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Exploration of factors affecting adoption of biometric technology by five-star Egyptian hotel employees

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Exploration of factors affecting adoption of biometric technology by five-star Egyptian hotel employees

by

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CHAPTER 1. INTRODUCTION

Tourism is the economic lifeblood for many parts of the world. Whether it be on a pristine beach on a tropical island or at a ski resort in the snowy Alps, tourists need and deserve to feel safe when on vacation. With today's increasing terror attacks aimed at tourists, the hospitality industry around the world is greatly concerned about the safety and security of its employees and property (Boss & Longmore-Etheridge, 2006; Higley, 2006). Biometrics, the process of personal identification and authentication, is a technology that could be used to improve security and work flow in hotels. This study will investigate the factors and the partial issues that could influence the adoption of biometrics by hotels in Egypt to improve safety and security as well as the expected efficiency in hotel processes. This chapter will include the statement of the problem, the significance of the study, the purpose, objectives, and organization of the study.

Statement of the Problem

Globally, terrorism has been a daily occurrence in many places for a long time. The travel and tourism demand after 9/11 fell 7.4% globally and 8.5% in the United States beginning in 2001, according to the World Travel and Tourism Council (WTTC) (2002). This decline cost the economy $92.3 billion. Europe was not spared; tourism demand fell from 4.5% in 2001 with an unexpected additional 3.1% decline (WTTC, 2002). The lodging industry stocks and revenues also saw a sharp decline after the same event (Enz & Canina, 2002). Terrorism on the hospitality services in Italy was executed to incite fear and intimidation during 1994 to 1997, leading to direct and indirect economic losses. Damage from destruction of physical property, injuries, death, and law enforcement expenditures, as well as indirect damage by raising the cost of doing business, made it harder for companies

to attract customers and employees (Greenbaum & Hultquist, 2006). Business and leisure travel was also deterred in countries that depended on tourism such as Ireland (O'Conner, Stafford, & Gallagher, 2008). Moreover, the hospitality industry overlap with the tourism and the travel industry made it difficult to isolate them; a hit to anyone can affect many people and could cripple an economy because of loss of jobs in many areas (Pizam, 2009).

The geopolitical and religious conflicts in Africa, Indonesia, the Middle East, South East Asia, Nepal, the Philippines, and many other areas have negatively impacted tourism and travel in those countries (Ford, 2004). The hospitality industry including travel and tourism represents 3.3% of the national Egyptian GDP and 28% of investments in the country (Blanke & Chiesa, 2007).

Due to the decline in travel and tourism because of terrorist attacks, the hospitality industry around the world has lost income, and needs to tighten up its security with protective measures to ensure the safety of guests, employees, and property (Boss & Longmore-Etheridge, 2006).

Technology and the Lodging Industry

The need for technology to deliver reliable and reproducible services in the lodging and hospitality industry is increasing daily (O'Conner & Frew, 2002). Use of technology application in this industry enhances customer services (Sweat & Hibbard, 1999), and results in increased efficiency and revenues and decreased costs, which in turn influence the ability to compete (Bacheldor, 1999; Huo, 1998; Wang & Qualls, 2007).

A technology that lends itself to the hospitality industry is biometrics. Biometrics, a technology that identifies individuals or authenticates identity using unique physiological or behavioral automated pattern recognition, such as hand geometry, iris scan, retinal scan,

fingerprint, speaker/voice recognition, and facial recognition, is a promising asset for hotels (Jackson, 2009). To recognize a subject, data are collected, the signal is transmitted and processed, a decision to authenticate or not is made, and the data are stored. These data are conveniently retrievable repeatedly over time with the same accuracy and cannot be stolen or replicated because they are unique to only one subject.

Technological advancements, in particular biometrics, can provide tools to enhance security in hotels. A number of hotels in the United States have recently adopted biometrics for use in the human resources arena and guest services to a limited extent (Jackson, 2009; Warren, 2010). Nine Zero Hotel in Boston is the first hotel to use IRIS biometrics for guests in two suites in the hotel. Another example is the Hyatt in Chicago which uses biometrics (fingerprint device) for its employees. In more volatile tourist locations with increased concerns about security such as the Middle East and, in particular, Egypt, such technology has not been implemented. Biometrics is an accurate useful technology as shown in Table 1, where the accuracy of different biometric technologies are shown (Ruggles, 1996). Accuracy of the different techniques is calculated based on the rate of false rejection or false acceptance (Ruggles, 1996).

Table 1. *Biometric Crossover Accuracy*

Biometric	**Crossover Accuracy**
Retinal Scan	1: 10,000,000 +
Iris Scan	1: 131,000
Finger Prints	1: 500
Hand Geometry	1: 1500

Source: http://www.bioconsulting.com/bio.htm

Purpose of the Research

The purpose of this study was to explore perceptions and acceptance of biometric technology by employees in Egyptian hotels: knowing what would be needed to install the biometric device, what kind of training would be required, how to maximize the synergy between the employees, managers, and decision makers towards the new technology, and trying to find out about the knowledge base available about biometrics among hotel employees. In this study there are many factors that could influence acceptance or rejection of the new technology (Jackson, 2009; Pato & Millett, 2010a; Warren, 2010). Social factors that could affect acceptance or rejection will also be explored as well as obstacles for implementation. Perceived usefulness, ease of use, and prior experiences with technology will be correlated with employees' willingness to adopt technology. The research goal was to provide the decision makers in Egyptian hotels with a clear picture about the employees' expectation for the biometrics adoption in both metropolitan and resort hotels.

A pilot test was conducted using Egyptian students showed that students were willing to adopt biometrics in Egyptian hotels. This was the first attempt to study biometrics in Egypt. The survey was modified and used to understand Egyptian hotel employee's knowledge of biometrics, attitudes, willingness to use, quality of information generated, and value added to the workplace. The researcher will discuss recommendations and limitations with hospitality leaders and other researchers for future application.

Significance of the Study

Employee safety is a top priority for hotel management, especially with regard to work-related accidents, violence, and external factors. This study focuses attention on keeping the workplace safe by controlling access to the hotel from the outside, controlling

access to specific areas inside the hotel, and controlling who has access to these areas (e.g., maintenance area, storage area, utilities power area, and air condition unit).

Additionally, increased security can be an insurance policy protecting the reputation and long-term viability of the business. Finally, cost-effective systems promoting efficiency within the operations of the hotel are important competitive tools with bottom-line results.

This study will also determine the impediments or challenges to utilizing biometrics in five star hotels in Egypt. These results could be useful in application of this technology in developing countries. It may prove to be significant for the human resource departments as they make new hiring decisions. It is presumed that potential employees with previous technology experience will be more valuable in the technology enhanced workplace (Pato & Millett, 2010a). It is also assumed that some employees will reject the new technology and be terminated or leave voluntarily to find other employment or work at a competitor's hotel.

This study will uncover needs for specialized training designed to eliminate or reduce avoidance or rejection behavior (Pato & Millett, 2010b). Training can be directed at specific areas of concern by management or employees operations to improve the potential for successful implementation. Providing training on usefulness of the system both long term and short term with positive outcomes for both the organization and the individual could positively affect users' perception of its usefulness, and stimulate increased willingness to manage difficulties in using the technology (Pato & Millett, 2010b)

Acceptance and adoption of technology by employees and front line employees of hotels 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). In the lodging

industry biometrics has been useful in the areas of access control and security, allocation of resources by controlling the attendance and work hours, payment of accounts, and customer identification (Singh & Kasavana, 2005). This study will focus on the aspects of time management and access control in an attempt to improve hotel security, employee identification, and, hopefully, increase the safety and satisfaction of guests in Egyptian hotels.

Organization of Dissertation

This dissertation will include the following chapters: introduction, literature review, methodology, results and discussion of findings, and a summary with recommendations and future research directions and limitations. Appendices contain the research instrument, the institutional review approval, correspondence, and other materials related to the research.

Objectives of the Research Questions

The objectives of this study are:

- Identify the level of knowledge of hotel employees in Egypt about biometrics.
- Identify the source of knowledge of biometrics among Egyptian hotel employees.
- Identify the most acceptable biometrics device to apply in Egyptian hotels according to the employees.
- Evaluate the perceived added values of the biometrics to the workplace (hotels in Egypt) of managers and employees.
- Explore the perception or expectation of five-star hotel employees in Egypt of biometrics performance.
- Explore the opinions of hotel employees in Egypt about the performance of biometrics with regards to improved work quality and customer service.

- Explore the concerns of hotel managers and employees in Egypt about using biometrics in the workplace.

Definition of Terms

The following section presents definitions of the major terms and concepts used in this study.

Biometric: The term *bio* is a Greek term meaning life; *metrics* means to measure. Biometrics refers to technologies that measure and analyze human body characteristics, such as DNA, fingerprints, eye retinas and irises, voice patterns, facial patterns and hand measurements, for authentication purposes (National Science and Technology & Committee on Homeland and National Security, 2004).

False Acceptance Rate: The rate at which an unauthorized individual is given access instead of being denied. This is commonly referred to as a type II error (Mansfield & Wayman, 2002).

False Rejection Rate: The rate at which an individual is denied access that should have been granted. This is referred to as type I error which means rejecting the person that should be accepted.

Crossover Accuracy Rate: The point at which the false acceptance rate and the false rejection rate intersect.

Fingerprint Recognition: Fingerprint recognition systems rely on biometrics device's ability to distinguish the unique impressions of ridges and valleys made by an individual finger.

Hand Geometry: It is a method to distinguish or identify the unique person using 90 dimensional measurements to record an accurate spatial representation of an individual hand.

Retina Scanning: Retina scanning involves an electronic scan of retina, the innermost layer of the wall of the eyeball.

IRIS Scanning: Iris scanning uses a camera mounted between three and 10 feet away from the person to take a high definition photograph of the individual's eye. It analyzes 266 different points of data from the meshwork of the iris.

Facial Recognition: Facial recognition attempts to identify subjects according to the facial characteristics such as eye socket position space between cheekbones, color, etc. (Polemi, 1997; Ruggles, 1996).

CHAPTER 2. LITERATURE REVIEW

This chapter will introduce the research background, including the history of terrorism in Egypt and its impact on tourism, the Geostrategic implications of unrest or ramification of terrorism in Egypt, security and the lodging industry, technology and the lodging industry, biometrics and its applications in the lodging industry, technology adoption history, purpose of the study, theoretical model, and the hypotheses.

Egypt, Terrorism, and Tourism

Egypt has endured several terror attacks. As early as 1992, the travel industry in Egypt was shocked by repeated attacks on tourists according to reports by Reuters Limited and U.S. Dive Travel Network (2011). In 1992 the militants warned tourists to stay away from the sites of the ancient tombs of the pharaohs. A Nile cruise boat containing 140 German tourists was shot at, a British tour bus was ambushed, and German tourists were ambushed in the town of Qena, all within two months in 1992. In 1993, terrorists carried out nine attacks on tourists traveling on tour boats and tour buses, killing and wounding many people of various nationalities. In 1992, terrorist attacks led to a 21.9% decline in tourists and a corresponding 42.5% drop in revenue (Aziz, 1995). In 1994, at least 12 attacks were directed at tourists (Reuters Limited and U.S. Dive Travel Network, 2011). Attacks on hotels in several areas in Egypt led to a dramatic decline in five-star hotel occupancy from 80–82% to 50% in Cairo, 60% in South Sinai, and 3–5% in Luxor and Aswan according to an interview with Mark Elawadi, the general manager of Conrad International (*World Investment News*, 2006).

Three explosions in the town of Dahab in South Sinai in April 2006 killed more than 20 people and wounded at least 80 others, including five U.S. citizens (Reuters Limited and

U.S. Dive Travel Network, 1997–2011). In July 2005, three explosions in Sharm el Sheikh killed more than 60 people, including one American (Reuters Limited and U.S. Dive Travel Network, 1997–2011).

The proximity of Egypt to countries in which violence and terrorist attacks are endemic makes it an unwilling but easy target. Israel, Jordan, and Saudi Arabia share borders with Egypt, and access is neither difficult nor expensive. A terrorist can travel from place to place undetected due to the absence of language and cultural barriers.

With the downturn in tourism, there are empty tour boats lining the Nile, empty streets in the formerly crowded Khan al-Khalili marketplace, and tour guides filling the outdoor coffee shops as they scan the streets for customers. The lodging industry in Egypt is a significant victim of the downturn in tourism (Essner, 2003). Many of the best known and publicized attacks have taken place in and around hotels in both Egypt and other developing countries. Terrorists appear to recognize the added news value their acts will receive in the worldwide media, making hotels an especially vulnerable location. Although most large hotels implement high security, they are still ready and easily accessible targets.

The South Sinai area, specifically Sharm el-Sheikh, relies almost totally on tourism. The coast is lined with upscale hotels filled with Europeans on holiday. They enjoy the warm waters and coral reefs, the fine food, and the local markets. According to the Egyptian Hotel Association's publication (2010), there are 47 five-star hotels in South Sinai (30% of the five-star hotels in Egypt) and a total of 230 lodging places, indicating the importance of this area to tourism and the crowds associated with the tourist trade.

In order to decrease the incidence of terrorist attacks in high tourist areas such as South Sinai and Cairo, the Egyptian government has armed police controlling all entry to the

South Sinai, whether by plane, bus, or car. Police are posted in every block in downtown Cairo as well. This is in recognition of the economic value of the tourist trade to these areas.

In response to the frequency of attacks on tourists in Egypt, there was a 13% decline in the number of international tourists in 1998. Japanese tourists decreased by 75%, German tourists decreased 38%; there was a 28% reduction in tourists from Great Britain, and a 13% reduction in American tourists (Sonmez, 1998).

Attempts to determine the monetary effect are imperfect (Blake, 2009). Far-reaching resulting factors such as unemployment, homelessness, crime, deflation, and multiple other economic and social ramifications are difficult to quantify (Blake & Sinclair, 2003).

The Middle East and, most specifically, Egypt rely heavily on tourism dollars, but these countries may also represent insecurity in the mind of the tourist. Thus, this area has a critical need for a means to ensure safety and security (*World Investment News*, 1998).

Egypt and Geostrategic Implications of Terrorism

The Egyptian culture is characterized by extreme poverty and sophisticated luxury with international hotels and luxurious resorts catering to high-end clientele existing side by side. Outside the tourist areas of Cairo, Alexandria, the Luxor area, and Sharm el-Sheikh on the Sinai Peninsula, there is little but sandy desert and a way of life that has remained unchanged for centuries.

The map in Figure 1 shows the critically important geographical location of Egypt as a connecter between Asia and Africa. The country has long beaches along the Red Sea and the Mediterranean Sea. It also is home to the Nile River, the longest river in the world, which crosses the country from south to north. Another important feature of Egypt is the Suez Canal, an artificial sea-level waterway in Egypt connecting the Mediterranean and Red

Seas. The canal was opened in November 1869 and allows water transportation between Europe and Asia without navigation around Africa. According to the 1988 Constantinople Convention of the Suez Canal, under international treaty it may be used "in time of war as in time of peace, by every vessel of commerce or of war, without distinction of flag" (Public International Law, 2011).

Figure 1. Geographic location of Egypt with respect to other Middle Eastern countries

Egypt has an open border with Israel due to the Camp David peace agreement in 1979, which allows visitors from Israel to enter South Sinai from Elat to Taba and all South Sinai (Sharm el Sheikh, Dahab, and many other tourist areas in South Sinai) (Camp David Accords, 1979). This map also shows the eastern borders with Israel, Saudi Arabia, Jordan, and Gaza.

The historical culture of this area makes Egypt one of the most desirable destinations in the world. President Mubarak cracked down on terror attacks and increased security measures (Hammond, 2001). In addition, decreased prices, agreements with airlines, and public campaigns to promote security and safety have been of paramount importance to the restoration of tourism in Cairo and other areas such as the Red Sea (Marshall, Marshall, Abdulla, Rouphael, & Ali, 2009).

Threats to the lodging industry were used as a tool to cripple the tourism, and many studies have been performed to find methods to handle the crisis in the industry (Blake & Sinclair, 2003). The numerous research studies recommended increasing security to save this industry.

In recognition of the role of tourism in Egypt, the Ministry of Tourism planned to increase options for tourist destinations in Egypt, increase the number of hotel rooms in the country, and increase the number of jobs in the industry (*Tourism of Egypt*, 2009).

Security and the Lodging Industry

Balancing security and hospitality is not an easy task. Terror threats pose challenges to the safety and security of hotels, shopping malls, and restaurants. Maintaining security of hotels includes security of the property, employees, and guests. Despite the availability of technology that could create an environment of safety, hotels are slow to embrace it due to

the difficulty of early stages of the development, cost, privacy invasion issues, and possible legal challenges (Adams, 2006; Rogers, 2003).

In the U.S., increased security has been shown to increase tourism. For instance, the management of the Sears Tower in Chicago used self check-in kiosks to inspect large items which resulted in increased numbers of visitors and higher satisfaction with the security (Longmore-Etheridge, 2007). The American Association of Mall Owners also enforced a training program to train employees and security officers (Anti-Terror Training, 2007).

Hotel customers felt more secure and comfortable when the staff was prepared to help and give information about security of the hotel (Gerald & Hein, 1994), in addition to having emergency telephone numbers and well-lit hallways and corridors (Gunter, 2004). Additional security for hotels can include fences or walls, barriers, cameras, height detectors at the gates, lighting, a well-trained guard force, and even radar for the outside of the building. Inside the typical hotel building, there are mazes of corridors and multiple exits, closets, rooms off of other rooms, each of which require a different security solution. Closed circuit TV networks can be configured in various locations within the hotel to alert automatically for objects left behind or taken, for loitering in areas where it is not allowed, or for intrusion in restricted areas (Goslin, 2008).

Technology and the Lodging Industry

Technology has become a component of everyday life in nearly every part of the world. Its use has permeated every segment of the business environment. The lodging industry is no exception and, like other industries, regularly seeks new technology as a way to streamline daily operations such as property management, inventory, and electronic points of sale (Murphy & Rottet, 2009). Reconfiguring the way transactions are processed with the

corollaries of better customer service combined with convenience and ease of transactions will be considered a "driver" for the customer and industry alike (Heracleous & Wirtz, 2006). The affected transactions include, but are not limited to, identification, security, and payment processes such as booking, reservation, check-in, payment, customer-specific information requests, and use of secure devices in guest rooms, conference areas, and offices. They can be defined as "guest-centered" to include all components of the information processes visible to and able to be used by guests, such as door entry and room entertainment systems and "operations-centered" which includes point of sale and other back-office components (Jackson, 2009).

Customer services using technology range from in-room entertainment service, to internet, to check out (Murphy & Rottet, 2009). These applications lead to increased efficiency, decreased costs, increased revenues, enhanced customer services, and the increased ability to compete (Bacheldor, 1999; Huo, 1998; Wang & Qualls, 2007).

There seems, however, to be the unleashed potential of technology which could enhance organizational practices to gain competitive advantage (Jackson, 2009). As the hospitality industry provides a homogeneous product, in which information is a driving force and key component, it will particularly benefit with the addition of technological advances to augment their existing technology (O'Conner & Frew, 2002).

Biometric Technology and Its Applications

The need for technology to deliver reliable and reproducible services in the lodging and hospitality industry is increasing daily (O'Conner & Frew, 2002). Employees in most hotels currently use multiple keys to access areas in the hotel to perform their duties as well as to gain entry to restricted areas. Human error, however, can result in loss of keys and the

need to replace them, as well as cause concern that unauthorized individuals may access restricted areas. Lock changes, key replacement, and the effort to make new passwords all add to cost and inefficiency in operations.

