

# ADOPTION OF NEAR FIELD COMMUNICATION IN HOTEL INDUSTRY BASED ON RISK PERSPECTIVES AND INDIVIDUAL CHARACTERISTICS

K. M. Sam<sup>1</sup>, C. R. Chatwin<sup>2</sup>

<sup>1</sup>Department of Accounting and Information Management, University of Macau, Macau, China

<sup>2</sup>Department of Engineering and Design, University of Sussex, Brighton, United Kingdom  
tonysam@umac.mo

*Abstract* - The emergence of the mobile phone has created great opportunities for businesses, especially those providing services to customers. Hotels are very important to a country as they provide accommodation to travelers. Better services attract more hotel customers. With the advent of NFC, a wireless mobile technology, hotel customers can use NFC to get hotel services efficiently. Previous studies found that risk and users' individual characteristics are very important in analyzing the adoption of Internet communication technologies. This paper presents a quantitative study on hotel customers' adoption of Near Field Communications (NFC) based on six dimensions of risk perspectives and individual characteristics. The results can provide useful indicators for the hotel industry to utilize NFC for a more productive business.

*Keywords* - Near Field Communication, risk aversion, face consciousness, perceived risk, adoption of NFC

## I. INTRODUCTION

Western as well as rapidly developing economies are dominated by the service sector as a result of its continuous expansion [1]. Progress in the tourism and hospitality sector is a key issue in this transformation [2]. In the traditional form of hospitality, customers usually go to register or check-in at the reception and get a key/keycard for their rooms. Receptionists need to verify the customers' identity and other accommodation information, collect payments and provide agreement documents for customers to sign. As a result, customers always need to waste a long time to get their rooms, particularly during rush hours.

### A. Near Field Communication

Near Field Communication (NFC) is a wireless data transmission technology that uses short-range radio waves to read data from tags that are a kind of passive circuit [3]. Such automatic identification of entities are also integrated into smartphones [4] and have been used in areas such as logistics, distribution and services [5]. In Stockholm of Sweden, a pilot test was conducted in the Clarion Hotel. A group of selected repeat visitors were given NFC-enabled mobile phones. With these devices, visitors are able to register for arrival at the hotel via a cell phone as well as activate their hotel key without having to check-in at the reception. Check-out is also done with the phone whereby the room key is disabled automatically [6]. Moreover, hotels do not need to make any changes to the door locks that are currently used. Thus, NFC has a huge potential and offers a vast field of possible applications for the tourism industry [7]. This study analyzes users' perceptions on the adoption of NFC in hotels based on risk perspectives. The purpose is to provide a vision for mobile phone manufacturers and mobile phone app designers to fully utilize the technology in hotels.

## II. RESEARCH MODEL

In this study, the adoption factors of NFC in the hotel industry are analyzed in terms of risk perceptions and individual characteristics. The research framework linking the antecedents and consequences of risk perceptions is shown in Fig. 1.

