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IMPROVEMENT OF SERVICE QUALITY BY USING UBIQUITOUS COMPUTING IN HOSPITALITY

Complete Research

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Abstract

Economies of developed countries are primarily based on the services sector, where the hospitality industry plays an important role. As such, new service design and service innovation are vital for maintaining competitive advantage. Recently, ubiquitous computing has emerged as a key enabler in various industries in support of service innovation by facilitating the design of new services. This study aims to investigate the benefits provided by ubiquitous computing in the hospitality domain for improved service quality, customer satisfaction, and profitability. First, the literature on service quality is presented, and important quality dimensions are selected accordingly. After providing a brief review of related technologies and existing applications, a ubiquitous computing framework is proposed in support of innovative services for the hotel industry. Via the analysis of the framework, changes in business processes are exposed and the contributions of ubiquitous computing are discussed according to the identified service quality dimensions.

Keywords: Ubiquitous Computing, Service Innovation, Hospitality, Service Quality, Servqual

1 Introduction

Western as well as rapidly developing economies are highly dominated by the service sector as a result of its continuous expansion (McKee, 2008). In countries such as UK, USA, France, Italy, and Japan, the services sector has about 80% contribution to these economies (IMF, 2013), which are significantly transformed from manufacturing-based into service-based (Wladawsky-Berger, 2009). Progress in the tourism and hospitality sector is a key issue in this transformation (Lorde et al., 2011). While customers are faced with numerous service offerings, there are many similar and easily substitutable services, resulting in higher customer expectation and increased competition. An important driver for economic growth is, therefore, the development of new, innovative services such as electronic services, mobile end-user services, or new personalized services. Service innovation, defined as introducing radical changes and developing new designs, procedures, methods and service concepts (Burrill et al., 1998), combines four trends that currently shape the western economies: the growing importance of services, the need for innovation, changes in consumer and business markets, and the advancements in information and communication technology (ICT).

Innovation processes are comprised of multi-disciplinary activities that require combining expertise and experience in various fields. One of the latest paradigms in ICT describes ubiquitous computing consisting of information-processing, communication-technology and computer-performance through embedding sensors, actuators and processors in the environment. It is expected that this new paradigm

will change the organization in various industries for introducing new services within the context of service innovation. The term ubiquitous computing appeared chronologically just before the Internet boom and the proliferation of computer use (many computers per person), (Weiser, 1991).As a result of recent developments in ICT, ubiquitous computing is being utilized in various industries for introducing new services within the context of service innovation.

Hospitality firms, such as hotels are good examples with demonstrated benefits due to service innovation providing differentiation in the market (Victorino et al., 2005) and keeping up pace with the rapid change in information and communication technology (Olsen et al., 2000). First, from a customer's perspective, the hospitality market is perpetually inundated by many similar, often easily substitutable service offerings. Hotels can enhance their offerings with innovative features for customers so that they have the chance to differentiate themselves from their competitors (Reid et al., 1992). Second, in order to stay competitive in such a dynamic environment, managers need to make innovative changes that focus even more intensely on customer preferences, quality, and technological interfaces (Karmarkar, 2004). Third, travelers do not demonstrate truly brand loyal behavior. Travelers instead choose to patronize hotels that offer the best value proposition under existing budgetary constraints (Olsen et al., 2000). Because of these reasons, many studies have been performed on ICT implementation and integrated system design issues in hospitality (Buhalis, 1998; Stephen et al., 2005; Korzay et al., 2002). However there is lack of studies related to performing service innovations provided by ubiquitous computing in the hospitality industry. In the current study, we intend to fill this gap by incorporating ubiquitous computing and services designed around them with the goal of providing service innovation around an integrated ubiquitous computing framework for the hospitality industry.

