Job Satisfaction of IT Workers in East Asia: The Role of Employee Demographics, Job Demographics, and Uncertainty Avoidance

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Abstract

The purpose of this study is to explore the drivers of job satisfaction of IT workers in the East Asian context, particularly in Taiwan, Japan, and China. Using data collected from IT workers, decision tree inductions were employed to identify the predictors of job satisfaction. Results indicate that the level of education has no effect on job satisfaction. Overall, higher uncertainty avoidance results in lower job satisfaction, and more experienced IT workers appear to be more satisfied. In Taiwan, longer serving IT workers, who are likely to hold more senior positions and spend more time on the job, are more satisfied with their jobs. Similarly, in Japan, older IT workers are more satisfied. In China, job satisfaction of IT workers differs across job roles and industries. It is recommended that management practices and policies in Taiwan focus on bridging gaps between longer serving and newer IT workers in terms of their ability to handle ambiguous work situations; whereas in Japan, these should focus on providing work flexibility and stress management programs to allow room for family support. In China, these should be tailored to specific job roles and industries in view of their different experiences with job satisfaction determinants.

Keywords: IT Workers; Uncertainty Avoidance; Job Satisfaction; Global IT; East Asia.

Introduction

Information technology (IT) workers, and hence, IT work, are an integral driver of economic development, generating output in the form of production and diffusion of innovation (Yeo, 2010). Thus, maintaining a strong IT workforce is vital because human capital plays an important role in the today's technology-driven society (Hulten, 2001). The use of IT boosts a country's productivity (*World Development Report 2016: Digital Dividends*, 2016), making IT workers extremely valuable to their employers (Uruthirapathy & Grant, 2015). Therefore, successful management practices to ensure the retention of IT workers are critical in today's context (Moore, 2000). In the IT workforce literature, the retention of IT workers has become a common theme (Wiesche et al., 2019), thus reflecting its importance. In the literature, scholars have found several variables that influence turnover decisions of workers in various industries, including IT; and among which, job satisfaction plays one of the most critical roles (cf. Igbaria & Siegel, 1992; Joseph et al., 2007; McKnight et al., 2009; Rutner et al., 2008; Scholtz et al., 2019; Thatcher et al., 2002).

However, while scholars agree that job satisfaction is a key driver of job turnover, predictors of job

satisfaction have been found to be different for different parts of the world (cf. Spector et al., 2007; Yousef, 2000). Most IS studies on IT workers tend to be Western-centric – they are conducted in North America or Western Europe and rely on samples collected in these countries. On the one hand, people around the world share many qualities, traits, and behaviors and we can expect some of this research to generalize to the other parts of the world. On the other hand, Henrich, Heine, and Norenzayan (2010) argue that most individuals are not WEIRD (Western, Educated, Industrialized, Rich, and Democratic), and people from the Western world are different from their non-Western counterparts in their approaches to reasoning, behaviors, and values. As Henrich et al. (2010) conclude, "many studies have shown that Americans, Canadians and Western Europeans rely on analytical reasoning strategies … substantially more than non-Westerners" (p. 29). Such differences are highly salient when we look at the entire body of research on IT personnel and observe that the overwhelming majority of it is conducted among so-called WEIRD populations. Research shows that only 12 percent of the world's population is WEIRD; this small margin of people tends to be outliers on many dimensions (Henrich et al., 2010). This is a significant limitation to our understanding of job satisfaction and turnover among the remaining 88 percent of the world's population. As such, both the scientific and practitioner communities would benefit from models generalizable across various geographical contexts as well as models specific to understanding behavior within a culture.

The preceding argument is applicable to the literature on IT workers and their job satisfaction as well. There is limited evidence to conclude that the predictors of job satisfaction that have been identified in the literature apply universally. This is because a vast majority of previous studies on the predictors of job satisfaction have been done in the Western contexts, mostly in the US (cf. Spector et al., 2007; Yousef, 2000). Because different countries have dissimilar cultures (Hofstede, 1980), and cultural factors predict job satisfaction (Bigliardi et al., 2012), it is reasonable to argue that not all findings from the Western-based literature are generalizable to the entire world. Furthermore, among the studies on the predictors of job satisfaction, there are even fewer that focus specifically on IT workers, who deserve attention due to the importance of the IT industry today (cf. Hulten, 2001; Moore, 2000; Uruthirapathy & Grant, 2015; Yeo, 2010). Therefore, what is missing in the stream of literature on the antecedents of IT workers' job satisfaction is studies conducted outside of the US.

Our study addresses this issue as an attempt to bring balance to the literature and add richness by studying the East Asian context. This study is not focused on identifying 'East vs. West' differences; instead, it recognizes the value of studying East Asia because, as a region, it comprises nearly 40 percent of the world's population and acknowledges the existence of the diverse cultures within this region. Thus, we contextualize our study of IT job satisfaction within East Asia and we examine three specific countries: Taiwan, Japan, and China. Our research goal is to investigate how the predictors of IT job satisfaction compare within these countries. Among the few studies on the predictors of IT workers' job satisfaction in East Asia is Kuo and Chen's (2004) notable work on the drivers of job satisfaction of IT workers from all industries in Taiwan. Hence, we use their findings as a benchmark for our investigation, given our similar focus on IT workers' job satisfaction in East Asia.

These three countries are among the top countries that leverage IT for innovation (Baller et al., 2016). However, there are some key differences that distinguish these countries' cultures. While two of the three countries share some similarities, there are differences. Unlike Japan, both Taiwan and China are predominantly Mandarin-Chinese speaking countries. However, according to the United Nations' classification, whereas China is still referred to as a developing country (although with a burgeoning economy), Japan is considered a developed country (*Country Classification*, 2014). However, the World Bank includes Taiwan in the high-income countries' aggregates (cf. World Bank, n.d.). Japan's cultural attributes have been assimilated in the Taiwanese cultural fabric and it has the same Confucian roots as Taiwan (Chew & Putti, 1995; Zhang et al., 2005). There are also several well-documented geographic, demographic, and political differences among Taiwan, Japan, and China (cf. Zhang et al., 2005); and different job satisfaction predictors were found across countries (cf. Spector et al., 2007; Yousef, 2000), thereby supporting a comparative study on IT worker job satisfaction among the three countries. Furthermore, there have been very few studies comparing job satisfaction levels among the Taiwanese, Japanese, and Chinese workers, and none that focus specifically on IT workers. Based on a comprehensive search of the literature, we found only one tangentially related study comparing job satisfaction levels between knowledge workers in Japan and China (Huang, 2011). However, the concept of the knowledge worker is broader than that of the IT worker, and these findings, despite their importance, do not address our research goal.

Cultural factors play a critical role in the context of the present study because they influence IT workers' job satisfaction (cf. Bigliardi et al., 2012). We used Hofstede's (1980) cultural dimensions as a useful and

consistent means to compare culture across different countries (Palvia et al., 2017). Hofstede's work comprises five cultural dimensions: power-distance, individualism-collectivism, masculinity-femininity, long-term orientation, and uncertainty avoidance (Hofstede, 1984a). Although research shows that power distance, uncertainty avoidance, and individualism-collectivism all have implications for job satisfaction (Ang et al., 2003), we focus on uncertainty avoidance in this study for four key reasons.

First, due to the complexity of our foundational model based on Kuo and Chen (2004), we sought to select only one cultural dimension, rather than several. Second, among the different cultural dimensions, uncertainty avoidance varies the most across the three countries examined in this study. Furthermore, since Kuo and Chen's (2004) work on Taiwan is used as a benchmark for this study, we also selected Japan and China because Taiwan's uncertainty avoidance measure is between those of Japan and China (Hofstede, 1980; Hofstede Insights, n.d.; *Uncertainty Avoidance Index*, n.d.). Third, in the literature on IT adoption studies that look at culture, uncertainty avoidance is the most frequently examined variable (cf. Leidner & Kayworth, 2006). Fourth, uncertainty avoidance is found to be the only cultural dimension that does not vary across gender (AlAnezi & Alansari, 2016). Since our sample from Japan comprises largely male workers, using uncertainty avoidance among other Hofstede's (1980) cultural dimensions avoids the gender bias.

The remainder of this paper is organized as follows. The next section is a literature review that provides the country backgrounds and a discussion of existing studies on the predictors of job satisfaction. This is followed by an explanation of the research method. Instead of a top-down approach, we employ decision tree induction to identify and compare the relevant predictors of IT job satisfaction among the three countries. Based on Peircan abduction, we then use these empirical results to generate explanatory hypotheses for future studies (cf. Fann, 2012; Osei-Bryson & Ngwenyama, 2011). Our selection of decision tree induction is based on three reasons. First, the data include several nominal and ordinal variables that decision trees can handle effectively. Second, decision trees do not require prior assumptions about the data distribution. Third, instead of coefficients of impact, decision tree induction generates value ranges of significant variables that predict the outcome, thus adding depth to the analyses. We conclude the paper with a presentation of the findings, and discuss the explanatory hypotheses, as well as theoretical and practical implications.

Literature Review

In their research on the East Asian context, Kuo and Chen (2004) investigated the impact of demographics on job satisfaction of IT workers in Taiwan, whereby marital status, age, job position, and salary were found to be influential. Their work has formed a conceptual and methodological foundation for subsequent studies on job satisfaction; however, among these, only two focused on IT workers in East Asia. Chiang and Wang (2008) found a positive correlation between organizational commitment and job satisfaction of workers in small to midsize IT companies in Taiwan. Subsequently, Wang, Tolson, Chiang, and Huang (2010) reported differences when comparing the notion of job satisfaction between workers in IT companies – including IT specialists and administrative personnel – in the US and Taiwan. In the former, job satisfaction comprised aspects such as being a somebody in the community, while in the latter, it is the pay.

There are also studies on job satisfaction extending Kuo and Chen's (2004) work in the non-East Asian context. For instance, Maamari (2014) studied the impact of pay on job satisfaction, finding that the impact of pay on job satisfaction is higher for women than for men IT employees in Lebanon. Wickramasinghe (2009) reported that among IT graduates employed full-time in offshore IT firms in Sri Lanka, women experience lower job satisfaction compared to men, and those working longer at the same job experience less job satisfaction. Lin (2008) found that job satisfaction depends on salary, education, a sense of belonging, job autonomy, and career advancement opportunities among library IT workers in the U.S.

Despite the merit and contribution of the above studies, they have a different focus, are done in the other countries, and their findings cannot be generalized to Taiwan, Japan, and China, given their different contexts (cf. Henrich et al., 2010). Although it may be convenient to assume that IT employees in geographically separate countries may behave in a similar way, taking this approach ignores the cultural and country differences between the West and the East as well as within the East Asian countries (Bond, 1996). Taken together, we conclude that there is a clear knowledge gap in the literature that focuses on job satisfaction among IT workers in Taiwan, Japan, and China, with a particular emphasis on demographics and culture.

Overview of Taiwan, Japan, and China

With respect to the cultural background, political system, and nature of the IT industry, Taiwan, Japan, and China exhibit both similarities and differences

which, in turn, may influence the behavior of their IT workers. On the one hand, Taiwan, Japan, and China are part of East Asia. Historically, these countries are racially homogenous with Confucian roots, have close relations, and exhibit high growth potential (Chew & Putti, 1995; Zhang et al., 2005). Although China has been under Communist Rule since 1949, Confucianism is deeply embedded in its core societal values (Ralston et al., 1996). Taiwan, on the other hand, was originally part of China, but has been politically separated and is currently a self-governing democracy. Taiwan was also a Japanese colony between 1895 and 1945, with some Japanese cultural traits lingering in its cultural fabric.

The political system of China differs from those in Taiwan and Japan. Taiwan and Japan are capitalist countries. Today, China cannot be considered a purely socialist country, but it has various socialist principles incorporated in its economy (Naughton, 2017). Its government has the authority and intention to shape its economy, a characteristic of socialist countries, and it tries to dramatically re-distribute income and fund social projects (Naughton, 2017). It also attempts to regulate its economy, including the IT industry. Taiwan, in contrast, has an intervention-free IT industry, whereas Japan has structured policies which have inhibited entrepreneurship in the form of high tech start-ups (Rowen & Toyoda, 2002).

