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Exploring Biometric Technology Adopted in the Hotel Processes

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Abstract: Biometrics are technologies that use measurable physical, biological or behavioral characteristics to perform identity verification or to recognize a person through automation. This study explored perceptions and acceptance of biometric technology by guests in hotels: Knowing what would be needed to install the biometric device, how to maximize the synergy between the guests and hotels toward the new technology and trying to find out about the knowledge base, available about biometrics among hotel guests. The results indicated that hotel guests are comfortable and already "slightly" willing to use biometrics, perhaps due to ongoing world-wide terrorism threats and consequently individuals may now be more sensitized to their own physical safety. For the hotel sector, they may be able to concentrate on those processes that are most preferred by the customer to ensure adoption.

Key words: Biometric technology, biometric device, hotel process

INTRODUCTION

Technology has permeated every facet of society and every segment of the economy and has impacted both business and society in several positive ways. The advent and growth of technology in everyday business has allowed adaptors of appropriate technology to gain competitive advantages, especially if they are able to harness the full potential of the technology and implement its ways that will enhance and complement existing organizational processes. Although, appropriate technology adoption will benefit most industries, it is of paramount importance for those that offer a homogeneous product and rely on information and streamlined business processes to gain competitive advantages. One such industry is the hospitality industry where information is often perceived as the driving force of the industry (O'Connor and Frew, 2002). From a strategic perspective, the use of technology in the hospitality industry is driven by the need to improve and refine customer service (Sweat and Hibbard, 1999), improve operational efficiency (Bacheldor, 1999), increase revenue and lower overall costs (Huo, 1998). Consequently, the hospitality industry is apt to adopt and incorporate new technologies to ameliorate existing business processes. One relatively new technological advance that has gained prominence and use in recent years is biometric technologies. As most of today's hotel guests, seek convenience (Law and Chen, 2001), biometrics appears to be one of the most promising technologies of the future, allowing guests to check in/out, access guest areas and make payments with unprecedented convenience and speed. However, despite a recent decrease in the overall price of biometric hardware, biometric systems represent that hotel have to make significant financial investments. In the absence of strong adoption from guests, the return on such investments may not be substantial for hotels. In this context, understanding the circumstances under which guests adopt biometric systems may provide hotels with insight into the types of systems to be offered and the characteristics that biometric systems should have to be adopted enthusiastically by guests. Therefore, this study reviews the critical issues regarding biometrics and, further generates a conceptual model that attempts to demonstrate the preferred devices and specific hotel processes that impact on the consumers' willingness to adopt biometrics.

Biometric systems are technologies that use "measurable physical, biological or behavioral characteristics that can be processed to establish identification, to perform identity verification or to recognize a person through automation" (Ives *et al*., 2005). Biometric systems require two operational dimensions enrollment, in which biometric data is obtained and linked with a person's identity and authentication or recognition, in which new biometric data are compared with the stored data (Langenderfer and Linnhoff, 2005). With biometrics, data from a fingerprint, are collected and transmitted to a computer to processes, to identify a match within the stored database, allow access to an area and document the entry time of a given individual. This information can

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be printed or retrieved at a later time to determine all those who accessed the area in question. This data is accurate, convenient and cannot be stolen or replicated because it is unique to only one subject (Jackson, 2009). An inventory of biometric system includes fingerprinting, face and voice recognition, hand geometry, handwriting pattern recognition and iris and retinal scanning (Ives *et al*., 2005). Bolle *et al*. (2004) commented that nearly every physical property of the body (density, reflectance, absorption, emission and chemical composition) could act as a biometric, especially if it can be measured and defined with enough precision. Although, biometrics is an available and potentially useful security tool, the hospitality industry as a whole has been slow to adopt it (Murphy and Rottet, 2009), arguably because of prohibitive factors such as reliability, lack of standards (Vijayan, 2004), perceived intrusiveness (Singh and Kasavana, 2005) and privacy concerns (Adler, 2008). In spite of such barriers, it is generally agreed that biometric systems could add value to guests' hotel stay experiences (Murphy and Rottet, 2009), as they are viewed as superior to traditional identification and access technologies. For hotels, biometric systems appear to be promising, as they can reduce costs and fraud and increase accuracy in transaction processing (Murphy and Rottet, 2009) while offering users security and convenience (Jones *et al*., 2007).