Biometrics is a technology that lends itself well to the hospitality industry. Biometrics is the technology of identifying individuals or authenticating identity using distinctive physical or behavioral patterns (Jackson, 2009). With biometrics, data from a fingerprint, for example, 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 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; Nanavati, Thieme, & Nanavati, 2002; Ruggles, 1996). The biometrics operations consist of the following phases:

- Data acquisition (finger print, face scan, hand geometry scan, iris scan, voice pattern). During this phase, quality is important. If the input is not accurate, the process may not proceed and may require another submission of data.
- Data transmission. Some systems self-store and can process at the same location of submission of the information, and other systems transmit the information over the Local Area Networks (LAN), intranet, or internet to other far locations requiring data compression for speedy transfer. This is a critical process and errors can occur; a complex protocol is necessary to ensure accuracy.
- Signal processing. During this phase, the system is used to either verify the identity of a person or identify an individual among a group. In the verification

process, the individual is required to access the system using a personal identification number or a log name for identification and then present the appropriate biometric feature. The system does a one-to-one comparison to the stored information. In the case of identification, the system compares a presented feature to the system which compares it to stored data and identifies the person if the feature is stored (one to many). The user is not asked to provide a log or PIN to be identified.

- Decision. The biometrics systems have a threshold to make a match or no match based on the quality and match scores. Low scores lead to rejection and high scores compared to the threshold ensure identification.
- Data storage. Data converted to templates are stored locally, on a network, or on portable or external devices based on the needs of the organization.

For example, a unique physical characteristic is submitted to the biometric data system, such as fingerprints. The fingerprint technology looks at the structure of the finger print picture which contains patterns known as *minutiae* (valleys and ridges) unique to each individual. Those patterns are stored in templates using encryption algorithms unique to each vendor (Nanavati et al., 2002). Once this information is digitized and stored, it can be recalled with ease and accuracy to identify an individual (Maghiros et al., 2005; Nanavati et al., 2002).

Currently, the technology is advancing and in experimental stages. Other indicators such as vein patterns in the hand, facial thermograph detecting facial pattern by the heat of the veins under the skin, DNA, body odor, sweat glands, hand grip, fingernail bed, gait, skin luminescence, and brain wave patterns are being evaluated (Jackson, 2009).

The wide spread application of biometrics in personal identification of consumer goods such as portable computers as well as government agencies (Homeland Security) to confirm identity has led to $3 billion in sales and is projected to increase to $7 billion by 2012 (Intellectual Security, 2007). These numbers point to the increased acceptance and trust of this technology by consumers.

Biometrics has been applied in airports, by airlines, and check-out points of sales and has proven effective, convenient, and time saving (Jones, Williams, Hillier, & Comfort, 2007). Some hotels including Nine Zero hotel in Boston applied biometrics in guest suites. Eighty-seven percent (87%) of hotel guests surveyed in Switzerland were willing to use biometrics (Murphy & Rottet, 2009). Las Vegas hotel guests favored keyless room entry when surveyed (Kim, Brewer, & Bernhard, 2008).

Although biometrics is an available and potentially a useful security tool, the hospitality industry as a whole has been slow to adopt it (Murphy & Rottet, 2009). In the U.S., implementation of biometrics has not occurred rapidly because of its cost, concerns about privacy and potential legal challenges, as well as its unproven effectiveness (Adams, 2006).

Technology Adoption History

Hotels have used information technology extensively because it has been shown to give them a competitive edge with increased customer satisfaction, as well as improved employee productivity (Ham, Gonkim, & Jeong, 2005; Lam, Cho, & Qu, 2007). Application of technology in hotels, however, is a complex process.

Adoption of new technology is considered successful when employees embrace and use it effectively (Lee, Kim, Rhee, & Trimi, 2006). The literature review showed that

research 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 & 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 towards technology, which in turn affects behavioral intention to use, translated into actions (Fishbein & 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 technology and factors relating to how and when they will use technology (Davis, 1989, p. 282). TAM reduced the beliefs in the TRA to two important beliefs; perceived ease of use and perceived usefulness (Bruner & Kumar, 2005; Davis, Bagozzi, & Warshaw, 1989; Hong, Thong, Wong, & Tam, 2002; Lee, Fiore, &Kim, 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, behavior is affected by intention to use which is a result of attitudes towards use of technology. Attitudes towards the use of technology are affected by perceived ease of use and perceived usefulness. In addition, perceptions have direct effects on intention to use technology. Perceived ease of use and usefulness has been shown to be affected by external factors such

as personal attributes, system or technology attributes, and organizational environment (Amoako-Gyampah & Salam, 2004; Burton-Jones & Hubona, 2005; Davis et al., 1989; Hong et al., 2002; Shang, Chen, & Shen, 2005).

No formal research in the understanding of the adoption was available, and most interested researchers used the generic TAM and extended TAM to understand customer acceptance of biometrics in hotels (Murphy & Rottet, 2007).

The literature review revealed a gap in studies on biometrics acceptance by employees, yet employees are a major part of the equation when trying to implement such technology. Adoption of new technology is considered successful when employees embrace and use it effectively (Lee et al., 2006). A planned study by Phillips and Zhao (2008) to survey a segment of New York hotel managers to understand their attitudes and perceptions towards biometrics is not completed yet. The authors emphasized the importance of understanding the attitudes of managers of hotels towards such a technology to ensure better application and adoption to the fullest extent. As suggested by Murphy and Rottet (2009), little attention is paid to consumers, and it is important to consider the employees as consumers and, hence, the interest in understanding their feeling and attitudes.

People have different perceptions of what the biometrics device would be used for. The fundamental obstacle or problem with biometrics is the lack of clear understanding of its capabilities and limitations (Pato & Millett, 2010a). The international concern of biometrics increased globally and rapidly on the government level especially after September 11, 2001. The focus was to secure the borders between countries and to use biometrics in issuing entry visas and in passports system. In 2006, the National Science and Technology Council (NSTC) in the U.S. put forth the following recommendations:

1. Develop and implement multi-agency strategy that advances the biometrics science to meet the satisfaction of public needs.
2. Ensure a consistent message about biometrics and government initiatives when agencies interact with congress, the press, and the public.
3. Strengthen international and public sector partnership to foster the advancement of biometrics technology.

These findings gave incentives to initiate an investigation to understand some the aspects of application of this technology in the lodging industry which interfaces with the public on a large scale.

Purpose of the Study

The urgent need for a technology like biometrics is highlighted by the increased security concerns of the lodging industry and hotels, hence the interest in understanding factors or issues related to the application of this technology in a country like Egypt, which is located in one of the most politically charged areas of the world. Application of biometrics could be used to control access and to increase security and productivity and, in turn, customer satisfaction. For example, hotel employees currently use multiple keys to access areas in the hotel to perform their duties as well as for some employees to gain entry to restricted areas. This process is flawed because human error could lead to loss of keys and the need to replace them for a cost, as well as the fear that some unauthorized individuals may have access to restricted areas prompting new measures such as lock changes or making new passwords. Application of biometrics in such instances would eliminate the upfront cost of making keys and make it easy to control access to restricted areas. The findings of this study will set the foundation for development of strategies to

improve security and identification of employees and, possibly, guests. This will have applications in human resource department tracking of internal hotel operations.

Theoretical Model

According to the known factors that affect acceptance behavior, it is plausible to hypothesize that the following depiction could represent the model for biometric adoptions in hotels.

Willingness to adopt any new technology depends on factors such as awareness of how this new technology works, the ease of use, the benefit to employees and management, and the financial impact considering the cost of acquiring the technology, implementation, training employees, continuous upgrades, and development. It is important to incorporate employees' input addressing their needs and concerns to ensure buy in and compliance as shown in Figure 2.

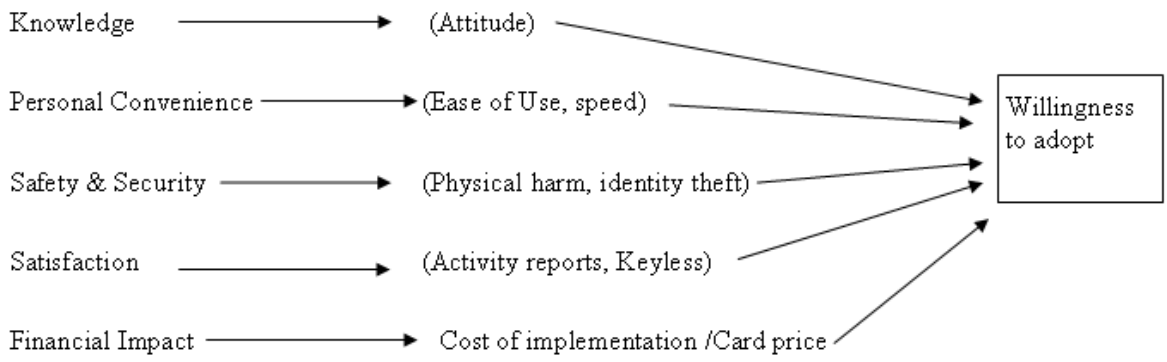

Figure 2. Technology Acceptance Model (TAM) of biometrics in hotels

Hypotheses

Based on the research, the following hypotheses are proposed:

H1a: Quality of information generated from biometrics devices positively influence perception of employees of value-added benefit to the work place.

H1b: Quality of information generated from biometrics devices positively influence ease of use.

H1c: Quality of information generated from biometrics devices influences device accepted.

H2a: Biometrics knowledge positively influences the perception of employees of value-added to the work place.

H2b: Biometrics knowledge positively influences ease of use.

H2c. Biometrics knowledge influences type of device accepted.

H3a: Technological intent positively influence employees perception of value added to the work place.

H3b: Technological intent is positively influenced by ease of use.

H3c: Technological intent influences type of device accepted.

H4a: Concerns about biometrics negatively influences employees' perception of value added to the work place.

H4b: Concerns about biometrics negatively influences ease of use.

H4c: Concerns about biometrics influences type of device accepted.

H5a: Location of the biometrics device positively influences perception of value added to the work place.

H5b: Location of the biometrics device positively influences ease of use.

H5c: Location of the biometrics device influences type of device accepted.

H6: Employee perception of value added positively influences type of device accepted

H7: Employee perception of ease of use will positively influence type of device accepted.

CHAPTER 3. METHODOLOGY

Technology application in the hospitality industry has increased the competitive edge of hotels, improved in-house operations, and increased customer services (Bacheldor, 1999; Huo, 1998; Sweat & Hibbard, 1999; Wang & Qualls, 2007). This chapter will discuss the steps and the methods used to collect data including human subject use, population and study sample, instrument, participants, procedure of data collection, and data analysis.

Human Subject Use

The Iowa State University Human Subjects IRB forms were submitted with information regarding the exploratory survey of students and hotel employees. The materials included a cover letter, a consent form, and the survey instrument. The Institutional Review Board Chair declared both studies exempt from the requirements of the Human Subject Protections regulations and approved the project (IRB number 09-399).

Population and Study Sample

The study population consisted of Egyptian employees and managers of five-star hotels in Egypt. Egypt has 1,035 hotels (Egyptian Hotel Association, 2006). Of those, 156 ranked in the five-star category. In 2006, the Egyptian Ministry of Tourism adopted a new ranking system of hotels (Dunn, 2006). This ranking system depended on factors including the number of rooms; the presence of a swimming pool, banquet hall, night club, 24-hour room service, and a business center, as well as service quality (Dunn, 2006). This ranking system is in accordance with the International Hotel and Restaurant Association (IH&RA) recommendations. Hence, one would assume that to accomplish these high standards of service, a large work force would be available, and we would increase our chances of having a representative sample of the work force. Moreover, large hotels may influence decision

makers in the government. The government agencies in Middle Eastern countries are involved in many big decisions for hotels like the adoption of biometrics even if it is for the employees only. Government agencies have the power of authority to enforce the application of the biometrics technology if they want.

A summary of five-star hotels in Egypt is shown in Appendix A. Seventy-six percent of the five-star hotels in Egypt (118) are located in the areas of South Sinai (Sharm el Sheikh), Cairo, and near the Red Sea. A stratified proportional sample of the population was selected from these three areas.

Instrument

Biometrics use is not totally new to Egypt as it has been implemented on a small scale in some banks such as Amman American Bank in Cairo. Most of the current applications are related to individual verification and authentication to receive services, according to Amr Shawki (2009), the chairman of Egytec, an engineering company responsible for organizing the smart card industry even yearly in Egypt. Other plans are in the works to expand the use of the smart cards for services such as health, pension card, family cards, etc. (Shawki, 2009).

In the hospitality industry, however, no applications are present at this time. It is essential to understand what hotel employees know about biometric technology, the types of the devices available, how this technology would impact their ability to perform their duties effectively, how it would serve them and be useful to them, and what they would perceive as added value of such technology. With these issues in mind, a survey was designed utilizing knowledge gained from the works of Murphy and Rottet (2009) in Switzerland and with

permission (Appendix B); and Kim et al. (2008) in the U.S., as well as the TAM understanding by Davis (1989).

Willingness to adopt any new technology depends on such factors as awareness of how this new technology works; ease of use; the benefit to employees and management; and the financial impact of (a) the cost of acquiring and implementing the technology, (b) training employees, (c) continuous upgrades, and (d) development. It is important to incorporate employees' input, addressing their needs and concerns to ensure buy in and compliance.

Table 2 shows a list of possible factors that could affect willingness to adopt and apply biometrics. The factors are numbered from one to six in the first row; under each factor are some variables or items which are marked alphabetically.

With 34 variables in the instrument, 340 completed surveys are needed in order to conduct appropriate factor analysis (Gorsuch, 1983). It is not clear from the literature review the actual number of Egyptian hotel employees and managers in five-star hotels. The survey was distributed proportionate to the density of the five-star hotels (Table 3).

In a preliminary study to test the instrument, a survey using a Likert-type scale (1 strongly agree, to 7 strongly disagree) based on the work of Murphy and Rottet (2009) and Kim et al. (2008), was developed and submitted to IRB for approval. The pilot test was performed to test the readability and the understanding of the questions in the instrument. The 300 students who participated in the preliminary study were students from Cairo University and Ain Shams University in Egypt who were taking a leadership course sponsored by IBM and the ministry of communication. The concepts of knowledge of biometrics, value added in work and school, expectation of how biometrics will function,

and willingness to use biometric devices were tested. One hundred and four surveys were collected and used in the analysis; the results are shown in Table 4.

Table 2. *Possible factors that affect willingness to adopt biometrics arranged from 1–6 with Subfactors or Variables Arranged Alphabetically Under Each Factor*

1. Type of biometrics	2. Source of knowledge	3. Value-added	4. Performance of biometrics device	5. Usability	6. Concerns
a) Fingerprint	a) Television	a) Employees (personal convenience)	a) Accuracy	a) Used for access control	a) Physical harm
b) Facial scan	b) Radio	b) Work flow	b) Eases of use	b) Use for attendance	b) Privacy
c) Retinal scan	c) Read	c) Safety of the work place. Increase/ decrease	c) Speed of use	c) Identity verification for main entrance, and restricted areas entry	c) Identity theft
d) IRIS scan	d) Used previously	d) Financial impact	d) Ease of upgrade and adaptability	d) Computer access	d) Data security
e) Hand geometry scan	e) Productivity increase/ decrease		e) Maintenance need		e) Access to data
			f) Ease of obtaining report		

Table 3. *Proportionate Survey Distribution*

State	Number and percentage of hotels	Number of the surveys distributed
South Sinai (Sharm el-Sheikh)	45 = 38 %	1140
Cairo	38 = 32%	960
Red Sea	32 = 30%	900

Table 4. *Cronbach's Alphas for the Pilot Test Variables (N = 104)*

Variable	Item Number	Alpha
Value added to the work place /school	12	0.93
The quality of the output information	6	0.91
Willingness to use the biometrics	9	0.85
Concern about biometrics use	5	0.83
Benefits expected from using the biometric	5	0.82
Knowledge about the biometrics	3	0.50
Type of biometric accepted	8	0.45

Based on the pilot test , the survey was modified, and a shorter version was developed and used with hotel employees in Egypt. A five-point Likert-type scale (1=strongly disagree, 5=strongly agree) was used to rate the items. A copy of the survey is shown in Appendix C. The change from the seven-point scale to the five-point scale was done to avoid the tendency of the participants to cluster the answers randomly in the middle.

The survey was divided into two sections. The first section contained demographic questions such as age, gender, level of education, salary, years of experience, department where the participant worked, and work shift. The second section focused on questions to address knowledge of biometrics, the preferred type of biometrics devices and the best location of those devices, the expected performance of biometrics, quality of information obtained from the biometrics applications, the value added to the work flow and customer service, and concerns about biometrics use.

The survey contained pictures to prompt the participants when the questions asked about biometric devices and their types such as the fingerprint, hand geometry, or handprint, as shown in Figure 3.

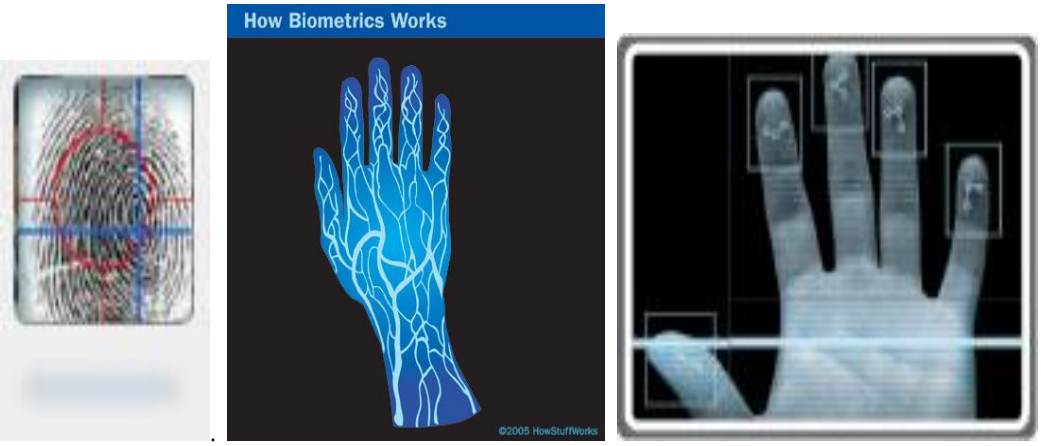

Figure 3. Representatives of fingerprint, hand geometry, and handprint

To avoid personal bias, a general statement was made to inform the participants that this is a new technology, and it is acceptable not to know the devices, not to have an answer like others, or not chose to answer.

Participants

The researcher contacted 75 five-star hotels in Cairo, Sharm el Sheikh, and Hurghada representing 80% of the five-star hotels in Egypt by telephone. Employees from various departments including front office, food and beverage, engineering, accounting, housekeeping, marketing, sales, and others participated in the survey.

In order to access the employee work force, the researcher had to meet with managers in hotels to explain study, deliver the surveys and to collect them later from the same managers after the employees had filled out the surveys.

Procedures of Data Collection

Survey Distribution Procedure

The researcher contacted a total of 75 five-star hotels and got approval from general managers and human resource managers to conduct the survey in the hotels. The researcher

was instructed to deliver the survey to the administration offices and have a meeting to discuss the logistics of conducting the survey. Several hotel managers asked for supporting letters from government agencies to support the research as a condition to take the surveys or allow the employees to participate. The head of the department of Apparel Education Studies and Hospitality Management (AESHM) at Iowa State University sent a letter via fax to the Egyptian Hotel Association and to the Senior Undersecretary Director of Hotel Section in the Ministry of Tourism (Appendix D). None of those locations, however, received the faxes. In addition, the head of the department of AESHM sent a letter via fax to the culture council in the American Embassy in Cairo with a similar request for assistance and facilitation. The American Embassy in Cairo issued a support letter (Appendix E) to the researcher to submit to hotel managers to facilitate the study.