The IT industries of these three countries also exhibit similarities and differences. According to the 2016 Global IT Report, Taiwan, Japan, and China are among the top countries in harnessing IT for innovation. All of them have invested heavily in the IT sectors and are home to leading and reputable IT corporations, such as United Microelectronics Corp. and Taiwan Semiconductor Manufacturing Company (Taiwan); Fujitsu Limited, NEC Corporation, and NTT Data Corporation (Japan); and Digital China Holdings (China). There are also stark differences. Taiwan, Japan, and China are ranked 19th, 10th, and 59th respectively on the Network Readiness Index, which comprises indicators related to the environment (political, regulatory, business, and innovation), readiness (infrastructure, affordability, and skills), usage (individual, business, and government usage), and impact (economic and social impact) (Baller et al., 2016). The comparatively lower ranking of China can be explained by its vast geography, resulting in wide disparities between urban and rural regions. Nevertheless, China's IT industry has been growing very fast. The IT services industry in China grew the fastest compared to those in Taiwan and Japan from 2012 to 2016 but is projected to be smaller than Japan's by 2021 (*IT Services Industry Profile: Japan*, 2017). In contrast, between 2012 and 2016, Taiwan's IT services industry grew the slowest compared to those of Japan and China (*IT Services Industry Profile: Japan*, 2017).

The discussion above reveals that due to the differences in their country backgrounds, political systems, and the nature of IT industries, it is reasonable to argue that IT workers in Taiwan, Japan, and China have established their own unique IT occupational values, which may further affect workers' perceptions and behaviors in the workplace. The present study empirically tests whether IT workers in Taiwan, Japan, and China exhibit different levels of job satisfaction and how they are affected by employee demographics, job demographics (i.e. job-related characteristics), and uncertainty avoidance. The findings point out country differences among IT workers.

Predictors of Job Satisfaction

Job satisfaction is an employee's overall assessment of all aspects of his or her job (Palvia et al., 2018; Spector, 1997). The literature advocates that job satisfaction is among the most important factors affecting job turnover (cf. Igbaria & Siegel, 1992; Joseph et al., 2007; McKnight et al., 2009; Rutner et al., 2008; Thatcher et al., 2002). Higher job satisfaction increases organizational commitment, which in turn, reduces job turnover (Thatcher et al., 2002) and possible turnover intentions (Chang et al., 2012; Serenko et al., 2015). There is also some evidence of a positive relationship between job satisfaction and job performance (Judge et al., 2001). Prior studies have looked at the various predictors of job satisfaction, but very few have focused on IT workers in the three countries of interest. However, job satisfaction remains an important issue in the workplace that deserves investigation across countries (Palvia et al., 2017). In our literature review, we discuss relevant findings from both the western and eastern worlds and show why the former may not fully apply to the latter. In view of the research gaps, we review relevant literature on employee demographics, job demographics, and uncertainty avoidance in relation to job satisfaction, for inclusion in the comparative analysis of the three countries. We discuss the literature on these variables in the subsequent sections.

Employee Demographics

In Kuo and Chen's (2004) study of IT workers in Taiwan, the authors found that IT workers aged 35 to 40 years old are significantly more satisfied with their jobs than their counterparts who are between 20 and 30 years old (Kuo & Chen, 2004), corroborating earlier studies showing that older workers are more satisfied with their jobs (Lee & Wilbur, 1985; Reiner & Zhao, 1999). In contrast, other studies reported that younger

and older workers are more satisfied than those aged in the middle (Eichar et al., 1991; Kacmar & Ferris, 1989). IT work is not a new occupation, and IT workers range in age. Such contradictory findings suggest a need for further research on the impact of age on job satisfaction.

Kuo and Chen (2004) reported no significant differences in job satisfaction across gender, corroborating earlier findings that no universal conclusions have been drawn in this area (Witt & Nye, 1992), and that there is a lack of evidence on the differences in job satisfaction between men and women (Clark, 1997). Nevertheless, it is reasonable to postulate that there may be gender differences in job satisfaction among IT employees in Taiwan, Japan, and China due to different societal expectations (cf. Chew & Putti, 1995; Trauth et al., 2008; Zhang et al., 2005). The Japanese culture has been argued to be nationalistic and ethnocentric (Chew & Putti, 1995). In Japan, women tend to be more conservative than men as well as both men and women in Taiwan and China (Zhang et al., 2005), due to traditional societal expectations of them to suppress career ambitions (Hofstede, 1980). In contrast, women students in China with high school examination scores are encouraged to pursue IT careers (Trauth et al., 2008), which suggests that gender may play different roles in influencing job satisfaction among IT workers in the three countries.

Kuo and Chen (2004) also offered no evidence on significant differences in job satisfaction across education levels. At the same time, there is contradictory literature on this topic. Howard and Frink (1996) found that white collar workers experience higher job satisfaction than their blue collar counterparts. Assuming that white collar workers have higher education in general, highly educated workers are likely to be more satisfied with their jobs. However, although highly educated workers are likely to occupy higher positions, they may have higher expectations from their jobs, which can lead to disappointment (Ross & Reskin, 1992) and thus to lower job satisfaction (Clark, 1997). IT work usually requires higher education due to the technical training, which implies that educational levels may have implications for IT workers' job satisfaction levels.

Job Demographics

We use job demographics as an umbrella term to include characteristics of the job held by an IT worker and argue that they can influence job satisfaction. Kuo and Chen (2004) found evidence that job satisfaction does not differ among IT workers with different IT work experience levels. On the contrary, Bedeian et al. (1992) reported that workers who are more experienced are more satisfied than those who are less experienced. Additionally, Kuo and Chen (2004) found evidence that managerial IT workers have significantly higher job satisfaction than their clerical colleagues. Thus, the position of an IT worker may potentially influence job satisfaction.

In terms of industry differences, Kuo and Chen (2004) found no evidence of significant differences in job satisfaction across different industries. However, they used only three general types of industries, which may not fully represent the nature of the contemporary economy. IT workers can span across multiple industries. For example, a retail company may have a dedicated IT department run by IT workers. Thus, the three broad categories used by Kuo and Chen (2004) may not be sufficient to capture all possible differences across different industries. In this study, we adopt a broader approach to include 17 different industries for a more in-depth analysis.

Job satisfaction may also differ across IT job roles. McKnight et al. (2009) studied the impact of factors related to the workplace (supervisor satisfaction, co-worker satisfaction, and organization-based rewards) and the job (job feedback, job significance, and job autonomy) on turnover intention. They found that job factors are more important for technical support IT workers, while workplace factors are more important for programmers and analysts. Although their study used different variables, their findings highlight possible differences in the predictors of job satisfaction across job roles. Furthermore, their study was based on IT workers in the US, which, if replicated in other contexts, may not yield similar results. Therefore, including job roles can add rigor to an analysis of what drives job satisfaction of IT workers in the East Asian context.

Uncertainty Avoidance

Kuo and Chen's (2004) study did not include the possible impact of culture, which has been found to influence job satisfaction of knowledge workers (Bigliardi et al., 2012). Especially, since our study includes multiple country comparisons, it follows that the inclusion of culture can enrich the analysis. According to Palvia et al. (2017), Hofstede's (1980) cultural framework is useful in assessing cultural differences across countries, including East Asian countries such as Taiwan, Japan, and China. It is widely used in IS research and has the advantage of simplicity in measurement. In the present investigation, we focus on uncertainty avoidance, as one of the five dimensions of culture (cf. Hofstede, 1980), because previous studies have demonstrated the impact of uncertainty avoidance on job satisfaction (Ang et al., 2003). We discuss this relationship in subsequent paragraphs.

In this study, uncertainty avoidance is considered an individual difference variable defined as the degree to which IT employees prefer unambiguous, clear, and well-structured situations instead of ambiguous, vague, and unstructured contexts, and it reflects their tendency to evade uncertainty and unknowns. As argued by Srite and Karahanna (2006), even those who reside in the same country espouse national culture to varying degrees. Thus, to predict people's behavior at an individual level, they recommend using constructs reflecting an individual level of analysis. Hoehle et al. (2015) further demonstrate that behaviors of individual employees are not driven by uncertainty avoidance at a national level; instead, they are influenced by espoused uncertainty avoidance which is the extent to which each individual accepts uncertainty avoidance values. Nonetheless, it is reasonable to argue that the individual and country level cultural characteristics can mutually influence each other. The direction of causality is beyond the scope of this study.

Prior research shows that uncertainty avoidance is positively correlated with job satisfaction (Ang et al., 2003). It makes one's job easier (Palich et al., 1995), and higher uncertainty avoidance is associated with adherence to rules and policies which makes one's job more predictable and, possibly, more satisfactory (Chew & Putti, 1995). Furthermore, the subsequent paragraphs show evidence that Taiwan, Japan, and China have different levels of uncertainty avoidance.

In the past, Taiwan had a medium uncertainty avoidance culture (Hofstede, 1984a), but it was later reported that Taiwan has high uncertainty avoidance (Wu, 2006). IT workers in Taiwan tend to follow a career path towards working for large, established, and reputable companies. They typically do not adopt a risk-taking mentality to work in companies at preliminary stages of research and development (Hu et al., 2005). This suggests that IT workers in Taiwan are not comfortable with uncertainty, which can potentially influence their job satisfaction.

Structure, risk minimization (Money & Crotts, 2003), and security needs (Hofstede, 1984b) are very important in Japan, a culture characterized by high uncertainty avoidance (Hofstede, 1984a) and a somewhat less emphasis on entrepreneurship (Angelino & Collier, 2004). In the Japanese culture, there is a tendency to consult professionals rather than peers (Money & Crotts, 2003), thereby suggesting people's adherence to authority and hierarchy. A cultural emphasis on the collective rather than on the individual reflects loyalty, community, and a sense of belonging (Lopez et al., 2009). These cultural traits suggest that the Japanese IT workers are likely to remain at their jobs for a long time. However, this may not necessarily result in high job satisfaction.

According to Hofstede (1984a), China has a risk avoidance culture; but it also exhibits collectivistic notions (Ralston et al., 1996, 2008). As such, the Chinese IT workers are expected to lack an entrepreneurial drive and avoid making immediate decisions under uncertain circumstances. However, although societal core values are deeply embedded (Ralston et al., 1996), Wu (2006) argued that work-related cultural values may gradually change. Hofstede's (1984a) work is dated shortly after China began its transition to capitalism and opened up its economy to the world. Therefore, it is plausible that China's work-related culture may have changed, albeit slowly (Ralston et al., 1995). Today, China's business culture exhibits the characteristics of individualistic, profit-driven entrepreneurial values (Swierczek & Ha, 2003). It is important to note that China is a large country, thus making it more culturally complex than Taiwan and Japan. The mix of cultural collectivism and individualistic tendencies makes their cultural fabric complex. The implications on IT job satisfaction deserves further investigation, given the importance of IT workers to the Chinese economy.

Research Questions

From the preceding discussion, we establish the gaps in literature and seek to address two important research questions. Figure 1 provides a general research model and illustrates the three constructs of interest – employee demographics, job demographics, and uncertainty avoidance – as predictors of job satisfaction.

> Research Question 1 (RQ1): What are the similarities and differences among IT workers in Taiwan, Japan, and China?
>
> Research Question 2 (RQ2): How do employee demographics, job demographics, and uncertainty avoidance drive job satisfaction among IT workers in Taiwan, Japan, and China?

Method

Data and Variables

This study is part of a larger investigation titled the World IT Project (Palvia et al., 2017, 2018). It was launched to bring a more balanced view of IT work by complementing research on western contexts with eastern contexts. In this project, 83 researchers worldwide collected data via an identical survey instrument (translated into the local languages if necessary) from 37 countries by surveying around 300 IT employees in each country. Further details on the data collection are available in Appendix A.