Accordingly, the purpose of this study is to present the impact of this ubiquitous computing framework for increasing service quality, employee efficiency, revenue, and customer satisfaction. In the next section, we provide a literature review on service quality, followed by an overview of ubiquitous computing and existing applications in the hospitality industry. After that, we present a ubiquitous computing framework followed by a hypothetical scenario highlighting the capabilities of the framework and the associated innovative services for the hotel industry. Finally, the benefits provided by this framework are discussed, and the conclusion is given, in the corresponding sections.

2 Literature Review

2.1 Service Quality in Hospitality

As competition increases, improving the quality of service offerings becomes more important in the service sector, and can be accomplished by providing value-added services in the hotel industry, where improved quality increases market share, customer satisfaction, and profitability significantly (Hoffman et al., 1997; Oke et al., 2008). Similarly, Berry (1991) shows that there is a positive relationship between perceived quality and organizations' financial performance. Hence, interest in service quality has increased recently as demonstrated by a growing literature related to service quality in the hotel industry.

Available literature provides plenty of service quality measurement methods proposed by several researchers (Cronin et al., 1992; Erto et al. 2002; Franceschini et al., 1997; Parasuraman et al., 1985; Philip et al, 1997; Schvaneveldt et al., 1991; Teas, 1994). Most of these studies aim to define dimensions of service quality and give importance to these dimensions by taking into consideration customer evaluations obtained by surveys. Most of them are based on the SERVQUAL approach

proposed by Parasuraman et al. (Parasuraman et al., 1985, 1988), since these dimensions are suitable for all service industries (Gilbert et al., 2002).

Parasuraman et al. first define ten SERVQUAL dimensions: access, communication, competence, courtesy, credibility, reliability, responsiveness, security, tangibles, and understanding/knowing the customer for the service sector including health services, transport, airline, and hotel. Then the researchers reduce these ten dimensions to five by combining some of them. These five dimensions are tangibles, reliability, responsiveness, assurance (credibility, security, competence, courtesy), empathy (communication, understanding/knowing the customer, access). Akbaba (2006) provides definitions for these dimensions in Table 1:

Dimension	Definition
Tangibles	Physical facilities, equipment, and appearance of personnel.
Reliability	Ability to perform the promised service dependably and accurately.
Responsiveness	Willingness to help customers and provide prompt service.
Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence.
Empathy	Caring, individualized attention the firm provides its customers.

Table 1. The Definitions of SERVQUAL Dimensions

Several studies focus on service quality in the hotel industry (e.g., Ekinci et al., 2003; Juwaheer, 2004; Mei et al., 1999). Mei et al. (1999) examine the dimensions of service quality in the hotel industry in Australia. They develop a scale referred to as HOLSERV, which is based on the SERVQUAL instrument. They conclude that service quality is represented by three dimensions in the hotel industry, given as ‘‘employees’’, ‘‘tangibles’’ and ‘‘reliability’’. Knutson et al. (1990) present LODGSERV for measuring service quality in the hotel industry, where five service quality dimensions are highlighted together with their order of importance for evaluating service quality: ‘‘reliability’’ with the highest rank, followed by ‘‘assurance’’, ‘‘responsiveness’’, ‘‘tangibles’’, and ‘‘empathy’’.

A possible approach for improving service quality is through service innovation which refers to replacing an existing system with a better one (Burill et al., 1998). Hence, in our study, the use of ubiquitous computing is proposed for service innovation in the hotel industry, and its effects on service quality are evaluated using the dimensions of SERVQUAL.

2.2 Ubiquitous Computing

Mark Weiser (1991) coined the term “Ubiquitous Computing” which is used to be describe an approach where many network connected computing devices, resources and technologies are available throughout the physical environment, but invisible to users. The spirit of his vision is the existence of such an environment saturated with communications and computing capabilities. The idea of weaving computers seamlessly into the physical environments provides embedded computation everywhere while these technologies are disappearing into the background. Its highest ideal is to make a computer so embedded, so fitting, so natural, that we use it without even thinking about it. As a result, people do not have to focus on the computer itself and carry out their work with the assistance of such a computing infrastructure. Weiser envisions a world full of connected computers in the form of tabs, pads and boards, cheap wireless networks and information accessible everywhere.