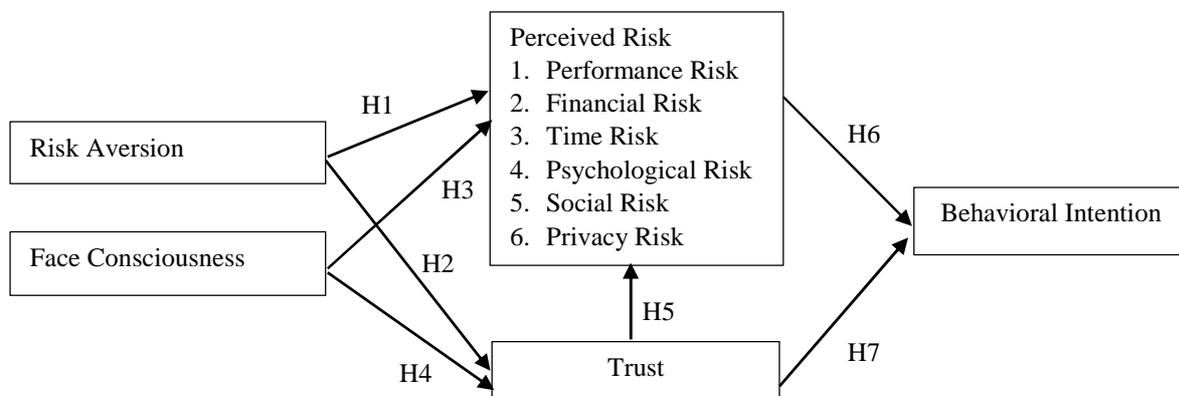


Fig. 1. Research Model

### A. Different dimensions of risks

Risk is defined as the adverse consequences of an uncertain outcome before and during product/service consumption [8, 9]. Since NFC is wireless technology transmitting transaction data, a higher level of risk should be considered. As a result, this study examines six dimensions of perceived risk – psychological, social, financial, performance, privacy and time risks [10]. Specifically, social risk is a loss of self-esteem in front of family or friends when the results cause embarrassment [8, 11]. Psychological risk is a loss of self-image or self-concept due to the results of a poor choice [8, 11]. Financial risk is a financial loss as a result of hidden costs or maintenance costs incurred [8, 12]. Performance risk is the loss incurred when the service does not perform as expected [8, 12]. According to Featherman and Pavlou [10], time risk occurs when time is lost by making poor purchasing decisions. Privacy risk reflects the potential loss of control over personal information.

### B. Risk aversion

Risk aversion is defined as “the extent to which people feel threatened by ambiguous situations, and have created beliefs that try to avoid these” [13]. According to Sun [14], risk aversion positively relates to psychological risk, social risk and performance risk for hotel service. Previous research has shown that for the 216 people who experienced a large decrease in trust, the qualitative measure of risk aversion increased by 22% [15]. In addition, risk aversion can affect consumers’ decision-making [16]. Consumers with high risk aversion feel more threatened by risky situations while those with low risk aversion feel less threatened by risky situations [17]. As a result, those high risk averse hotel customers who always prefer custom ways of getting hotel services such as using hotel room cards to lock/unlock their rooms do not trust the new technologies of getting transactions completed using NFC. Thus, the following hypothesis is proposed:

H1: Risk aversion has a positive impact on (a) performance risk, (b) financial risk; (c) time risk; (d) psychological risk; (e) social risk; (f) privacy risk of adopting NFC in hotels.

H2: Risk aversion has a negative impact on the trust of adopting NFC in hotels.

### C. Face Consciousness

Face is threatened when a person’s feelings or wants are ignored, disapproved, or challenged. Having lost face, this situation may lead to negative emotional responses such as: “annoyance, anger, and outright hostility” [18]. Researchers acknowledge the importance of face in consumption behavior, especially in Asian countries where Confucianism is the dominant culture [19]. The face

concept is related to the perceived importance of a service. The more desire a consumer has on maintaining or even increasing his/her face during a service event, the more important the service is to him/her [20]. In other words, consumers with a high level of face consciousness usually pay more attention to the various types of risk associated with the purchase [14]. Meanwhile, if people of high face consciousness are using a product which does not work properly, it is considered a loss of face [21]. Similarly, they may perceive a loss of face when they are in touch with a new type of technology such as NFC, which has the possibility of failure. On the other hand, people of high face consciousness try to adopt a new technology in secret, indicating they trust the new technology. As a result, the following hypotheses are proposed:

H3: Face consciousness has a positive impact on (a) performance risk, (b) financial risk; (c) time risk; (d) psychological risk; (e) social risk; (f) privacy risk of adopting NFC in hotels.

H4: Face consciousness has a positive impact on the trust of adopting NFC in hotels.

### D. Perceived risk and Trust

According to Featherman and Pavlou [10], the dimensions of risk mentioned above comprised the perceived risk influencing the behavioral intention of adopting e-services negatively. Similarly, the perceived risk of adopting NFC may have a negative impact on the behavioral intention of adopting NFC in hotels. In addition, trust is one of the most important factors in determining the adoption intention of m-commerce users [22, 23]. Furthermore, trust was found to have a negative impact on perceived risk to use Internet technologies [24]. As a result, the following hypotheses are proposed:

H5: Trust has a negative impact on (a) performance risk, (b) financial risk; (c) time risk; (d) psychological risk; (e) social risk; (f) privacy risk of adopting NFC in hotels.

H6: (a) performance risk, (b) financial risk; (c) time risk; (d) psychological risk; (e) social risk; (f) privacy risk have a negative impact on behavioral intention of adopting NFC in hotels.

