data, the distinctive and unusual higher percentages of younger and single women (aged under 40) and a moderately higher proportion of women, instead of men, obtaining tertiary educational qualifications suggested that the following analysis has to be interpreted with care as women in this sample were probably on a higher and more professional tier in the workforce.

Table 30 Characteristics of respondents in the online career development survey

	All	Men	Women
Age			
22-30	9.1	8.6	9.5
31-40	27.9	24.3	30.5
41-50	33.9	31.4	35.8
>=51	29.1	35.7	24.2
Tenures at current jobs (N=142)			
1-5 years	25.5	22.9	27.4
6-10 years	18.2	15.7	20.0
11-20 years	29.1	30.0	28.4
>20 years	27.3	31.4	24.2
Educational level			
<=Junior college	6.7	8.6	5.3
University	37.0	31.4	41.1
Postgraduate	56.4	60.0	53.7
Educational areas			
STEM	23.0	28.6	81.1
Non-STEM	77.0	71.4	18.9
Employment status			
Currently employed	86.1	92.9	81.1
Currently unemployed	13.9	7.1	18.9
Marital Status			
Married	61.6	68.1	56.8
Single	33.5	27.5	37.9
Divorced/Separated/Widowed	4.9	4.4	5.3
STEM work experiences			
Currently in the STEM	20.6	30.0	13.7
Previously in the STEM	1.8	0.0	3.2
Occupational areas			
Information Technology	15.8	18.6	13.7
Science & engineering	6.7	11.4	3.2
Non-STEM	77.6	70.0	83.2
N	165	70	95

Table 31 juxtaposes respondents' characteristics and work experiences at workplaces by their genders and industries. Across three industries, female respondents were generally younger than their male counterparts with respondents in IT being the youngest. Moreover, the sex ratios show that, in line with previous findings, the STEM workforces—IT and S/E (Science and Engineering)—experienced by the respondents were still male-dominated with fewer women becoming managers proportionally.

In terms of the income and working hours, while women in IT seemed to enjoy the smallest gender pay gap, they also had the longest daily working hours and the highest working overtime frequency. Judging from Table 31, the long working hours of IT women seemed to be sustained by their higher percentages of singlehood and lower percentages of childbearing. Nonetheless, the results show that this highly demanding work condition probably still took its toll on some IT professionals as more than 50% of them had thought about quitting their jobs, even though they enjoyed higher wages than their counterparts in other industries.

Table 31 Gender differences in respondents' characteristics and work experiences

	Non-STEM		IT		S/E	
Sex ratio of colleagues [a]	3.34		**2.15**		2.54	
Sex ratio of managers [a]	2.82		**2.19**		2	
	men	women	men	women	men	women
Average age	47.76	44.71	**39.15**	**36.69**	47.13	40.33
Average education level	4.53	4.44	4.46	**4.62**	4.25	4.67
Marital status						
Married	70.83	62.03	**53.85**	**30.77**	75.0	33.3
Single	22.92	32.91	**46.15**	**69.23**	25.0	33.3
Divorced/separated/widowed	6.25	5.06	0	0	0	33.3
Have kids or not						
Have kids	75.51	60.76	**53.85**	**7.69**	62.5	66.67
No kids	24.49	39.24	**46.15**	**92.31**	37.50	33.33
Average tenures	17.77	14.57	12.23	**7.38**	11.83	7.67
Positions						
Employers/managers	30.61	8.86	**15.38**	**7.69**	37.50	33.33
Employees	69.39	91.14	**84.62**	**92.31**	62.50	66.67
Average annual income level [b]	6.63	4.73	6.54	6.33	6.5	3.33
Average daily working hours [c]	1.79	1.63	**1.69**	**2.33**	2	1.67
Overtime frequency	1.90	1.87	**1.92**	**2.08**	2	2
Self-accessed promotion opportunities	2.09	2.35	**2.69**	**2.2**	2.25	2
Percentage of respondents had quitting intention	31.82	43.75	**61.54**	**50.0**	**50.0**	**100.00**
N	49	79	13	13	8	3

Notes:
1. [a] sex ratio index <3 indicates that men were more than women whereas >3 indicates women more than men.
2. [b] income level: 3=600-700 k, 4=700-800k, 5=90-1000k, 6=1000-1200k, 7=1200-1300k
3. [c] working hours index: 1=8-9 hours, 2=9-10 hours, 3=10-12 hours

Table 32 compares respondents' personal attitudes and perceptions of the workforces by genders and industries. As expected, across the board, women tended to hold a more equalitarian gender role attitude. However, generally, the gender differences across all scales of attitudes and perceptions were not evident, except for the "observed hostility towards women". Women were significantly more likely to report a higher level of observed hostility at workplaces than their male counterparts, especially in STEM. This result underscores the importance of a gendered perspective and calls for further examinations based on large-scale data.