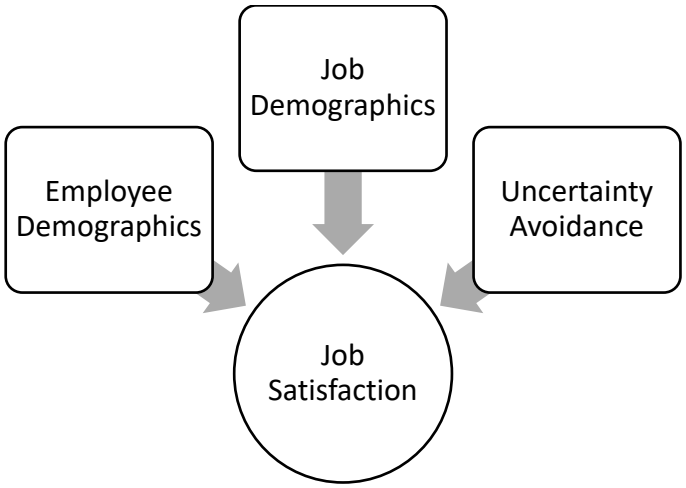

Figure 1. The Research Model

In the present study, which uses the datasets from the three countries, only a small subset of items was used. As shown in Figure 1, there are four constructs of interest. We operationalized IT workers' demographics using age, gender, and education. For job demographics, we used job role (i.e., job title), years of IT work experience, job position (not part of management, lower management, middle management, senior management), and the industry of the IT worker's company. Since our extension involves inter-country comparisons, we included similar variables from these countries in our analysis.

Work-related cultural values may change over time. Given that Hofstede's work is dated more than three decades ago at the time of writing, it is important to assess a current measure of uncertainty avoidance of the respondents (Wu, 2006). Therefore, Hofstede's original items were included in the instrument and an uncertainty avoidance score was computed by following the formula provided in the manual by Hofstede et al. (2008 p. 9). In terms of their interpretation, these scores are similar to the espoused national culture values described by Srite and Karahanna (2006). Another rationale for computing these scores anew is that IT workers may differ in terms of the degree to which they identify themselves with national culture values; and therefore, each respondent's uncertainty avoidance score may be considered an individual differences variable.

Job satisfaction was obtained as a composite of three survey items. Respondents were asked to rate their agreement with the following three statements: "In general, I like working here" (JS1); "All in all, I am satisfied with my current job" (JS2); and "In general, I don't like my current job" (JS3, a negatively worded item). A higher score indicates a higher level of job satisfaction. After removing the third item from the China dataset due to poor reliability, all satisfaction constructs exhibited acceptable reliability with Cronbach's Alpha and item-to-total correlations exceeding 0.7. Table 1 summarises the variables used in this study.

Table 1. Summary of the Variables

Construct	Operationalization	Measurement Level
Employee Demographics	Age	Ordinal
	Gender	Nominal
	Education	Ordinal
Job Demographics	Job role	Nominal
	Years of IT work experience	Ordinal
	Job position	Ordinal
	Industry	Nominal
Culture – Uncertainty Avoidance	Uncertainty Avoidance	Continuous
Jobs satisfaction	Job satisfaction scale	Continuous

Methodological Overview

We used R v.3.4.3 and SPSS Modeler v.15 for the empirical analysis. The research method comprised four primary steps. First, we executed reliability analyses in R to compute a composite job satisfaction measure for each country. Second, we ran Shapiro-Wilk tests in R on the measures of uncertainty avoidance and job satisfaction to assess if they are normally distributed. This enabled us to determine the appropriate mean difference tests to compare differences in uncertainty avoidance and job satisfaction across the three countries in the descriptive analysis. Third, we performed descriptive analyses of the variables, as well as mean differences in uncertainty avoidance and job satisfaction across the three countries in R. Given that the data were not normally distributed, we executed Kruskal-Wallis and Dunn's tests to assess these mean differences. Fourth, we used SPSS Modeler v.15 to execute decision tree induction on all three countries to determine their respective predictors of job satisfaction to build decision trees.

Decision Tree Induction

We used decision tree induction to identify the predictors of job satisfaction among IT workers in Taiwan, Japan, and China. Decision trees have been used in data mining applications for predictive analyses (Andoh-Baidoo et al., 2012; Osei-Bryson, 2004). They are different from clustering algorithms that group data into homogenous groups. Decision trees identify significant variables that can be used to predict an outcome, or target variable, similar to a regression analysis in traditional statistics (see Appendix B).

Decision tree induction, rather than traditional statistics, is preferred in this study for three reasons. First, several independent variables are nominal or ordinal. For example, the industry variable alone has 17 categories. Using a regression to predict job satisfaction will require the creation of too many dummy variables. At the same time, decision trees are capable of processing nominal and ordinal data effectively. Second, decision tree induction can handle non-linear relationships among variables and does not require the satisfaction of assumptions about data frequency distributions (Pal & Mather, 2003). Third, unlike regression analyses that provide a coefficient of impact for each independent variable, decision tree induction generates value ranges of significant variables that predict the outcome. Thus, the use of decision tree induction provides additional depth to the analyses.

To build decision trees, we computed job satisfaction of IT workers for each country as an ordinal (high and low) variable, where the cut-off point was determined by the respective means of job satisfaction in each country (see Appendix B). We used the results from our decision tree induction to develop explanatory hypotheses for future investigations that are presented in the Discussion and Conclusion section. These hypotheses are generated from the significant splits of the decision trees, which reflect their empirical justification and test worthiness, thus addressing the limitation of generalization from a single empirical study. A global explanatory hypothesis generated from a decision tree induction reflects the overall relationship between two variables across the problem domain, while a local explanatory hypothesis is more specific and stems from subsequent splits in a decision tree (Osei-Bryson & Ngwenyama, 2011) (see Appendix C). We advance global and local explanatory hypotheses based on the decision trees in each country, as well as more general ones based on common findings across all three decision trees that can be tested in other countries. However, this does not mean that country-specific explanatory hypotheses cannot be tested in other countries.

Findings

Comparative Analyses

The dataset used for this study included responses from 303, 310, and 297 IT workers from Taiwan, Japan, and China, respectively. Reliability analyses were executed on the composite measure of job satisfaction for all three countries to assess the reliability of the three job satisfaction items (see Table 2). The results show that the measures were sufficiently reliable for Taiwan and Japan ($\alpha = 0.81$ and $\alpha = 0.73$, respectively). For China, however, the reliability was poor ($\alpha = 0.56$). Upon further examination, the removal of the negatively worded item – "In general, I don't like my current job" – resulted in a very good reliability measure ($\alpha = 0.91$). Therefore, we removed this item from the China's dataset to compute job satisfaction levels among its IT workers.

Table 3 describes the respondents' age, gender, and education. Some percentages do not add up to 100 percent due to missing data. We decided against imputation for three reasons. First, age is a demographic variable, is independent, and has no bearing on the other records. This increases the difficulty of imputing age. Second, imputation methods are not perfect and can lead to erroneous interpretations. Third, the choice of imputation methods, including regression, maximum likelihood, and mean, depends heavily on randomness and reasons for the missing data (Lodder, 2013). Given our non-random sampling method, we are not poised to determine the most suitable imputation method.

Table 2. Summary of Reliability Analysis for Job Satisfaction

Country	Survey Items	Mean	Std. Dev.	Item-to-Total Correlation	Cronbach's Alpha
Taiwan	JS1	3.91	0.79	0.86	0.81
	JS2	3.74	0.87	0.88	
	JS3	3.55	1.00	0.83	
Japan	JS1	3.49	0.96	0.84	0.73
	JS2	3.27	0.98	0.84	
	JS3	3.33	1.05	0.75	
China	JS1	3.77	0.83	0.96	0.91
	JS2	3.68	0.78	0.95	

Table 3. Employee Demographics – Age, Gender, and Education

Variable	Taiwan	Japan	China
Age			
From 18 to 20 years old	2.30%	1.00%	10.40%
From 21 to 29 years old	36.00%	3.20%	50.50%
From 30 to 39 years old	28.10%	12.60%	31.30%
From 40 to 49 years old	19.50%	33.90%	5.40%
From 50 to 59 years old	14.20%	39.0%	1.70%
More than 60 years old	0.00%	9.7%	0.70%
Gender			
Men	71.00%	91.30%	64.00%
Women	28.40%	8.70%	36.00%
Education			
High school or less	3.00%	17.70%	2.40%
Associate degree or some college	10.90%	11.30%	13.10%
Bachelor's degree	43.60%	50.00%	54.50%
Master's degree	41.30%	18.40%	26.90%
Ph.D.	1.30%	2.60%	3.00%

The respondents from China are the youngest where over half of the IT workers are from 21 to 29 years old, and those from Japan are the oldest where almost 40 percent are between 40 and 49 years old. The majority of the respondents from each country are men. Among the respondents, Taiwan's and China's percentage of men is fairly similar, making up 71 percent and 64 percent respectively. Men in Japan make up 91.3 percent of the sample. Overall, the IT workers are highly educated; 86.2 percent (Taiwan), 71 percent (Japan), and 84.4 percent (China) of them have a college/university degree. Japan is an outlier where 17.7 percent have only high school education or less.

Table 4. IT Work Experience and Job Position

Variable	Taiwan	Japan	China
IT Work Experience			
4 years or less	46.20%	17.40%	52.50%
5 – 9 years	12.50%	8.70%	27.60%
10 – 19 years	22.80%	22.30%	18.90%
20 – 29 years	14.50%	28.70%	0.70%
More than 30 years	4.00%	22.90%	0.30%
Job Position			
Not part of management	56.80%	51.60%	56.90%
Lower management	16.20%	15.20%	19.20%
Middle management	18.50%	14.50%	15.80%
Senior management	8.60%	18.70%	8.10%

According to Table 4, IT workers from Japan have the longest tenure within the IT industry (73.9 percent have at least 10 years of IT work experience) whereas those from China have the shortest tenure (only 19.9 percent have at least 10 years of IT work experience). This is not surprising because the Japanese IT workers are older than those in China and Taiwan. China's respondents have less IT work experience comparatively, with 52.5 percent having four years or less, 27.6 percent having five to nine years, and 18.9 percent having 10 to 19 years. Most of the respondents from Taiwan (56.8 percent), Japan (51.6 percent), and China (56.9 percent) are not part of management in their organizations. At the same time, in Japan, 18.7 percent are in senior management, compared to 8.6 percent and 8.1 percent in Taiwan and China, respectively. Thus overall, we can see that Japan's respondents are generally older, have more IT work experience, and are more senior in terms of their job position.

Table D1 in Appendix D presents the distribution of IT roles. In Taiwan, a vast majority (23.1 percent) are involved in programming, followed by analysis and design (10.6 percent) and maintenance (9.6 percent). In Japan, many are in the analysis and design role (15.2 percent), followed by operations (13.2 percent), management and strategy (11.3 percent), and programming (11 percent). In China, a substantial majority are in programming (32 percent), followed by analysis and design (13.1 percent), financial roles (7.7 percent), and system administration (7.1 percent). The roles of IT workers in Taiwan and China are fairly similar, and analysis and design is a highly common role among IT workers in all three countries. Based on Table D2 in Appendix D, slightly less than a half of the respondents in Taiwan (44.9 percent) come from the IT industry and 21.1 percent are from the manufacturing industry. In Japan, the distribution is similar to that in Taiwan – half of the respondents (50 percent) come from the IT industry and 23.9 percent are from manufacturing. In China, only 27.6 percent come from the IT industry, 22.2 percent work in the manufacturing industry, and 12.8 percent are in retail and service. Overall, the industries where the respondents work are similar for Taiwan and Japan, and IT and manufacturing make up the majority. China differs slightly in this regard, with a comparatively higher percentage of respondents from retail and service. Table 5 shows a summary of the means and standard deviations of the measures of uncertainty avoidance and job satisfaction. Given that the distributions of uncertainty avoidance and job satisfaction are not normal in all three countries, we conducted Kruskal-Wallis and Dunn's tests to explore significant differences in uncertainty avoidance and job satisfaction across the three countries.

Table 5. Summary Statistics for Uncertainty Avoidance and Job Satisfaction

	Taiwan		Japan		China	
	Mean	SD	Mean	SD	Mean	SD
Uncertainty avoidance	55.94	60.73	57.94	68.08	34.06	56.92
Job satisfaction	3.73	0.76	3.36	0.80	3.73	0.77

With regards to uncertainty avoidance, there are significant differences across the groups (H = 35.46, $p < 0.001$). Looking at the post-hoc Dunn's Test results, there is no significant difference between respondents from Taiwan and Japan (mean difference = 2.00, $z = 0.39$, $p = 0.35$). However, respondents from China have a significantly lower score than those from Japan (mean difference = -23.88, $z = -5.36$, $p < 0.001$) and Taiwan (mean difference = -21.88, $z = -4.95$, $p < 0.001$).

