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Factors that affect the acceptance of new technologies in the workplace: a cross case analysis between two universities

Dimitra Skoumpopoulou
Northumbria University, UK

Adam Wong, Peggy Ng and Man Fung Lo
Hong Kong Polytechnic University

ABSTRACT

The introduction of a new IT application within an organisation represents change, and the acceptance of such change starts with the individual end users since they are the ones that often resist the newly introduced IT. With the use of survey, this research identified the factors that affect the acceptance of new technologies in the workplace in order to understand better how end-users can influence the successful introduction of IT in academic institutions. We used one Higher Education Institution (HEI) in Hong Kong and one HEI in the UK in order to gather our data and cross analyse the differences between the two institutions. Our research showed that the staff at both universities have a high Behavioral Intention (BI) to use new technologies. However, there was no significant difference between the two universities, which meant these dimensions had no effect on the staff who worked at these universities.

Keywords: *technology acceptance, workplace, cross case analysis, higher education institutes*

1.0 INTRODUCTION

The introduction of new technology in an organisation provides a number of benefits such as sustainable competitive advantage, lower production and labour costs. This in turn adds value to products and services, and generally improves the business processes (Nguyen, Newby and Macaulay 2013). Technological changes are often driven by either an emphasis on improving efficiency and business expansion, or a pressure to meet certain requirements from customers and industry standards (Nguyen, 2009). Nguyen, et al (2013) referred to these drivers as part of an innovation decision process, where management and organisations assess the advantages and disadvantages of adopting the new technology.

According to Arasteh, Aliahmadi, Mahmoodi and Mohammadpour (2011), Information Technology (IT) on the one hand facilitates fast communication in organisationsand on the other it automates business processes. They also state that technology reduces user's task through computerisation processes and allows the users to do their task differently. However, introducing new technologies in companies is not a straightforward task and companies often face a lot of resistance during the adoption of new systems. These challenges in the usage of IT in organisations have led to the investigation of how different individuals interact with the new technology in their work environment. As academic institutions are organisations that rely on IT to implement its processes, such as handling a large number of student applcations and examination results within short periods of time. This research looked into the factors that influence the acceptance of IT in academic institutions.

In academic institutions, the freedom of individuals, especially those of acadmics, are highly valued. However, as Aubert, Barki, Patry and Roy (2008) argue the benefits from a new

technology are not gained if organisations experience low utilisation by the intended users. Research (Lippert and Davis 2006; Sharma, 2013; Kim and Kankanhalli, 2009) suggested that when introducing new technologies, the acceptance of change started within the individuals and this could be affected by the way they perceived how the new applications would affect their job performance. Also, Hidayanto and Ekawati (2010) concluded that the success of implementation would depend on user acceptance and use of the technology in an organisation. A major aspect of this research was to identify the various factors that affect the acceptance of new technologies in order to understand better how end-users can influence the successful introduction of IT in academic institutions.

The data for this study was gathered through the use of purpose sampling at one Higher Education Institution (HEI) in Hong Kong and one HEI in the UK. The main objectives of our research are:

- Examine the factors that influence IT acceptance in Higher Education Institution (HEI)
- Investigate the differences between those factors between an HEI in HK and one in the UK

2.0 LITERATURE

2.1 IT success and failure

Information systems play anessential role in organisations with the power to change how business is conducted (Heeks, 1999). However, the power and efficiency of information systems is constantly evolving (Atler, 1999) which means that the need for companies to incorporate up-to-date technology into their workplace also increases. It is this need faced by organisations to operate at the highest levels of efficiency that causes them to implement new, updated Information systems into their business. In 1992, William DeLone and Ephraim McLean suggested that the dependent variable for information technology (IT) research is IT Success. The D&M research reviewed 180 studies from seven major MIS publications and synthesized six key measures of success within IT: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact (Delone McLean and Peter 2013).

However, often companies fail to succesfuly implement new technologies in their existing operations and this often results either of never seen a ROI from an IS introduction or in some cases even losing large sums of money because the new systems are underused or not utilised. Poulymenakou & Serafeimidis (1997) have found that IT projects can be deemed to fail at one of three specific stages; during development, when introduced to users or at some point during operation. They suggested that IT implementations fail because they are treated purely as an IT project and the human involvement aspect is completely overlooked. This can be a fatal mistake in the development of an information system, if the users requirements are overlooked then the technology will never match its planned goals. There is a large body of evidence that a significant number of information system implementations end in failure, and approximately 70% of major IS implementations will fail (Drummond, 2005). HEIs are also organisations that need to operate efficiently and update their information systems to meet the needs of its teaching staff and students. Therefore, this research was aimed at examining the factors that affect the acceptance of new technologies in the workplace in academic institutions order to help schools in their future IS implementations.