Table 32 Gender differences in respondents' gender role attitudes and perceptions of the work environment

	Non-STEM		IT		S/E	
	men	women	men	women	men	women
Gender role attitudes—gender equality support level	3.71	3.91	3.68	3.92	3.78	3.93
Perceived gender equality at workplace	3.76	3.74	3.86	3.86	4.1	3.2
Work engagement level	3.65	3.59	3.45	3.34	3.65	3.59
Professional role conflicts	2.29	2.36	2.49	2.46	2.5	2
Observed hostility to women	1.29	1.57	**1.13**	**1.72**	**1.38**	**2.17**
N	49	79	13	13	8	3

As we move on to the analysis results in Table 33, it has become clear that, surprisingly, except for the "observed hostility to women", overall, female respondents seemed to hold a positive view of the work environment.

Table 33 shows that women, particularly married women in the STEM, gave a higher and positive rating on gender equality at workplaces than their male counterparts. This result contradicted the researcher's expectation as the literature often indicated that married women felt higher work-family conflicts while marriage might obstruct women's pursuits for career development with family responsibilities. To explain, the researcher ran a further analysis and found that 38.5% of the married respondents in STEM were employers or managers. Their positions at workplaces might help to explain the unusual association between marital status and positive evaluations on gender equality at workplaces observed in Table 33.

Table 33 Perceived level of gender equality at workplaces by marital status (married vs single)

	Non-STEM		IT		S/E	
	men	women	men	women	men	women
Married	3.83	3.75	3.94	**4.55**	4.23	**5.00**
Single	3.56	3.68	3.77	**3.56**	3.7	**1.8**
N	45	75	13	13	8	2

Note: Further analysis shows that, of married respondents in the STEM, 38.5% of them were employers or mangers; whereas 0% of single respondents was in the managerial position.

Table 34 investigates the influence of marital status on women from another aspect—work-family and family-work conflicts. Again, as nearly 40% of the married respondents in the STEM were employers or in managerial positions, the result may be skewed by their higher likelihood or accessibility to autonomy at work. Nonetheless, Table 34 still demonstrates a distinct conflict pattern between work and family, especially in the aspect of "family impeding work". Consistently, respondents across different industries and workforces were more strained at work under family obligations. By comparison with the non-STEM respondents, more married respondents in the STEM felt the family-cork pressure. Moreover, with respect to "work interfering family or personal life", interestingly, single respondents in the non-

STEM and IT areas reported a higher degree of conflicts than their married counterparts, which shows that work-life balance is definitely not just an issue concerning married employees. Single individual's commitment to work, such as long working hours, should not be presumed as a given or taken for granted simply because they have not yet formed a family.

Table 34 Perceived level of Family and work conflicts at workplaces by marital status

	Non-STEM		IT		S/E	
	men	women	men	women	men	women
Work interfering family/personal life						
Married	2.78	2.66	2.67	2.58	2.94	4.33
Single	3.09	3.05	**3.39**	**2.89**	2.00	3.33
Divorced/separated/widowed	2.89	3.17	--	**--**	--	3.00
Family impeding work						
Married	2.46	2.39	2.10	**2.42**	2.78	**2.33**
Single	1.97	2.12	2.50	**1.89**	2.33	**1.33**
Divorced/separated/widowed	2.11	2.75	--	--	--	2.33
N	49	79	13	13	8	3

Overall, to summarize, a preliminary analysis of the data collected through an online survey shows persistent gender disparities in the workforces in wages, working hours, and sex ratios. However, having said that, except for the "observed hostility toward women", subjectively, female respondents generally reported a surprisingly positive view towards gender equality in the workforce. As this self-reported attitude contradicted the observed gender imbalance in pay and occupational positions in Table 31, this paradoxical mismatch might imply two things: first, the statistical numbers regarding the work conditions of men and women do not sufficiently delineate the reality of the workplace. Hence, although with evident gender differences in pay and gender imbalance in the composition of the overall workforce and the managerial board, women in the workforce were not actually in inferior positions with lower pay and under-representation. Second, female respondents were unaware of gender inequality or choosing to downplay its influence because an examination of the workforce based on a gendered perspective had long been scant.

3.2 Kaleidoscope career model

Although a small sample size might not provide a valid empirical ground in terms of disentangling the complicated factors inducing women's attrition or retention in the STEM, a preliminary descriptive analysis which maps respondents' career stage based on the KCM model could still offer some insights into women's career development in the STEM.