Figure 2 shows the spread of uncertainty avoidance in the three countries using juxtaposed violin and box plots. The median uncertainty avoidance levels in Taiwan (55.00) and Japan (70.00) are higher than that of China (30.00), although Japan has more extreme values that are higher and lower than those of Taiwan. Approximately 75 percent of the respondents from China scored lower on uncertainty avoidance than those from Taiwan and Japan, thus pointing to the significant differences highlighted by the post-hoc tests.

In terms of job satisfaction, the Kruskal-Wallis Test results show that the differences are significant (H = 42.85, $p < 0.001$). Specifically, there is no significant difference in job satisfaction between Taiwan and China (mean difference = 0.00, $z = 0.33$, $p = 0.37$) where the IT workers exhibit similar levels of job satisfaction. However, IT workers in Japan are significantly less satisfied with their jobs compared to those in Taiwan (mean difference = -0.37, $z = 5.82$, $p < 0.001$) and in China (mean difference = -0.37, $z = -5.47$, $p < 0.001$).

Figure 3 shows the data distribution of job satisfaction for the three countries using juxtaposed violin and box plots. Respondents in Taiwan and China have the same median job satisfaction level (median = 4.00). Japan has a lower median (median = 3.33) with more respondents scoring below 3.00 compared to the other two countries.

In summary, IT workers from Taiwan and Japan are more likely to avoid uncertainty than those from China; and IT workers from Japan are likely to be less satisfied with their jobs than those from Taiwan and China. Japan's IT workers are older, have more years of IT work experience, and are more likely to be in senior management that those from Taiwan and China. However, they are also the least educated. From the employee demographics, it is plausible that IT workers in Japan are those who worked their way up the management levels, whereas those in Taiwan and China obtained IT jobs via their educational qualifications.

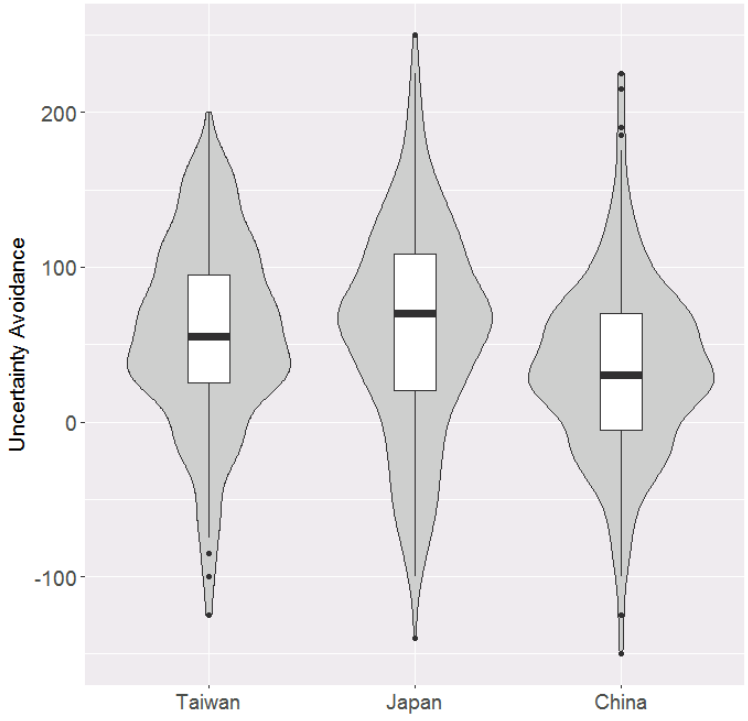

Figure 2. Uncertainty Avoidance Density and Box Plots across the Countries

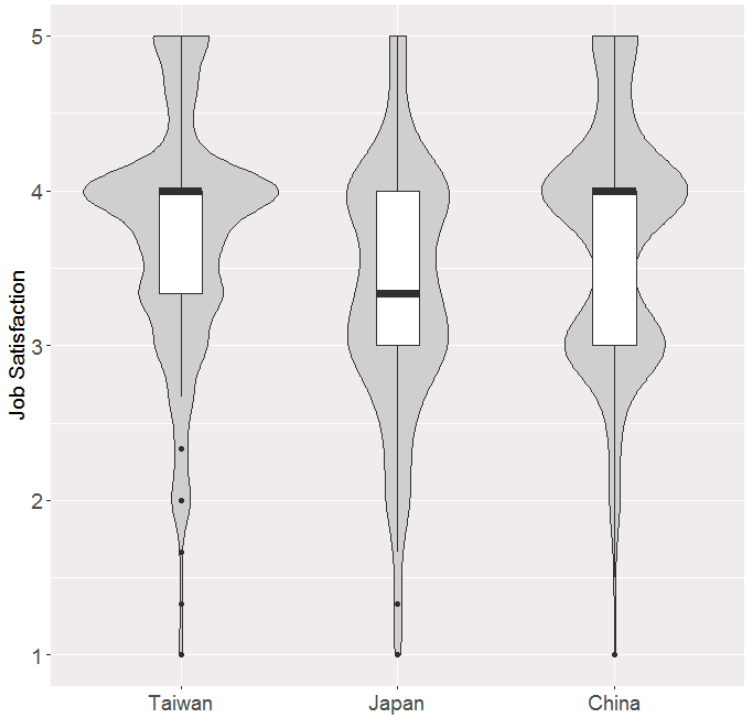

Figure 3. Job Satisfaction Density and Box Plots across the Countries

Predictive Analyses

Three decision trees were built to identify the predictors of job satisfaction in Taiwan, Japan, and China using the variables included in this study. We implemented stopping rules to enhance the robustness of the decision trees by setting the minimum number of records in a child node, the minimum number of records in a parent node (cf. Song & Ying, 2015), and reducing the depth of each decision tree (cf. Bramer, 2013; Song & Ying, 2015) (see Appendix B for rationale). The default built-in algorithms employ pruning to limit over-training based on the performance of the training data. We also set the minimum records in each child and parent node to be 1 percent and 2 percent, respectively, and each tree's depth to be 3 levels. We acknowledge that k-fold validation can also be used to prevent over-fitting. However, this was not available in the software package.

Taiwan

The decision tree induction shows that the predictors have a 65.02 percent accuracy in predicting job satisfaction of IT workers in Taiwan. Table 6 presents the confusion matrix, where there are 197 records that were correctly predicted. The preceding section shows that IT workers in Taiwan generally have a moderately high job satisfaction. Their mean level of job satisfaction (mean = 3.73) is significantly higher than that of Japan's (mean difference = -0.37, $p < 0.001$). Figure 4 shows the decision tree for job satisfaction in Taiwan, with the rules that split the sample to classify the records as low or high satisfaction levels, based on modes in each node.

The first branch shows that IT respondents with uncertainty avoidance scores of 55 or less tend to exhibit high job satisfaction levels ($\chi^2=13.72$, $p < 0.005$) (Node 1). Next, we look at IT workers from the second branch who have an uncertainty avoidance score above 55. Among these IT workers, those who are not part of management or are in middle management tend to exhibit low job satisfaction levels ($\chi^2=7.58$, $p < 0.05$) (Node 3). Those who are in lower or senior management, and with less than or equal to nine years of IT work experience, tend to exhibit low job satisfaction ($\chi^2=6.82$, $p < 0.05$) (Node 5), while those who have more than nine years of IT work experience tend to have high job satisfaction ($\chi^2=6.82$, $p < 0.05$) (Node 6).

Table 6. The Confusion Matrix for Decision Tree Induction, Taiwan

Job Satisfaction	High (Predicted)	Low (Predicted)
High (Actual)	119	44
Low (Actual)	62	78

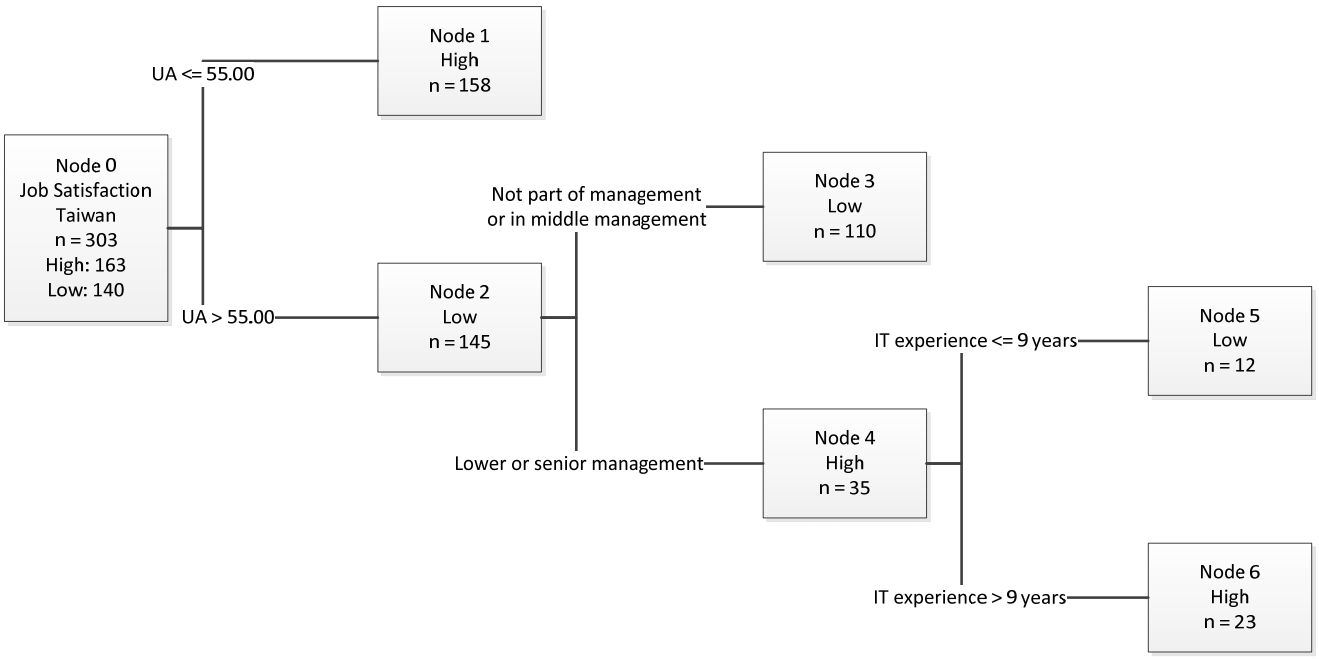

Figure 4. Decision Tree for Job Satisfaction in Taiwan (UA – Uncertainty Avoidance)

Taken together, the results indicate that IT workers with low job satisfaction in Taiwan are those who tend to avoid uncertainty (Node 1 and Node 2). However, the IT work environment in Taiwan may have long-term rewards, resulting in those who are more experienced being more satisfied with their jobs (Node 5 and Node 6). We explored these findings further by investigating the significant predictors. We aggregated the variables: uncertainty avoidance scores and IT job position into ordinal categories based on the splits in the decision tree. For uncertainty avoidance, a score of less than or equal to 55 is recoded as low, while a score of more than 55 is recoded as high. Figure 6 shows the mean job satisfaction levels among IT workers in different categories, which corroborates our finding that IT workers with a higher uncertainty avoidance score (more than 55) are less satisfied with their jobs. This is more evident in senior management where the difference is substantially larger (Figure 5).

Following the split in the decision tree, IT workers with less than 10 years of experience are recoded as having less experience, while those who have more than or equal to 10 are recoded as having more experience. Figure 6 shows that IT workers with more IT work experience tend to have higher levels of job satisfaction across different levels of management. Interestingly, the largest difference occurs between those in senior management, where IT workers with comparatively low IT work experience have a substantially higher level of job satisfaction.

Japan

The decision tree induction shows that the predictors have a 68.71 percent accuracy in predicting job satisfaction of IT workers in Japan. Table 7 shows the confusion matrix, where there are 200 records that are correctly predicted. As discussed in the preceding section, the mean level of job satisfaction of IT workers in Japan (mean = 3.36) is significantly lower than that of Taiwan (mean difference = -0.37, $p < 0.001$) and China (mean difference = -0.37, $p < 0.001$). Figure 7 shows the decision tree for job satisfaction in Japan. It illustrates the rules that split the sample to classify the records as low or high satisfaction levels.