The survey was distributed in the participating hotels in Cairo, Sharm el Sheikh, and Hurghada. During the first trip to the hotels, the researcher discussed with the hotel manager the distribution of the surveys. Would they be distributed by the department heads, or would they be left at the security gate where the employees punch their time cards? The managers asked the supervisors to distribute equal numbers of surveys at all work shifts (morning, afternoon, and night) and to distribute the survey randomly using work ID serial number instead of the alphabetical ranking as is commonly used in Egypt. Two to three trips were made to collect the completed surveys. A gift raffle was started to improve participation and to increase the response rate. Because this culture frowns upon giving a direct gift to a specific person for participating in a survey, the raffle allowed the participants to feel they have a chance to win something, thus avoiding the conflict. Ten days to two weeks later, the completed surveys were collected.

Data Analysis

The completed surveys were analyzed using SPSS Version 18 (SPSS 18). Descriptive analysis of hotel sample surveyed, demographic variables of the participants, source of knowledge, and the overall response of the completed usable surveys (N=809) were performed. The internal consistency of each of the measures was assessed via Cronbach's alpha. Univariate analysis of variance with 95% confidence intervals was conducted. Estimated marginal means of type accepted model with the variables was performed, and the profile plot was obtained.

Further analysis for missing values and screening for outliers was done, and 68 surveys with two missing values were eliminated leaving 741 surveys for further analysis. Linear regression was conducted to determine whether there were outliers in the x- and y-space. The mean composite scores were computed for all the variables. Type of biometric procedure accepted was regressed on quality of information, knowledge, concern, location, technological intent, value, and ease of use. Twenty cases whose Cook's D values were two standard deviations above the Cook's D mean were considered as outliers (Cook's D values above .008, M = .002; SD = .006) and were deleted from consequent analyses, making the final sample size 719.

Descriptive analyses including frequencies and percentages of the demographic variables, the overall responses, and mean and standard deviation were calculated. To test the reliabilities of the measures, the internal consistency of each of the measures was assessed via Cronbach's alpha. Because of the unacceptable low alpha for the knowledge about biometrics measures, all items were used to create the knowledge composite. The low alpha for the type accepted was also unacceptable, but alpha for the items relating to the

eyes were acceptable (iris and retina) and were only used to create the type accepted composite. The alpha for the location of biometric device at the entrance was low and was eliminated from the location composite. Cronbach's alpha for the other three measures (i.e., performance of biometrics, concern about biometrics use, and biometrics information quality) were acceptable. ANOVA descriptive analysis testing was applied to examine how age, education, salary, experience, department, and shift differences related to the study variable.

Structure Equation Model (SEM) was used by applying path analysis instead of confirmatory factor analysis. The fit of the whole model was assessed using the statistical indices Chi-square, Chi-square/degrees of freedom, Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square (SRMR). The magnitude of the individual parameters (i.e., path coefficients and correlations) was assessed at the .05 level. The direction of the individual parameters was evaluated vis-à-vis prior research findings. A predicted model was developed. Fit models for employees working in the metropolitan and resort hotels were developed in an attempt to find any differences among the two populations.

CHAPTER 4. RESULTS AND DISCUSSION

The survey used was based on the work of Murphy and Rottet (2009) and Kim et al. (2008) utilizing a five-point Likert-type scale (1=strongly disagree, 5=strongly agree) to rate the items. The items in the survey were planned to test the conceptual model proposed in Figure 1. The self-administered survey was divided into two segments. The first set of questions was focused on demographic determinants (gender, marital status, age, years of education, years of experience, salary, work shift, and assigned department. The second set of questions were intended to understand issues related to awareness of biometrics technology such as which technology employees would prefer; where they would prefer to place it; what they would think about its performance in the job place; the ease of use and the value added to themselves and to customer service; and how those factors would affect their willingness to use the technology when implemented. The cross-sectional data were collected from surveys completed by employees in five-star hotels in Egypt from Cairo (metropolitan area) and Sharm el Sheikh and Hurgada (resorts).

Description of the Hotel Sample

Two thousand four hundred surveys were distributed in 31 hotels in metropolitan Cairo and in resort hotels in Hurghada and Sharm. A summary of the hotels contacted and surveyed are shown in Table 5.

The hotels surveyed in the study represented 75% of the five-star hotels in Egypt. The researcher was able to contact 25 of 38 hotels in Cairo representing 66% of the five-star hotels in that area, 30 of 45 in Sharm el Sheikh representing 67% of the five-star hotels in that area, and 20 of 35 in Hurgada representing 75% of the five-star hotels in that area.

Table 5. *Summary of the Hotels Contacted*

Area	Hotels contacted	Hotels accepted	Surveys distributed	Surveys collected	Response rate	Useful/ used	Response rate used
Cairo	25	8	600	300	50%	244	40.66 %
Sharm	30	12	1000	350	35%	276	27.6 %
Hurghada	20	11	800	310	38.7%	199	24.8 %
Total	75	31	2400	960	40%	719	31.02

Description of the Demographic Variables of the Participants

Of the 2,400 surveys distributed, 960 were collected, and 809 were found to be usable for analysis. A summary of the demographics of the participants is shown in Table 6 (see Appendix G). Employees were asked about their knowledge of biometrics and how they found out about it. The source of knowledge and the summary of the responses are shown in Table 7.

Table 7. *Source of Knowledge Mean and SD*

Source of knowledge	Mean	SD
Television	0.49	.50
Word of mouth	0.44	.49
Newspaper	0.29	.40
Had used biometrics	0.29	.44
Radio	0.13	.34
Never heard about it	0.19	.39

Television and word of mouth communication were the most effective sources of knowledge. Radio was the least effective method. One hundred and fifty respondents said they had never heard about biometrics; they were able to answer the questions, however, because the survey had pictures that helped them. For source of knowledge, in many cases the participants marked more than one source of knowledge, thus a total of more than 100%.

Survey questions sought to determine factors that could influence intent to use the technology, such as the type of biometric devices, appropriate location of the device, expected performance of biometrics, the information quality in conducting better work and customer service, the added value, and the concerns about biometrics use. A summary of overall responses is shown in Table 8 (see Appendix G). The employees seemed to favor finger print devices, wanted to place them at the employee entrance, felt that the technology is easy to use, flexible and adaptable to change, the information obtained from the device is clear and accurate, and the use of this technology will help with security. Physical harm and concerns about who has access to the information were at the top of the list of concerns when it came to biometrics.

Preliminary Data Analysis

The first round of screening of the 960 collected surveys eliminated 151 unusable surveys. The response rate was 33.7% (809/2,400). The internal consistency of each of the measures was assessed via Cronbach's alpha as shown in Table 9.

Table 9. *Cronbach's Alphas for the Study Variables (N=809)*

Variable	Item N	Alpha
Performance of biometrics	6	.88
Biometrics information quality	6	.86
Added value	5	.84
Concern about biometrics use	6	.82
Appropriate location of device	6	.70
Type of biometrics device	5	.55
Knowledge about biometrics	6	.21

Univariate analysis and estimated marginal means of type accepted to evaluate the covariate (gender, age, education, and marital status) values are shown in Figure 4, and the profile plot obtained is shown in Figure 5.

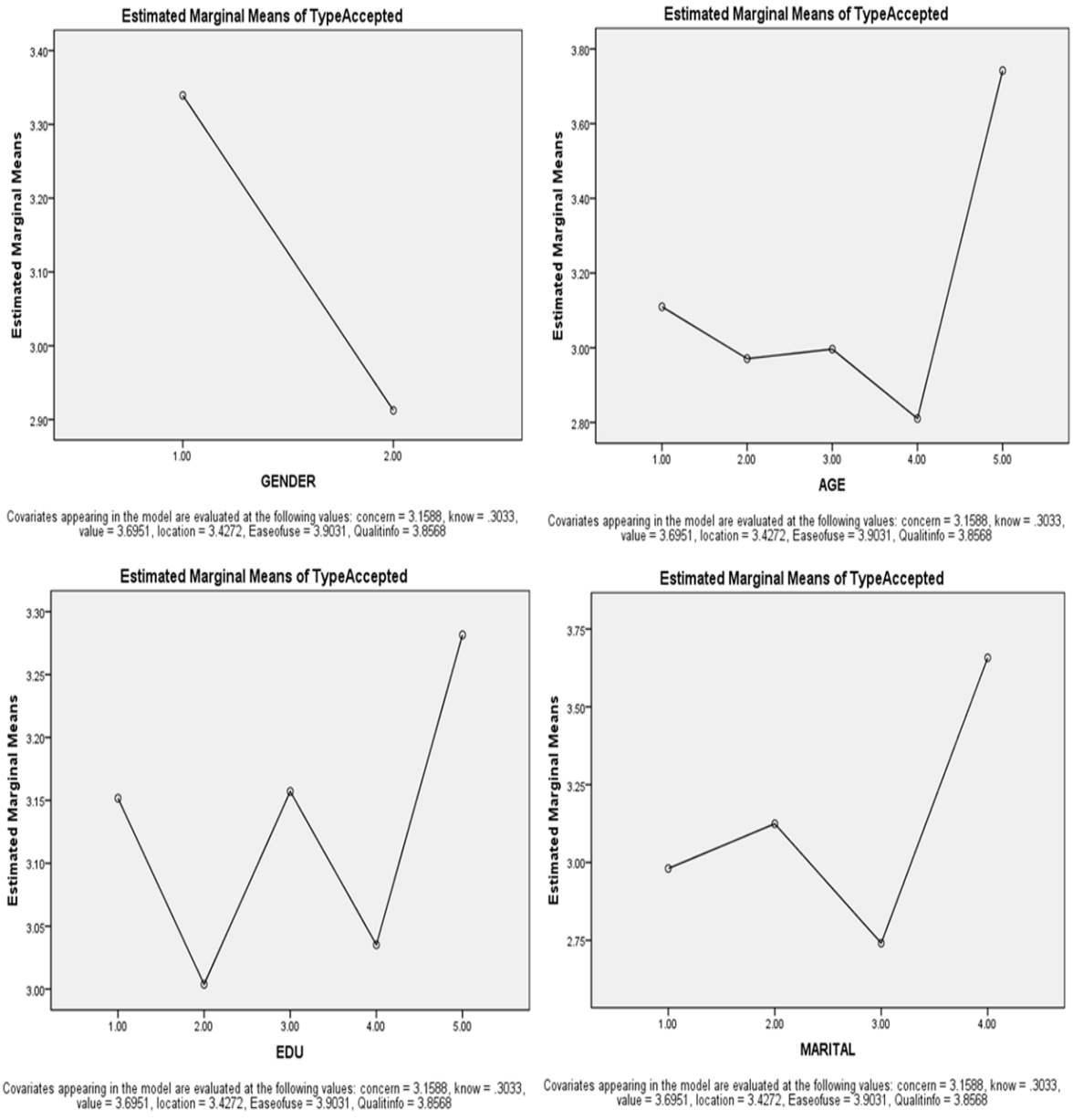

Figure 4. Estimated marginal means of type accepted related to the covariates (gender, age, education, and marital status)

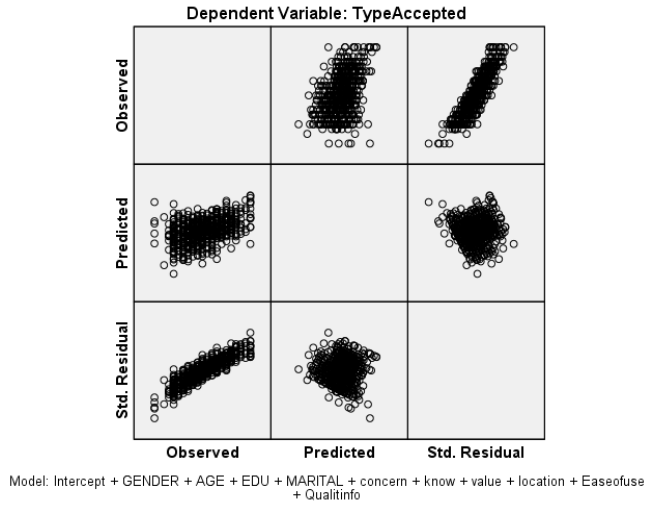

Figure 5. Profile plot

Further analysis done for missing data and screening for outliers made the final sample size 719. The demographic variables of the final sample (N=719) showed the following:

1. The frequencies and percentages of the demographic variables are displayed in Table 10 (see Appendix G).
2. The majority of the respondents were males (88.7%) between 18 and 39 years of age (87.8%). One third of the respondents were high school graduates (30.6%), while slightly more than one third were college graduates (36.4%). More than half of the respondents were single (53.4%); 43.4% were married. The majority of the respondents earned between 500 and 3,000 Egyptian pounds ($90–$545.45) (72%), and respondents ranged from inexperienced (20.3%) to experienced (17.8%).
3. Most of the respondents worked at resort hotels (66.1%) and were from different departments. The majority worked the morning shift (64.1%).

A summary of the survey responses of the 719 participants is shown in Table 11.

Table 11. *Overall Responses and Mean and SD (N=719)*

	mean	SD
Type of biometric device		
Finger print	3.44	1.28
Hand scan	3.41	1.33
Iris scan	2.92	1.41
Retinal scan	2.89	1.33
Face scan	2.67	1.45
Appropriate location of device		
Employee entrance	3.86	1.34
Employee clock in/out	3.77	1.24
Restricted area	3.47	1.36
Computer access	3.29	1.33
Employee locker	3.24	1.38
Others	2.98	1.31
Performance of Biometrics		
Ease of use	4.03	1.02
Flexibility and adaptability	4.00	0.99
Speed	3.93	0.99
Low maintenance	3.86	1.08
Security of restricted areas	3.86	1.20
Timely reports	3.73	1.09
Biometrics information quality		
Clear information	3.93	1.00
Accurate information	3.89	1.06
Sufficient information	3.88	1.07
Up-to-date information	3.84	1.00
Relevant	3.82	1.06
Useful format	3.77	1.19
Added value		
Enhance security	3.90	1.08
Data collection and reports	3.71	1.12
Improve productivity	3.64	1.12
Convenience	3.58	1.07
Profitable	3.58	1.25
Concerns about biometrics use		
Physical harm	3.26	1.44
Who has access to information	3.25	1.29
Identity theft	3.24	1.09
Information security	3.23	1.20
Privacy	3.21	1.29
Other concerns	2.79	1.29

Reliabilities of the Measures

The internal consistency of each of the measures was assessed via Cronbach's alpha:

1. The alphas for each of the measures are displayed in Table 12. Alphas ranged from acceptable to unacceptable.
2. Alpha for knowledge about biometrics measure was unacceptable at .51. Since removal of any item did not increase alpha by much, all items were used to create the knowledge composite.
3. Alpha for the type accepted was also unacceptable at .49. Since alpha for the items relating to the eyes was acceptable at .75 (iris and retina), only these two items were used to create the type accepted composite.
4. Alpha for the type accepted was also unacceptable at .49. Since alpha for the items relating to the eyes was acceptable at .75 (iris and retina), only these two items were used to create the type accepted composite.
5. Alpha for the location of biometric device was also unacceptable at .67. Since the item-total correlation for the first location item (i.e., entrance) was low, this item was not used to create the location composite. Alpha without this item was acceptable at .75.
6. Alphas for the other three measures (i.e., performance of biometrics, concern about biometrics use, and biometrics information quality) were acceptable.

Study Variables

1. The descriptive statistics for the study variables are shown in Table 13.
2. The skew index of two variables, value and ease of use, were higher than the acceptable criteria of three (Kline, 2005); accordingly, they were transformed

using a power function. The skew index of the transformed variables fell below three; thus, these transformed variables were used in consequent analyses.

ANOVA descriptive analysis testing was applied to examine how age, education, salary, experience, department, and shift differences relate to technological intent, concern about use, location of device, knowledge, added value, ease of use, and type accepted.

Table 12. *Cronbach's Alphas for the Study Variables (N=719)*

Variable	Item N	Alpha
Performance of biometrics	6	.87
Concern about biometrics use	6	.82
Biometric information quality	5	.82
Appropriate location of device	6	.67
Knowledge about biometrics	5	.51
Type of biometrics device	5	.49
Eyes	2	.75
Hand	2	.37

Table 13. *Descriptive Statistics of the Study Variables (N=719), SE for Skew Statistic = .09*

Variable	Range	Mean	*SD*	Skew
Ease of use	1 to 5	3.90	.78	.12
Added value	1 to 5	3.68	.88	-.39
Location of device	1 to 5	3.24	1.02	-.32
Concern about use	1 to 5	3.17	0.94	-.16
Type accepted	1 to 5	3.07	.78	.12
Total knowledge	0 to 6	2.45	1.42	.09
Technological intent	1 to 3	1.89	.67	.14

During calculating the knowledge responses, participants were given options range from 0 to 6 where 0 is never heard about it and the other numbers were assigned to television, radio,

newspapers, word of mouth, and have used it before. The highest possible number is 6, and the lowest is supposed to be 0. The answers were either yes or no for any of these 6 items (either yes = 1 or no = 0).

Age Difference Analysis

One-way ANOVAs were conducted to analyze age differences for the perception of quality of information, knowledge of biometrics, concerns about the technology, technological intent, location, ease of use, and value added. Table 14 presents the means and standard deviations of the variables by age group (see Appendix G). There were no differences in concerns about technology ($F(3, 718) = .965$, $p > .05$), quality of the information ($F(3, 718) = 1.560$, $p > .05$), value ($F(3, 718) = 1.208$, $p > .05$), location ($F(3, 695) = 1.787$, $p > .05$), and technological intent ($F(3, 718) = 2.115$, $p > .05$) by age.

There was, however, a significant difference in knowledge about biometrics by age ($F(3, 718) = 3.581$, $p < .05$). Those 18–28 had significantly lower scores ($M = .2827$) than those 29–39 ($M = .3235$). There was a significant difference in ease of use by age ($F(3, 718)= 2.676$, $p < .05$). Those 18–28 had significantly higher scores ($M = 3.9448$) than those 51 and older ($M = 3.4211$) (see Table 15).

Education Differences

One-way ANOVAs were conducted to analyze education differences for the perception of quality of information, knowledge of biometrics, concerns about the technology, technological intent, location, ease of use, and value added. Table 16 presents the means and standard deviations of the variables by education level (see Appendix G). There were no significant differences in concerns about technology ($F(3, 718) = 1.207$, $p > .05$) and knowledge about biometrics ($F(3, 718) = 1.966$, $p > .05$) by education.

Table 15. *ANOVA Table for Age*

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Concern about technology	Between Groups	2.583	3	.861	.965	.409
	Within Groups	637.973	715	.892		
	Total	640.556	718			
Quality of the information	Between Groups	3.324	3	1.108	1.560	.198
	Within Groups	507.956	715	.710		
	Total	511.280	718			
Knowledge about biometrics	Between Groups	.397	3	.132	3.581	.014
	Within Groups	26.427	715	.037		
	Total	26.824	718			
Ease of use	Between Groups	5.215	3	1.738	2.676	.046
	Within Groups	464.414	715	.650		
	Total	469.629	718			
Value	Between Groups	2.785	3	.928	1.208	.306
	Within Groups	549.575	715	.769		
	Total	552.360	718			
Location	Between Groups	3.726	3	1.242	1.787	.148
	Within Groups	481.034	692	.695		
	Total	484.760	695			
Technological intent	Between Groups	2.873	3	.958	2.115	.097
	Within Groups	323.775	715	.453		
	Total	326.648	718			

There was, however, a significant difference in quality of information by education level ($F(3, 718) = 16.966$, $p < .05$). Those with some high school had significantly lower scores ($M = 3.4467$) than high school graduates ($M = 3.7326$), those with some college ($M = 3.9107$), and those with a college or postgraduate education ($M = 4.0732$).