H7: Trust has a positive impact on behavioral intention of adopting NFC in hotels.

## III. RESEARCH METHODOLOGY

In order to know the behavioral intention of NFC in hotels, we distributed a questionnaire among the visitors in Macau and received around 117 respondents’ feedbacks. Among 117 valid responses, 75 of them were female (64.1%) and 42 (35.9%) were male. Each item was measured on a five-point Likert scale from strongly

disagree to strongly agree. In order to test the hypotheses, Structural Equation Modeling (SEM) was used to validate the proposed research model. The AMOS software package was used to conduct the analysis procedures of the SEM [25]. A confirmatory factor analysis (CFA) is performed to examine the overall fit, validity, and reliability of the measurement model. The hypotheses are then examined using the structural model.

First of all, exploratory factor analysis was conducted and the principal axis factoring method was used to obtain the factor loading values on each component shown in Table 1, which categorizes 34 items into 10 factors, although a few items have been removed due to their low factor loading values. Cronbach alpha values are also computed and shown in Table 1 in order to test the reliability of each factor.

TABLE 1.  
THE LOADINGS OF EACH FACTOR

Factor and corresponding items	Loadings
<b>Factor 1-Risk Aversion</b> ( $\alpha = 0.767$ )	
I would rather stick with a hotel service I usually use, rather than trying those I am not very sure of. (RiskAver2)	0.714
I never try something I do not know about due to the risk of making a mistake. (RiskAver3)	0.862
<b>Factor 2-Face Consciousness</b> ( $\alpha = 0.718$ )	
It is important that others like the products or services that I try. (Face1)	0.917
Sometimes I try a service because my friends do so. (Face2)	0.592
<b>Factor 3-Performance Risk</b> ( $\alpha = 0.727$ )	
NFC in hotels might not perform well and thus create problems. (PFMRsk1)	0.704
The security systems built into the NFC in hotels are not powerful enough to protect my private information. (PFMRsk2)	0.807
The probability that something's wrong with the performance of NFC in hotels or it cannot fulfill as promised is high. (PFMRsk3)	0.597
<b>Factor 4-Financial Risk</b> ( $\alpha = 0.855$ )	
Using NFC mobile payment in hotels subjects my credit card account to potential fraud. (FNCRsk2)	0.747
Using NFC mobile payment in hotels subjects my credit card account to financial risk. (FNCRsk4)	0.807
<b>Factor 5-Time Risk</b> ( $\alpha = 0.812$ )	
If I use NFC in hotels, I will lose time due to having to switch to a different way of handling transactions. (TIMERsk1)	0.642
Using NFC in hotels would be inconvenient due to a lot of time wasted for fixing errors. (TIMERsk2)	0.922
<b>Factor 6-Psychological Risk</b> ( $\alpha = 0.898$ )	
Using NFC service in hotel makes me feel psychologically uncomfortable. (PSYRsk1)	0.785
Using NFC service in hotel gives me a feeling of unwanted anxiety. (PSYRsk2)	0.965
Using NFC service in hotel causes me to experience unnecessary tension. (PSYRsk3)	0.615
I would worry a lot when using NFC service in hotel. (PSYRsk4)	0.627
<b>Factor 7-Social Risk</b> ( $\alpha = 0.868$ )	
If I use NFC in hotels, it will negatively affect the way others think of me. (SOCRsk1)	0.776
My signing up for NFC and using NFC in hotels would lead me to a social loss because others would think less highly of me. (SOCRsk2)	0.942
Using NFC service in hotel would cause me to be thought of as being foolish by some people whose opinions I value. (SOCRsk3)	0.701
<b>Factor 8-Privacy Risk</b> ( $\alpha = 0.808$ )	
Using NFC in hotels can increase the probability of losing control over my personal information. (PRVRsk1)	0.880
My signing up for and using NFC in hotels would lead to a loss of privacy because my personal information would be used without my consent. (PRVRsk2)	0.685
If I use NFC for mobile payment, Internet hackers (criminals) might take control of my credit card account. (PRVRsk3)	0.687
<b>Factor 9-Trust</b> ( $\alpha = 0.831$ )	
NFC in hotels can handle transactions appropriately. (Trust1)	0.659
The promises made by NFC in hotels are likely to be reliable. (Trust2)	0.925
Overall, NFC in hotels is trustworthy. (Trust3)	0.800
<b>Factor 10- Behavioral Intention</b> ( $\alpha = 0.816$ )	
I intend to use NFC in hotels in the next few months. (INT1)	0.820
I predict I would use NFC in hotels in the next few months. (INT2)	0.882
I intend to check the balance of my credit card on the mobile application after using NFC to make mobile payment in hotels. (INT3)	0.629