2.2 Theoretical Framework

The introduction of a new IT application within an organisation represents change, and the acceptance of such change starts with the individual end users because they are the ones that may resist the newly introduced IT, due to fear of uncertainty or the complexity of the technology

(Jiang, Muhanna and Klein, 2000; Davis, 1993). This may be as a result of fear of losing their job(s), and the fear that the new application may be difficult to learn. Resistance to new IT applications is viewed as the opposition of individuals to change, which is associated with the new technology implementation (Sharma, 2013; Kim and Kankanhalli, 2009). Therefore user acceptance is an important factor to consider in IT adoption, implementation and usage within the organisation because its usage will be determined by the level of user acceptance of the newly introduced IT (Lippert and Davis, 2006; Agarwal and Karahanna, 2000).

IT acceptance research has been built on theories, such as the Theory of Planned Behavior (TPB) (Taylor and Todd, 1995; Ajzen, 1985) and the Technology Acceptance Model (TAM) (Davis, 1989; Davis, Bangozi and Warshaw, 1989) in an effort to capture the individual acceptance and use of information technology in organisations. The common features among these models are the individual beliefs or perceptions towards the new technology, which influences their actual usage Behavior (Agarwal and Karahanna, 2000).

In particular, the TAM model was designed to predict the acceptance of technology usage and also to examine individual user's reaction towards a new application (Davis, 1993; Davis, Bangozi and Warshaw, 1989). More specifically, TAM predicts two factors, which affect individual usage behaviour, namely the perceived usefulness (PU) and the perceived ease of use (PEOU). PU refers to the situation where using a particular system enhances individual job performance whilst the PEOU represents when using a particular system by an individual is free of effort (Davis 1989; Davis, Bangozi and Warshaw, 1989). Individual beliefs influence attitudes towards the behavior, and the behavioral intention in turn influences the actual behavior to use the new technology within the organisation (Davis, Bangozi and Warshaw, 1989).

Though the TAM model is widely used in the IT literature, it has also been criticised by researchers. It was criticised because it lacks the adaptive nature in an IT changing environment and ignores the social influence in the IT implementation process.

According to Burton-Jones and Hubona's (2005) study, the original TAM belief construct such as PU and PEOU remains an important predictor in capturing individual system users acceptance. However,they claim that the two constructs remain incomplete predictors of systems usage behavior because they suggest self-identity and habits to impact individual intentions. They suggested that individual acceptance and usage of technology can only be predicted with individual difference variables and these include staff seniority, age and education level. Bagozzi (2007) claimed that the TAM model failed to consider the importance of group, social and cultural aspects of technology acceptance. He emphasized that people do not act in isolation; rather they live in social environment where they relate with other peers, parents, members and other group. The group norms are also important aspect in technology acceptance as well as the individual differences between cultures. He further highlighted that individuals from different cultures would react differently towards technology in terms of their individual emotions, motivations and cognitive (self-awareness of group membership) processes. He considered group, culture and social aspects of technology to be integrated in explaining individual decisions towards new technology.

In order to overcome the shortcomings of the TAM, Venkatesh Morris, Davis and Davis (2003) developed the Unified Theory of Acceptance and Use of Technology (UTAUT) model and identified various determinants such as behavioral intention to use IT (social influence, performance expectancy and effort expectancy), technology use (facilitating conditions and behavioral intention), and the contingencies (age, gender, voluntariness and experience). The UTAUT suggests behavioral intention determined by performance expectancy and the effect of behavioral intention to vary across individual characteristics such as age and gender. Effort expectancy on the other hand expected behavioral intention to vary across individual

characteristics such as age and gender and to exact effect on different individual experience. Social influence was found to influence behavioral intention. This was contingent on individual characteristics such as age, gender, voluntariness and experience. The facilitating condition, such as the technical and organisation support to influence the behavioral intention on technology use, was also moderated by age and experience (Venkatesh and Zhange, 2010; Wong, Teo and Russo, 2013).