There was a significant difference in ease of use by education level ($F(3, 718) = 14.428$, $p < .05$). Those with some high school had significantly lower scores ($M = 3.4733$) than high school graduates ($M = 3.8470$), those with some college ($M = 4.0208$), and those with a college or postgraduate education ($M = 4.0488$).

There was a significant difference in value by education level ($F(3, 718) = 9.317$, $p < .05$). Those with some high school had significantly lower scores ($M = 3.3260$) than high school graduates ($M = 3.6164$), those with some college ($M = 3.7500$), and those with a college or postgraduate education ($M = 3.8341$). There was a significant difference in location by education level ($F(3, 695) = 5.440$, $p < .05$). Those with a college or postgraduate education had significantly higher scores ($M = 3.5613$) than those with some high school ($M = 3.2268$) and high school graduates ($M = 3.3264$) (see Table 17).

There was a significant difference in technological intent by education level ($F(3, 718) = 29.450$, $p < .05$). Those with some high school had significantly lower scores ($M = 1.5900$) than those with some college ($M = 1.9107$) and those with a college or postgraduate education ($M = 2.1359$).

Salary Difference

One-way ANOVAs were conducted to analyze salary differences for the perception of quality of information, knowledge of biometrics, concerns about the technology, technological intent, location, ease of use, and value added. Table 18 presents the means and standard deviations of the variables by salary group (see Appendix G). There were no differences in location ($F(4, 648) = .247$, $p > .05$) by salary.

Table 17. *ANOVA Table for Education*

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Concern about technology	Between Groups	3.227	3	1.076	1.207	.306
	Within Groups	637.329	715	.891		
	Total	640.556	718			
Quality of the information	Between Groups	33.978	3	11.326	16.966	.000
	Within Groups	477.303	715	.668		
	Total	511.280	718			
Knowledge about biometrics	Between Groups	.219	3	.073	1.966	.118
	Within Groups	26.604	715	.037		
	Total	26.824	718			
Ease of use	Between Groups	26.806	3	8.935	14.428	.000
	Within Groups	442.823	715	.619		
	Total	469.629	718			
Value	Between Groups	20.781	3	6.927	9.317	.000
	Within Groups	531.579	715	.743		
	Total	552.360	718			
Location	Between Groups	11.169	3	3.723	5.440	.001
	Within Groups	473.591	692	.684		
	Total	484.760	695			
Technological intent	Between Groups	35.923	3	11.974	29.450	.000
	Within Groups	290.725	715	.407		
	Total	326.648	718			

There was, however, a significant difference in concern about technology by salary level ($F(4, 670) = 3.724$, $p < .05$). Those with a salary of 1,001–3,000 Egyptian pounds had significantly lower scores ($M = 2.9672$) than those who preferred to not mention their salary ($M = 3.4207$).

There was a significant difference in quality of information by salary level ($F(4, 670) = 4.432$, $p < .05$). Those with a salary of less than 500 E.P./month had significantly lower scores ($M = 3.5513$) than those with a salary of 501–1,000 (M = 3.8828), those with a salary of 1,001–3,000 ($M = 3.9343$), those with a salary >3,001 ($M = 3.8899$), and those who preferred to not mention their salary ($M = 3.9512$).

There was a significant difference in knowledge of biometrics by salary level ($F(4, 670) = 7.215$, $p < .05$). Those with a salary of less than 500 E.P./month had significantly lower scores ($M = .2977$) than those with a salary of >3,001 ($M = .3805$).

There was a significant difference in ease of use by salary level ($F(4, 670) = 3.951$, $p < .05$). Those with a salary of less than 500 E.P./month had significantly lower scores ($M = 3.6425$) than those with a salary of 1,001–3,000 ($M = 4.0207$) and those with a salary >3,001 ($M = 3.9686$).

There was a significant difference in value by salary level ($F(4, 670) = 4.071$, $p < .05$). Those with a salary of less than 500 E.P./month had significantly lower scores ($M = 3.4479$) than those with a salary of 1,001–3,000 ($M = 3.8292$) and those who preferred to not mention their salary ($M = 3.8292$).

There was a significant difference in technological intent by salary level ($F(4, 670) = 12.752$, $p < .05$). Those with a salary of less than 500 E.P./month had significantly lower scores ($M = 1.6496$) than those with a salary of 1,001–3,000 ($M = 1.9635$), those with a salary >3,001 ($M = 3.8899$), and those who preferred to not mention their salary ($M = 1.9390$) (see Table 19).

Table 19. *ANOVA Table for Salary*

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Concern about technology	Between Groups	13.358	4	3.339	3.724	.005
	Within Groups	597.155	666	.897		
	Total	610.513	670			
Quality of the information	Between Groups	12.653	4	3.163	4.432	.002
	Within Groups	475.339	666	.714		
	Total	487.992	670			
Knowledge about biometrics	Between Groups	1.053	4	.263	7.215	.000
	Within Groups	24.295	666	.036		
	Total	25.348	670			
Ease of use	Between Groups	10.541	4	2.635	3.951	.004
	Within Groups	444.253	666	.667		
	Total	454.794	670			
Value	Between Groups	12.609	4	3.152	4.071	.003
	Within Groups	515.737	666	.774		
	Total	528.346	670			
Location	Between Groups	.712	4	.178	.247	.911
	Within Groups	463.731	644	.720		
	Total	464.444	648			
Technological intent	Between Groups	21.299	4	5.325	12.752	.000
	Within Groups	278.093	666	.418		
	Total	299.392	670			

Differences by Experience

One-way ANOVAs were conducted to analyze differences by years of experience for the perception of quality of information, knowledge of biometrics, concerns about the technology, technological intent, location, ease of use, and value added. Table 20 presents the means and standard deviations of the variables by years of experience (see Appendix G).

With the ANOVA analysis and no differences in concerns about technology ($F(6, 718) = 1.021$, $p > .05$), quality of the information ($F(6, 718) = 1.228$, $p > .05$), knowledge about biometrics ($F(6, 718) = .282$, $p > .05$), ease of use ($F(6, 718) = 1.777$, $p > .05$), value ($F(6, 718) = 1.187$, $p > .05$), location ($F(6, 695) = .383$, $p > .05$), and technological intent ($F(6, 718) = 1.554$, $p > .05$) by years of experience (Table 21).

Table 21. *ANOVA Table for Years of Experience*

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Concern about technology	Between Groups	5.464	6	.911	1.021	.410
	Within Groups	635.092	712	.892		
	Total	640.556	718			
Quality of the information	Between Groups	5.236	6	.873	1.228	.290
	Within Groups	506.044	712	.711		
	Total	511.280	718			
Knowledge about biometrics	Between Groups	.064	6	.011	.282	.946
	Within Groups	26.760	712	.038		
	Total	26.824	718			
Ease of use	Between Groups	6.927	6	1.155	1.777	.101
	Within Groups	462.702	712	.650		
	Total	469.629	718			
Value	Between Groups	5.468	6	.911	1.187	.311
	Within Groups	546.891	712	.768		
	Total	552.360	718			
Location	Between Groups	1.610	6	.268	.383	.890
	Within Groups	483.150	689	.701		
	Total	484.760	695			
Technological intent	Between Groups	4.221	6	.704	1.554	.158
	Within Groups	322.427	712	.453		
	Total	326.648	718			

Differences by Department

One-way ANOVAs were conducted to analyze department differences for the perception of quality of information, knowledge of biometrics, concerns about the technology, technological intent, location, ease of use, and value added. Table 22 presents the means and standard deviations of the variables by department (see Appendix G). There were no differences in concerns about technology ($F(7, 718) = 1.122$, $p > .05$) and location ($F(7, 695) = . 1.831$, $p > .05$). There appeared to be a significant difference in quality of information by department ($F(7, 718) = 3.216$, $p < .05$). Post hoc analyses, however, revealed there were not significant differences between the departments.

There was a significant difference in knowledge about biometrics by department ($F(7, 718) = 4.523$, $p < .05$). Those in marketing had significantly higher scores ($M = .4649$) than those in housekeeping ($M = .2751$), food and beverage ($M = .3121$), and those in other departments ($M = .2548$). There was a significant difference in ease of use by department ($F(7, 718) = 3.539$, $p < .05$). Those in marketing had significantly lower scores ($M = 3.3596$) than those in accounting ($M = 3.9964$), food and beverage ($M = 3.9872$), and those in other departments ($M = 3.9817$).

There was a significant difference in value by department ($F(7, 718) = 2.172$, $p < .05$). Those in food and beverage had significantly lower scores ($M = 3.7745$) than those in sales ($M = 3.2000$). There was a significant difference in technological intent by department ($F(7, 718) = 5.880$, $p < .05$). Those in front office had significantly higher scores ($M = 2.1098$) than those in housekeeping ($M = 1.6667$) and engineering ($M = 2.0000$) (see Table 23).

Table 23. *ANOVA Table for Department*

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Concern about technology	Between Groups	6.999	7	1.000	1.122	.347
	Within Groups	633.556	711	.891		
	Total	640.556	718			
Quality of the information	Between Groups	15.693	7	2.242	3.216	.002
	Within Groups	495.587	711	.697		
	Total	511.280	718			
Knowledge about biometrics	Between Groups	1.144	7	.163	4.523	.000
	Within Groups	25.680	711	.036		
	Total	26.824	718			
Ease of use	Between Groups	15.814	7	2.259	3.539	.001
	Within Groups	453.816	711	.638		
	Total	469.629	718			
Value	Between Groups	11.567	7	1.652	2.172	.035
	Within Groups	540.793	711	.761		
	Total	552.360	718			
Location	Between Groups	8.864	7	1.266	1.831	.079
	Within Groups	475.895	688	.692		
	Total	484.760	695			
Technological intent	Between Groups	17.876	7	2.554	5.880	.000
	Within Groups	308.772	711	.434		
	Total	326.648	718			

Differences by Shift

One-way ANOVAs were conducted to analyze differences by shift for the perception of quality of information, knowledge of biometrics, concerns about the technology, technological intent, location, ease of use, and value added. Table 24 presents the means and standard deviations of the variables by years of experience. There were no differences of quality of information, knowledge of biometrics, concerns about the technology, in concerns about technology ($F(6, 718) = 1.021$, $p > .05$), quality of the information ($F(6,$

Table 24. *Descriptive Analysis by Shift*

Variable	Shift	*N*	Mean	SD	Min	Max
Concern about technology	morning	461	3.1414	.94548	1.00	5.00
	afternoon	165	3.2838	.93183	1.00	5.00
	night	53	3.0409	.93650	1.00	5.00
	Total	679	3.1681	.94276	1.00	5.00
Quality of the information	morning	461	3.8818	.83127	1.00	5.00
	afternoon	165	3.8232	.86205	1.83	5.00
	night	53	3.7642	.82976	1.00	5.00
	Total	679	3.8584	.83830	1.00	5.00
Knowledge about biometrics	morning	461	.2805	.18054	.00	1.00
	afternoon	165	.3515	.22241	.00	1.00
	night	53	.3208	.19017	.17	1.00
	Total	679	.3009	.19439	.00	1.00
Ease of use	morning	461	3.9328	.78200	1.00	5.00
	afternoon	165	3.8717	.82714	1.00	5.00
	night	53	3.8239	.89956	1.00	5.00
	Total	679	3.9094	.80234	1.00	5.00
Value	morning	461	3.7150	.84435	1.00	5.00
	afternoon	165	3.6230	.91901	1.60	5.00
	night	53	3.6038	.91019	1.40	5.00
	Total	679	3.6839	.86810	1.00	5.00
Location	morning	441	3.4002	.82564	1.17	5.00
	afternoon	163	3.4560	.85603	1.17	5.00
	night	52	3.5801	.79108	1.83	5.00
	Total	656	3.4284	.83093	1.17	5.00
Technological intent	morning	461	1.8742	.65392	1.00	3.00
	afternoon	165	1.8727	.67321	1.00	3.00
	night	53	1.8868	.75091	1.00	3.00
	Total	679	1.8748	.66559	1.00	3.00

718) = 1.228, $p > .05$), ease of use ($F(6, 718) = 1.777$, $p > .05$), value ($F(6, 718) = 1.187$, $p > .05$), location ($F(6, 695) = .383$, $p > .05$), and technological intent ($F(6, 718) = 1.554$, $p > .05$) by shift (see Table 25).

Table 25. *ANOVA Table for Shift*

		Sum of Squares	*df*	Mean Square	*F*	Sig.
Concern about technology	Between Groups	3.398	2	1.699	1.917	.148
	Within Groups	599.212	676	.886		
	Total	602.610	678			
Quality of the information	Between Groups	.927	2	.463	.659	.518
	Within Groups	475.536	676	.703		
	Total	476.463	678			
Knowledge about biometrics	Between Groups	.635	2	.317	8.584	.000
	Within Groups	24.986	676	.037		
	Total	25.621	678			
Ease of use	Between Groups	.873	2	.437	.678	.508
	Within Groups	435.584	676	.644		
	Total	436.457	678			
Value	Between Groups	1.397	2	.698	.926	.396
	Within Groups	509.538	676	.754		
	Total	510.935	678			
Location	Between Groups	1.672	2	.836	1.211	.298
	Within Groups	450.572	653	.690		
	Total	452.244	655			
Technological intent	Between Groups	.009	2	.004	.010	.990
	Within Groups	300.351	676	.444		
	Total	300.359	678			

There was a significant difference in knowledge about biometrics ($F(2, 678) = 8.584$, $p < .05$) by shift. Those who worked the morning shift ($M = .2805$) had significantly lower mean scores that those who worked the afternoon shift ($M = .3515$).

Path Analysis

To confirm the results of exploratory factor analysis, Structural Equation Model (SEM) methodology was used by applying path analysis, in which all variables are observed directly. In evaluating a path model, the fit of the whole model as well as the magnitude and direction of its individual parameters must be assessed (Kline, 2005). Thus, the fit of the whole model was assessed using the following statistics and indices:

1. Chi-square.
2. Chi-square/degrees of freedom—the lower the ratio, the better the fit; not much agreement on cut-off points at this time (some say two, while others say three).
3. Comparative fit index (CFI)—indices above .95 indicate good fit (Hu & Bentler, 1999); indices above .90 indicate reasonable fit (Hu & Bentler, 1998).
4. Root mean square error of approximation (RMSEA)—indices below .06 indicate good fit; indices below .08 indicate reasonable fit; indices below .10 indicate mediocre fit (Browne & Cudeck, 1993).
5. Standardized root mean square residual (SRMR)—values less than .08 indicate good model fit (Hu & Bentler, 1998).

The magnitude of the individual parameters (i.e., path coefficients and correlations) was assessed at the .05 level. The direction of the individual parameters was evaluated vis-à-vis prior research findings.

The proposed path model (with standardized coefficients) is depicted in Figure 6.

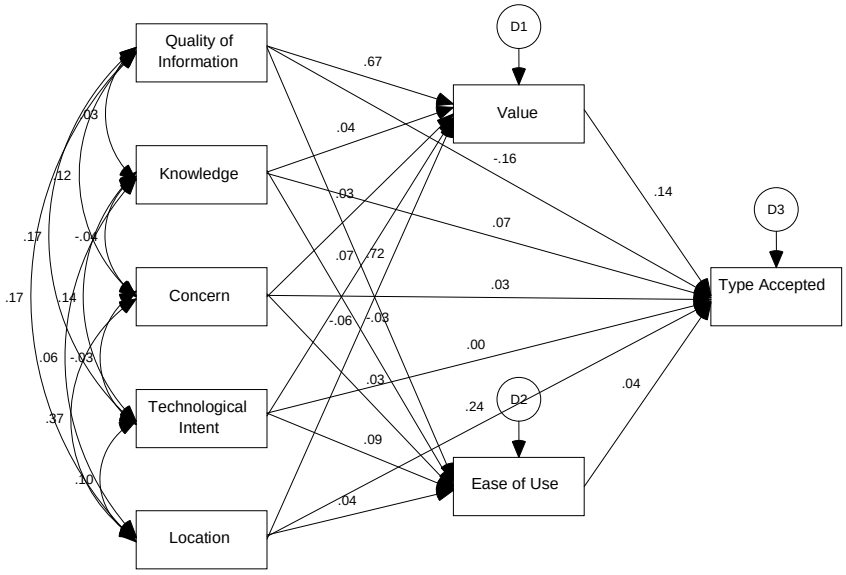

Figure 6. The proposed path model (with standardized coefficients)

Table 26. *Fit Statistics and Indices for the Proposed and Revised Path Models*

Index	Proposed	Revised
Chi-square	141.52	15.53
Degrees of freedom	1.00	8.00
Sig.	.00	.05
Chi-square/df	141.52	1.94
Comparative fit index (CFI)	.90	.99
Root mean squared error (RMSEA)	.44	.04
Lower bound of 90 percent confidence interval	.38	.00
Upper bound of 90 percent confidence interval	.51	.06
Standardized root mean square residual (SRMR)	.03	.02

The fit statistics and indices are summarized in Table 26. This proposed model did not fit the data well. Although the SRMR was below .08, the ratio of chi-square to degrees of freedom was high; the CFI was below .95, and the RMSEA was above .10. Further, not all path and correlation coefficients were statistically significant.

Accordingly, a second path model was tested. All predictors were kept in the model, but only the paths and correlations that were statistically significant were retained in the model. This revised path model is depicted in Figure 7.

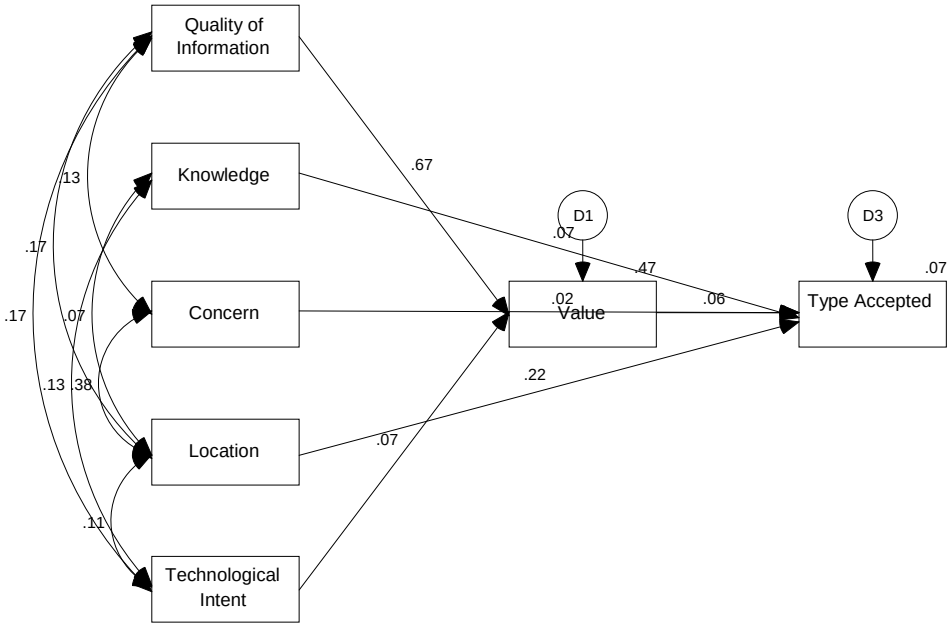

Figure 7. The revised path model

Table 27. *Standardized and Unstandardized Path Coefficients for the Revised Direct Path Model*

Path	B	SE	Beta	C.R.	Sig.
Quality to value	4.95	.20	.67	24.29	<.001
Knowledge to type	.06	.03	.07	1.84	.066
Concern to type	.03	.05	.02	.62	.537
Location to type	.27	.05	.22	5.67	<.001
Technology to value	.65	.26	.07	2.56	.010
Value to type	.01	.01	.06	1.73	.083

Table 28. *Standardized and Unstandardized Coefficients for the Revised Indirect Path Model*

Path	B	SE	Beta	C.R.	Sig.
Quality of information and:					
concern	.10	.03	.13	3.42	<.001
location	.14	.03	.17	4.46	<.001
technology	.10	.02	.17	4.62	<.001
Knowledge and:					
location	.11	.05	.07	2.12	.034
technology	.13	.04	.13	3.59	<.001
Location and:					
technology	.07	.02	.11	3.08	.002
concern	.37	.04	.38	9.56	<.001

The fit statistics and indices are summarized in Table 26. The direct revised path coefficients are shown in Table 27, while the indirect revised path coefficients are displayed in Table 28.