The CFA procedure was then conducted to assess the measurement model in terms of goodness-of-fit, convergent validity and discriminant validity. The overall fit of the measurement model was assessed and the results of the analysis indicated that the goodness-of-fit indices for the hypothesized measurement model were reasonable ( $\chi^2 / d.f. = 4.611$ , CFI = 0.903, SRMR=0.088, GFI = 0.905, AGFI = 0.802). With regard to convergent validity, the factor loading results of CFA are shown in Table 2. The standardized factor loadings reached a significant level while the composite reliability (CR) values and the average variance extracted (AVE) values were all higher than 0.6

and 0.5 respectively, which showed good reliability on all measures. Overall, the measurement model exhibits adequate reliability and convergent validity.

TABLE 2.  
CONVERGENT VALIDITY FOR THE MEASUREMENT MODEL

Construct	Indicator	Factor Loading	C.R.	AVE
Risk aversion	RiskAver2	0.60	0.796	0.675
	RiskAver3	0.99		
Face consciousness	Face1	0.61	0.750	0.610
	Face2	0.92		
Performance risk	PFMRsk1	0.55	0.732	0.501
	PFMRsk2	0.77		

	PFMRsk3	0.74		
Financial risk	FNCRsk2	0.87	0.858	0.751
	FNCRsk4	0.86		
Time risk	TIMERSk1	0.87	0.814	0.687
	TIMERSk2	0.79		
Psychological risk	PSYRsk1	0.85	0.899	0.690
	PSYRsk2	0.87		
	PSYRsk3	0.84		
	PSYRsk4	0.77		
Social risk	SOCRsk1	0.79	0.872	0.696
	SOCRsk2	0.91		
	SOCRsk3	0.79		
Privacy risk	PRVRsk1	0.90	0.814	0.598
	PRVRsk2	0.74		
	PRVRsk3	0.65		
Trust	Trust1	0.76	0.835	0.628

	Trust2	0.84		
	Trust3	0.77		
Behavioral intention	INT1	0.92	0.831	0.629
	INT2	0.83		
	INT3	0.59		

Finally, the discriminant results are reported in Table 3. Since the square roots of all AVEs are greater than the correlations between the constructs (Diagonal values in Table 3 represent the square root values of AVEs), we conclude that all the constructs show evidence of discrimination.

TABLE 3.  
Discriminant validity

Construct	1	2	3	4	5	6	7	8	9	10
1. Time risk	<b>0.829</b>									
2. Psychological risk	0.307	<b>0.831</b>								
3. Social risk	0.272	0.620	<b>0.834</b>							
4. Privacy risk	0.349	0.594	0.304	<b>0.773</b>						
5. Trust	0.203	-0.155	0.041	0.039	<b>0.792</b>					
6. Behavioral intention	0.045	-0.403	-0.262	-0.347	0.314	<b>0.793</b>				
7. Performance risk	0.374	0.448	0.184	0.288	0.056	-0.033	<b>0.708</b>			
8. Financial risk	0.564	0.496	0.286	0.607	0.009	-0.129	0.352	<b>0.867</b>		
9. Risk aversion	0.355	0.244	0.240	0.080	-0.100	-0.064	0.175	0.132	<b>0.821</b>	
10. Face consciousness	0.360	0.178	-0.056	0.200	0.250	0.117	0.264	0.219	0.135	<b>0.781</b>

#### IV. RESULTS

Once the measurement model is determined as satisfactory, the structural model is then examined to confirm the relationships among the constructs. Table 4 shows results of path coefficients and their significance for all hypotheses tests. The results showed that H1c, d and e, H3a, b, c, d, f, H4, H5d and H6f and H7 are supported.