Venkatesh and Zhang (2010) examined technology adoption in two different cultures and integrated the UTAUT model to capture the employees' similarities and differences between U.S and China. They collected data from employees in the same business unit, business analysis, in an organization with a presence both in the U.S. and China. Their findings revealed that culture plays an important role in IT adoption between the two countries. They found that the difference in technology adoption was due to the role of social influence, which was different between the two countries. Since their research was based the findings on the acceptance of IT in non-academic organisations by individual end users, this research built upon their research to examine the factors that affect the successful IT acceptance in academic institutions.

The research framework is composed of five hypotheses, presented in Figure 1.

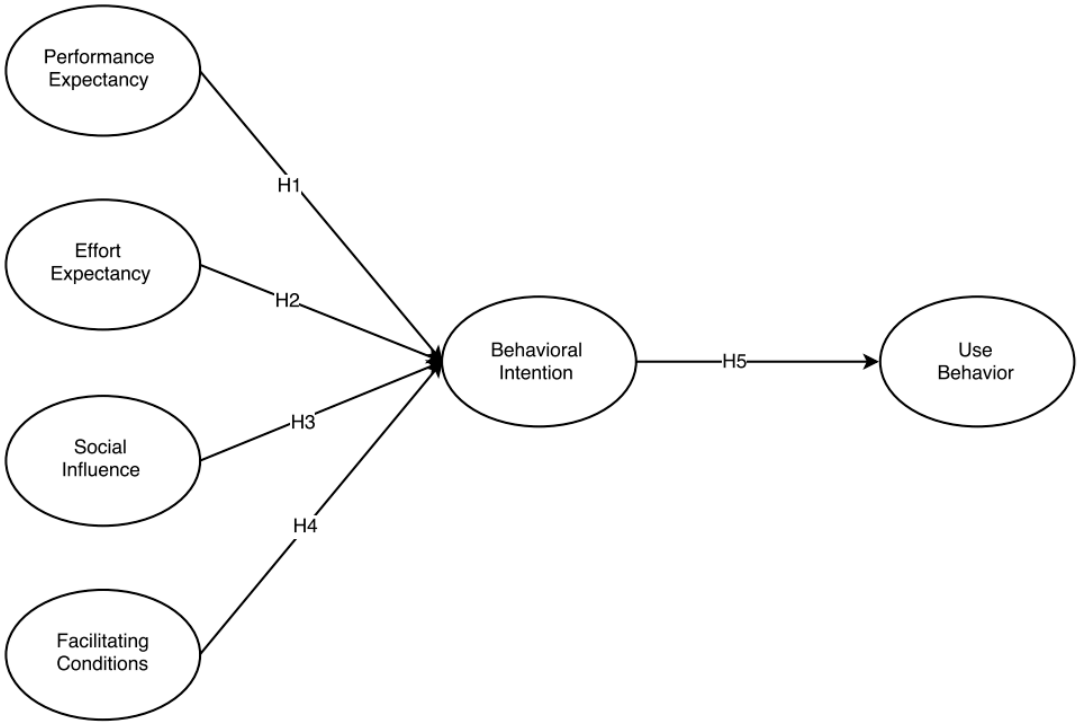

Figure 1: *Research Framework*

Hypothesis 1: Performance expectancy has a positive association with the Behavioral Intention to adopt new technologies in a higher education institute.

Hypothesis 2: Effort expectancy has a positive association with the Behavioral Intention to adopt new technologies in a higher education institute.

Hypothesis 3: Social influence has a positive association with the Behavioral Intention to adopt new technologies in a higher education institute.

Hypothesis 4: Facilitating conditions has a positive association with the Behavioral Intention to adopt new technologies in a higher education institute.

Hypothesis 5: The intention to adopt new technologies in a higher education institute positively affects the actual adoption of new technologies in workplace.