Table 35 shows the career stages of female respondents in the STEM by their tenures and ages. Generally, though only with a small difference across groups, based on the calculated means of the KCM scales—challenge, balance, and authenticity, the highest scores derived from respondents with different lengths in jobs tenures—1-5, 6-10, and 11-20 years—corresponded to the three career stages of KCM. Female respondents in the STEM were then classified as in their early, middle, and mid-late career stages. Drawing on the argument in the literature, female respondents at three career stages would prioritize their desires for challenge, balance, and authenticity differently with those at early stage desiring challenges and those at mid or late stages attaching more importance to balance and authenticity. On the basis of this established connection between career stages and tenures, the research then looked into the personal attitudes of female respondents across different KCM stages and found some interesting results.

Table 35 Career stages of female respondents in the STEM based on the KCM model

	Challenge	Balance	Authenticity	N
Tenures				
1-5 years	**3.57**	2.83	3.60	7
6-10 years	2.84	**3.76**	3.44	5
11-20 years	3.55	3.55	**4.1**	4
Age				
22-30	3.20	2.8	3.57	3
31-40	**3.52**	**3.48**	**4.00**	8
>40	3.12	3.32	3.16	5

Figure 4 shows the quitting intention and personal attitudes of female respondents in the STEM across the three kaleidoscope career stages[6]. As depicted, the levels of respondents' professional role conflicts (green), work-family conflict (green), family-work conflicts, and the observed hostility (purple) seemed to increase as they moved along the career stages. Whereas many factors might account for changes in personal attitudes, this changing pattern was somewhat unusual in a way that work experiences and seniority did not seem to benefit. On the contrary, across the three career stages, by comparison with those with least experiences and accordingly lowest rank in the workforce, a higher percentage of women at mid or late stages had quitting intentions.

6 For detailed statistics of the three career stage, please see Appendix 3.

Figure 4 Kaleidoscope Career stages of female respondents in the STEM

Stage wise, this finding seems to fit into the KCM model as it suggests that the highly competitive, highly demanding STEM work environment may agree with women at the early stage more as they tend to desire more challenges. In line with KCM literature, the results here did find that as women entered middle or later career stages, this work environment seemed to become less compatible with their desire for balance or authenticity, which might, in turn, led to an increase in the percentages of them having quitting intention and a higher level of work-family conflicts.

In sum, although with relatively small sample size, the analysis based on the data collected through an online survey provided valuable information on Taiwan's STEM work environment by showing distinct gender disparities and women's perceptions of the workforce. Whereas the persisting gender imbalance was generally in line with the analysis results based on the TEPS-B and PSFD, the paradoxically positive views of female respondents towards the workforce were manifested in the online data. As women's personal attitudes were less examined in the TEPS-B or PSFD, the online survey helps enhance our understanding on women's career choices by shedding light on the subjective evaluations and values of women in STEM. In this respect, the analysis based on the Kaleidoscope career model found women in STEM with different priorities and values at different stages. The results suggested that how women felt about their work environment, or how aware they were of the gender inequality in the workplace were interacted with their career stages as their focus in life shifted along the career.

V. Discussions and conclusions

This study set out to understand the career development of women in a male-dominated field from a life-course perspective. By adopting three data sources—TEPS-B, PSFD, and a self-administered online survey, this study has contributed to the current discussions on women's career development in the STEM field by offering empirical examinations on women's entrance and retention in the workforce.

In corresponding to a life-course perspective, career paths of women in STEM were established with the longitudinal data drawn from TEPS-B and PSFD, which contains samples of birth cohorts between 1984-1986 and 1977-1983 with observation periods spanning 2001-2010 and 2009-2018, respectively. Life-stage wise, throughout the observation period, while TEPS-B respondents went through the age from 18 to 25, respondents in the PSFD survey were in their late 20s to 40s. The distinctive different career paths found in the analysis supported the validity and necessity of taking a life-course approach to tackling the research question. Specifically, while a long-lasting STEM career path was found in the PSFD data, the career paths of TEPS-B respondents were generally shorter with education taking an essential part.

This distinction among life stages was also found with the analysis results derived from the logit regression analysis. For those in their early 20s, female respondents with a STEM educational background were found more likely to stay in the workforce than their male counterparts as military service might have interrupted men's careers. In contrast, among the respondents in their late 20s to 30s, men, instead of women, were more likely to have a STEM career.