This proposed model fit the data well. The ratio of chi-square to degrees of freedom was below three; the CFI was above .95; the RMSEA was below the acceptable criterion of .06; and the SRMR was below .08. Three of the six path coefficients were statistically significant and in the predicted direction: the path from quality of information to value, the path from technological intent to value, and the path from location to acceptability of eye biometrics. Two of the six path coefficients were almost significant and in the predicted direction: the path from knowledge to acceptability of eye biometrics, and the path from value to acceptability of eye biometrics. All correlations were statistically significant and in the predicted direction. Statistically significant relationships were noted in the indirect path as shown in Table 28.

Analysis of the data collected from employees working in the metropolitan hotels and resorts showed the following findings:

1. The revised path model for respondents working in metropolitan hotels is depicted in Figure 8. The fit statistics and indices are summarized in Table 29.
2. The direct revised path coefficients are shown in Table 30, while the indirect revised path coefficients are displayed in Table 31.
3. This proposed model fits the data well: the ratio of chi-square to degrees of freedom was below three, the CFI was above .95, the RMSEA was below the acceptable criterion of .06, and the SRMR was below .08.
4. Four of the six path coefficients were statistically significant and in the predicted direction: the path from quality of information to value, the path from technological intent to value, the path from knowledge to acceptability of eye biometrics, and the path from location to acceptability of eye biometrics. The path coefficients of value to type and concern to type were .054 and .073, respectively, and were in the predicted direction.
5. Four out of the seven correlations were statistically significant and in the predicted direction.

Data collected from resort hotels was subjected to the same analysis and the results of the revised model for respondents working in resort hotels are as follows:

1. The revised path model for respondents working in resort hotels is depicted in Figure 9. The fit statistics and indices are summarized in Table 29. The direct revised path coefficients are shown in Table 32, while the indirect revised path coefficients are displayed in Table 33.

2. This proposed model fit the data well: the ratio of chi-square to degrees of freedom was below three; the CFI was above .95; the RMSEA was below the acceptable criterion of .06; and the SRMR was below .08.
3. Only two of the six path coefficients were statistically significant and in the predicted direction: the path from quality of information to value and the path from location to acceptability of eye biometrics. One out of the six path coefficients was almost significant (.095) and in the predicted direction: the path from technological intent to value.
4. Five out of the seven correlations were statistically significant and in the predicted direction.

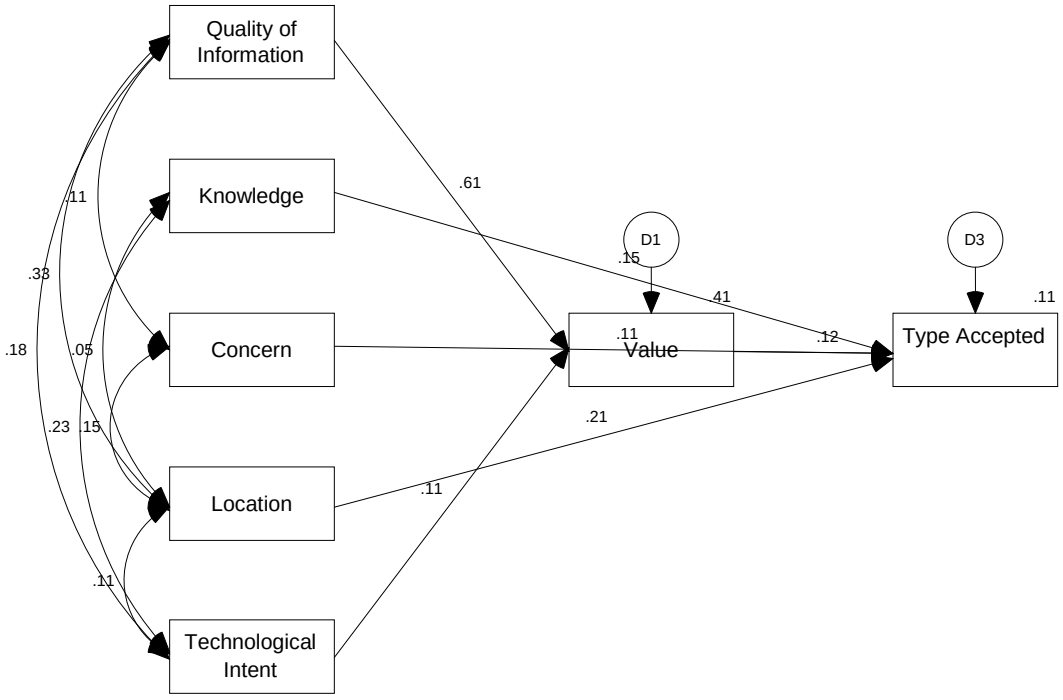

Figure 8. Revised path model for respondents working in metropolitan hotels

Table 29. *Fit Statistics and Indices for the Revised Path Model for Respondents Working in Metropolitan and Resort Hotels*

Index	Metropolitan	Resort
Chi-square	9.61	11.65
Degrees of freedom	8.00	8.00
Sig.	.29	.17
Chi-square/df	1.20	1.46
Comparative fit index (CFI)	.99	.99
Root mean squared error (RMSEA)	.03	.03
Lower bound of 90 percent confidence interval	.00	.00
Upper bound of 90 percent confidence interval	.08	.07
Standardized root mean square residual (SRMR)	.04	.02

Table 30. *Standardized and Unstandardized Path Coefficients for the Revised Direct Path Model for Respondents Working in Metropolitan Hotels*

Path	B	SE	Beta	C.R.	Sig.
Quality to value	4.60	.38	.61	12.28	<.001
Knowledge to type	.13	.06	.15	2.41	.016
Concern to type	.15	.09	.11	1.79	.073
Location to type	.26	.08	.21	3.31	<.001
Technology to value	.99	.45	.11	2.19	.028
Value to type	.03	.01	.12	1.93	.054

Table 31. *Standardized and Unstandardized Coefficients for the Revised Indirect Path Model for Respondents Working in Metropolitan Hotels*

Path	B	SE	Beta	C.R.	Sig.
Quality of information and:					
Concern	.08	.04	.11	1.80	.073
Location	.25	.05	.33	4.90	<.001
Technology	.09	.03	.18	2.88	.004
Knowledge and:					
Location	.07	.08	.05	.88	.380
Technology	.20	.06	.23	3.57	<.001
Location and:					
Technology	.07	.04	.11	1.74	.082
Concern	.12	.05	.15	2.28	.023

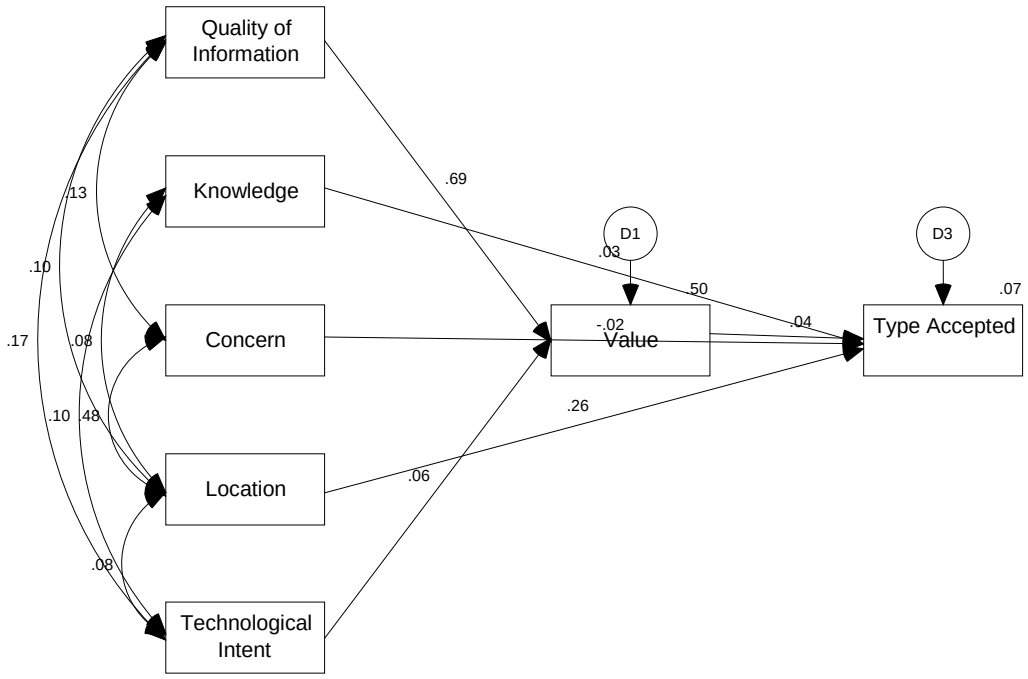

Figure 9. Revised path model for respondents working in resort hotels

Table 32. *Standardized and Unstandardized Path Coefficients for the Revised Direct Path Model for Respondents Working in Resort Hotels*

Path	B	SE	Beta	C.R.	Sig.
Quality to value	5.08	.24	.69	20.93	<.001
Knowledge to type	.02	.04	.03	.61	.544
Concern to type	-.03	.06	-.02	-.45	.656
Location to type	.31	.06	.26	5.04	<.001
Technology to value	.52	.31	.06	1.67	.095
Value to type	.01	.01	.04	.91	.362

Table 33. *Standardized and Unstandardized Coefficients for the Revised Indirect Path Model for Respondents Working in Resort Hotels*

Path	B	SE	Beta	C.R.	Sig.
Quality of information and:					
Concern	.11	.04	.13	2.87	.004
Location	.09	.04	.10	2.16	.031
Technology	.10	.03	.17	3.66	<.001
Knowledge and:					
Location	.12	.06	.08	1.94	.052
Technology	.10	.05	.10	2.23	.026
Location and:					
Technology	.06	.03	.08	2.01	.045
Concern	.49	.05	.48	9.48	<.001

CHAPTER 5. SUMMARY, LIMITATIONS, AND RECOMMENDATIONS

This chapter will tie together the sections of this dissertation, evaluate the results of this study to reach the objectives, and evaluate the several hypotheses presented in the theoretical framework of this project. The first section will present a summary of the results and correlation with the hypotheses. The second section will present the limitations of the study due to difficulties experienced during the study and during the attempt to collect the data. The final section will present future recommendations.

Summary of the Results

This study is the first of its kind to explore the factors that affect biometrics technology acceptance in Egyptian five star hotels. The hotels surveyed represented more than 75% of the hotels in Egypt, namely the five-star hotels in Cairo, Sharm el-Sheikh, and Hurgada. This study excluded the Nile cruise lines because the focus of the study was the hospitality industry.

The participants in the survey were predominantly men (87.9%), consistent with prior studies of the hospitality work force in Egypt (Kattara, 2005). The majority were between the ages of 18 and 39 (87.6 %) and were educated (high school, college, and postgraduate) (83.8%). More than 50% were single, and the majority earned between 500-3,000 LE (66. 1%).

The researcher's primary goal was to get a better understanding of Egyptian hotel employees' perceptions and tendencies to adopt biometrics in the hotels where they worked. The TAM model shown in Figure 2 suggested that knowledge, personal convenience (ease of use, speed), safety and security (physical harm, identity theft, security of the information), and satisfaction (quality of information) influenced the tendency to adopt a given

technology, TAM. The survey used in this study did not explore the financial impact of the adoption of this technology.

The survey participants reported that television and word of mouth communications were the sources of their knowledge of biometrics. Other methods such as newspapers or radio were ineffective, and nearly 10% of the participants claimed they did not know anything about biometrics. When these participants were given the survey with the pictures of several biometrics devices, however, they realized they were familiar with the technology or recalled prior knowledge. This information will be useful when planning future training or education as the use of television or visual media might be a better vehicle to disseminate information or educate employees.

When the questions in the survey inquired about the best type of the biometrics technology or devices, the participants favored fingerprint biometrics, followed by the retina and iris scans. This finding could be attributable to the use of this technology by hotel employees in other places within the Egyptian government; it could suggest that their familiarity with this method could make them be more inclined to use this technology.

The survey attempted to gather the employees' thoughts about the expected performance of biometrics with regards to security of the facility, ease of use, flexibility, and low cost of maintenance. The employees related that biometrics applications should be easy to use, flexible, fast, and would require low maintenance especially with the development of technology. In an effort to improve quality and customer services, employees reported that the information generated should be clear, accurate, and updated, and could be displayed in a useful and adaptable format. They indicated that this application would have a great added

value in security, data collection, convenience, and improved productivity that would, in turn, increase customer satisfaction.

The employees favored placement of the device at the employees' entrance, followed by a clock in/out procedure used to access rooms, secure areas, storage, and computers. They were concerned about personal harm from using this technology, especially regarding pregnant women. Access to information, identity theft, and privacy were other concerns.

Several reliable variables were identified, and ANOVA testing was done to examine the relation between factors such as age, education, economical status, work experience, type of work, and work schedule and the study variables such as concern about technology, quality of the information generated by biometrics, knowledge about biometrics, ease of use, value-added, technological intent, and location of placement of biometrics devices. A summary of the findings is shown in Table 34.

Table 34. *The Significant and not Significant Variables in the Results in Level 0.05*

	Concern	Quality of information	Knowledge	Ease of use	Value added	Technological intent	Location of the device
Age	NS	NS	S	S	NS	NS	NS
Education	NS	S	NS	S	S	S	S
Economical status	S	S	S	S	S	S	NS
Work experience	NS	NS	NS	NS	NS	NS	NS
Work type	NS	NS	S	S	S	S	NS
Work schedule	NS	NS	S	NS	NS	NS	NS

S= Significant
NS = Not Significant

Some remarks on the ANOVA testing are as follows

- A significant difference in biometrics knowledge was seen where participants between the ages of 29 and 39 years were more knowledgeable than participants between the ages of 18 and 28 years of age. Older participants (age above 51) had difficulty with use of biometrics when compared to participants 18–28 years of age.
- Education level was positively related to confidence in quality of information generated from biometrics, ease of use, value-added, and technological intent. Significant differences in the location of placement of the technology were noted with relation to education.
- Salary, as a social status indicator, affected concerns about information or biometrics technology. Individuals who chose not to mention their salaries were more concerned than individuals making 1,000–3,000 LE. Why people chose not to mention their income is possibly related to cultural factors or could imply that those individuals did not want anyone to know how much they made because either they made more money than they should or they might have a fear of persecution or superstition. The increase in salary was positively related to quality of information, knowledge of biometrics, ease of use, value-added, and technological intent. These findings are consistent with previously reported findings about adoption of technology.
- Years of experience did not show any significant relationship with the variables in the study.

- Workers in marketing were more knowledgeable about biometrics when compared to other departments such as housekeeping and food and beverage. Accounting department employees reported improved ease of use more than other employees in other departments such as marketing. Sales department employees had more confidence in the value-added from biometrics when compared to those working in other departments. Front desk employees were more inclined to use technology compared to housekeeping and even engineers.
- Employees working in the morning shift were more knowledgeable of biometrics compared to those working the night or other shifts.
- The above tested variables were used in the path analysis, and the results did not fit the proposed model as seen in Figure 6. A revised model was developed where the data fit better as seen in Figure 7. The revised model reduced the significant correlations in the proposed direction of quality of information to value-added, the path from technological intent to value-added, and the path from location to type accepted. The path of knowledge and to type accepted and the path of value-added to type accepted was almost significant.

Reviews of the findings with respect to the hypotheses are as follows:

1. Findings confirmed H1a where quality of information generated from biometrics devices positively influences perception of employees of value-added to the work place.
2. Findings confirmed H3a where technological intent positively influences employees' perception of value-added to the work place.

3. Findings confirmed H5c where location of the biometrics device influences type of device accepted.
4. The data did not support H6 where it was hypothesized that employee perception of value added positively influences type of device accepted.
5. The data did not support H7 where it was hypothesized that employee perception of ease of use positively influences type of device accepted.

Further analysis of data collected from two different types of hotel settings (the metropolitan area and the resort area) were tested, and a revised model from each setting was obtained. A revised model for the metropolitan hotel employees (depicted in Figure 8) reduced the significant correlations in the proposed direction to quality of information to value-added, the path from technological intent to value-added, the path from knowledge to acceptability of type accepted, and the path from location to type accepted. The path from concern to type accepted and the path from value to type acceptable were almost significant. Reviews of the findings with respect to the hypotheses are as follows:

1. Findings confirmed H1a where quality of information generated from biometrics devices positively influences perception of employees of value-added to the work place.
2. Findings confirmed H2c where biometrics knowledge influences type of device accepted.
3. Findings confirmed H3a where technological intent positively influences employees' perception of value-added to the work place.
4. Findings confirmed H5c where location of the biometrics device influences type of device accepted.

A revised model for the resort hotel employee data is depicted in Figure 9. Two out of the six path coefficients were statistically significant including the path from quality of information to value-added and the path from location to type accepted. The path from technological intent to value-added was almost significant.

Reviews of the resort hotels with respect to the hypotheses are as follows:

1. Findings confirmed H1a where quality of information generated from biometrics devices positively influences perception of employees of value-added to the work place.
2. Findings confirmed H5c where location of the biometrics device influences type of device accepted.

Limitations

The limitations discovered in this study are listed:

1. The study findings are limited to five-star hotels in Egypt only and may not be generalized to all types of hotels in Egypt or even the Middle East. This is often a limitation faced when research is conducted in certain geographic locations or research is looking at different cultural settings.
2. Lack of the database for hotels and employees in Egypt made it very cumbersome to collect data and may affect accuracy.
3. Security status and the use of national guards and the high level of emergency status in the country for many years made many suspect the intent of the survey and inhibited the researcher's ability to reach more participants.

4. Lack of a government agency that could support such research led to inability to access more participants or a wider group of hotels and made it impossible to have face-to-face contact with employees.
5. Because of the bureaucracy faced in Egypt, the researcher was unable to reach the participants to deliver and collect the surveys. If the researcher had been able to do so, possible employee questions might have been answered by the researcher, and possible wider participation might have been expected.
6. Global weather conditions prevented wider participation of employees in the survey.
7. A large percentage of hotel employees do not have a hospitality background because they have different education background, and, therefore, the responses in the survey might have differed if the respondents had a broader education.
8. Employees in Egyptian hotels and, especially, in resort hotels are not accustomed to participating in surveys and research, which might have had a negative impact on the research.
9. Hotel employees in resort hotels in Egypt work 12 hour shifts which might have affected the response rate because of the time constraints or fatigue.
10. The majority of hotel headquarters in Egypt are located in Cairo and, in turn, the top management is located in Cairo. Mostly middle management personnel are stationed in the resort hotels; this distribution might have affected the data.
11. Despite accurate and careful translation efforts, the language barrier leads to some unclear findings, and continued attempts to improve survey tools to investigate among cultures are needed.