3.0 METHODOLOGY

3.1 Research Design and Measurement instrument

This research used a quantitative cross-country comparative approach to determine if the hypotheses in the previous section was supported. Two universities, one Hong Kong and one in Newcastle, the Unitied Kingdom, were selected, because they offer similar programmes and the authors worked in these academic institutions. The survey instrument was piloted before usig theExisting literature related to UTAUT in the workplace was reviewed to create a survey questionnaire (Escobar-Rodríguez and Carvajal-Trujillo, 2014; Kijsanayotin, Pannarunothai and Speedie, 2009; Oye, Iahad and Rahim, 2014; Raman, Don, Khalid, Hussin, Omar, and Ghani, 2014; Williams, Rana and Dwivedi, 2015; Yueh, Lu and Lin, 2016). The set of measurement items in the questionnaire were adapted to the specific context of this study on the acceptance of new technologies in the academic institutions. As exhibited in the previous section, there are in total six constructs, namely Performance Expectancy (4 items), Effort Expectancy (4 items), Social Influence (4 items), Facilitating Conditions (4 items), Behavioral Intention (3 items) and Use behavior.Also, a part was designed to collect the demographic details of respondents. Except Use Behavior, each item was measured by a 5-point Likert scale, anchored by 1 (strongly disagree) and 5 (strongly agree). Aligned with prior studies (Behrend, Wiebe, London and Johnson, 2011; Im, Hong and Kang, 2011), Use Behavior was measured by a 9-point Likert scale(have not used, once a year, once in six months, once in three months, once a month, once a week, once in 4–5 days, once in 2–3 days, almost every day). A pilot study was conducted to test the validity of the questionnaire.

3.2 Sampling and data collection

This study aimed at providing insights on the acceptance of new technologies between two universities. Therefore, two universities (one from United Kingdom and one from Hong Kong, China) were invited to participate in this survey. The population was the academic and administrative staff at these two universities. The students were not part of the population. The size of the population was obtained from the university contact lists. The university in HK has a population of 147 at the time when the survey was conducted.

The finalized questionnaire was published in an online survey platform and a QR code was prepared for respondents. An introduction email, together with the QR code, were sent to both academics and administrative staff in these two institutions. A friendly reminder email was sent one week after to remind the potential respondents. In total, there are 187 valid responses were used in the data analysis. Among the usable returns from this survey, 117 (63.9%) were collected from United Kingdom while 66 (44.9%) were completed by staff in Hong Kong. Other demographics details were tabulated in Table 1. The response rates were satisfactory.

Table 1: *Demographics Profile of Respondents*

Attributes	Categories	Frequency	Percent (%)
Gender	M	72	38.92
	F	65	35.14
	Other / Transgender	1	0.54
	Blank	47	25.41
	Total	***185***	***100.00***
Highest Education Level	Primary	2	1.08
	Secondary	5	2.70
	Bachelor	18	9.73
	Master	36	19.46
	Doctor	77	41.62
	Blank	47	25.41
	Total	***185***	***100***
Age Group	Below 25	4	2.16
	25 – 34	28	15.14
	35 – 44	45	24.32
	45 – 54	36	19.46
	55 or above	25	13.51
	Blank	46	25.41
	Total	***185***	***100***

3.3 Data Analysis

In this study, SPSS V23.0 and SmartPLS 3.0 were used to analyse the data collected from two regions. Descriptive statistics was obtained through the use of SPSS V23.0 package. To analyse the relationship of multiple independent and multiple dependent variables in the research model, Structural Equation Modelling (SEM) was utilized. With the use of SmartPLS 3.0, the measurement model evaluation and structural model evaluation results are presented.First, Table 2: Descriptive Statistics of Measurement Items presents the description and descriptive statistics of each of the items and the constructs that they are intended to measure. The average of each measurement item ranges from 3.19 (SI3) to 3.96 (PE1). Moreover, the reliabilities of all constructs are greater than the minimum acceptable Cronbach's alpha level of 0.70, indicating internal consistency.

3.4 Measurement model evaluation

Based on the SmartPLS 3.0 result, the items' outer loadings, average variance extracted (AVE) and composite reliabilities (CR) were presented in Table 3: Assessment of the measurement model. First, the CR values obtained in this study ranged from 0.816 to 1.000 and these values are over the minimum acceptable limit of 0.70 (Gefen, Straub and Boudreau 2011, Gefen, Straub and Boudreau 2000; Nunnally and Bernstein, 1994). Together with the result of Cronbach's alpha, the internal consistency reliability was considered as acceptable in this research.Second, theitems' outer loadings and AVE values are used to examine the convergent validity.Hair, Ringle, and Sarstedt (2011) suggested that any items with loading below 0.4 should be removed. According to the result, all outer loadings are above 0.5. Third, the AVE values are between 0.816 (Facilitating Conditions) to 0.963 (Behavioral Intention) which are above the acceptable AVE value (0.5) (Fornell and Larcker, 1981). To sum up, convergent validity was exhibited in this study.