Overall, given that TEPS-B and PSFD data focused on respondents at different life stages, the analysis results based on these two datasets would obscured and limited if viewed individually. Nonetheless, the current study combined these two and thus provided an extra lens to elucidate a more dynamic and progressive career development of women. By combining the results of these two data, the above results told a career development story of women in STEM from their school years to their early 40s. On the verge of finishing school and embarking on their career, the female protagonists seemed to take a more advantageous position by comparison with men as they, given the same educational background (i.e. graduated with a STEM educational qualifications), were more likely to enter the STEM workforce (Table 8) and less likely to drop out in a few years (Tables 5 and 9). However, as the story continued, the female protagonists entered their late 20s and started losing their edges by becoming less likely to hold onto a STEM career (Tables 21 and 27).

Clearly, the current study is not a story. Drawing on the data, the study meant to disassemble and disentangle this simple and sometimes even typical story happening in many male-dominated career fields by excavating the mechanism and associated factors that led to our female protagonists' career destiny.

While women's relatively advantageous positions at the beginning of their career may be attributed to men's career disruptions due to military service or education advancement, it is imperative to find answers to women's attrition from the workforce since their late 20s to 40s, which happens to be the essential career development stage in one's life course with family formation and childbearing usually taking place at the same time. As the literature suggested that the traditional gendered division of labor might pull women who juggle both family and work responsibilities out of the workforce, the impact of marital status and childbearing, though not found significantly related in the current study given a small sample size, was still suspected to be one of the critical catalysts triggering women's retreat. Moreover, although by comparison with their female counterparts on other career paths, a positive and significant relationship between higher income and women's likelihood of embarking on the long-lasting STEM career path was found (Table 28), a comparison of men and women's work conditions in this career path showed evident gender disparities in the workforce (Table 29) with women being paid less than men. Organizational factors, the inequality and inferior work conditions experienced by women, are therefore likely to be the culprit or at least the accomplice of women's attrition from the STEM field. This observation was further illuminated in the analysis with data from the online survey.

Based on the Kaleidoscope career model, the analysis found that the levels of conflicts and hostility experienced by women increase as they move along the career stages (Figure 4). This shows that in contrast to the generally assumed growing workforce compatibility along the career development course, women in STEM seemed to voice a higher volume of dissents as they entered later stages of the career. Stage wise, the analysis based on the KCM suggested that the increasing disagreements between women and the workplace might come from both the shifts in women's' personal attitudes and the reality of a gendered work environment. Arguably, a gendered and unequal work environment has always been there. However, as women accumulate their experiences and tenures at the job, and as they enter a life stage of more family responsibilities with a desire for a more balanced life, the conflicts increase and the observed hostility becomes intolerable. Accordingly, the finding of this study underscores the importance and necessity of workplace reform. Whereas gender inequality is sometimes treated as folklore or cliché among some public discussions, the empirical finding here delineates a vivid reality of its existence.

To improve gender equality in the STEM work environment, based on the finding, this study proposed the following suggestions.

First, based on the evident family-work and work-family conflicts found in the study, it is suggested that the policy-makers should review and reconsider the current measures in encouraging companies to build a family-friendly work environment. Whereas the often-suggested approaches, such as increasing childcare facilities or a bonus for parents, may help employees to juggle family and work responsibilities with reduced resentment, higher flexibility at work could probably address the problem more effectively. As Tables 16, 29 and 31 show, women in the STEM tend to work overtime with weekly average working hours way beyond 40 hours. Given the relatively low flexibility embedded in the Taiwanese work culture, a slight change in the organizational practice in allowing women more flexible working hours may benefit women a lot without costing the employers more than losing female employees.

Second, although both the Act of Gender Equality in Employment and the Sexual Harassment Prevention Act have been implemented in Taiwan for nearly two decades, the analysis still found that women in the male-dominated workforce felt a higher degree of hostility towards women (Table 32). The differences in the level of the observed hostility between men and women showed that more education on gender equality based on the concept of gender mainstreaming is needed as hostile behavior is not always detected by those who practice it.

Apart from the reforms in the workplace, changes at the stage of education are probably even more urgent. The analysis results of this study have pointed out that the underrepresentation of women was largely due to fewer numbers of women chose the STEM track at the education stage. The selection or attrition process has already started when girls decided their majors at school. While individuals' education track decision is obviously a complex issue with extensive studies, the current study suggests that policymakers and educations could consider moving the track choosing to a later stage of the education system to allow more students the opportunity to become future workforce members.

Before concluding this report, certain limits of the current study need to be mentioned. Apart from the limits in the availability of large-scale longitudinal data of women's work environment information and personal attitudes, it has to be noted that the regression analysis on the career paths established on sequence and cluster analyses was partially compromised due to anticipatory analysis. Moreover, although the researcher has dedicated lots of efforts to make consistent comparisons across data to establish a valid and clear career stage development of women, there were still apparent inconsistencies due to the existing structural differences of data.