Recommendations

The outcome of this research should encourage the hotel management to plan for training programs before the implementation of biometrics. The training should focus on the benefits and value-added which seemed to be a major driver and factor mentioned by the participants as a possible motivator for adoption or use for a device. Special emphasis in the training should be directed towards the personal benefits reaped from such technology. Participation in the survey was limited due to a number of obstacles. The research suggests that a close collaboration between universities in Egypt and the U.S. could improve access to data and employees to gather information and allow better understanding. Methods used in the U.S. to encourage participation, such as compensations or gifts, were not used as they are not acceptable or are considered a shameful act in Egypt.

Studies on behavior and cultural differences should continue and use both quantitative and qualitative research to better understand the population.

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APPENDIX A

Summary of Five-Star Hotels in Egypt

Geographic Distribution of Five-Star Hotels in Egypt

State	Number of five-star hotels	Percentage of five-star hotels	Percentage of state five-star hotels in Egypt
Sharm El-Shikh, South Sinai	45	28.85%	4.35%
Cairo	38	24.36%	3.67%
Red Sea State (Hurghada, Safaga, Alqusier, and Algouna)	35	22.43%	3.38%
Alexandria	8	5.13%	0.77%
Luxor	8	5.13%	0.77%
Taba (Sinai)	6	3.85%	0.58%
Aswan	5	3.20%	0.48%
MarsaAlam	3	1.92%	0.29%
Arish, North Sinai	2	1.28%	0.19%
Al Alamien	2	1.28%	0.19%
MarsaMatrouh	2	1.28%	0.19 %
Al Fayoum	1	0.64%	0.10%
Port said	1	0.64%	0.10%
Total	156	99.98%	15.06%

APPENDIX B

Permission From Dr. Murphy

From: Ahmed Abdelbary [mailto:ahmad@iastate.edu]
Sent: Mon 18/01/2010 20:52
To: MURPHY Hilary
Subject: Re: would like to obtain permission to use survey to test biometrics

Dear professor Murphy:
Thanks very much, but could I impose on you and ask you to send me the

questions since I do not have it and when I reviewed the article I could find them. In addition, I would like to see if there is any possibility of the collaboration between us once I get the results and maybe compare to your findings and see if cultural differences influence technology adoption styles in different areas of the world
Sincerely,
Ahmed

On Mon, Jan 18, 2010 at 1:11 AM, MURPHY Hilary <Hilary.MURPHY@ehl.ch> wrote:
> Hello Ahmed- sorry to be so long- BUSY! You have permission to proceed to use the questionnaire provided that you keep me posted on the final results!- HM
>
>
> Hilary Catherine Murphy
> PhD, MPhil, MCIM, PGdip BIT, BA
> Professeur IT & E-Marketing
>

-----Original Message-----
From: Ahmed Abdelbary [mailto:ahmad@iastate.edu]
Sent: 17 January 2010 22:41
To: MURPHY Hilary
Subject: Re: would like to obtain permission to use survey to test biometrics

Dear Dr. Murphy:

hope you had a good holiday and wish you the best this new year. I was hoping that you had a chance to think about my request. My Phd is about applications of biometics in hotels and I was hoping to test your survey in Egyptian hotels. I have been working on contacts to be able to go into the hotels and conduct the survey, but before I proceed I was waiting for your permission and the original questions because I will nee to translate them and then submit to the IRB at the University. Please let me know if is possible that we can collaborate together.
thanks
Ahmed

On Mon, Dec 28, 2009 at 11:27 AM, MURPHY Hilary <Hilary.MURPHY@ehl.ch> wrote:
> Ahmed- I am away from my desk and will get back to you on 4th- HM
>

From: Ahmed Abdelbary [mailto:ahmad@iastate.edu]
Sent: Sat 26/12/2009 22:07
To: MURPHY Hilary

Subject: would like to obtain permission to use survey to test biometrics

Dear Dr. Murphy: I did sned an e.mail earlier asking permission to use your survey in the article published "An exploration of the key hotel processes implicated in biometric adoption". If you could please let me know what you think about that and if there are any other possiblities of collaboration. I am a PhD student and is working on biometric research.
thanks
ahmad

Appendix C

IRB Approval

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 4/15/2010

To: Ahmed Abdelbary
7E MacKay Hall

CC: Dr. Robert Bosselman
31 MacKay

From: Office for Responsible Research

Title: Exploration of Factors Affecting Adoption of Biometrics Technology in Egyptian Hotels

IRB Num: 09-399

Submission Type: Modification **Exemption Date:** 4/14/2010

The project referenced above has undergone review by the Institutional Review Board (IRB) and has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b). The IRB determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as proposed in the IRB application,** including obtaining and documenting informed consent if you have stated in your application that you will do so or if required by the IRB.
- **Any modification of this research should be submitted to the IRB on a Continuing Review and/or Modification form, prior to making any changes,** to determine if the project still meets the federal criteria for exemption. If it is determined that exemption is no longer warranted, then an IRB proposal will need to be submitted and approved before proceeding with data collection.

Please be sure to **use only the approved study materials** in your research, including the **recruitment materials and informed consent documents that have the IRB approval stamp**.

Please note that you must submit **all** research involving human participants for review by the IRB. **Only the IRB may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

For IRB Use Only	Modification Approval Date April 14, 2010 Continuing Review Approval Date _____ Approval Expiration Date: n/a - exempt	IRB MAR 2 5 2010

ISU HUMAN SUBJECTS CONTINUING REVIEW AND/OR MODIFICATION FORM

TYPE OF SUBMISSION: ☐ Continuing Review x☐ Modification ☐ Continuing Review and Modification

Principal Investigator: Ahmed Abdelbary		Phone: 563 249 3434
Degree: MBA PhD Candidate	Correspondence Address: 7E Mackay Hall, Ames, Iowa 50011	
Department: Department of Apparel, Education Studies, and Hospitality management		E-mail Address: ahmad@iastate.edu
Project Title: Exploration of Factors Affecting Adoption of Biometrics Technology In Egyptian Hotels		
IRB ID: 09-399		Date of Last Continuing Review: {28 August 2009} to {08 August 2010}
Alternate Contact:		
Correspondence Address:		Email Address: drbob@iastate.edu
IF STUDENT PROJECT		
Name of Major Professor: Robert Bosselman	Phone: 515-294-7474	E-mail Address:drbobo@iastate.edu
Department: PLM	Campus Address: 31 MacKay Hall	

FUNDING INFORMATION:

☐ External Grant/Contract ☐ Internal Support (no specific funding source) or Internal Grant (indicate name below)	
Name of Funding Source:	OSPA Record ID on Gold Sheet:
☐ Part of Training, Center, Program Project Grant – Director:	Overall IRB ID No:
☐ Student Project—No funding or funding provided by student	

CONFLICT OF INTEREST

The proposed project or relationship with the sponsor requires the disclosure of significant financial interests that present an actual or potential conflict of interest for investigators involved with this project. By signing this form, all investigators certify that they have read and understand ISU's Conflict of Interest policy as addressed by the ISU Faculty Handbook (http://www.provost.iastate.edu/faculty) and made all disclosures required by it.)

Do you or any member of your research team have a conflict of interest? ☐ Yes X☐ No
If yes, has the appropriate disclosure form been completed? ☐ Yes ☐ No

ASSURANCE

I certify that the information provided in this application is complete and accurate and consistent with proposal(s) submitted to external funding agencies. I agree to provide proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the IRB for review. I agree that modifications to the originally approved project will not take place without prior review and approval by the Institutional Review Board, and that all activities will be performed in accordance with state and federal regulations and the Iowa State University Federal Wide Assurance.

Signature of Principal Investigator 3/24/10 Date

Student Projects: Faculty signature indicates that this application has been reviewed and is recommended for IRB review.

Signature of Supervising Faculty 3/23/10 Date

Kelly A. Bonitsel April 14, 2010
IRB Approval Signature Date

For IRB	EXPEDITED per 45 CFR 46.110(b) _____, Category _____, Letter _____ STUDY REMAINS EXEMPT per 45 CFR 46.101(b) 2 WAIVER of SIGNED CONSENT per 45 CFR 46.117(c)

ISU IRB # 1 09-399
EXEMPT DATE: 14 April 2010

Informed Consent Document

وثيقة اطلاع وقبول

Title of the study: Exploration of Factors Affecting Adoption of Biometrics Technology in Egyptian Hotels

عنوان الدراسة : استكشاف العوامل التي تؤثر على استخدام تكنولوجيا علم البيومتركس فى فنادق مصر

Investigator: Ahmed Abdelbary BS.MBA.PhD candidate, and Robert Bosselman BS.MS.PhD.

This is a research study. Please take your time in deciding if you would like to participate. Please feel free to ask questions at any time

الباحث : أحمد عبد الباري وروبرت بسلمان
هذه دراسة بحثية. يرجي تحديد ما إذا كنت ترغب في المشاركة او لا واذتتردد في طرح الأسئلة في أي وقت.

Introduction:

You are invited to participate in this study because you work in a five stars hotel in Egypt. The study is designed to explore factors affecting adoption and willingness to incorporate new technologies biometrics (the science of using individual characteristics to identify individuals such as fingerprints, retinal scan, hand scan, face, and others) to improve work flow, speed, and security in hotels. Your input is very important to understand your concerns and issues that could be addressed and will help guide the development and implementation of devices that will make your life and work better, faster, productive, and improved security in your work place.

مقدمة:
انتم مدعوون للمشاركة في هذه الدراسة اما لأنك تعمل في فندق خمس نجوم في مصر او انك طالبا في إحدى الجامعات المصرية. او بسبب مهنتك. هذه الدراسة تهدف الى استكشاف العوامل التي قد تؤثر على اعتماد وإدماج التكنولوجيات الجديدة مثل تكنولوجيا البيومتركس (تكنولوجيا التعرف على الأفراد بواسطة بصمات الاصابع ومسح شبكية العين ، ومن جهة المسح الضوني ، والوجه ، وغيرها) لتحسين تدفق العمل والأمن في الفنادق. المدخلات الخاصة بك من المهم جدا أن نفهم مخاوفكم والقضايا التي يمكن معالجتها ، وسوف تساعد في توجيه وتطوير وتنفيذ الأجهزة التي من شأنها أن تجعل حياتك وعملك على نحو أفضل ، وتوفير الأمن .

Description of Procedure: وصف الاجراءات:

This brief survey will take about 5-10 minutes to complete.

هذه الدراسة وجيزة سوف تستغرق حوالي **5-10** دقيقة لانهاءها.

Risks: None المخاطر : لا توجد مخاطر

Benefits: There are no direct benefits الاستفادة: ليست هناك فوائد مباشرة

Cost and compensation: You will not incur any costs and no compensation will be provided.
التكلفة والتعويض : أنك لن تتكلف أي تكاليف ولن يتم دفع أي تعويض.

Participation Rights: Participation is voluntary, you may withdraw from the survey at any time, and all information provided will be confidential and anonymous. If you decide to leave at any time there will be no penalty or loss of any benefits you are otherwise entitled to.
حقوق المشاركة : تكون المشاركة طوعية ، وقد تنسحب من الدراسة في أي وقت ، وجميع المعلومات المقدمة سوف تكون سرية ومجهولة المصدر وإذا قررت المغادرة في أي وقت لن يكون هناك أي عقوبة أو فقدان أي من الفوائد.

CONFIDENTIALITY: الخصوصية:

Records identifying participants will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available. However, federal government regulatory agencies, auditing departments of Iowa State University, and the Institutional Review Board (a committee that reviews and approves human subject research studies) may inspect and/or copy your records for quality assurance and data analysis. These records may contain private information.

ISU IRB # 1 09-399
EXEMPT DATE: 14 April 2010

سجلات المشاركين محددة وستبقى سرية إلى الحد الذي تسمح به القوانين والأنظمة المعمول بها وسوف لا تكون في متناول الجمهور.ومع ذلك ، وكالات الحكومة الاتحادية التنظيمية ، ومراجعة قسم الحسابات بإدارة جامعة ولاية ايوا ، ولجنة مراجعة المؤسسات (لجنة مراجعة واعتماد دراسات بحثية انسانية) قد تستخدم السجلات للبحث و تحليل البيانات. هذه السجلات قد تحتوي على معلومات خاصة.

To ensure confidentiality to the extent permitted by law, the following measures will be taken where surveys will be numbered, and results will be kept in a secured computer where no one have access to the information. If the results are published, your identity will remain confidential. Information will be stored in a locked file cabinet in 31 MacKay Hall, Iowa State University, Ames, IA.

لضمان السرية في الحدود التى يسمح بها القانون ، فإن عمليات الاستبيان سيتم ترقيمها ، والنتائج التي سيتم الاحتفاظ بها في كمبيوتر أمن حيث لا يمكن لاحد الوصول إلى هذه المعلومات. وإذا كانت النتائج ستنشر ، فسوف تظل سرية هويتك وسيتم تخزين المعلومات في ملف مغلق بمجلس مدينة ماكاي القاعة 31 ، جامعة ولاية آيوا ، مدينة أميس فى ولاية ايوا.

Records will be destroyed after 3 years of completion of the project

السجلات سيتم تدميرها بعد ثلاث سنوات من اكتمال المشروع.

QUESTIONS OR PROBLEMS أسئلة أو مشاكل.

You are encouraged to ask questions at any time during this study.

نحن ندعوك ونرحب بأسئلتك في أي وقت خلال هذه الدراسة.

- For further information about the study contact Ahmed Abdelbary (563)-249-3434 or Robert Bosselman BS.MS.PhD (515)-294-7474

لمزيد من المعلومات حول الدراسة يرجاء الاتصال: أحمد عبد الباري **563.249.3434** او روبرت بوسلمن **294.747.4 515**

If you have any questions about the rights of research subjects or research-related injury, please contact the IRB Administrator, (515) 294-4566, IRB@iastate.edu, or Director, (515) 294-3115, Office of Research Assurances, Iowa State University, Ames, Iowa 50011.

إذا كان لديك أي أسئلة حول الاحقية البحثية أو البحوث ذات الصلة ، يرجى الاتصال على مدير مجلس الهجرة واللاجئين.

(515) 294-4566, IRB@iastate.edu

او مدير المشروع

(515) 294-3115

او مكتب توثيق الابحاث

Iowa State University, Ames, Iowa 50011

PARTICIPANT SIGNATURE امضاء المشارك

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document and that your questions have been satisfactorily answered. You will receive a copy of the written informed consent prior to your participation in the study

توقيعك يشير إلى أنك موافق على شروط المشاركة في هذه الدراسة ، أن هذه الدراسة قد تم شرحها لك ، وإنك قد أعطيت الوقت الكافي لقراءة الوثيقة وأن أسئلتك قد تم تقديم إجابة كافية لها. سوف تتلقى نسخة من الموافقة الخطية المسبقة على علمك بالمشاركة في هذه الدراسة

Participant's Name (printed) الرجاء كتابة اسمك كاملا

(Participant's Signature) الامضاء (Date) التاريخ

Dear participant:

I am a doctoral candidate in the Department of Apparel. Educational Studies and Hospitality Management at Iowa State University of Science and Technology at Ames Iowa. I am currently working on exploring factors affecting adoption of biometrics (the science of using individual characteristics to identify individuals such as fingerprints, retinal scan, hand scan, face, and others) in Egyptian hotels. Biometrics application is intended to improve work flow and security in the lodging industry. In addition, personal benefits such as ease of use and usefulness are important to evaluate.

عزيزي المشارك :

أنا مرشح لنيل درجة الدكتوراه في ادارة علم الفنادق والمعاهد التعليمية الدراسات التربوية وإدارة الضيافة في جامعة آيوا ، في مدينة أميس بولاية أيوا. وأنا أعمل حاليا على استكشاف العوامل المؤدية لاعتماد المقاييس الحيوية (*علم باستخدام الخصائص الفردية للتعرف على الأفراد مثل بصمات الاصابع وبصمة شبكية العين ، والبصمة الصوتية للوجه ، وغيرهم*) في الفنادق المصرية. ان تطبيق المقاييس الحيوية يهدف إلى تحسين تدفق العمل والأمن في قطاع الضيافة. بالإضافة إلى ذلك ، فوائد شخصية ، مثل سهولة الاستخدام وفائدة مهمة للتقييم.

Your input on the topic of biometrics is very important because this data will help guide the development and implementation of devices that will make your life and work better and provide security improvement. This brief survey will take about 5-10 minutes to complete and is voluntary. You may withdraw from the survey at any time. Moreover, all information provided will be confidential and anonymous. For more information, you can contact Ahmed Abdelbary at 563-249-3434 or ahmed@iastate.edu.

Thank you for your participation.

مدخلاتك الخاصة بك في موضوع القياس الحيوي مهم جدا لأن هذه البيانات ستساعد على توجيه التنمية وتنفيذ الأجهزة التي من شأنها أن تجعل حياتك على نحو أفضل ، وتحسين وتوفير الأمن . هذه الدراسة وجيزة سوف يستغرق حوالي **5-10** دقيقة لإكمالها طوعية. قد تنسحب من الدراسة في أي وقت. وعلاوة على ذلك ، فإن كل المعلومات ستكون سرية ومجهولة المصدر. لمزيد من المعلومات ، يمكنك الاتصال أحمد عبد الباري في **3434-249-563** أو **ahmed@iastate.edu.**

أشكركم على المشاركة .

Sincerely,

Ahmed Abdelbary

BS. MBA.PhD Candidate

احمد عبد البارى

APPENDIX D

Letter to Embassy from Dr. Bosselman

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

College of Human Sciences
Department of Apparel, Educational Studies, and Hospitality Management
31 MacKay Hall
Ames, Iowa 50011-1121
515 294-7474
FAX 515 294-6364
e-mail aeshm@iastate.edu

April 13, 2010

Ms. Susanna J. Dedeyan
OMS-Public Affairs Office
American Embassy-Cairo
EGYPT

Dear Ms. Dedeyan:

I serve as the Chair of the Department of Apparel, Educational Studies and Hospitality Management at Iowa State University. In my capacity as a Professor, I supervise graduate students engaged in research. Mr. Ahmed Abdelbary is one of my students, and he is currently in the research phase of his degree.

Mr. Abdelbary prepared and defended his research proposal, 'Exploration of factors affecting adoption of biometrics technology in Egyptian hotels' to his five-member graduate committee, and received approval for conducting the study. As major professor to Mr. Abdelbary, I can report the graduate committee was pleased with the proposal and look forward to the results. We believe this study is cutting edge research in the field of hospitality and tourism management. Mr. Abdelbary had to submit his proposal for review by our university human subjects review board, and the proposal was approved without revision. All data obtained in the study is confidential and no individual or hotel property will be identified in the study. In order to complete his study, Mr. Abdelbary does require a sample size which was determined and approved by his graduate committee.

On behalf of Mr. Abdelbary's graduate committee, I would request consideration and support of Mr. Abdelbary's research project. Results of the study should prove useful to the Egyptian hotel industry.

Please contact me directly should you require further information.

Sincerely,

Robert H. Bosselman, Chair

APPENDIX E

Letter of Support from American Embassy in Cairo

Embassy of the United States of America

Cairo, April 15, 2010

To Whom It May Concern:

On behalf of the Public Affairs Office, I would like to state the following:

Mr. Ahmed Abdel Bary is affiliated with Iowa State University, in the United States of America. His professor, Robert Bosselman, Chair of the Department of Apparel, Educational Studies and Hospitality Management, supports the project.
It appears to be a worthwhile subject that will benefit educational and scientific exchange between the U.S. and Egypt.