On the other hand, acceptance and adoption of technology by guests is essential for the success of implementation (Ghorab, 1997). Understanding, why individuals accept or reject information technology innovation has proved to be one of the most challenging issues in information technology research (Ghorab, 1997). The literature review showed that study attempting to understand technology acceptance in general has relied on the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), the Innovation Diffusion Theory (IDT) and Technology Acceptance Model (TAM) (Davis, 1989; Venkatesh and Brown, 2001). The Theory of Reasoned Action (TRA), popularized by Fishbein and Ajzen (1975), suggested that subjective norm (beliefs, norm beliefs and motivation to comply) and belief and evaluation influence attitudes toward technology which in turn affects behavioral intention to use, translated into actions (Fishbein and Ajzen, 1975). Ajzen (1991) developed the TPB which was an extension of the TRA and included the perceived behavior control under the influence of interior and exterior control factors.

TAM, a well respected model used to understand human behavior and attitudes towards technology, focused on modeling how users come to accept and see

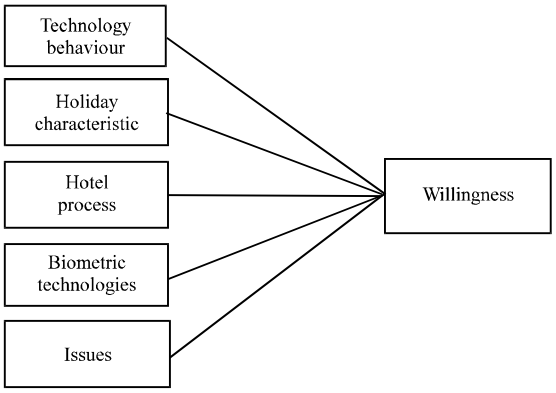

Fig. 1: Formulating a conceptual biometric adoption model in hotel

technology and factors relating to how and when they will use technology (Davis, 1989). The TAM reduced the beliefs in the TRA to two important beliefs, perceived ease of use and perceived usefulness (Bruner II and Kumar, 2005; Lee *et al*., 2006). According to Davis (1989), perceived ease of use is the degree to which a person believes that use of a particular system would be free of effort and perceived usefulness is the degree to which a person believes that use of a particular system would enhance his or her job performance. In TAM, users' new technology adoption behavior is affected by four constructs: Perceived usefulness, perceived ease of use, attitudes and intentions to use the new technology. The model theorizes that users would adopt a new technology if that technology is perceived to help them perform a task better (Davis, 1989), referred to as "perceived usefulness." In addition, users would adopt a new technology if the technology is perceived as easy to use and requires little effort to perform a task, referred to as "perceived ease of use" (Davis, 1989). Both perceived usefulness and ease of use affect users' attitudes toward new technologies which in turn, affect their intentions to use the new technologies. Thus, the TAM proposes a direct belief-attitude intention relationship (Oh *et al*., 2009) and help to formulate a conceptual framework of biometric adoption by customers in hotel settings (Fig. 1).

METHODOLOGY

The conceptual model (Fig. 1), is tested by data collected in a survey which takes the form of a structured questionnaire and is cross-section as data only collected at one point of time (Balnaves and Caputi, 2001). The questionnaire is developed from the study of Li (2006) and Jain and Ross (2004) who investigated

biometrics issues, albeit in a wider context and the study of Wang and Namen (2004) and Stavins (2001) who examined demographic determinants, "willingness to use" and "technology acceptance". Additionally, it is modified by the authors to include the context of hotels and hospitality processes.

The data collected in this study is mostly quantitative, collected via quota sampling, stratified on the demographic profile of the Taiwan population. From the 520 questionnaires that were distributed, 461 valid ones were obtained. The questionnaire follows a structured classification type and administration is self-completion. An informative cover letter was established containing relevant technical and introductive information. The questionnaire covered the key issues that were elicited from the literature review and contained the following sections from which the conceptual model: Technology behaviour, holiday characteristics, hotel processes, biometric technologies and the "willingness" to adopt biometrics and used a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) to rate the items in the dimensions. Means and standard deviations are used to review the overall model dimensions and for the focus on hotel processes and biometric devices linear regression and ANOVA tests are performed to test the relationships between these dimensions/items of the model on "willingness". Confidence limits for all statistical tests are 95%.