In conclusion, the researcher hopes that the findings contribute to the current literature of women's career development in STEM and enhance future research in this field. With gratitude to the Ministry of Science and Technology for funding this research, it is hoped that more resources will be put into the examinations and improvements of the gendered workforce in the future.

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Appendix 1

Characteristics of TEPS-B and PSFD data (% by column)

	TEPS-B (2010)		PSFD (2009)	
	Women (51.6%)	Men (48.4%)	Women (43.8%)	Men (56.2%)
Occupational areas				
Never entered STEM	93.5	80.2	86.1	62.8
Ever entered STEM	6.5	19.8	13.9	37.2
Stayed at STEM >1 year	4.0	9.6	12.4	34.1
Stayed at STEM >2 years	2.8	3.5	8.8	27.5
Stayed at STEM >3 years	1.5	1.2	6.6	23.0
Education				
High school & lower	10.8	17.1	25.2	34.7
College/University	74.0	61.4	65.0	49.6
Post-graduate	15.2	21.5	9.8	15.7
Education areas				
Non-STEM	87.6	45.0	89.5	59.3
Science	8.0	11.7	1.1	3.1
T/E/M	4.4	43.4	9.4	37.6
Marital status in 2009(PSFD) / 2010(TEPS-B)				
Single	94.4	96.6	58.8	75.6
Married/cohabited	5.4	3.3	40.2	23.1
Divorced/Separated/Widowed	0.2	0.1	0.9	1.3
Have kids or not in 2009				
No kids	--	--	70.5	83.2
Have kids	--	--	29.5	
N	1969	1846	532	683

Appendix 2

職涯發展調查問卷（正式問卷）

您好， 非常感謝您願意協助填寫這份問卷。本問卷主要是想了解科技相關領域的職涯發展，並從職涯理論與性別覺察的角度檢視您對職場現況與未來規劃的想法。以下所有問題請您就實際情形填答。您在本問卷所填的資料絕對保密，調查結果僅作學術研究之用，請安心作答。感謝您在百忙中撥空回答，並祝事業順利 平安喜樂。 研究計畫主持人 康寧大學健康照護管理學系副教授 張詠菡 敬上 聯絡方式：yhchang@ukn.edu.tw

＊為確保問卷調查之品質，如您已經填答過此份問卷，請勿重複作答，謝謝。

一、基本資料

1. 您的性別：□女 □男 □其他
2. 您的年齡：______
3. 您的居住地區：□北部 □中部 □南部 □花東或離島 □國外
4. 您的學歷： □研究所(含)及以上 □大學/技術學院 □專科 □高中(職) □國中(含)及以下
5. 請問您最高學歷之科系名稱為：______________________
6. 請問您最高學歷的科系或主要專業領域最符合以下哪一類：

□1 人文藝術、教育領域
□2 社會科學、商業、法律、社福領域
□3 自然科學領域
□4 建築、土木工程、製造、營造
□5 資訊工程、通訊科技
□6 農學領域
□7 醫學、藥學、公共衛生
□8 餐飲、長照服務領域
□9 其他________

7. 請問您目前的婚姻狀態

□已婚 □未婚 □離婚/喪偶 □其他

8. 請問您是否育有子女

□是（續答題 8.1） □否

8.1 請問您目前有幾名年齡未滿 6 歲的子女？
□無 □1 □2 □3 □ 3 個以上

二、工作經驗

1. 請問您目前是否有工作？

□有 □無（請跳答第 14 題）

2. 請問您目前工作的領域（產業）屬於下列哪一類？
□人文藝術、教育領域
□社會科學、商業、法律、社福領域
□自然科學領域
□建築、土木工程、製造、營造
□資訊工程、通訊科技
□農學領域
□醫學、藥學、公共衛生
□餐飲、長照服務領域
□其他_____

3. 請問您的職業屬於下列哪一類？
□民意代表、公司負責人
□企業主管、經理
□軍官、軍人
□科學及工程專業人員
□醫療保健專業人員
□資訊及通訊技術專業人員
□商業、行政、法律、社會及文化專業人員
□教學專業人員
□技術員及助理專業人員
□科學及工程助理專業人員
□醫療保健助理專業人員
□商業、行政、法律、社會及文化領域助理專業人員
□資訊及通訊傳播技術員
□各類事務與行政業務支援人員
□服務及銷售工作人員
□個人照顧、保安服務工作人員
□農林漁牧、狩獵工作人員
□建築、機具製造、電力設備、成衣製造工人
□駕駛及搬運設備操作人員
□其他_______