IT workers who are 39 years old or younger generally exhibit low job satisfaction (Node 1) (χ^2=27.35, $p < 0.001$). For those who are over 39, but younger than 60, their level of uncertainty avoidance becomes important. Among these older IT workers, those who have an uncertainty avoidance score of 60 or less and have 29 or less years of IT work experience generally have low job satisfaction (Node 6); whereas those with more than 29 years of IT work experience have high job satisfaction (Node 7) (χ^2=10.49, $p < 0.005$). Next, we turn to IT workers who are older than 39 years old and have an uncertainty avoidance score of more than 60. Most of these workers have low job satisfaction levels. Due to the small number of women respondents, the subsequent split must be interpreted with caution. The third branch of the decision tree for Japan comprises IT workers who are 60 years or older. These workers generally exhibit high job satisfaction (Node 3) (χ^2=27.35, $p < 0.001$).

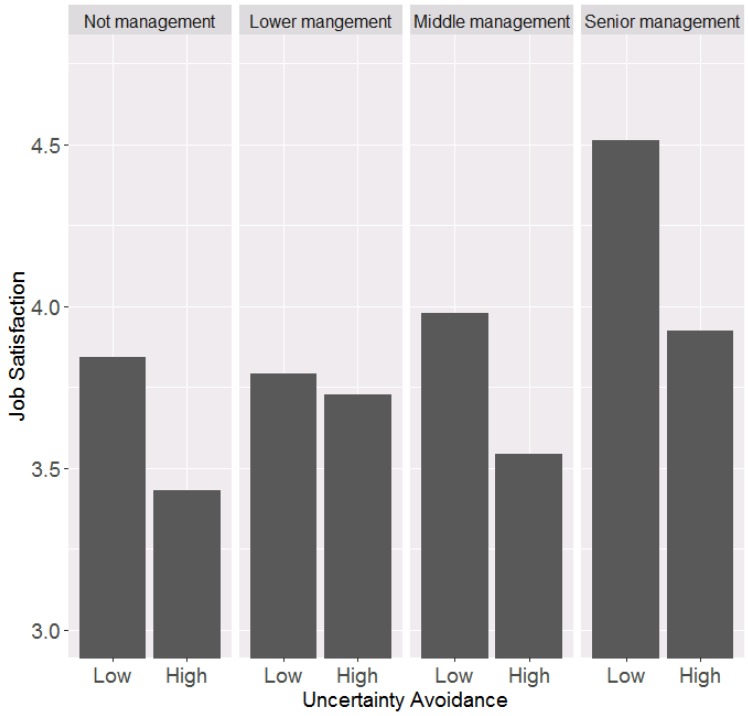

Figure 5. Job Satisfaction by Uncertainty Avoidance and Management Level in Taiwan

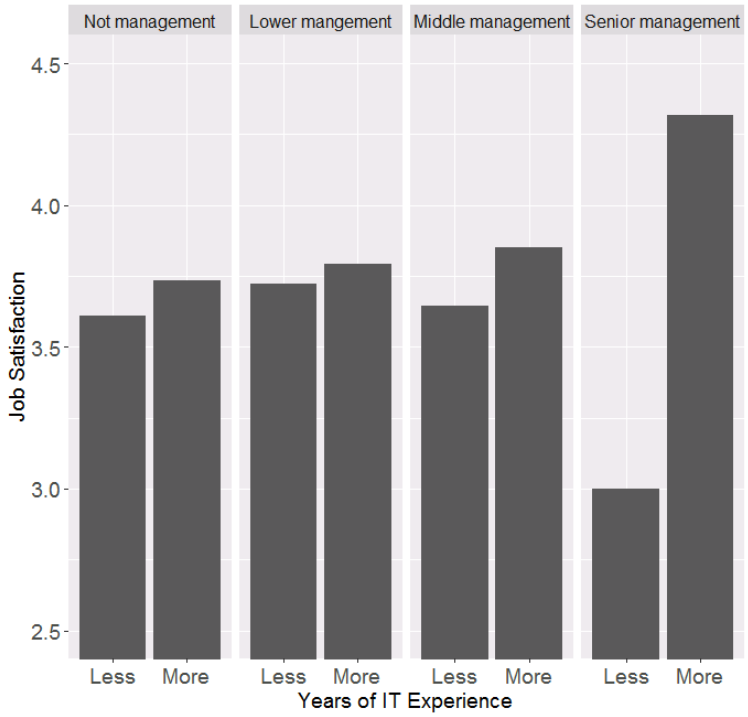

Figure 6. Job Satisfaction by Years of IT Work Experience and Management Level in Taiwan

Table 7. The Confusion Matrix for Decision Tree Induction, Japan

Job Satisfaction	High (Predicted)	Low (Predicted)
High (Actual)	53	85
Low (Actual)	12	160

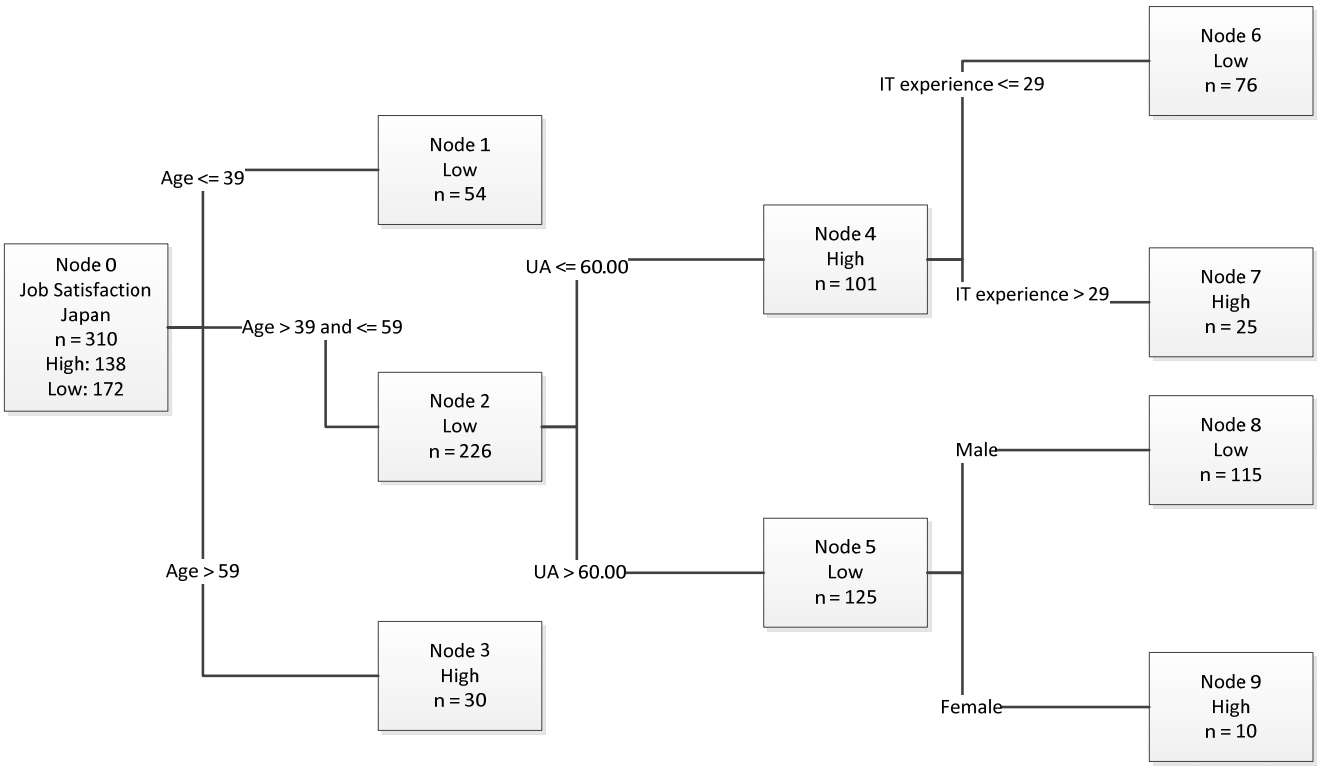

Figure 7. Decision Tree for Job Satisfaction in Japan (UA – Uncertainty Avoidance)

In Japan, the more experienced IT workers exhibit high job satisfaction levels, comparable to those in Taiwan. We explored these findings further by investigating the significant predictors: uncertainty avoidance, years of IT work experience, and age. We aggregated these into ordinal categories based on the splits in the decision tree. IT workers aged 39 years or less are considered younger, while those aged above 39 are considered older. An uncertainty avoidance score of equal to or less than 60 is considered low, while a score over 60 is considered high. Gender was excluded from the analysis because only 8.7 percent of the sample comprises women respondents. Hence, its relevance must be interpreted with caution. Figure 8 shows that older IT workers in Japan exhibit higher mean levels of job satisfaction; and IT workers who have higher uncertainty avoidance scores are less satisfied with their jobs. This corroborates our finding on the significance of uncertainty avoidance and age in Japan. Similar to Taiwan, we posit that long-term rewards in the IT industry may result in higher job satisfaction levels among more experienced IT workers in Japan. However, workers with higher uncertainty avoidance have lower job satisfaction levels regardless of IT work experience.

Exploring further, we find that older IT workers in Japan with more experience exhibit higher levels of job satisfaction compared to those with less IT work experience, and those who are younger. In the sample, obviously there are no respondents with more IT work experience (30 years or more) who are among the younger IT workers (39 years or younger) (see Figure 9). Thus, even though IT workers in Japan have lower levels of job satisfaction compared to those in Taiwan and China, and many IT workers in Japan may have worked their way up given their relatively lower educational qualifications and experience, those IT workers who are less experienced may warrant attention to enhance their overall lower job satisfaction.

China

The decision tree induction shows that the predictors have a 67.00 percent accuracy in predicting job satisfaction of IT workers in China. Table 8 shows the confusion matrix, where there are 199 records that are correctly predicted. In China, the mean job satisfaction level among IT workers (mean = 3.73) is similar to that of Taiwan but is significantly higher than that of Japan (difference = -0.37, $p < 0.001$). Figure 10 summarizes the results from the decision tree. It lists the rules that split the sample to classify the records as low or high satisfaction levels.

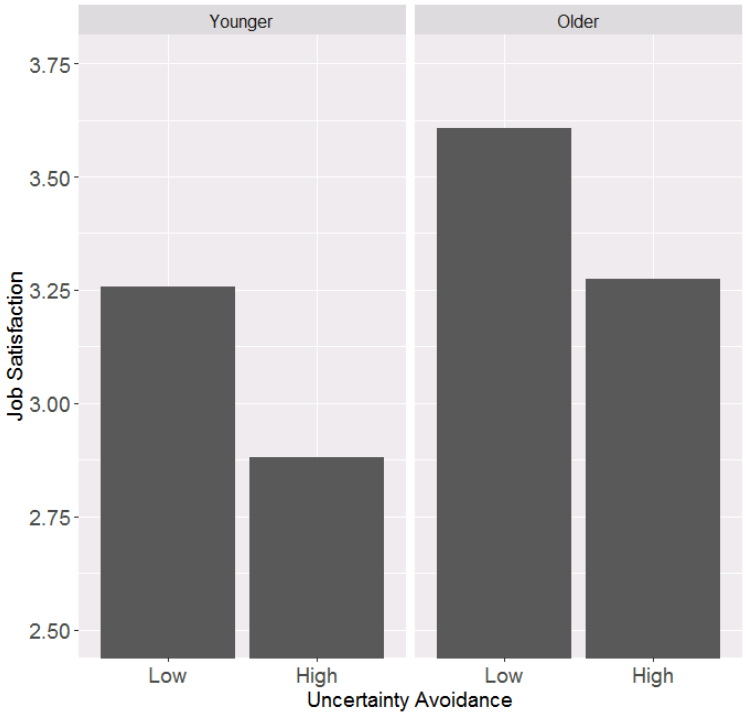

Figure 8. Job Satisfaction by Uncertainty Avoidance and Age in Japan

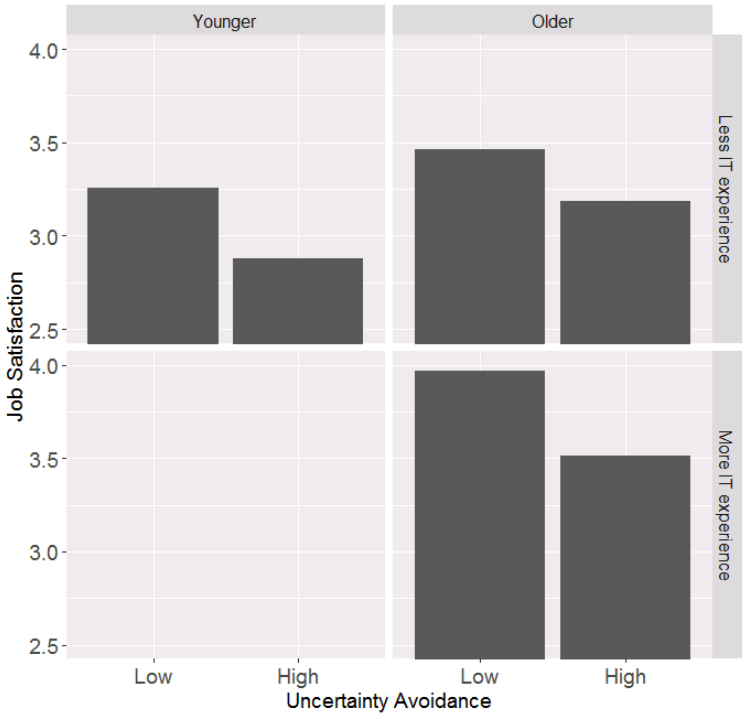

Figure 9. Job Satisfaction by Uncertainty Avoidance, Age, and IT Work Experience in Japan