Table 2: *Descriptive Statistics of Measurement Items*

Constructs	Items	Descriptions	Mean	Standard deviation	Cronbach's alpha
Performance Expectancy (PE)	PE1	I would find the new technologies useful in my job.	3.96	0.80	0.875
	PE2	Using the new technologies enable me to accomplish tasks more quickly.	3.67	0.97	
	PE3	Using the new technologies increases my productivity.	3.64	1.00	
	PE4	If I use the new technologies, I will increase my chances of getting a better performance review rating.	3.34	0.96	
Effort Expectancy (EE)	EE1	It would be easy for me to become skillful at using the new technologies.	3.58	0.96	0.885
	EE2	I would find the new technologies easy to use.	3.35	0.96	
	EE3	Learning to use the new technologies is easy for me.	3.47	0.96	
	EE4	My interaction with the new technologies would be clear and understandable.	3.48	0.89	
Social Influence (SI)	SI1	People who influence my behavior think that I should use the new technologies.	3.50	0.88	0.713
	SI2	People who are important to me think that I should use the new technologies.	3.35	0.81	
	SI3	The senior management of my school has been helpful in the use of the new technologies.	3.19	0.94	
	SI4	In general, my school has supported the use of the new technologies.	3.82	0.91	
Facilitating Conditions (FC)	FC1	I have the resources necessary to use the new technologies.	3.59	0.88	0.712
	FC2	I have the knowledge necessary to use the new technologies.	3.49	0.88	
	FC3	Technical colleagues in my organization are available for assistance with system difficulty.	3.71	0.88	
	FC4	I think that the new technologies fits well with the way I like to work.	3.50	0.93	
Behavioral Intention (BI)	BI1	I intend to use the new technologies in the next 6 months.	3.95	0.71	0.943
	BI2	I predict I would use the new technologies in the next 6 months.	3.95	0.74	
	BI3	I plan to use the new technologies in the next 6 months.	3.86	0.77	

Table 3: *Assessment of the measurement model*

Constructs	Items	Loadings	AVE	CR
PE	PE1	0.856	0.916	0.732
	PE2	0.92		
	PE3	0.912		
	PE4	0.72		
EE	EE1	0.844	0.920	0.742
	EE2	0.868		
	EE3	0.866		
	EE4	0.868		
SI	SI1	0.683	0.820	0.533
	SI2	0.757		
	SI3	0.723		
	SI4	0.754		
FC	FC1	0.712	0.816	0.529
	FC2	0.778		
	FC3	0.588		
	FC4	0.812		
BI	BI1	0.948	0.963	0.897
	BI2	0.944		
	BI3	0.949		
UB	UB	1.00	1.000	1.000

Remarks: Cut-off values for: (1) CR: 0.7; (2) AVE: 0.5

Apart from convergent validity, this paper also reviewed the discriminant validity. Table 4 presents the results about the discriminant validity of sixconstructs. The bolded numbers in the matrix diagonals refer to the square roots of the AVEs and these values are greater in all cases than the off-diagonal numbers in their corresponding row and column. As a result, this study exhibited discriminant validity.

Table 4: *Discriminant Validity using Fornell-Larcker Criterion*

Constructs	BI	EE	FC	PE	SI	UB
BI	**0.947**					
EE	0.391	**0.862**				
FC	0.401	0.653	**0.728**			
PE	0.458	0.640	0.587	**0.856**		
SI	0.325	0.343	0.508	0.462	**0.730**	
UB	0.251	0.036	0.061	0.097	-0.010	**1.000**

Notes: Boldface numbers on the diagonal are the square root of AVE values

3.5 Structural model evaluation

The structural model was presented in Figure 2: Structural modelling results. Performance Expectancy showed a positive influence on Behavioral Intention (H1: β=0.276; $p < 0.05$), H1 is supported. Secondly, a positive association between Behavioral Intention and Use Behavior was proven (H5: β=0.251; $p < 0.05$). Thus, H5 is supported. However, the impact of Effort

Expectancy, Facilitating Conditions and Social Influence on Behavioral Intention are insignificant, H2, H3 and H4 are not supported. Table 5 summarizes the evaluation result of the structural mode.