4. 請問您從事這份工作的年資有幾年？
__________年

5. 根據您目前這份工作，請問您任職單位**同事的性別比例**符合以下哪一種？
□沒有女性，全部都是男性。
□少數女性，大部分是男性。
□不同性別的比例差不多。
□大部分是女性，少數男性。
□全部都是女性，沒有男性。

6. 根據您目前這份工作，請問您任職單位**主管的性別比例**符合以下哪一種？
□沒有女性，全部都是男性。
□少數女性，大部分是男性。
□不同性別的比例差不多。
□大部分是女性，少數男性。
□全部都是女性，沒有男性。

7. 請問您的直屬主管的性別是？
□女 □男

8. 請問按照您的自我評估，您在目前這份工作的升遷機會如何？
□非常有機會升遷
□有機會升遷
□不太有機會升遷
□沒有機會升遷

9. 您作出上述評量的主要依據為何？
□個人的工作能力
□個人可投入在工作上的時間與心力
□主管對您的看法
□其他同事的經驗
□組織內的文化與結構
已是老闆/已到最高階
法律制度面問題
□其他____________

10. 這份工作近兩年來，平均**每年**的收入(包含年終、績效獎金等)約為？
□50(含)萬以下 □50-60(含)萬 □60-70(含)萬 □70-80(含)萬 □80-90(含)萬
□90-100(含)萬 □100-120(含)萬 □120-130(含)萬 □130-140(含)萬
□140-150(含)萬 □150 萬以上

11. 這份工作近一年來，平均**每日**的工時約多長？
□8-9(含)小時 □9-10(含)小時 □10-12(含)小時
□12-14(含)小時 □14-16(含)小時 □16 小時以上

12. 這份工作是否常加班？
□一個月中超過一半以上的工作日數都在加班
□一個月中會有幾次加班，但不頻繁。
□一個月中很少遇到加班。

13. 請問您是否有想過要離職
□有想過要離職 （請續答第 13.1 題）
□沒有想過要離職

13.1 如有想過要離職，**最主要**的原因為何？

□與個人興趣不符
□該工作無升遷或未來發展機會
□無法認同組織與主管的管理經營方向
□與家庭責任衝突
□其他

*無現職者工作題組
14. 請問您之前是否有工作過？ □是（續答以下問題）□否（問卷作答完畢，謝謝您。） 15. 之前做過最久的工作的產業屬於下列哪一類？ □人文藝術、教育領域 □社會科學、商業、法律、社福領域 □自然科學領域 □建築、土木工程、製造、營造 □資訊工程、通訊科技 □農學領域 □醫學、藥學、公共衛生 □餐飲、長照服務領域 □其他________________ 16. 延續上題，請問您在這份工作的職業屬於下列哪一類？ □民意代表、公司負責人 □企業主管、經理 □軍官、軍人 □科學及工程專業人員 □醫療保健專業人員 □資訊及通訊技術專業人員 □商業、行政、法律、社會及文化專業人員 □教學專業人員 □技術員及助理專業人員 □科學及工程助理專業人員 □醫療保健助理專業人員 □商業、行政、法律、社會及文化領域助理專業人員 □資訊及通訊傳播技術員 □各行業及領域事務與行政業務支援人員 □服務及銷售工作人員 □個人照顧、保安服務工作人員 □農林漁牧、狩獵工作人員 □建築、機具製造、電力設備、成衣製造工人 □駕駛及搬運設備操作人員 □其他________

17. 請問您從**在這份工作的年資有多久？**
__________年

18. 請問根據您的印象，這份工作中同事的性別比例符合以下哪種？
□沒有女性，全部都是男性。
□少數女性，大部分是男性。
□不同性別的比例差不多。
□大部分是女性，少數男性。
□全部都是女性，沒有男性。

19. 請問根據您的印象，這份工作中主管的性別比例符合以下哪種？
□沒有女性，全部都是男性。
□少數女性，大部分是男性。
□不同性別的比例差不多。
□大部分是女性，少數男性。
□全部都是女性，沒有男性。

20. 請問您當時的直屬主管的性別是？
□女 □男 □其他

21. 當時這份工作**每年**的平均收入（包含年終、績效獎金等）約為？
□50(含)萬以下 □50-60(含)萬 □60-70(含)萬 □70-80(含)萬 □80-90(含)萬
□90-100(含)萬 □100-120(含)萬 □120-130(含)萬 □130-140(含)萬
□140-150(含)萬 □150 萬以上