Table 8. The Confusion Matrix for Decision Tree Induction, China

Job Satisfaction	High (Predicted)	Low (Predicted)
High (Actual)	85	38
Low (Actual)	60	114

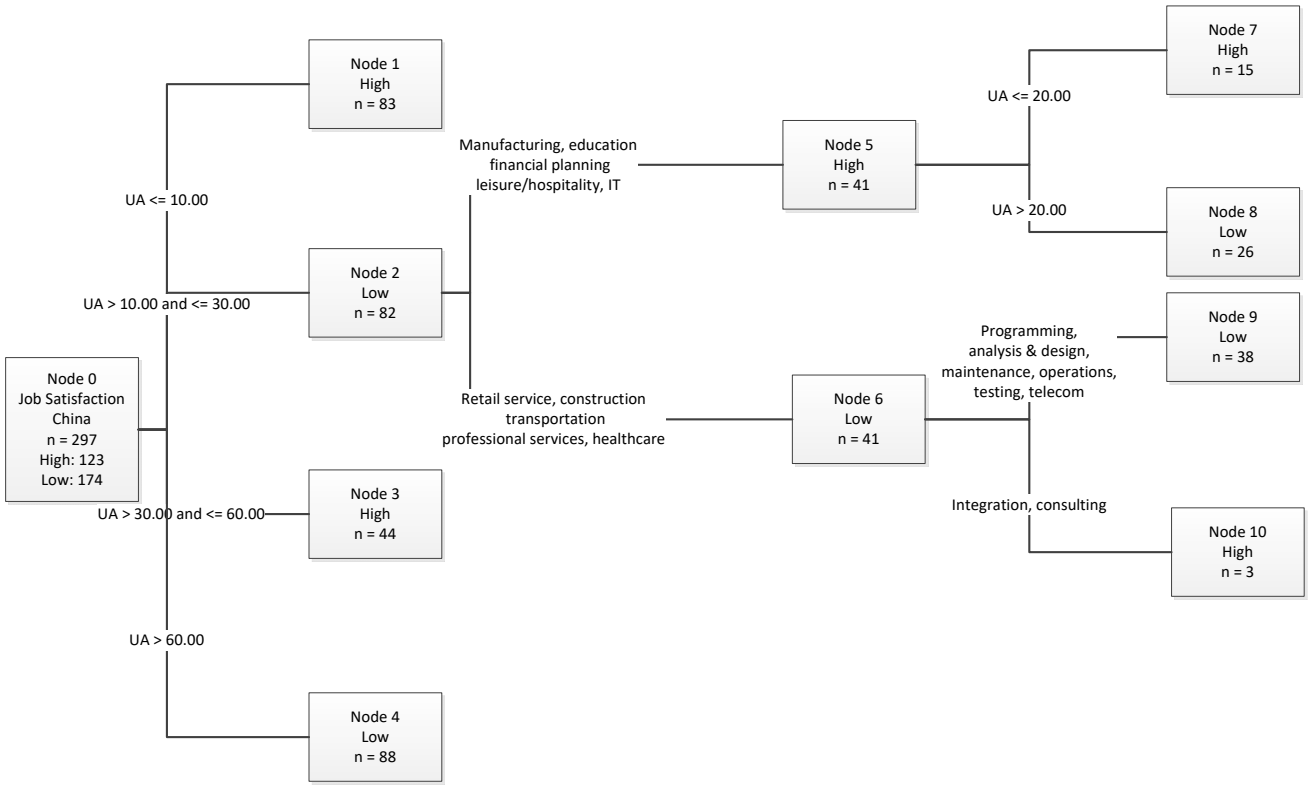

Figure 10. Decision Tree for Job Satisfaction in China (UA – Uncertainty Avoidance)

The first split of the decision tree is based on uncertainty avoidance (χ^2 = 20.94, p < 0.01). IT workers with an uncertainty avoidance score of 10 or below generally exhibit high job satisfaction (Node 1), while in the fourth branch, those with uncertainty avoidance scores of more than 60 tend to exhibit low job satisfaction (Node 4) (χ^2 = 20.94, p < 0.01). This is consistent with the previous finding that uncertainty avoidance is negatively related to one's job satisfaction.

In the second branch, IT workers with an uncertainty avoidance score between 10 and 30 generally have low job satisfaction levels (Node 2) (χ^2 = 20.94, p < 0.01). In this subset, those working in the manufacturing, education, financial institutions, leisure/hospitality, and IT industries (Node 5) (χ^2 = 22.53, p < 0.001), and having an uncertainty avoidance score of 20 or less (but more than or equal to 10 as this is a subset of Node 2) (Node 7) (χ^2 = 5.487, p < 0.05) have high job satisfaction. However, those working in these industries but having an uncertainty avoidance score of more than 20 (but less than or equal to 30 as this is a subset of Node 2) generally have low job satisfaction (Node 8) (χ^2 = 5.487, p < 0.05). This, again, supports a negative relationship between uncertainty avoidance and job satisfaction. Within the second branch, those working in retail services, construction, transportation, professional services, and healthcare industries (Node 6) (χ^2 = 22.53, p < 0.001), and mostly involved in programming, analysis and design, maintenance, operations, testing, and telecommunications, generally exhibit low job satisfaction (Node 9) (χ^2 = 16.812, p < 0.005). However, those involved in integration and consulting exhibit high job satisfaction (Node 10) (χ^2 = 16.812, p < 0.005). It is important to note that there are only three cases recorded in Node 10, with two showing high job satisfaction levels. Hence, this specific finding on the IT job role must be interpreted with caution. In the third branch, IT workers with uncertainty avoidance scores between 30 and 60 generally have high job satisfaction (Node 3) (χ^2 = 20.94, p < 0.01).

Given the small number of cases in Node 10 stemming from an IT job role, we further focused on uncertainty avoidance and industry. Although they are significant predictors, industry is a nominal variable with multiple categories, thus complicating the analysis. Of note, uncertainty avoidance scores are categorized arbitrarily into four groups – very low, low, high, and very high – based on the top-level split in the decision tree for further analysis. However, no clear picture emerged from the comparison (and was thus not reported), due to the multiple categories and lack of equal representation across the industries.

Discussion

Summary

The present study explores the drivers of job satisfaction among IT workers in Taiwan, Japan, and China. In light of the importance of the IT industry, and hence IT workers, in these countries, the study brings balance to the literature and adds richness by investigating the East Asian context amidst western-centric literature on the topic. It includes culture, more specifically uncertainty avoidance, in the analysis which was done as a direct response to the importance of cultural characteristics in the workplace (Ang et al., 2003; Bigliardi et al., 2012; Palich et al., 1995). We adopt an abduction approach using empirical findings to advance explanatory hypotheses for testing, thus supporting scientific theory development (cf. Osei-Bryson & Ngwenyama, 2011). These explanatory hypotheses are interjected in the next subsection as we discuss the predictors of job satisfaction in all three countries.

Pertaining to the first research question – What are the similarities and differences among IT workers in Taiwan, Japan, and China? – we find that overall, IT workers in Japan are less satisfied with their jobs than IT workers in Taiwan and China. Chinese IT workers have lower uncertainty avoidance than those in Taiwan and Japan. The demographics of IT workers in Taiwan and China are more similar to each other than to those in Japan. IT workers in China have less experience than those in Taiwan and Japan, but the job positions are fairly similar across all three countries. The job roles of IT workers in Taiwan and China are fairly similar, and analysis and design appears to be a highly common role in all three countries. The industry breakdowns among IT workers are similar between Taiwan and Japan, where IT and manufacturing make up the majority. China differs slightly, with a comparatively higher percentage of respondents in the wholesale industry. In regards to the second research question – How do employee demographics, job demographics, and uncertainty avoidance drive job satisfaction among IT workers in Taiwan, Japan, and China? – we show that uncertainty avoidance is a common predictor in all three countries, suggesting the importance of cultural attributes to job satisfaction. Job demographics are more important predictors than employee demographics in Taiwan and China, contrary to the previous findings on IT workers in Taiwan (Kuo & Chen, 2004). In Japan however, employee demographics, specifically, age, matter along with various job demographics.

Drivers of Job Satisfaction

Table 9 provides a summary of the predictors of job satisfaction in the three countries and highlights similarities and differences. Looking at employee demographics, age and gender are only significant in Japan but not in Taiwan and China. Note, however, that the effect of gender may be inconclusive due to a small number of women respondents in the Japan sample. The level of education plays no role in job satisfaction. In Japan, younger IT workers are generally less satisfied with their jobs. However, as they grow older, their satisfaction becomes dependent on other factors. Those who exhibit low uncertainty avoidance are more satisfied. In Japan, it is a cultural norm for an employee to stay at his or her job from graduation until retirement. It is plausible that after many years at the same job, IT workers may experience higher valence for rewards, which encompasses job security, feelings of accomplishment, social recognition, and personal growth and foster a feeling of professional development (cf. Money & Graham, 1999), thus resulting in a positive influence of the years of IT work experience on job satisfaction in Japan (cf. Lin et al., 2003). They are able to live with uncertainty in their work environment resulting in higher levels of job satisfaction, even though Japan generally has a high uncertainty avoidance culture. Given the top split in the decision tree for Japan, it is more appropriate to advance a global (H1) and two local (H2 and H3) explanatory hypotheses as follows. Note that the global hypothesis is based only on one (global) factor without any contingencies, while the local hypotheses are contingent upon other factors.

> Hypothesis 1 (H1): In Japan, age has a positive impact on job satisfaction of IT workers.
>
> Hypothesis 2 (H2): In Japan, if the age is high, uncertainty avoidance has a negative impact on job satisfaction of IT workers.
>
> Hypothesis 3 (H3): In Japan, if the age is high and uncertainty avoidance is low, IT work experience has a positive impact on job satisfaction of IT workers.

Job role and industry matter in China, but to a small extent, and they do not matter in Taiwan and Japan. In China, IT workers in the retail service, construction, transportation, professional services, and healthcare industries, who are involved in programming, analysis and design, maintenance, operations, testing, and telecommunications, exhibit low job satisfaction. In contrast, those in integration and consulting have high job satisfaction. IT workers who are in manufacturing, education, financial planning, leisure/hospitality and who do not avoid uncertainty are more satisfied. As there are no such differences in Taiwan and Japan, the nature of IT jobs may be similar across industries. Thus, we advance the following local explanatory hypothesis regarding industry type for China.

Table 9. Predictors (indicated by √) of Job Satisfaction in Taiwan, Japan, and China

Variables	Taiwan	Japan	China
Age		√	
Gender		√	
Education			
Job role			√
Years of IT work experience	√	√	
Job position	√		
Industry			√
Uncertainty Avoidance	√	√	√

Hypothesis 4 (H4): In China, given moderately low levels of uncertainty avoidance, industry type has an impact on job satisfaction of IT workers.