RESULTS

Table 1 indicates the relative importance of various items and dimensions, particularly the items of security and privacy are highly ranked by hotel customers. The overall mean value of the dimension of technology behaviour is 3.18 and reinforces the fact that they are familiar and comfortable with technology in general which may then impact of their use of other "unknown" technologies. Additionally, the dimension of holiday characteristics has a mean score of 3.06, the most important of the independent items in this dimension being, the importance of settings, activities offered and the need to use technology. This may be the result of not wanting to carry devices-cards-cash-identification while on holiday or engaging in sports and therefore the minimalism of biometric identification may be further appealing.

Biometric technologies mean score 2.97 shows that respondents are comfortable and already "slightly" willing to use biometrics. Additionally, the item of willingness is 3.11 to use biometrics is significant and may be because these respondents already trust in these technologies, e.g., they may be using biometric devices in other settings. The hotel process, mean score 2.03 is the lowest overall dimension score and may be as a result of the fact that these respondents do not see the value in a more rapid/secure/seamless transaction and biometrics is viewed by them as more of a business value driver for the hotel.

Table 1: Overall results (means and standard deviations)

Parameters	Mean	Std. dev
Technology behaviour	3.18	0.91
Interest in technology	3.23	1.06
Frequency of use	3.14	0.76
Holiday characteristics	3.06	1.07
Importance of settings	3.45	1.10
Importance of activities offered	3.20	1.08
Level of technology offerings	2.44	0.91
Need to use technology	3.15	1.18
Holiday-hotel processes	2.03	1.98
Confirm identity	2.07	1.92
Information request	1.95	2.13
Booking	1.94	2.01
Activation	1.94	1.91
Payment	2.02	1.90
Access	2.25	1.98
Biometric technologics	2.97	0.99
Knowledge on biometrics	2.33	0.84
Interest into biometrics	2.76	0.89
Feel comfortable when using biometrics	3.42	1.00
Willingness to use biometrics	3.35	1.24
Issues	3.57	1.13
Privacy	3.67	0.94
Usability	3.51	1.20
Accuracy	3.67	1.13
Security	3.93	1.12
Rapidity	3.05	1.26
Willingness	3.11	1.09
Willingness to use	3.11	1.09

The dimension of issues (which include privacy and security issues), mean score 3.57 is the highest as may be expected from the existing study and literature and confirms that these factors are still critical for the consumer. Table 2 looks further at the devices that customers prefer for specific hotel processes and shows that fingerprint is most commonly acceptable for payment, mean score 3.35, also confirmation of identity, mean score 3.31, for access mean score 3.28 and for activation mean score 3.16. For other processes booking with voice/speech recognition has a mean score 2.43 and information request, mean score 2.45. These results indicate that customers are more likely to find less intrusive biometric devices more appropriate for hotel processes that do not include critical transactions, e.g., financial. Table 3 and 4 reveal that the most critical items in the regression model are payment and access which are both are statistically significant and that the R^2 value indicates that hotel processes "explain" 18.2% of willingness. This willingness to use biometrics devices, in general, may be due to the convenience, simplicity and security proffered by biometric devices.

Table 2: Hotel processes and biometric devices (means and standard deviations)

Hotel process	Mean	Std. dev
Confirm identity		
Figerprint	3.31	1.90
Iris scanning	2.63	1.96
Retina scanning	2.02	2.05
Hand geometry identification	1.62	1.93
Voice recognition	1.53	1.86
Keystroke recognition	1.21	1.73
Face recognition	2.03	1.93
Information request		
Figerprint	2.01	2.02
Iris scanning	1.97	2.07
Retina scanning	1.54	1.88
Hand geometry identification	1.76	2.12
Voice recognition	2.45	1.96
Keystroke recognition	2.28	1.93
Face recognition	1.56	1.88
Booking		
Figerprint	2.02	2.11
Iris scanning	1.76	2.06
Retina scanning	1.88	2.03
Hand geometry identification	1.78	2.02
Voice recognition	2.43	1.89
Keystroke recognition	2.29	2.05
Face recognition	1.37	2.01
Activation		
Figerprint	3.16	1.76
Iris scanning	2.43	2.03
Retina scanning	2.02	2.03
Hand geometry identification	1.77	1.92
Voice recognition	1.56	1.91
Keystroke recognition	1.33	1.82
Face recognition	1.24	1.72
Payment		
Figerprint	3.35	1.83
Iris scanning	2.78	1.93
Retina scanning	1.96	1.98
Hand geometry identification	1.59	1.89
Voice recognition	1.53	1.93
Keystroke recognition	1.38	1.87
Face recognition	1.23	1.96
Access		
Figerprint	3.28	1.96
Iris scanning	2.95	2.03
Retina scanning	2.23	2.06
Hand geometry identification	1.86	1.97
Voice recognition	1.92	1.95
Keystroke recognition	1.36	1.86
Face recognition	2.03	2.02