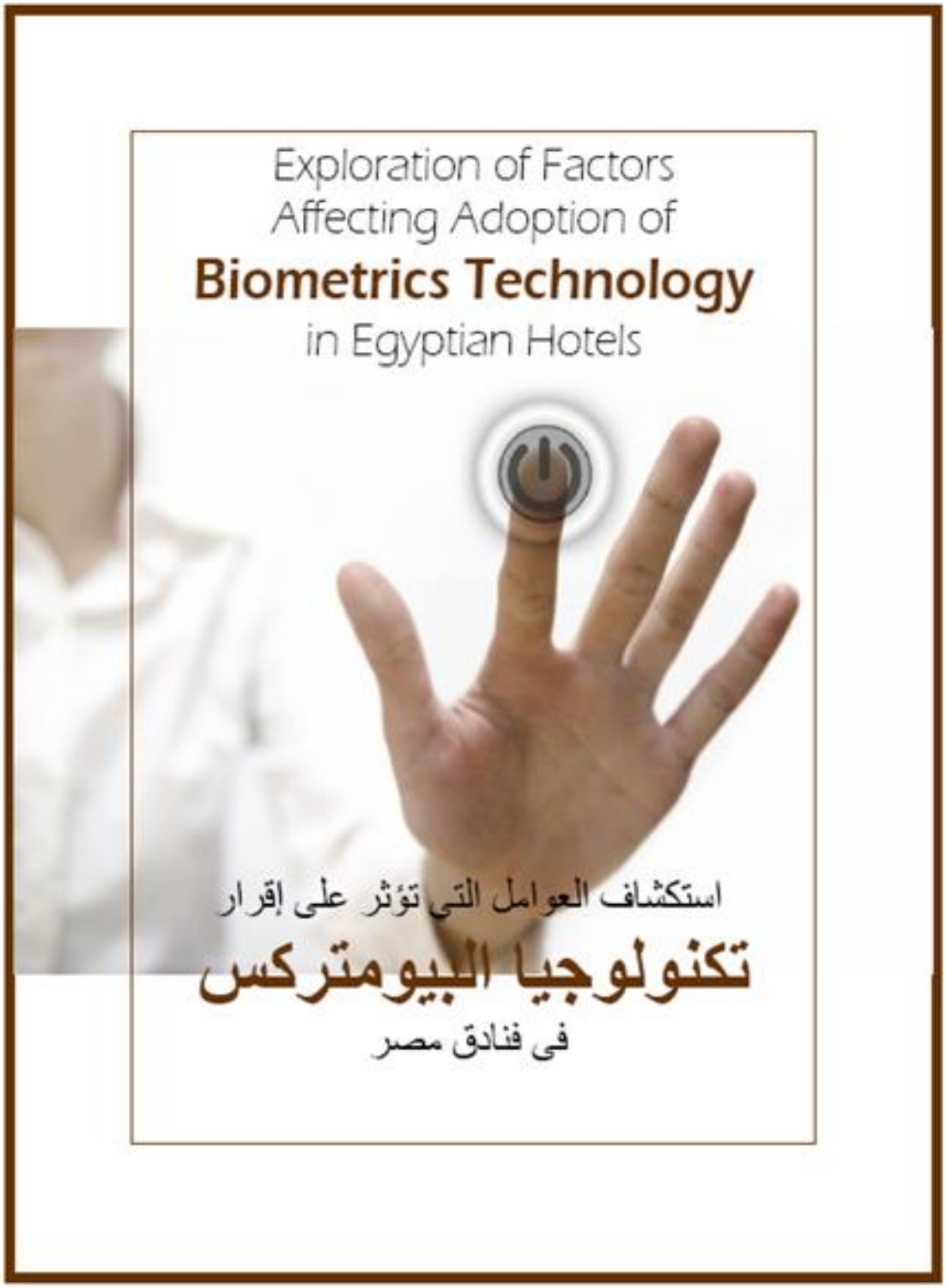
We would appreciate any assistance for Mr. Ahmed Abdel Bary.

Sincerely,

Haynes R. Mahoney
Counselor of Public Affairs
American Embassy | Cairo

APPENDIX F

Questionnaire



Survey
Appendix B

إستبيان
ملحق ب

The Title
Exploration of Factors Affecting Adoption of Biometrics Technology in Egyptian Hotels

العنوان
استكشاف العوامل التي تؤثر على إقرار تكنولوجيا البيومتركس فى فنادق مصر

Description: Biometrics, a technology to identify individuals or authenticate identity using unique physiological or behavioral automated pattern recognition, such as hand geometry, iris scan, retinal scan, fingerprint, speaker/voice recognition, and facial recognition.

التوصيف: تستخدم تكنولوجيا البيومتركس للتعرف و تحديد هوية العاملين في مجال السياحة عن طريق تكنولوجيا مطابقة البيانات البيولوجية / الفسيولوجية مثل بصمة اليد او بصمة قزحية العين ، او بصمة شبكية العين ، بصمات الأصابع ، او بالتعرف على الصوت ، اوالتعرف على الوجه.

Demographic Part 1

الديموغرافية - الجزء الاول

- What is your gender ?
  - ☐ Male
  - ☐ Female
- ما هو نوعك ؟
  - ☐ ذكر
  - ☐ انثى
- What is your age ?
  - ☐ 18-28
  - ☐ 29-39
  - ☐ 40-50
  - ☐ 51-60
  - ☐ over 60
- ما هو عمرك ؟
  - ☐ 18-28
  - ☐ 29-39
  - ☐ 40-50
  - ☐ 51-60
  - ☐ اكبر من 60
- What type of hotel do you work in ?
  - ☐ Resort
  - ☐ Metropolitan
- ما نوعية الفندق الذى تعمل به ؟
  - ☐ منتجع
  - ☐ فندق داخل العاصمة
- What is the highest level of education completed ?
  - ☐ Some high school
  - ☐ High school graduate
  - ☐ Some college
  - ☐ College
  - ☐ Post graduate
- ما هو أعلى مستوى من التعليم إنتهيت له ؟
  - ☐ قليل من الدراسة الالزامية
  - ☐ متخرج من الدراسة الالزامية
  - ☐ قليل من الدراسة الجامعية
  - ☐ انهيت الدراسة الجامعية
  - ☐ دراسات ما بعد التخرج
- What is your current marital status ?
  - ☐ Single
  - ☐ Married
  - ☐ Widow
  - ☐ Divorced
- ما هى حالتك الاجتماعية ؟
  - ☐ أعزب
  - ☐ متزوج
  - ☐ أرمل
  - ☐ مطلق

- Which department do you work in ?
  - ☐ Front Office
  - ☐ Housekeeping
  - ☐ Food &beverage
  - ☐ Accounting
  - ☐ Engineering
  - ☐ Marketing
  - ☐ Sales
  - ☐ Other Please

Please specify .....

- ما هى الادارة الذى تعمل بها ؟
  - ☐ الاستقبال
  - ☐ خدمة الغرف
  - ☐ التغذية
  - ☐ المحاسبة
  - ☐ الهندسة
  - ☐ التسويق
  - ☐ المبيعات
  - ☐ إدارات أخرى

حدد من فضلك .....

- What is your working shift ?
  - ☐ Morning shift
  - ☐ Afternoon shift
  - ☐ Night shift
  - ☐ If work only one shift

please specify .....

- ما هى الوردية التى تعمل بها ؟
  - ☐ صباحية
  - ☐ مسائية
  - ☐ ليلية
  - ☐ اذا كنت تعمل وردية ثابتة

حدد من فضلك .....

- How long have you been working in the hotel business ?
  - ☐ Less than one year
  - ☐ More than 1-less than 3 years
  - ☐ More than 3-less than 5 years
  - ☐ More than 5-less than 7 years
  - ☐ More than 7-less than 10 years
  - ☐ More than 10-less than 15 years
  - ☐ More than 15-less than 20 years
  - ☐ More than 20-less than 25 years
  - ☐ More than 25 years

- منذ متى وانت تعمل في قطاع الفندقة ؟
  - ☐ اقل من سنة واحدة
  - ☐ اكثر من سنة واقل من ثلاث سنوات
  - ☐ اكثر من ثلاثة واقل من خمسة سنوات
  - ☐ اكثر من خمسة واقل من سبعة سنوات
  - ☐ اكثر من سبعة واقل من عشر سنوات
  - ☐ اكثر من عشرة واقل من خمسة عشر سنوات
  - ☐ اكثر من خمسة عشر واقل من عشرون سنوات
  - ☐ اكثر من عشرون واقل من خمسة وعشرون
  - ☐ اكثر من خمسة وعشرون

- Please indicate your average annual income for your household ?
  - ☐ Less than 500 lb/m
  - ☐ 501-1000 EGP/M
  - ☐ 1001-3000 EGP/M
  - ☐ 3001-5000 EGP/M
  - ☐ 5001-7000 EGP/M
  - ☐ 7001-10000 EGP/M
  - ☐ More than 10000 EGP/M
  - ☐ Prefer not to respond

- الرجاء الإشارة إلى متوسط الدخل السنوي لأسرتك ؟
  - ☐ اقل من 500 ج/ش
  - ☐ 501 - 1000 ج/ش
  - ☐ 1001 - 3000 ج/ش
  - ☐ 3001 - 5000 ج/ش
  - ☐ 5001 - 7000 ج/ش
  - ☐ 7001 - 10000 ج/ش
  - ☐ اكثر من 10000 ج/ش
  - ☐ لا احبذ ذكر ذلك

- What is your native language?
  - ☐ Arabic
  - ☐ English
  - ☐ French
  - ☐ Italian
  - ☐ German
  - ☐ Others

Please specify .....

- ما هى لغتك الام ؟
  - ☐ العربية
  - ☐ الانجليزية
  - ☐ الفرنسية
  - ☐ الايطالية
  - ☐ الالمانية
  - ☐ اخرى

حدد من فضلك .....

- What is your country of origin?
  - ☐ Egypt
  - ☐ Other

Please specify .....

- ما هو بلدك الاصلى ؟
  - ☐ مصر
  - ☐ بلد

حدد من فضلك .....

Please check your general interest in technology?
  - ☐ Low
  - ☐ Medium
  - ☐ High

- ما هى اهتماماتك التكنولوجية ؟
  - ☐ قليلة
  - ☐ متوسطة
  - ☐ عالية

Part II — الجزء الثاني

- The next set of questions is designed to know the source of your knowledge of biometrics.

Select your response to the statement by circling your answer (*Yes, No*)

- للمجموعة التالية من الأسئلة مصممة لمعرفة مصدر علمك لتكنولوجيا البيومتركس. حدد ردودك على البيانات بإجابتك **بـ نعم او لا**.

I have heard about biometrics on Television سمعت عنه من خلال التلفزيون	Yes	No
I have heard about biometrics on the Radio سمعت عنه من خلال الراديو	Yes	No
I read about biometrics in the Newspapers قرأت عنه في الصحف	Yes	No
I have used it لقد استخدمته	Yes	No
Word of mouth قيل لي	Yes	No
I have never heard about biometrics لم اسمع عنها نهائيا	Yes	No

- The next set of questions are designed to explore your acceptance of biometrics in hotels and other areas to improve security using personal identification characteristic including fingerprint scan, face scan, retinal scan, Iris scan, and hand scan.

Select your response to the statement by circling your answer (*1=Strongly Disagree; 2=Disagree; 3=No Opinion; 4=Agree; 5=Strongly Agree*)

- للمجموعة التالية من الأسئلة مصممة لاستكشاف قبولك التحقق من الهوية في الفنادق وغيرها من المناطق لتحسين الوضع الأمني باستخدام خاصية تحديد الهوية الشخصية بما في ذلك فحص البصمات ، بصمة الوجه ، بصمة شبكية العين ، بصمة قزحية العين، وبصمة اليد.

تخير اجابتك بوضع دائرة حول اجابتك المفضلة - **1 اعارض بشدة 2 اعارض 3 لا رأي لدي 4 موافق 5 موافق بشدة**

Face scan is the best method of identification بصمة الوجه هي الافضل لتحديد الهوية	1	2	3	4	5
Finger scan is the best method of identification بصمة الاصبع هي الافضل لتحديد الهوية	1	2	3	4	5
Retinal scan is the best method of identification بصمة الشبكية هي الافضل لتحديد الهوية	1	2	3	4	5
Iris scan is the best method of identification بصمة قزحية العين هي الافضل لتحديد الهوية	1	2	3	4	5
Hand scan is the best method of identification بصمة اليد هي الافضل لتحديد الهوية	1	2	3	4	5

- What do you think the use of biometrics in your Hotel would provide in terms of added value?

Select your response to the statement by circling your answer (*1=Strongly Disagree; 2=Disagree; 3=No Opinion; 4=Agree; 5=Strongly Agree*)

- هل تعتقد ان استخدام البيومتركس في الفندق الذى تعمل به سيضيف قيمة ايجابية للفندق

تخير اجابتك بوضع دائرة حول اجابتك المفضلة - **1 اعارض بشدة 2 اعارض 3 لا رأي لدي 4 موافق 5 موافق بشدة**

Investment of time and effort in biometrics is profitable استثمار الوقت والجهد باستخدام البيومتركس مربح ومثمر	1	2	3	4	5
A biometric entry access system is convenient نظام البيومتركس للدخول متوافق وملائم	1	2	3	4	5
A biometric entry access system will enhance hotel security نظام البيومتركس للدخول سيعزز من امن الفندق	1	2	3	4	5
Biometrics use can improve work productivity نظام البيومتركس للدخول سيطور من الطاقة الانتاجية	1	2	3	4	5
Biometric use can improve data collection and generating reports نظام البيومتركس للدخول سيطور جمع البيانات وانتاج التقارير	1	2	3	4	5

- The next set of questions is designed to explore your thoughts about the expected performance of Biometric technology.

Select your response to the statement by circling your answer (***1=Strongly Disagree; 2=Disagree; 3=No Opinion; 4=Agree; 5=Strongly Agree***)

- للمجموعة التالية من الأسئلة صممت لاستطلاع رأيك حول الأداء المتوقع لتكنولوجيا البيومتركس.

تخير اجابتك بوضع دائرة حول اجابتك المفضلة - **1 اعارض بشدة 2 اعارض 3 لا رأي لدي 4 موافق 5 موافق بشدة**

Biometrics will increase security on all hotel access controlled areas نظام البيومتركس سيزيد الامن في جميع مناطق الفندق	1	2	3	4	5
A biometric device should be easy to use أداة البيومتركس يجب أن تكون سهلة الاستخدام	1	2	3	4	5
A biometric device would be faster than the current applied method جهاز البيومتركس من شأنه أن يكون مرنا وقابلا للتكيف مع ظروف العمل الجديدة	1	2	3	4	5
A biometric device would be flexible and adaptable to new working conditions نظام البيومتركس يجب ان يكون مرن وسريع التقبل للمستخدم الحديث	1	2	3	4	5
A properly installed biometric device is low maintenance جهاز مثبت بشكل صحيح صيانته منخفضة	1	2	3	4	5
A biometric device give activity reports at any time نظام البيومتركس يعطي نتائج النشاط في اى وقت	1	2	3	4	5

- In an effort to improve work quality and customer service, Biometrics will

Select your response to the statement, with regards to quality of the information collected, by circling your answer (***1=Strongly Disagree; 2=Disagree; 3=No Opinion; 4=Agree; 5=Strongly Agree***)

- في محاولة لتحسين نوعية العمل وخدمة العملاء مع نظام البيومتركس.

تخير اجابتك بوضع دائرة حول اجابتك المفضلة - **1 اعارض بشدة 2 اعارض 3 لا رأي لدي 4 موافق 5 موافق بشدة**

Offer information in a useful format النظام سوف تقدم المعلومات في شكل مفيد	1	2	3	4	5
Supply accurate information النظام سيوفر المعلومات الدقيقة	1	2	3	4	5
Offer clear information النظام سيقدم معلومات واضحة	1	2	3	4	5
Supply sufficient information النظام سيقوم بالتزويد بالمعلومات الكافية	1	2	3	4	5
Give up-to-date information النظام سيكون دائم على أستحدث المعلومات	1	2	3	4	5
Offer relevant and necessary information نظام البيومتركس سوف يقدم المعلومات ذات الصلة والضرورية	1	2	3	4	5

- In your opinion, where are the appropriate places to install Biometrics?

Select your response to the statement by circling your answer (***1=Strongly Disagree; 2=Disagree; 3=No Opinion; 4=Agree; 5=Strongly Agree***)

- ما هو المكان المناسب فى رأيك لتثبيت وتركيب البيومتركس

تخير اجابتك بوضع دائرة حول اجابتك المفضلة - **1 اعارض بشدة 2 اعارض 3 لا رأى لدى 4 موافق 5 موافق بشدة**

Hotel Employee entrance مدخل الموظفين	1	2	3	4	5
Employee locker خزانة الوظفين	1	2	3	4	5
Employee clock in/out ساعة توقيت الدخول والخروج للموظفين	1	2	3	4	5
Restricted area entries (Rooms , Storage areas, secure area) (المناطق المحظور دخولها (الغرف – المخازن – المناطق المؤمنة	1	2	3	4	5
Computer access منافذ الكمبيوتر	1	2	3	4	5
Other areas? Please specify مناطق اخرى سمها لو أمكن	1	2	3	4	5

- When biometrics device is applied, do you have concerns about the any of the followings?

Select your response to the statement by circling your answer (***1=Strongly Disagree; 2=Disagree; 3=No Opinion; 4=Agree; 5=Strongly Agree***)

- هل لديك ما تريد اضافته عند تشغيل جهاز البيومتركس

تخير اجابتك بوضع دائرة حول اجابتك المفضلة - **1 اعارض بشدة 2 اعارض 3 لا رأى لدى 4 موافق 5 موافق بشدة**

I am concerned if using this equipment would cause physical harm إنني أشعر بالقلق إذا كان استخدام هذه المعدات من شأنه أن يسبب الأذى الجسدي	1	2	3	4	5
I am concerned about the security of the information إنني أشعر بالقلق إزاء أمن المعلومات	1	2	3	4	5
I am concerned about identity theft إنني أشعر بالقلق إزاء سرقة الهوية	1	2	3	4	5
I am concerned about my own privacy اشعر بالقلق حيال خصوصيتي الذاتية	1	2	3	4	5
I am concerned about who has access to the information إنني أشعر بالقلق إزاء الذي يملك حق الوصول إلى المعلومات	1	2	3	4	5
Other concerns? Please specify هل لديك اشياء اخرى تبعث على القلق, سجلها لو امكن	1	2	3	4	5

Thank You

Thank you for participating in this survey. Your responses help us provide better educational options for you. We greatly appreciate your time and feedback.