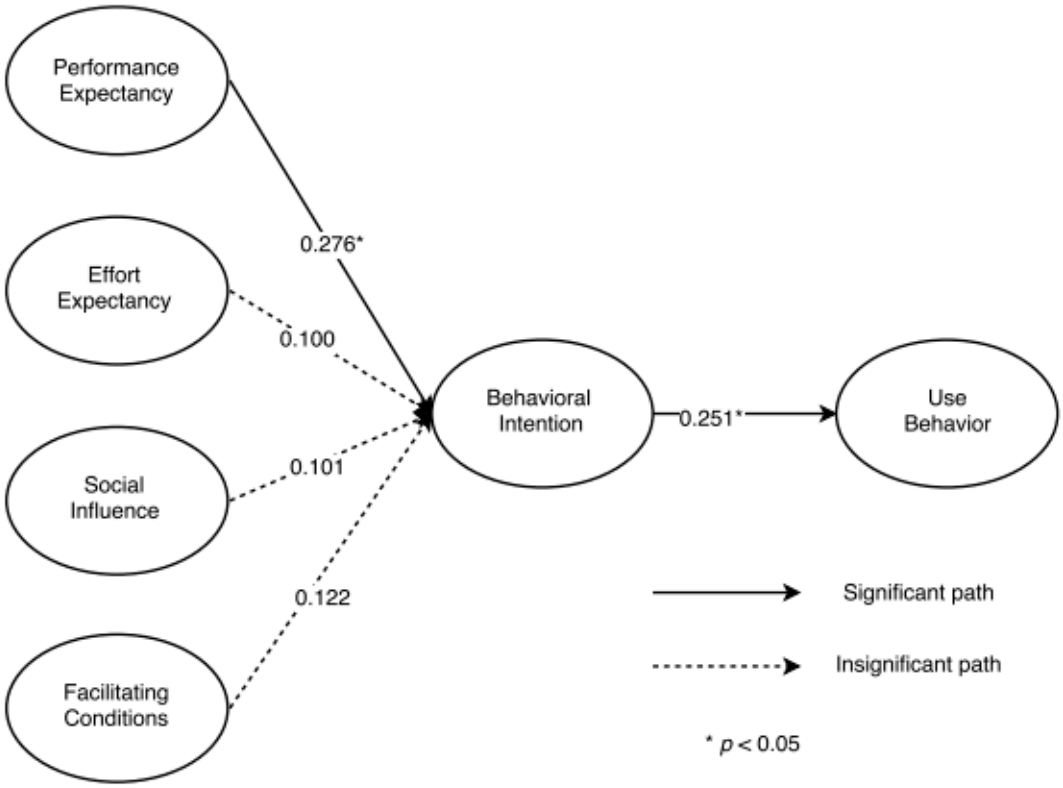

Figure 2: *Results of structural model*

Table 5: *Structural modelling results*

Hypothesis	Path Coefficient	t-value	p-value	Result
H1: Performance Expectancy -> Behavioral Intention	0.276	2.718	0.007*	Supported
H2: Effort Expectancy -> Behavioral Intention	0.100	1.040	0.298	Not Supported
H3: Social Influence -> Behavioral Intention	0.101	1.294	0.196	Not Supported
H4: Facilitating Conditions -> Behavioral Intention	0.122	1.215	0.224	Not Supported
H5: Behavioral Intention -> Use Behavior	0.251	2.907	0.004*	Supported

Notes: * Significant at the 0.05 level (2-tailed).

Table 6: *The Difference of Use Behavior between Two Universities*

	Value	df	Significance (2-sided)
Pearson Chi-Square	11.246a	8	.188
Likelihood Ratio	12.290	8	.139
Linear-by-Linear Association	5.007	1	.025
N of Valid Cases	130		

A Chi-squared test was conducted to test whether there is any significance between Use Behavior and university. As shown in Table 6, the p-value is 0.188 (which is greater than 0.05), hence there is no significance between the Use Behavior and the university at 5% level of significance.

4.0 FINDINGS AND DISCUSSION

The data analysis section shows that only hypotheses H1 and H5 are supported. It also shows that the staff at both universities have a high Behavioral Intention (BI) to use new technologies. This section will review the constructs in the hypotheses and will discuss the possible explanations of the findings.

Since there is no significant difference between the two universities, this means that these dimensions have no effect on the staff who work at these universities. One possible explanation is that both universities have policies and the telecommunications infrastructure that encourage their staff to make frequent contacts with the international academic society. This in turn has created a culture that is unique to universities, but different from the general population within which the universities operate.