Table 3: Critical hotel processes

Hotel processes	Mean	Std. dev	t-value	Sig.
Confirm identity	2.02	1.93	0.915	0.361
Information request	1.96	2.14	0.721	0.463
Booking	1.93	2.02	0.146	0.883
Activation	1.92	1.93	0.526	0.601
Payment	2.08	1.91	2.063	0.036
Access control	2.31	1.97	3.131	0.003

Table 4: ANOVA table

Model	Sum of squares	df	Meansquare	F	Sig.
Regression	65.042	6	10.832	10.831	0.000
Residual	294.102	293	1		
Total	357.136	299			
R	0.42				
R^2	0.183				

DISCUSSION

The results of this study indicated that hotels should focus on specific hotel processes and devices for successful assimilation of the customer into the biometric experience in hotels. Nonetheless, technology should be implemented in a way that is customer-centric, e.g., customers could be offered greater convenience and control, rather than taking the short term view of "forcing" new technologies on customers without consideration of the issues. Though other biometrics related syudy demonstrates the benefits that service-oriented companies might seek when using biometric technologies, i.e., on improving operational efficiency or security. It is the end user (i.e., customer) that is considered here and his preference and needs for specific processes and devices that may lead to successful rollout of technology. Customers seek convenience and to avoid "card clutter", particularly in "resort settings", preferring not to carry keys and identification. The hotel manager might, therefore, anticipate the integration of biometric devices with other information systems that are offered to guests (i.e., reservations, entertainment). In that sense, a number of advantages can be foreseen, especially in terms of value to guests, accessibility and cost. First, a fully integrated system that allows guests to use the same biometrics at multiple properties would definitely add value to guests' hotel stay experiences, especially in terms of optimization of interactions with the hotel. Furthermore, such fully integrated systems could set up switch barriers which, in the long term, could result in an increase in guests' purchasing behavior of a particular hotel brand. Coupled with strong attitudes toward the brand, this may result in a true, strong sense of loyalty toward the property/brand. Second, an integration of biometrics into other systems that guests have already adopted would eventually result in an easier adoption of the biometric component, as their perceptions of usefulness may transfer from the existing (i.e., traditional access or payments methods) to the new (i.e., biometric systems) parts of the integrated system.

This study reveals that consumer resistance to this "invasive" technology is low, perhaps due to ongoing world-wide terrorism threats and consequently, individuals may now be more sensitized to their own personal physical safety. For the hotel sector, they may be able to concentrate on those processes that are most preferred by the customer to ensure adoption (with future rollout of biometrics to more sensitive areas when the benefits are proven). The implications for the hotel manager is that, as biometric systems are more

widely spread in contexts such as airport and border security, users might diminish some of their concerns associated with the use of biometric systems. With increasing use and resulting familiarity with biometric systems while traveling, it is anticipated that more users would eventually become convinced of the efficiency, convenience and harmlessness of such technologies, contributing to the development of more positive beliefs and attitudes toward biometric systems. Although, when crossing borders or entering certain countries, travelers might find the use of biometrics to be mandatory, they might eventually develop attitudes that could be strong enough to stimulate curiosity and voluntary use in further settings, such as hotels. Thus, hotels might embrace and at least explore the offering of biometric systems to guests, with the expectation that they would eventually recover the cost associated with the implementation of such systems.

In terms of limitations, this model may not adequately reflect the constantly changing technology-security environment and is limited to a sample of respondents in Taiwan which may make the findings difficult to generalise. Though this model's measures (dimensions and items) are derived form the generic literature, the academic literature and empirical research are still at an early stage and therefore limited. There may be additional factors to consider for the hotel sector, e.g., issues of integration into existing hardware and software, country-specific legislation on privacy and security etc., and therefore additional dimensions may need to be exposed to further assess the model. Finally, it is acknowledged that this study focuses on only two of the dimensions, further examination of all dimensions and their inter-relationship will be the focus of future study.

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