In both Taiwan and Japan, the number of years of IT work experience is a predictor, but not in China. More experienced IT workers appear to be more satisfied. This finding coincides with the finding in Japan where older workers are more satisfied. There is a perception among workers in Taiwan that they are under-compensated (Kleingartner & Peng, 1991). As IT workers in Taiwan get older and are thus likely to hold more senior positions with presumably better salaries, they may become increasingly satisfied with their jobs *ceteris paribus*.

Lin et al. (2003) found that higher valence for rewards leads to higher job satisfaction of workers in both Taiwan and Japan. It is thus plausible that these older and more senior IT workers are seeing the rewards of their hard work compared to their younger, inexperienced counterparts. In contrast, IT workers in China have much less experience than those in Taiwan and Japan. This may explain why the years of IT work experience is not a significant predictor of job satisfaction in China. Our findings suggest that the longer people work in the IT industry in these countries, the more satisfied they become with their jobs. This is contrary to Duffy et al. (1998) who reported a negative correlation of 0.17 ($p < 0.05$) between one's job tenure and job satisfaction. We argue that this may depend on the occupation, as job satisfaction can be influenced by a multitude of factors. Senior and more experienced IT workers are likely to have more job control in terms of their ability to determine how specific tasks are completed (cf. Bakker et al., 2003); and this has a positive relationship with job satisfaction (Jang et al., 2018). Because the number of years of IT work experience played a role in Taiwan's and Japan's decision trees and based on the literature discussed, we argue that the number of years of IT work experience warrants itself as part of a global explanatory hypothesis.

Hypothesis 5 (H5): The number of years of IT work experience has a positive impact on job satisfaction of IT workers.

In Taiwan, but not in Japan and China, job position matters. In all three countries, most IT workers are not part of management. However, in Taiwan, those who are part of management or in middle management tend to have low job satisfaction levels. At the same time, those in senior management and have a lot of IT work experience are more satisfied. This corroborates the earlier finding on IT work experience, whereby the longer workers stay in the IT profession or job, the more likely they become satisfied with the job, possibly due to higher valence for rewards (cf. Lin et al., 2003). Hence, we advance the following local explanatory hypothesis for Taiwan.

Hypothesis 6 (H6): In Taiwan, if uncertainty avoidance is high, job position has an asymmetrical curvilinear relationship with job satisfaction of IT workers.

According to Ang et al. (2003), uncertainty avoidance has a positive relationship with job satisfaction, while more recently, Jang et al. (2018) find otherwise, whereby in low job control environments, higher uncertainty avoidance coincides with lower job satisfaction. Our results corroborate the latter. In all three countries, uncertainty avoidance is a significant predictor, whereby higher uncertainty avoidance leads to lower job satisfaction levels. While this may first appear counterintuitive, those who tend to avoid uncertainty (i.e., seek structure and clarity) are more likely to experience job stress (Keenan & McBain, 1979; Rodriguez-Calcagno & Brewer, 2005) and are hence less satisfied with their jobs, given the positive relationship between tolerance of ambiguity and job satisfaction (Srivastava et al., 2016).

In Taiwan, IT workers with higher uncertainty avoidance, who are less senior and have less IT work experience (presumably having less job control) are less satisfied. In Japan, the IT workers who have low uncertainty avoidance, who are less experienced (presumably having less job control) are less satisfied. Promotion in Japanese firms is based more on seniority rather than performance (Lin et al., 2003). Hence, those with more IT work experience are likely to hold higher positions, and thus be tasked with higher level, more ambiguous problems compared to lower level workers. It is important to note that the impact of uncertainty avoidance is less clear in China. We posit that this is due to cultural differences across its vast geography (Miller, 1995; Ralston et al., 1996). Taken together, we demonstrate that culture can influence job satisfaction of IT workers and posit the following global explanatory hypothesis.

> Hypothesis 7 (H7): Uncertainty avoidance has a negative impact on job satisfaction of IT workers.

Managerial and Policy Implications

Taiwan

In Taiwan, job demographics and personal behavior in terms of uncertainty avoidance are better predictors of job satisfaction than employee demographics. Those who have worked longer in IT and those who do not avoid uncertainty are generally more satisfied. IT workers at the non-management or middle level management experience low job satisfaction, while those at the lower or high management levels have high job satisfaction. Experienced IT workers are rewarded for their long-term commitment and accumulated expertise, resulting in higher job satisfaction levels. Promotion is based on performance, and when rewards are consistent, workers have higher job satisfaction (Lin et al., 2003). Therefore, a key to increasing job satisfaction of IT workers in Taiwan lies in addressing the gap between the senior and junior workers who have high uncertainty avoidance, rather than employee demographics per se as the literature posits (Kuo & Chen, 2004). Training to handle ambiguous work situations may help these IT workers become more acclimated to the dynamic IT industry, resulting in better performance, career advancement, and hence higher job satisfaction.

To enhance overall job satisfaction of IT workers in Taiwan, management and policymakers have to focus on the new IT workers to bridge the gap in job satisfaction between them and their more experienced colleagues. IT workers who have served longer may be at higher positions and are therefore paid more. Managers may want to look into increasing transparency for salaries and including incentives for recently hired IT workers in order to ensure that IT workers are duly compensated and rewarded in accordance with their experience and job positions.

Japan

In Japan, uncertainty avoidance is the key to the overall functioning of firms. However, uncertainty avoidance is also likely to be the source of their job stress. Those with low uncertainty avoidance and a lot of IT work experience have higher job satisfaction. The stereotypical Japanese white collar worker (termed “salaryman”) works long hours, starts working at a company after graduation, and is expected to stay till the end of his or her career (Iida & Morris, 2008). At the same time, the Japanese work culture is extremely stress prone. Evidence suggests that the Japanese employees are overloaded at work and, as a result, tend to experience psychological job stress which has detrimental effects on their mental and physical health (Kawakami & Haratani, 1999). As such, they may not deal with uncertainties well, leading in some extreme cases to suicide (Tamakoshi et al., 2000). However, among the older and more experienced IT workers, those who have lower uncertainty avoidance have higher job satisfaction. Promotion in Japanese firms is largely based on seniority rather than performance (Lin et al., 2003). Thus, these senior workers are better poised to manage their job stress levels.

While it may be conceived that as a result of Japanese IT workers’ embodiment of loyalty, community, and a sense of belonging (Lopez et al., 2009) they are unlikely to leave their jobs, we argue that job satisfaction is a different but important issue. Literature has established that enhancing job satisfaction may improve job performance and productivity. Thus, to enhance overall job satisfaction of IT workers, management practices and policies should include incentives and recognition for both new and long-serving IT workers that involve leisure and work flexibility. Even though their cultural preference for structure and risk aversion (Money & Crotts, 2003) can lower their job satisfaction levels, increased flexibility at work can allow the IT workers to have more social and family support, both of which have been found to be influential to job satisfaction particularly among Japanese workers (Lin et al., 2003).

China

The drivers of job satisfaction of IT workers in China are less clear than those in Taiwan and Japan. Although uncertainty avoidance was identified as a predictor of job satisfaction, the relationship is less clear. The lack of clarity could be due to the vast cultural differences across China, which is a much larger country and more culturally complex than Taiwan and Japan. According to Miller (1995), there

are vast differences in work values among Chinese workers. Ralston et al. (1996) find that there are cultural differences among Chinese managers across China. For example, cosmopolitan Chinese are more individualistic and more open to change than their regional Chinese counterparts who work in more locally oriented companies with smaller markets.

Pertaining to the other variables, the results show that job satisfaction in China differs across industries. Service industries are more often located in cosmopolitan areas than manufacturing industries. Therefore, the cultural differences between cosmopolitan and regional Chinese (Ralston et al., 1996) may help explain these industry differences. Although China's societal core in Confucianism remains unchanged (Ralston et al., 1995), there are subtle differences in work values (Miller, 1995; Ralston et al., 1996), resulting in a much more complex culture compared to those of Taiwan and Japan.

Efforts to enhance job satisfaction levels among IT workers in China are important because IT forms a key component of its industry base, and we show that IT workers in China are generally moderately satisfied with their jobs. Management efforts to enhance overall job satisfaction of IT workers in China may be tailored towards specific industries and IT job roles. From our findings, Chinese IT workers with high job satisfaction are employed in manufacturing, education, financial institutions, leisure/hospitality, and IT industries, and they have low uncertainty avoidance. Given China's vast geography, there may be other factors that can better predict job satisfaction of its IT workers, especially given its regional differences in culture (Miller, 1995; Ralston et al., 1996). Therefore, we argue that in China, policies and actions have to be tailored to local contexts, and a one-size-fits-all approach is ineffective.

Limitations and Future Research Directions

Although this study is a comprehensive comparative analysis of IT workers in three countries, it has several limitations. First, in comparison with Taiwan and Japan, China is a vast country and there are cultural differences across its geography. As such, a larger sample of IT workers may be able to provide more in-depth details on how industry types and job roles influence job satisfaction. Nonetheless, we have laid the foundation for future studies to explore the impact of industry types and job roles.

Second, Hofstede's (1984a) work provides several dimensions of culture. In this study, we focused on uncertainty avoidance. Future studies can include other dimensions to investigate their possible impact on job satisfaction. Third, there is generally a negative relationship between IT job satisfaction and organizational and occupational job turnover; this has been confirmed in Canada and other Western countries (Serenko et al., 2015). In our study, we focused on IT job satisfaction. Given the cultural differences between East Asian countries and the West, future studies can explore how the relationship between IT job satisfaction and organizational and occupational job turnover differs in the East Asian countries.

Fourth, despite our attempt to ensure the rigor of the data collection process, it was impossible to obtain a purely random sample, which may affect the validity of the findings. This can lead to causality issues that are beyond our control. Fifth, this empirical investigation was cross-sectional. Data in all three countries were collected at similar periods, using identical constructs, and the data were analysed using a single method. The data collection methods enhance the measurement invariance in our survey instruments that make our results comparable across the country samples (van de Schoot et al., 2012). With sufficient resources, future studies can replicate the data collection method to obtain new data at different periods. Last, researchers using decision tree induction or other methods can re-code the target variable in multiple categories to enrich the analysis.

Conclusion

This study examined the drivers of job satisfaction among IT workers in three countries in East Asia – Taiwan, Japan, and China. Overall, in these countries, higher uncertainty avoidance results in lower job satisfaction, and more experienced IT workers appear to be more satisfied. Further, IT workers in Taiwan and Japan are more similar to each other than to those in China in terms of their demographic characteristics. Job demographics predict job satisfaction in Taiwan and China, while employee demographics influence job satisfaction in Japan. In terms of management and policy implications, it is recommended that Taiwanese companies focus on bridging the gap between longer-serving and newer IT workers. Japanese companies should provide work flexibility and stress management programmes, and Chinese companies need to tailor their policies to specific job roles and industries. These findings have implications for comparison studies, and future researchers should not treat the East Asian IT workers as a homogenous group, but rigorously investigate the similarities and differences between the various countries and their underlying causes.

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Appendix A

Survey and Data Collection

An identical instrument was used in each country to measure the same constructs. In some countries, the instrument was translated into the employees' native language followed by back-translations and revisions to ensure the instrument's validity. Data were collected between 2016 and 2017. These steps helped to collect a data set that allows comparability across 37 different countries (van de Schoot et al., 2012). The World IT Project's methodology is documented by Palvia et al. (2017) in detail. The entire instrument included 160 questions. According to the screening questions, respondents must be at least 18 years old, and at least 50 percent of their work must be IT-related. Researchers in charge of each of the countries were responsible for data collection.

In Taiwan, an electronic version of the instrument was created that was accessible via a computer or a mobile device. Graduate students from the Department of Communication and Technology, National Chiao Tung University, in Taiwan were recruited and trained to collect primary data from IT workers from February 2016 to July 2016. The main strategy was to approach IT managers, who would then refer their subordinates to participate in the survey. In addition, personal and professional contacts were sought during the same period. Respondents were selected from a variety of industries. Taiwan is a relatively small country, and geographical coverage is easy to achieve.