Since H1 is supported, it means that in both universities, the staff have a higher Behavioral Intention to use new technologies in the workplace if there is a higher performance expectancy (PE) associated with those new technologies. An interesting observation is that among the four items that made up PE, item PE1 “I would find the new technologies useful in my job” has the highest score and smallest standard deviation. In contrast, PE4 “...I will increase my chances of getting a better performance review rating” has the lowest score and a higher standard deviation. This means that the staff in the universities are intrinsically motivated to use the new technologies that they think are useful to them.

Since H5 is supported, it means that in both universities, the staff have a higher Behavioral Intention to use new technologies in the workplace within 6 months. In fact, the BI construct has the highest average score, and the lowest standard deviation among all the constructs. This means the staff at these two universities do have the intention to use the new technologies, but only the PE construct contributes to the high BI in this study.

The hypotheses H2, H3 and H4 are not supported. This means that in both HE institutions, the staffs’ Behavioral Intention to adopt new technologies is not positively associated with effort expectancy (EE), social influence (SI) and facilitating conditions (FC). This is despite the fact that all the items in these three constructs each have mean scores higher than “3”, which means “neutral” in our 5-point Likert scale, in which “5” means “Strongly Agree” and “1” means “Strongly Disagree”. A possible explanation is that the staff at these universities have highself-efficacy. With a high self-efficacy, they have a strong belief in their abilities to use new technologies successfully despite the extra effort in learning and becoming skilful with the new technologies.

Furthermore, universities have a tradition of encourage independent and freethinking among its staff. Therefore, the staff are less likely to be influenced by other people. It is noted that SI3 "The senior management of my school has been helpful in the use of the new technologies" has the lowest score of 3.19 among all items in the questionnaire.This means that the senior management must not only support the use of new technologies, but also make their support clearly felt by the staff.This re-iterates the importance of senior management in the successful implementation of new technologies in organisations.

5.0 CONCLUSIONS

Organisations nowadays invest huge amounts of money on new technologies in an effort to become more efficient, more competitive and most importantly more profitable. However, a factor that often hinders the introduction and adoption of new technologies in the workplace is the resistance and attitude of the end users and the various employees who are supposed to use the new technologies. Often companies spend a lot of time, money and effort on new technologies only to realise that their employees either do not use them. Although there is research that examines the factors that affect employees' behaviour towards new technologies however, companies are still struggling with the successful introduction of IT. Therefore, this research is making a significant contribution in examining the factors that affect the acceptance of new technologies in the workplace through a cross case analysis between two HE institutions.

Therefore, the main objectives of our research were to:

- Examine the factors that influence IT acceptance in Higher Education Institution (HEI)
- Investigate the differences between those factors between an HEI in HK and one in the UK

Our study found that the staff have a higher Behavioral Intention to use new technologies in the workplace if they feel that the new technology will help them perform better in their jobs. In order to realise the importance and relevance of new technologies staff need to be appropriately educated of any new systems while senior management must be seen by their staff as supporting the use of new technologies. Also, we found that there is no significant difference between the two universities possibly because academic staff have frequent contacts with the international academic society. This might be the case because, although university staff might treat new technologies differently than in other sectors universities have a similar culture unique to the sector. However, this needs to be further investigated in future research in order to measure the scores in the cultural dimensions in the university context.

In addition, hypotheses H2, H3 and H4 are not supported in this research. This means that in both universities, the staffs' Behavioral Intention to adopt new technologies is not positively associated with effort expectancy (EE), social influence (SI) and facilitating conditions (FC). We believe that this might be the case due to the unique environment that universities operate in.HE institutions have a tradition of encouraging independent and freethinking among its staff. Therefore, the staff are less likely to be influence by their social environment. However, future research can further explore thesefactors by focusing on a more specific technology e.g. enterprise cloud computing.

Our research contributes in theory as well as in practice. From a theoretical perspective we are building on existing literature that has utilised the UTAUT model and we are providing a furtherunderstanding of the factors that can affect the acceptance of new technologies in organisations. From a practical perspective we believe that our findings can enable managers and practitioners in organisations,especiallyin HE institutions, to be better equipped regarding the introduction of new technologies by allowing them to address those factors that could potentially

hinder any new technology investment and therefore increase the acceptance and smooth adoption of IT.

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