TABLE 4.  
Results of the structured model and hypothesis tests

Hypothesis	Path Coefficient	t value	Support
H1a: Risk_Aver → PF_Rk	0.156	1.760	No
H1b: Risk_Aver → FN_Rk	0.108	1.187	No
H1c: Risk_Aver → TM_Rk	0.367	4.679***	Yes
H1d: Risk_Aver → PY_Rk	0.225	2.591*	Yes
H1e: Risk_Aver → SC_Rk	0.284	3.126**	Yes
H1f: Risk_Aver → PV_Rk	0.052	0.558	No
H2: Risk_Aver → Trust (-)	-0.117	-1.731	No
H3a: Face_Consc → PF_Rk	0.295	3.196**	Yes
H3b: Face_Consc → FN_Rk	0.267	2.840**	Yes
H3c: Face_Consc → TM_Rk	0.311	3.817***	Yes
H3d: Face_Consc → PY_Rk	0.255	2.831**	Yes
H3e: Face_Consc → SC_Rk	-0.129	-1.370	No
H3f: Face_Consc → PV_Rk	0.225	2.350*	Yes
H4: Face_Consc → Trust	0.307	3.453***	Yes
H5a: Trust → PF_Rk (-)	0.000	-0.005	No
H5b: Trust → FN_Rk (-)	-0.049	-0.525	No
H5c: Trust → TM_Rk (-)	0.186	2.298	No
H5d: Trust → PY_Rk (-)	-0.239	-2.666**	Yes
H5e: Trust → SC_Rk (-)	0.108	1.155	No
H5f: Trust → PV_Rk (-)	-0.019	-0.200	No
H6a: PF_Rk → INT (-)	0.106	1.197	No
H6b: FN_Rk → INT (-)	0.168	1.499	No
H6c: TM_Rk → INT (-)	0.096	0.985	No

H6d: PY_Rk → INT (-)	-0.213	-1.574	No
H6e: SC_Rk → INT (-)	-0.116	-1.083	No
H6f: PV_Rk → INT (-)	-0.397	-3.522***	Yes
H7: Trust → INT	0.301	3.621***	Yes

Note. \*\*\*  $p < 0.001$ ; \*\*  $p < 0.01$ ; \*  $p < 0.05$ .

#### V. CONCLUSION

In order to increase customers' satisfaction towards hotel service, "Near Field Communication" (NFC) technology has been introduced into the hotel industry in recent years. The practice of using NFC in the hotel industry can help to increase the efficiency, flexibility and productivity of front-desk work, reduce communication costs and provide more convenience to hotel customers. In previous studies, much of the attention has been focused on the impact of system quality or the value of NFC, while this study has focused on risk perspectives and users' individual characteristics. The results found that risk aversion only has a positive impact on time, psychological and social risks while it has the highest impact on time risk. In addition, face consciousness has a positive impact on all categories of risks except social risk, while it has the highest impact on time risk. In addition, face consciousness has a positive impact on trust while risk aversion does not. Regarding behavioral intention of adopting NFC, only privacy risk has a negative impact on it, while trust has a positive impact. This indicates that face consciousness, privacy risk and trust play very important roles in determining the behavioral intention of adopting NFC in hotels. If the hotel businesses pay attention to these factors, they will increase the adoption of NFC in their hotels.

## ACKNOWLEDGMENT

This research was funded by the Research Committee at the University of Macau.