Data from Japan were collected via a web survey of IT employees from September to November 2016 with the help of a web survey company. The survey company is one of the largest such companies in Japan, and it has a countrywide network. The web survey company had a list of IT workers who were invited to participate in the study. The sample comprises respondents from all regions of Japan.

Data from China were collected using an online survey. Email invitations including the link to the online survey were sent to prospective respondents, who were recruited in two ways. First, the country investigators contacted several senior executives of various industries in major metropolitan cities of China, including Wuhan, Suzhou, Shenzhen, Jinan, Nanjing, and Guangzhou, and invited them to forward the invitation to their respective IT departments or IT teams. Second, a headhunting firm specializing in the IT industry was contacted and requested to forward the invitation to its candidates. Through this combined sampling method, the sample of IT workers in China covers key geographical areas and various industries.

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Appendix B

Decision Trees

Given its advantages, researchers have used decision trees in medicine (Murphy & Comiskey, 2013; Rodríguez et al., 2016) and marketing (Amir et al., 2015; Legohérel et al., 2015). Regrettably, they are seldom used in IS research for theory development and testing (Osei-Bryson & Ngwenyama, 2014).

We ran the Shapiro-Wilk Test to explore the distributions of uncertainty avoidance and job satisfaction – the only two continuous variables – for all three countries. From the results, we concluded that the population distributions of uncertainty avoidance and job satisfaction from Taiwan (W = 0.99, p = 0.01; and W = 0.93, p < 0.001, respectively), Japan (W = 0.99, p = 0.01; and W = 0.96, p < 0.001, respectively), and China (W = 0.98, p < 0.001; and W = 0.91, p < 0.001, respectively) are non-normally distributed, thus ruling out the possibility of using regression modelling.

Decision trees have a tree-like structure that illustrates the splitting or partitioning rules based on values in significant predictors (Samoilenko, 2008). Each branch of a decision tree represents a subset of values from a significant predictor that ultimately leads to the outcome of the dependent or target variable, which are terminal nodes (Osei-Bryson & Ngwenyama, 2011). Therefore, decision trees enable researchers to categorize future events using various if-then rules (Osei-Bryson, 2004).

Figure B1 illustrates a generic decision tree. The visual outcome is easy to interpret by a non-technical audience (Murphy & Comiskey, 2013). Readers follow the tree-like structure from the root node to one of the terminal nodes, encountering if-then rules along the way. These rules partition the data based on values of each predictor (independent variable). Each branch comprises a subset of values from each predictor (Osei-Bryson & Ngwenyama, 2011). It is important to note that similar to all modelling techniques, decision trees are not 100 percent accurate (Yeo & Grant, 2019). The outcomes are based on modes in each split. For instance, from the root node in Figure B1, the data are split into three branches. Branch 1 comprises cases that satisfy Predictor 1 <= 10, and these cases exhibit a negative outcome. Branch 2 comprises cases that satisfy Predictor 1 > 10 and Predictor 1 <= 20. Although most of the records in this branch exhibit positive outcomes, a subsequent rule adds depth by explaining why not all of these cases exhibit positive outcomes. Among these cases, those satisfying Predictor 2 <= 50 exhibit positive outcomes, while those satisfying Predictor 2 > 50 exhibit negative outcomes. In the same way, Branch 3 comprises cases that satisfy Predictor 1 > 20 that mostly exhibit a negative outcome. Among these, those satisfying Predictor 2 <= 25 exhibit negative outcomes and those satisfying Predictor 2 > 25 exhibit positive outcomes.

There is a trade-off between complexity and robustness in decision tree induction. Complex decision trees lack robustness. They may be harder to interpret (Yeo & Grant, 2018, 2019) and are less reliable for prediction. A very complex decision tree with very few records in each leaf node will be overly fitted to the observations, thus lacking robustness and having poor generalizability (Song & Ying, 2015). It is not useful for supporting theory and management practices (cf. Yeo & Grant, 2018, 2019).

Chi-Squared Automatic Interaction Detection (CHAID) and Classification and Regression (CART) are two popular decision trees (Samoilenko, 2008), and both may be used for discrete target variables (Osei-Bryson, 2014). These are both available in SPSS Modeler v. 15. We selected CHAID over CART because in the former, each node can have several child nodes (Berry & Linoff, 1997), whereas the latter allows each node to have only two child nodes (Ture et al., 2009). Several of our variables are nominal and ordinal, with several levels, such as age and industry. Hence, multiple splits from CHAID are better than binary ones from CART. These splitting rules are determined by the chi-square statistic, whereby the predictor for each partitioning that best predicts the outcome of the target variable has the lowest p-value from the Chi-square tests (Legohérel et al., 2015). The most significant predictor occurs at the top node as the first partition into child nodes. The process continues until there is no longer a significant relationship between the remaining predictors and the target variable (Díaz-Pérez & Bethencourt-Cejas, 2016). Several other decision tree induction methods can perform multivariate splits (cf. Barros et al., 2015), including Entropy and Gini splitting methods. However, we selected the tool and technique above due to the popularity of SPSS Modeler v.15 as a frequently used decision trees tool. It is important to note that researchers can build various decision induction methods that are capable of multivariate splits, which are available in several software packages, and sometimes, the selection of a software tool is simply a matter of choice.

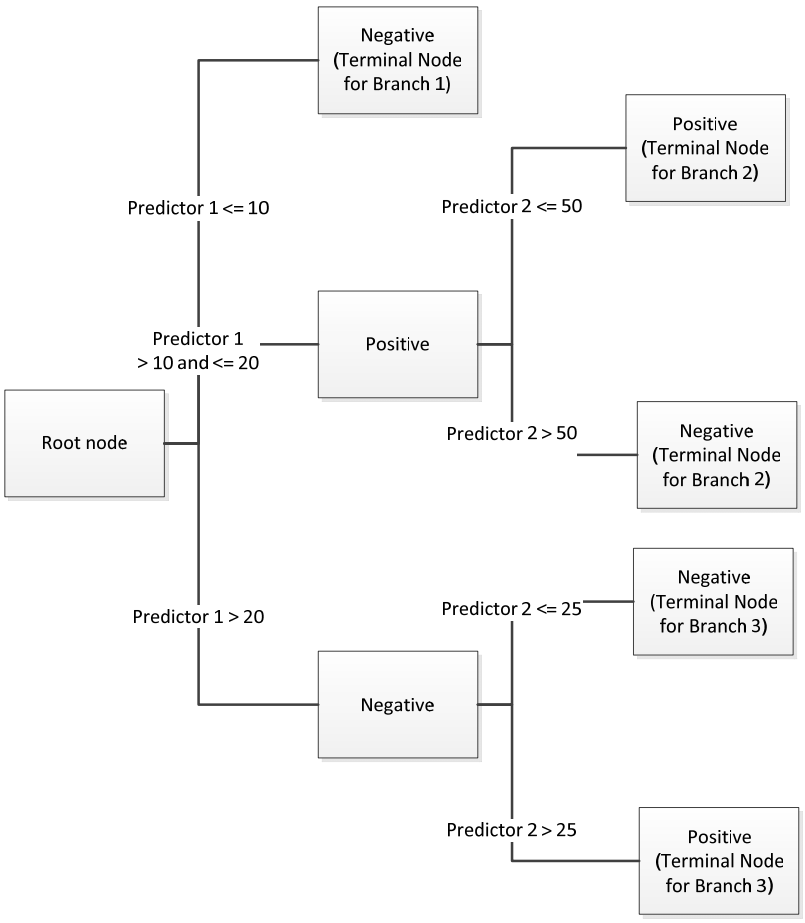

Figure B1. A Generic Decision Tree

In our decision trees, an IT worker whose job satisfaction score was below the mean job satisfaction score for the corresponding country was categorised as having low job satisfaction. Esposito et al. (1997) argue that researchers should limit the number of terminal nodes to simplify decision trees. Although decision tree induction can be executed with interval target variables, computing job satisfaction at two levels rather than three or more simplifies decision trees and yields more useful results. Conversely, having too many levels can result in complex trees that may not be useful in informing theory and management practices. This approach is consistent with previous studies (cf. Yeo & Grant, 2018, 2019). In addition, we also considered recoding job satisfaction into three categories, where low satisfaction was given by a score of less than the mean – 1 standard deviation, medium satisfaction was given by a score between the mean – 1 and + 1 standard deviation, and high satisfaction was computed by a score greater than the mean + 1 standard deviation. However, this resulted in highly unbalanced categories for all three countries. In Taiwan, we had 32, 225, and 46 records with low, medium, and high job satisfaction respectively. In Japan, we had 39, 238, and 33, and in China, we had 20, 220, and 57. In contrast, computing job satisfaction in 2 categories resulted in more balanced categories: in Taiwan, there were 140 and 163 records; in Japan, there were 172 and 138 records; and in China, there were 174 and 123 of low and high job satisfaction groups, respectively. The more balanced categories can minimize bias in the analysis.

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Appendix C

Hypothesis Generation through Peircian Abduction

Popper's (2014) systematic testing involves the falsification of existing theories and proposing alternative hypotheses for falsification. In positivist scientific inquiry, it is difficult for researchers to push the boundaries of existing theories for alternative explanations (Popper, 1957) and hypotheses for future testing (Popper, 1959). Osei-Bryson and Ngwenyama (2011) argue that this challenge is more salient in the dynamic information systems field that is rapidly changing. We, therefore, propose the rejection of ad-hoc hypotheses in favour of using decision tree induction to generate explanatory hypotheses that are observation-based and test-worthy, in line with Peircan abduction, whereby empirical findings are inferred to hypotheses that can be tested for their explanatory power (cf. Fann, 2012; Osei-Bryson & Ngwenyama, 2011).

Looking at the first split of the generic decision tree in Figure B1 (Appendix B), which shows a significant split based on Predictor 1, a global explanatory hypothesis can be advanced as "Predictor 1 has a U-shaped curvilinear impact on the outcome." Looking at the third branch of the generic decision tree in Figure 2, a local explanatory hypothesis can be advanced as "Given that Predictor 1 is high, Predictor 2 has a positive impact on the outcome." The local explanatory hypothesis is based on a subset of the problem domain, given the condition that Predictor 1 is high. The actual value of the split for Predictor 1 is not specified in the hypothesis because this value can vary in a different dataset. In this study, we further extend this method, because our abduction of explanatory variables involves three decision trees, as opposed to a single one.

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Appendix D

Summary of IT Roles and Industry

Table D1. IT Roles

Variable	Taiwan	Japan	China
Programming	23.10%	11.00%	32.00%
Analysis & design	10.60%	15.20%	13.10%
Maintenance	9.60%	4.20%	3.00%
Operations	8.30%	13.20%	4.40%
Integration	3.30%	3.20%	3.00%
Testing	2.60%	3.50%	3.40%
Database administration	3.00%	2.30%	2.40%
System administrator	5.90%	7.40%	7.10%
Telecommunications	3.00%	0.30%	3.00%
Management and strategy	6.30%	11.30%	3.40%
Email/Messaging systems	1.00%	1.60%	0.00%
Consulting	2.00%	6.10%	3.00%
Help desk	1.30%	2.30%	4.40%
User liaison	1.00%	0.00%	0.30%
Training	1.00%	1.90%	0.70%
Project management	7.60%	8.70%	4.40%
Security	1.70%	3.90%	0.70%
Financial	2.00%	0.00%	7.70%
Application support	2.00%	3.20%	2.00%
Other	5.00%	0.60%	2.00%

Table D2. Industry

Variable	Taiwan	Japan	China
Construction	1.00%	1.00%	7.70%
Education	1.70%	1.90%	4.40%
Entertainment/Leisure	1.70%	1.30%	1.00%
Financial institution	2.30%	1.90%	11.10%
Government/Public	2.00%	2.90%	1.00%
Healthcare	1.00%	0.30%	1.30%
Information technology	44.90%	50.00%	27.60%
Leisure/Hospitality	1.00%	0.00%	0.70%
Manufacturing	21.10%	23.90%	22.20%
Media	1.00%	0.30%	0.70%
Non-Profit/NGO	1.00%	0.60%	0.30%
Other	2.00%	0.60%	2.00%
Professional services	3.60%	3.90%	2.70%
Retail & service	12.20%	4.50%	12.80%
Transportation	0.30%	2.30%	2.70%
Utilities	0.70%	2.90%	1.70%
Wholesale	2.60%	1.60%	0.00%