22. 當時這份工作的**每日**平均工時約為？
□8-9(含)小時 □9-10(含)小時 □10-12(含)小時
□12-14(含)小時 □14-16(含)小時 □16 小時以上

23. 當時工作是否常加班？
□一個月中超過一半以上的工作日數都在加班
□一個月中會有幾次加班，但不頻繁。
□一個月中**很少**遇到加班。

25. 請問您離開這份工作的**最主要**原因為何？
□與個人興趣不符
□該工作無升遷或未來發展機會
□無法認同組織與主管的管理經營方向
□與家庭責任衝突
□其他

三、職涯階段

以下是關於個人職涯的看法，針對下列各描述，請根據您的實際狀況勾選最適當的選項。(1=完全不符合 5=非常符合)

	完全不符合1	少部分符合2	還算符合3	大部分符合4	非常符合5
1.我希望能找到符合我本性與特質的生涯方向。					
2.我渴望在人生中獲得心靈上的成長。					
3.我發現生命中的危機能帶給我日常生活所無法提供的啓發。					
4.若我能現在就去追尋自己的夢想，我一定馬上行動。					
5.我希望我的人生能發揮影響力，並留下可紀念的成就。					
6.若必要，我會放棄我的工作來解決家中的問題與困難。					
7.我總是以家庭需求為優先，然後才安排工作。					
8.若我無法有時間與家人相處，工作就毫無意義了。					
9.能在工作與家庭間取得平衡，是人生中的巨大勝利。					
10.對現在的我而言，沒有什麼比平衡工作與家庭的責任更為重要。					
11.在我所從事的一切事上，我總是不斷尋找新的挑戰。					
12.我認為挫敗不是需要克服的「問題」，而是需要解決的「挑戰」。					
13.工作責任上的增加，對我而言不是問題。					
14.大部分的人都認為我是一個十分有目標的人。					
15.我能勝任工作上的挑戰，並將工作上的問題轉化為機會。					

四、性別角色態度

以下是有關性別角色態度與職場裡性別差異的看法，請問您同不同意以下的說法？（1=非常不同意 5=非常同意）

1-5 性別角色態度 6-10 職場性別差異知覺	非常不同意1	不同意2	無所謂同意不同意3	同意4	非常同意5
1.丈夫應與妻子公平分擔照顧小孩與做家事的責任。					
2.如果母親外出工作，對還沒上小學的小孩比較不好。					
3.當妻子有份全職的工作時，家庭生活總是會受到妨害。					

4.當工作機會稀少時，一個職缺與其給女性，不如給男性。					
5.女性應跟男性有相同且平等的機會升遷成為主管。					
6.有時候我會擔心，我的性別會影響其他人對我的專業能力的評量。					
7.有時候會因為我的性別，讓我在工作職場裡感到不自在。					
8.在工作分配上，無論我的性別為何，主管都會做出公平的分配。					
9.在升遷上，無論我的性別為何，工作表現都是最主要的依據。					
10.就我付出的工作努力而言，無論我的性別為何，我覺得我的考績結果都不會改變。					

五、工作自我效能

以下是有關您對於目前工作的看法，請問您同不同意以下的說法？（1=非常不同意 5=非常同意）

1-7 工作投入 8-10 專業角色衝突	非常不同意1	不同意2	無所謂同意不同意3	同意4	非常同意5
1.我在目前這份工作上的表現很好					
2.這工作是我真正感興趣的					
3.我相信我能在這工作完全發揮我的能力					
4.每天一早醒來，我都對要去上班感到開心。					
5.我願意將目前的工作當作終生事業					
6.從事這份工作可以實現我的理想與抱負					
7.工作時，我覺得充滿活力與信心。					
8.在我的工作領域，女性很難同時兼顧職業發展與家庭生活。					
9.在這領域，倘若女性中斷工作去生育小孩，之後將很難跟得上職場的發展。					
10.踏入這工作領域的女性，最好要有不生小孩的心理準備。					

六、家庭與工作關係

以下是有關家庭與工作間的關係，請您就過去一年內的實際狀況，回答下列情形有多常發生。（1=完全沒有 5=幾乎總是）

	完全沒	很少2	有時3	經常4	幾乎總

	有 1				是 5
1.工作上的要求干擾您的家庭生活					
2.家庭生活的要求干擾您的工作					
3.因為工作，您犧牲了與家人或朋友相處的時間。					
4.工作回到家，因為太累而無法做您自己喜歡做的事情。					
5.因為家事過度負荷，而導致您上班時疲憊。					
6.為了家庭生活，您降低對工作的投入。					