## REFERENCES

- [1] McKee, "Services, growth poles and advanced economies. Service Business," *An International Journal*, vol. 2, no. 2, pp. 99–107, 2008.
- [2] T. Lorde, B. Francis and R. Drakes, "Tourism Services Exports and Economic Growth in Barbados," *The International Trade Journal*, vol. 25, no. 2, pp. 205-232, 2011.
- [3] S. Ortiz, "Jr. Is near-field communication close to success?" *Computer*, vol. 39, no. 3, pp. 18–20, 2006.
- [4] Arcese, G. Campagna, S. Flammini and O. Martucci, "Near Field Communication: Technology and Market Trends," *Technologies*, vol. 2, no. 3, pp. 143-163, 2014.
- [5] P. Talone and G. Russo, "RFID - Fondamenti di una Tecnologia Silenziosamente Pervasiva," *Fondazione Ugo Bordon*, Rome, Italy, 2008.
- [6] S. Clark, "NFC phones replace room keys and eliminate check-in at Swedish hotel," *NFC World* [online] 2010. Available at: <http://www.nfcworld.com/2010/11/03/34886/nfc-keys-hotel-sweden/>
- [7] R. Egger, "The impact of near field communication on tourism," *Journal of Hospitality and Tourism Technology*, vol. 4, no. 2, pp.119 – 133, 2013.
- [8] T. Kushwaha and V. Shankar, "Are multichannel customers really more valuable? The moderating role of product category characteristics," *Journal of Marketing*, vol. 77, July, pp. 67–85, 2013.
- [9] H. Wu, H. C. Liao, K. P. Hung, and Y. H. Ho, "Service guarantees in the hotel industry: Their effects on consumer risk and service quality perception," *International Journal of Hospitality Management*, vol. 31, pp. 757–763, 2013.
- [10] M. S. Featherman and P. A. Pavlou, "Predicting e-services adoption: A perceived risk facets perspective," *International Journal of Human-Computer Studies*, vol. 59, no. 4, pp. 451–474, 2003.
- [11] K. B. Murray and J. L. Schlacter, "The impact of services versus goods on consumer assessment of perceived risk and variability," *Journal of the Academy of Marketing Science*, vol. 18, no. 1, pp. 51–65, 1990.
- [12] Sweeney, J., Soutar, G.N., Johnson, L.W., "The role of perceived risk in the quality value relationship: a study in a retail environment," *Journal of Retailing*, vol. 75, vol. 1, pp. 77–105, 1999.
- [13] Hofstede and M. H. Bond, "Hofstede's culture dimensions: An independent validation using Rokeach's value survey," *Journal of Cross-Cultural Psychology*, vol. 15, pp. 417–433, 1984.
- [14] J. Sun, "How risky are services? An empirical investigation on the antecedents and consequences of perceived risk for hotel service," *International Journal of Hospitality Management*, vol. 37, pp. 171-179, 2014.
- [15] L. Guiso, P. Sapienza and L. Zingales, "Time Varying Risk Aversion," NBER Working Paper No. 19284, August 2013.
- [16] J. Baz, E. Briys, B. J. Bronnenberg, M. Cohen, R. Kast, P. Viala, L. Wathieu, M. Weber and K. Wertenbroch, "Risk perception in the short run and in the long run," *Marketing Letters*, vol. 10, no. 3, pp. 267–283, 1999.
- [17] Hofstede, *Cultures and organizations: Software of the mind*. London: McGraw-Hill, 1991.
- [18] B. White, R. Tynan, A. D. Galinsky and L. Thompson, "Face Threat Sensitivity in Negotiation: Roadblock to Agreement and Joint Gain," *Organizational Behavior and Human Decision Processes*, vol. 94, no. 2, pp. 102-124, 2004.
- [19] K. Tse, "Understanding Chinese people as consumers: past findings and future propositions," In: Michael, H., Bond (Eds.), *The Handbook of Chinese Psychology*. Oxford University Press, Hong Kong, pp. 352-363, 1996.
- [20] M. Li, "Exploration of Chinese consumer complaint behavior in the hospitality industry," UNLVTheses/ Dissertations/ ProfessionalPapers/ Capstones. Paper 653, 2010.
- [21] L. Graham and N. M. Lam, "The Chinese negotiation," *Harvard business review*, 2003
- [22] T. T. Wei, G. Marthandan, A. Y. L. Chong, K. B. Ooi, and S. Arumugam, "What drives Malaysian m-commerce adoption? An empirical analysis," *Industrial Management & Data Systems*, vol. 109, no. 3, pp. 370-388, 2009.
- [23] A. Y. L. Chong, F. T. S. Chan and K. B. Ooi, "Consumer decision to adopt m-commerce: A cross country empirical examination between China and Malaysia," *Decision Support Systems*, vol. 53, no. 1, pp. 34-43, 2011.
- [24] S. L. Jarvenpaa, N. Tractinsky and L. Saarinen, "Consumer Trust in an Internet Store: A Cross-Cultural Validation," *Journal of Computer-Mediated Communication*, vol. 5, no. 2, pp. 0, 1999.
- [25] K. M. Sam, M. Gao and C. R. Chatwin, "An Assessment of Acceptability and Use of Computer Aided Translation Systems: The Case of Macao Government," *Journal of Information Technology Management*, vol. 26, no. 2, pp. 56 - 69, 2015.