Ahmed Abdelbary

APPENDIX G

Tables 6, 8, 10, 14, 16, 18, 20, 22

Table 6. *Frequencies and Percentages of the Demographic Variables (N = 809)*

Variable	Frequency	Percentage
Gender		
Male	711	87.9
Female	98	12.1
Age in years		
18 to 28	399	49.3
29 to 39	310	38.3
40 to 50	76	9.4
51 to 60	23	2.8
Over 60	1	0.1
Highest level of education		
Some high school	109	13.5
High school graduate	234	29.0
Some college	130	16.1
College graduate	304	37.7
Post-graduate	30	3.7
Marital status		
Single	420	51.9
Married	364	45.0
Widow(er)	14	1.7
Divorced	11	1.4
Salary per month		
Less than 500	126	15.6
501 to 1,000	256	31.6
1,001 to 3,000	153	18.9
3,001 to 5,000	67	8.3
5,001 to 7,000	32	4.0
7,001 to 10,000	7	0.9
More than 10,000	21	2.6
Prefer not to mention	96	11.9
Missing data	51	6.3
Number of years of experience		
Less than 1	155	19.2
More than 1, but less than 3	168	20.8
More than 3, but less than 5	153	18.9
More than 5, but less than 7	92	11.4
More than 7, but less than 10	87	10.8
More than 10, but less than 15	80	9.9
More than 15, but less than 20	48	5.9
More than 20, but less than 25	18	2.2
More than 25	8	1.0

Table 6 (continued)

Variable	Frequency	Percentage
Type of hotel		
Resort	537	66.4
Metropolitan	272	33.6
Department		
Front office	97	12.0
Housekeeping	137	16.9
Food and beverage	208	25.7
Accounting	109	13.5
Engineering	33	4.1
Marketing	23	2.8
Sales	30	3.7
Other	172	21.3
Work shift		
Morning	522	64.5
Afternoon	185	22.9
Night	56	6.9
No shift	38	4.7
Missing data	8	1.0

Table 8. *Overall Responses and Mean and SD (N=809)*

	mean	**SD**
Type of biometric device		
Finger print	3.46	1.30
Retinal scan	3.43	1.36
Iris scan	2.89	1.43
Hand scan	2.85	1.35
Face scan	2.66	1.45
Appropriate location of device		
Employee entrance	3.86	1.34
Employee clock in/out	3.77	1.24
Restricted area	3.47	1.36
Computer access	3.29	1.33
Employee locker	3.24	1.38
Others	2.98	1.31
Performance of Biometrics		
Ease of use	4.05	1.02
Flexibility and adaptability	4.02	1.00
Speed	3.95	1.00
Low maintenance	3.88	1.08
Security of restricted areas	3.87	1.19
Timely reports	3.72	1.12
Biometrics information quality		
Clear information	3.94	0.99
Accurate information	3.90	1.06
Sufficient information	3.88	1.07
Up-to-date information	3.83	1.02
Relevant	3.82	1.06
Useful format	3.78	1.18
Added value		
Enhance security	3.92	1.08
Data collection and reports	3.72	1.12
Profitable	3.69	1.25

Improve productivity	3.65	1.13
Convenience	3.60	1.08

Table 8 (continued)

	mean	**SD**
Concerns about biometrics use		
Physical harm	3.25	1.45
Who has access to information	3.25	1.30
Information security	3.23	1.21
Identity theft	3.23	1.31
Privacy	3.21	1.31
Other concerns	2.79	1.30

Table 10. *Frequencies and Percentages of the Demographic Variables (N=719)*

Variable	Frequency	Percentage
Gender		
Male	638	88.7
Female	81	11.3
Age in years		
18 to 28	359	49.9
29 to 39	272	37.8
40 to 50	69	9.6
51 to 60	18	2.5
Over 60	1	.1
Highest level of education		
Some high school	100	13.9
High school graduate	220	30.6
Some college	112	15.6
College graduate	262	36.4
Post-graduate	25	3.5
Marital status		
Single	384	53.4
Married	312	43.4
Widow(er)	13	1.8
Divorced	10	1.4
Salary per month		
Less than 500	117	16.3
501 to 1000	229	31.8
1001 to 3000	137	19.1
3001 to 5000	54	7.5
5001 to 7000	27	3.8
7001 to 10000	7	1.0
More than 10000	18	2.5
Prefer not to mention	82	11.4
Number of years' experience		
Less than 1	146	20.3
More than 1 but less than 3	148	20.6
More than 3 but less than 5	139	19.3
More than 5 but less than 10	152	21.1
More than 10	134	17.8
Type of hotel		
Resort	475	66.1
Metropolitan	244	33.9

Table 10 (continued)

	Frequency	Percentage
Department		
Front office	82	11.4
Housekeeping	126	17.5
Food and beverage	196	27.3
Accounting	93	12.9
Engineering	21	2.9
Marketing	19	2.6
Sales	27	3.8
Other	155	21.6
Work shift		
Morning	461	64.1
Afternoon	165	22.98
Night	53	7.4

Table 14. *Descriptive Analysis by Age*

Variable	Age group	*N*	Mean	Std. Deviation	Minimum	Maximum
Concern about technology	18 - 28	359	3.1685	.94445	1.00	5.00
	29 - 39	272	3.1170	.94568	1.00	5.00
	40 - 50	69	3.3237	.93099	1.00	5.00
	51 and over	19	3.2719	.98164	1.00	5.00
	Total	719	3.1667	.94453	1.00	5.00
Quality of the information	18 - 28	359	3.8928	.79611	1.17	5.00
	29 - 39	272	3.8609	.88143	1.00	5.00
	40 - 50	69	3.7367	.90947	1.00	5.00
	51 and over	19	3.5439	.89035	1.00	5.00
	Total	719	3.8565	.84385	1.00	5.00
Knowledge about biometrics	18 - 28	359	.2827	.18349	.00	1.00
	29 - 39	272	.3235	.20376	.00	1.00
	40 - 50	69	.2947	.18556	.00	.83
	51 and over	19	.3860	.20826	.00	.83
	Total	719	.3020	.19328	.00	1.00
Ease of use	18 - 28	359	3.9448	.75423	1.17	5.00
	29 - 39	272	3.8781	.88025	1.00	5.00
	40 - 50	69	3.9130	.75169	1.00	5.00
	51 and over	19	3.4211	.82845	1.00	4.67
	Total	719	3.9026	.80875	1.00	5.00
Value	18 - 28	359	3.7276	.83719	1.00	5.00
	29 - 39	272	3.6397	.90942	1.00	5.00
	40 - 50	69	3.7072	.95399	1.00	5.00
	51 and over	19	3.4000	.83799	1.60	5.00
	Total	719	3.6837	.87710	1.00	5.00
Location of device	18 - 28	347	3.4947	.80285	1.50	5.00
	29 - 39	264	3.3750	.85785	1.17	5.00
	40 - 50	66	3.2803	.88538	1.67	5.00
	51 and over	19	3.4211	.86668	2.00	5.00
	Total	696	3.4270	.83516	1.17	5.00

Table 14 (continued)

Variable	Age group	*N*	Mean	Std. Deviation	Minimum	Maximum
Technological intent	18 - 28	359	1.9359	.68407	1.00	3.00
	29 - 39	272	1.8603	.65055	1.00	3.00
	40 - 50	69	1.7246	.68350	1.00	3.00
	51 and over	19	1.8947	.73747	1.00	3.00
	Total	719	1.8860	.67449	1.00	3.00

Table 16. *Descriptive Analysis by Education*

Variable	Education	*N*	Mean	Std. Deviation	Min	Max
Concern about technology	Some high school	100	3.0650	.82501	1.00	5.00
	High school graduate	220	3.1061	.92864	1.00	5.00
	Some college	112	3.2232	1.00289	1.00	5.00
	College and post graduate	287	3.2265	.97063	1.00	5.00
	Total	719	3.1667	.94453	1.00	5.00
Quality of the information	Some high school	100	3.4467	.81094	1.00	5.00
	High school graduate	220	3.7326	.86614	1.00	5.00
	Some college	112	3.9107	.79567	1.83	5.00
	College and post graduate	287	4.0732	.78809	1.00	5.00
	Total	719	3.8565	.84385	1.00	5.00
Knowledge about	Some high school	100	.3417	.22270	.00	1.00
	High school graduate	220	.3061	.19249	.00	1.00
	Some college	112	.2902	.19081	.00	1.00
	College and post graduate	287	.2898	.18263	.00	.83
	Total	719	.3020	.19328	.00	1.00
Ease of use	Some high school	100	3.4733	.84311	1.00	5.00
	High school graduate	220	3.8470	.81669	1.00	5.00
	Some college	112	4.0208	.71138	1.67	5.00
	College and post graduate	287	4.0488	.77144	1.00	5.00
	Total	719	3.9026	.80875	1.00	5.00
Value	Some high school	100	3.3260	.89968	1.40	5.00
	High school graduate	220	3.6164	.91287	1.20	5.00
	Some college	112	3.7500	.86097	1.00	5.00
	College and post graduate	287	3.8341	.80788	1.00	5.00
	Total	719	3.6837	.87710	1.00	5.00

Table 16 (continued)

Variable	Education	*N*	Mean	Std. Deviation	Min	Max
Location	Some high school	97	3.2268	.79901	1.50	5.00
	High school graduate	216	3.3264	.80652	1.17	5.00
	Some college	111	3.4685	.86003	1.17	5.00
	College and post graduate	272	3.5613	.83972	1.67	5.00
	Total	696	3.4270	.83516	1.17	5.00
Technological intent	Some high school	100	1.5900	.66810	1.00	3.00
	High school graduate	220	1.6818	.62566	1.00	3.00
	Some college	112	1.9107	.67855	1.00	3.00
	College and post graduate	287	2.1359	.61933	1.00	3.00
	Total	719	1.8860	.67449	1.00	3.00

Table 18. *Descriptive Analysis by Salary*

Variable	Salary	*N*	Mean	SD	Min	Max
Concern about technology	Less than 500 E.P./month	117	3.2835	.92000	1.00	5.00
	501—to 1000	229	3.1579	.97504	1.00	5.00
	1001—3000	137	2.9672	.98577	1.00	5.00
	>3001	106	3.0676	.92146	1.00	5.00
	Prefer not to mention	82	3.4207	.86710	1.00	5.00
	Total	671	3.1587	.95458	1.00	5.00
Quality of the information	Less than 500 E.P./month	117	3.5513	.91640	1.17	5.00
	501—to 1000	229	3.8828	.82465	1.00	5.00
	1001—3000	137	3.9343	.82455	2.00	5.00
	>3001	106	3.8899	.88458	1.00	5.00
	Prefer not to mention	82	3.9512	.77180	1.67	5.00
	Total	671	3.8450	.85343	1.00	5.00
Knowledge about	Less than 500 E.P./month	117	.2977	.22084	.00	1.00
	501—to 1000	229	.2846	.18117	.00	1.00
	1001—3000	137	.3175	.19996	.00	1.00
	>3001	106	.3805	.19620	.00	.83
	Prefer not to mention	82	.2419	.14381	.00	.67
	Total	671	.3035	.19451	.00	1.00
Ease of use	Less than 500 E.P./month	117	3.6425	.93241	1.00	5.00
	501—to 1000	229	3.8923	.79352	1.00	5.00
	1001—3000	137	4.0207	.75717	2.00	5.00
	>3001	106	3.9686	.85762	1.00	5.00
	Prefer not to mention	82	3.9593	.74239	1.17	5.00
	Total	671	3.8952	.82389	1.00	5.00
Value	Less than 500 E.P./month	117	3.4479	.91223	1.00	5.00
	501—to 1000	229	3.6245	.88343	1.20	5.00
	1001—3000	137	3.8292	.86315	1.40	5.00
	>3001	106	3.7660	.93380	1.00	5.00
	Prefer not to mention	82	3.8268	.77285	1.00	5.00
	Total	671	3.6826	.88802	1.00	5.00

Table 18 (continued)

Variable	Salary	N	Mean	SD	Min	Max
Location	Less than 500 E.P./month	113	3.3909	.89275	1.17	5.00
	501—to 1000	220	3.4068	.84581	1.67	5.00
	1001—3000	135	3.4469	.82248	1.67	5.00
	>3001	102	3.4248	.91697	1.17	5.00
	Prefer not to mention	79	3.5000	.73574	1.67	5.00
	Total	649	3.4266	.84660	1.17	5.00
Technological intent	Less than 500 E.P /month	117	1.6496	.60624	1.00	3.00
	501—to 1000	229	1.7904	.62807	1.00	3.00
	1001—3000	137	1.9635	.69036	1.00	3.00
	>3001	106	2.2170	.71720	1.00	3.00
	Prefer not to mention	82	1.9390	.57408	1.00	3.00
	Total	671	1.8867	.66847	1.00	3.00

Table 20. *Descriptive Analysis by Years of Experience*

Variable	Experience	*N*	Mean	SD	Min	Max
Concern about technology	< 1 year	146	3.2340	.82503	1.17	5.00
	>1 year < 3 years	148	3.2038	.97218	1.00	5.00
	>3 years < 5 years	139	3.0695	1.04390	1.00	5.00
	>5 <7 years	77	3.0866	.98476	1.00	5.00
	>7 <10 years	75	3.0756	.90265	1.00	5.00
	>10, <15 years	73	3.1621	.86690	1.00	5.00
	> 15 years	61	3.3552	.99139	1.00	5.00
	Total	719	3.1667	.94453	1.00	5.00
Quality of the information	< 1 year	146	3.7683	.77765	1.50	5.00
	>1 year < 3 years	148	3.8243	.83135	1.17	5.00
	>3 years < 5 years	139	3.9424	.81024	1.67	5.00
	>5 <7 years	77	3.8225	.80629	1.67	5.00
	>7 <10 years	75	3.8844	.85071	1.67	5.00
	>10, <15 years	73	4.0274	.83980	1.33	5.00
	> 15 years	61	3.7541	1.09866	1.00	5.00
	Total	719	3.8565	.84385	1.00	5.00
Knowledge about biometrics	< 1 year	146	.2934	.18806	.00	1.00
	>1 year < 3 years	148	.3063	.19735	.00	1.00
	>3 years < 5 years	139	.3010	.19232	.00	1.00
	>5 <7 years	77	.2835	.18350	.00	.83
	>7 <10 years	75	.3133	.17959	.17	.83
	>10, <15 years	73	.3128	.22213	.00	1.00
	> 15 years	61	.3115	.19597	.00	1.00
	Total	719	.3020	.19328	.00	1.00
Ease of use	< 1 year	146	3.7660	.76328	1.00	5.00
	>1 year < 3 years	148	3.8671	.80436	1.00	5.00
	>3 years < 5 years	139	4.0156	.80804	1.17	5.00
	>5 <7 years	77	3.8853	.75619	2.17	5.00
	>7 <10 years	75	3.9644	.75650	1.67	5.00
	>10, <15 years	73	4.0502	.80970	1.67	5.00
	> 15 years	61	3.8279	.99998	1.00	5.00
	Total	719	3.9026	.80875	1.00	5.00

Table 20 (continued)

Variable	Experience	*N*	Mean	SD	Min	Max
Value	< 1 year	146	3.5329	.83551	1.40	5.00
	>1 year < 3 years	148	3.6905	.85693	1.20	5.00
	>3 years < 5 years	139	3.7079	.85237	1.60	5.00
	>5 <7 years	77	3.7169	.83499	1.00	5.00
	>7 <10 years	75	3.7307	.79355	1.60	5.00
	>10, <15 years	73	3.8411	.93983	1.00	5.00
	> 15 years	61	3.6852	1.11263	1.00	5.00
	Total	719	3.6837	.87710	1.00	5.00
Location	< 1 year	141	3.4137	.79995	1.67	5.00
	>1 year < 3 years	145	3.4632	.86835	1.17	5.00
	>3 years < 5 years	133	3.4749	.84549	1.67	5.00
	>5 <7 years	76	3.3092	.75459	1.67	5.00
	>7 <10 years	69	3.4058	.75919	1.67	4.83
	>10, <15 years	72	3.4306	.85340	1.83	5.00
	> 15 years	60	3.4333	.98300	1.17	5.00
	Total	696	3.4270	.83516	1.17	5.00
Technological intent	< 1 year	146	1.7877	.68691	1.00	3.00
	>1 year < 3 years	148	1.8108	.69352	1.00	3.00
	>3 years < 5 years	139	1.9209	.66009	1.00	3.00
	>5 <7 years	77	1.9221	.68376	1.00	3.00
	>7 <10 years	75	1.9867	.64710	1.00	3.00
	>10, <15 years	73	1.9315	.63089	1.00	3.00
	> 15 years	61	2.0000	.68313	1.00	3.00
	Total	719	1.8860	.67449	1.00	3.00

Table 22. *Descriptive Analysis by Department*

Variable	Department	*N*	Mean	SD	Min	Max
Concern about technology	Front Office	82	3.1870	.95560	1.33	5.00
	Housekeeping	126	3.1124	.91914	1.00	5.00
	Food beverage	196	3.0859	.98861	1.00	5.00
	Accounting	93	3.1129	.97125	1.00	5.00
	Engineering	21	3.2619	.81406	1.00	4.50
	Marketing	19	3.0175	.70688	2.00	4.50
	Sales	27	3.1914	.81742	1.67	5.00
	Other	155	3.3355	.94319	1.00	5.00
	Total	719	3.1667	.94453	1.00	5.00
Quality of the information	Front Office	82	3.9553	.86743	1.33	5.00
	Housekeeping	126	3.6415	.83747	1.00	5.00
	Food beverage	196	3.9532	.84053	1.00	5.00
	Accounting	93	3.8566	.86169	1.67	5.00
	Engineering	21	3.9444	.69589	2.83	5.00
	Marketing	19	3.5175	.93276	2.17	5.00
	Sales	27	3.4938	.70783	2.33	5.00
	Other	155	3.9495	.81592	1.00	5.00
	Total	719	3.8565	.84385	1.00	5.00
Knowledge about biometrics	Front Office	82	.3354	.20200	.00	1.00
	Housekeeping	126	.2751	.19812	.00	1.00
	Food beverage	196	.3121	.20458	.00	1.00
	Accounting	93	.3226	.19475	.00	.83
	Engineering	21	.2937	.18185	.17	.67
	Marketing	19	.4649	.23293	.17	1.00
	Sales	27	.3457	.16619	.00	.67
	Other	155	.2548	.14993	.00	.67
	Total	719	.3020	.19328	.00	1.00
Ease of use	Front Office	82	3.9146	.85074	1.00	5.00
	Housekeeping	126	3.7500	.79352	1.00	5.00
	Food beverage	196	3.9872	.80063	1.00	5.00
	Accounting	93	3.9964	.82202	1.00	5.00
	Engineering	21	3.9683	.59772	2.67	5.00
	Marketing	19	3.3596	.88238	2.17	5.00
	Sales	27	3.5185	.74296	2.17	5.00
	Other	155	3.9817	.78048	1.00	5.00
	Total	719	3.9026	.80875	1.00	5.00

Table 22 (continued)

Variable	Department	*N*	Mean	SD	Min	Max
Value	Front Office	82	3.6317	.92934	1.60	5.00
	Housekeeping	126	3.5984	.79377	1.40	5.00
	Food beverage	196	3.7745	.93126	1.00	5.00
	Accounting	93	3.7247	.82405	1.00	5.00
	Engineering	21	3.7714	.83015	2.20	5.00
	Marketing	19	3.4000	.92376	2.20	5.00
	Sales	27	3.2000	.82088	1.20	4.80
	Other	155	3.7484	.85973	1.00	5.00
	Total	719	3.6837	.87710	1.00	5.00
Location	Front Office	82	3.5346	.86612	1.83	5.00
	Housekeeping	123	3.2385	.78612	1.67	5.00
	Food beverage	190	3.4096	.89294	1.17	5.00
	Accounting	91	3.5293	.81293	1.17	5.00
	Engineering	20	3.2750	.62892	2.00	5.00
	Marketing	18	3.3519	.95296	1.67	4.83
	Sales	25	3.3133	.81126	2.17	4.67
	Other	147	3.5329	.78868	1.67	5.00
	Total	696	3.4270	.83516	1.17	5.00
Technological intent	Front Office	82	2.1098	.68504	1.00	3.00
	Housekeeping	126	1.6667	.59330	1.00	3.00
	Food beverage	196	1.8520	.66683	1.00	3.00
	Accounting	93	2.1290	.64649	1.00	3.00
	Engineering	21	2.0000	.70711	1.00	3.00
	Marketing	19	2.0526	.77986	1.00	3.00
	Sales	27	1.9259	.67516	1.00	3.00
	Other	155	1.8000	.66840	1.00	3.00
	Total	719	1.8860	.67449	1.00	3.00