七、敵意職場經驗

依據您的工作經驗，請問您是否曾經觀察到主管或同事有以下的行為。（1=完全沒有 5=很經常）

	完全沒有1	很少2	有時3	經常4	幾乎總是5
1.刻意打斷或不聽女性員工的意見表達。					
2.以高人一等的姿態與女性員工交談。					
3.以不尊重或不禮貌的態度對待女性員工。					
4.以性別相關的貶抑用語評價女性員工。					
5.針對女性員工的外表，公開發表令人不愉快的評語。					
6.性騷擾女性員工					

問卷填答完畢，非常感謝您願意撥出時間幫忙，
您無私的付出是提升整體職場環境的寶貴助力。

Appendix 3

Career stages of female respondents at STEM workforce and work environment perceptions and quitting intention

	Early Stage (tenure: 1-5yrs)	Mid Stage (tenure: 6-10yrs)	Mid-late Stage (11-20yrs)
Average annual income level [a]	4.7	7.5	5.8
Average daily working hours [b]	1.9	**2.6**	2.3
Overtime frequency	1.9	2.2	2.3
Percentage of singlehood	71.4	60.0	50.0
Percentage of having kids	14.3	20.0	25.0
Percentage of respondents had quitting intention	**57.1**	**80.0**	**75.0**
Gender role attitudes—gender equality support level	**4.3**	3.2	4.1
Perceived gender equality at workplace	3.8	3.6	3.7
Work engagement level	3.2	2.7	3.4
Professional role conflicts	**2.1**	**2.3**	**2.8**
Work interfering family/personal life	**2.3**	**3.3**	**3.5**
Family impeding work	**1.5**	**2.4**	**2.6**
Observed hostility to women*	**1.3**	**2.0**	**2.3**
N	7	5	4

Notes:
1. [a]=income level: 3=600-700 k, 4=700-800k, 5=90-1000k, 6=1000-1200k, 7=1200-1300k
2. [b]=working hours index: 1=8-9 hours, 2=9-10 hours, 3=10-12 hours

108年度專題研究計畫成果彙整表

<table>
<tr><td colspan="3">計畫主持人：張詠菡</td><td colspan="3">計畫編號：108-2629-E-426-001-</td></tr>
<tr><td colspan="6">計畫名稱：以生命歷程觀點檢視資訊科技業女性的職業發展(L07)</td></tr>
<tr><td colspan="3">成果項目</td><td>量化</td><td>單位</td><td>質化
（說明：各成果項目請附佐證資料或細項說明，如期刊名稱、年份、卷期、起訖頁數、證號...等）</td></tr>
<tr><td rowspan="6">國內</td><td rowspan="6">學術性論文</td><td>期刊論文</td><td>0</td><td rowspan="2">篇</td><td>期刊投稿審查中。</td></tr>
<tr><td>研討會論文</td><td>0</td><td></td></tr>
<tr><td>專書</td><td>0</td><td>本</td><td></td></tr>
<tr><td>專書論文</td><td>0</td><td>章</td><td></td></tr>
<tr><td>技術報告</td><td>1</td><td>篇</td><td>本研究之執行報告已完成。</td></tr>
<tr><td>其他</td><td>0</td><td>篇</td><td></td></tr>
<tr><td rowspan="6">國外</td><td rowspan="6">學術性論文</td><td>期刊論文</td><td>0</td><td rowspan="2">篇</td><td>期刊投稿審查中。</td></tr>
<tr><td>研討會論文</td><td>0</td><td>投稿中，預計將於明年於國際研討會發表。</td></tr>
<tr><td>專書</td><td>0</td><td>本</td><td></td></tr>
<tr><td>專書論文</td><td>0</td><td>章</td><td></td></tr>
<tr><td>技術報告</td><td>0</td><td>篇</td><td></td></tr>
<tr><td>其他</td><td>0</td><td>篇</td><td></td></tr>
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<tr><td>碩士生</td><td>1</td><td>本研究執行過程中聘雇一名碩士級兼任助理</td></tr>
<tr><td>博士生</td><td>0</td><td></td></tr>
<tr><td>博士級研究人員</td><td>0</td><td></td></tr>
<tr><td>專任人員</td><td>0</td><td></td></tr>
<tr><td rowspan="5">非本國籍</td><td>大專生</td><td>0</td><td></td></tr>
<tr><td>碩士生</td><td>0</td><td></td></tr>
<tr><td>博士生</td><td>0</td><td></td></tr>
<tr><td>博士級研究人員</td><td>0</td><td></td></tr>
<tr><td>專任人員</td><td>0</td><td></td></tr>
<tr><td colspan="3">其他成果
（無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。）</td><td colspan="3"></td></tr>
</table>