At the time of Weiser’s article, this was a vision ahead of its time. Today, various elements of ubiquitous computing are beginning to appear and becoming useful in their own right, as increasing numbers of devices and objects become addressable (have a unique ID) and connected (usually

wirelessly) through significant improvements regarding hardware, sensors, wireless communications and global networking, both technically and economically. Such developments include fiber optics for data transmission providing nearly limitless bandwidth (Gilder, 1993), human voice controlled systems used for new generation user interfaces (Tatai, 1997) and discoveries on image processing (Roska et al., 1993). Similarly, improvements regarding wireless networking and cloud computing technologies facilitate flexible collaboration of connected devices.

The key elements that devices/objects/nodes in a ubiquitous computing environment need are: *identification, location, sensing and connectivity. Identification* is vital for objects and devices to usefully become part of a wider intelligent, information sharing network. Radio Frequency Identification (RFID) tags containing tiny microchips attached to antennae (transponders) are used to give unique identities to objects and devices. The data on these chips can be read by a wireless reader (transceiver) and are passed back to supporting computer systems. *Location* information which adds another important level of intelligence to the objects and devices allows the discovery of people, objects and resources and enables location based services. Global Positioning System (GPS) chips are used to provide location information. *Sensing* capability can give systems 'eyes and ears' creating intelligent networks that can collect a range of data and even respond to events. Sensor networks consisting of sensor(s) connected to micro-controllers, memory, batteries and radios are used in order to achieve sensing capability. Typically sensors can measure things like pressure, temperature, speed, air/water quality, stress, humidity, or acceleration. And, *connectivity* is provided by wireless information sharing networks.

2.3 Ubiquitous Computing in Hospitality

Regarding the impact of ubiquitous computing technologies in the hospitality domain, the available examples are mostly in the form of Radio Frequency Identification (RFID) based deployments.

As seen in Table 2, most of the ubiquitous applications currently found in the hospitality market are primarily focused on the RFID technology; hence integration with other ubiquitous computing technologies is missing. We aim to fill this gap with the proposed ubiquitous framework given in the next section.

Systems	Examples
Contactless systems	• Keyless room entry (O'Connor, 2006; Collins,2006) • Cashless payment (O'Connor, 2006) • RFID-enabled member cards (Kugler, 2011)
Assets and valuables tracking systems	• Inventory control and alcohol consumption tracking (Swedberg, 2011) • Food and beverage management (Swedberg, 2008) • Towel tracking and inventory control (O'Connor, 2009)
Human tracking and control systems	• Children tracking in LegoLand (Collins, 2006) • Cruise ships (Swedberg, 2010), • Amusement parks (SafeTzone Technology Corporation, 2002), • Ski resorts (Vail Resorts, 2010).
Information systems	• RFID Electronic Tickets in Expo 2010 (Du, 2010) • Museum in the Exploratorium (Raptis et al., 2005) • Tracking and reporting visitors performance for games and competitions (Contagious, 2010)
Tour Systems	• Automating message displays on signs to give personalized guest directions (Event Solutions, 2007) • Automating social networking posts (Contagious, 2010, Vail Resorts, 2010).

Table 2. Ubiquitous Computing Examples in Hospitality

3 The Proposed Ubiquitous Computing Framework

Our main objective in designing the proposed framework is to address automation issues related to ubiquitous computing systems within a multimodal and multimedia environment. We intend to automate services and application selection according to user and hardware profiles, and optimally configure them automatically, when possible.

Components of the proposed framework (Figure 1) are users (hotel customers and staff), mobile devices (smartphones, tablets, or kiosks in the hotel), software applications installed on these devices, device access manager, privacy manager, task manager, performance manager, information manager, services manager, application manager, server, profile manager and databases for tasks, services, and profiles.

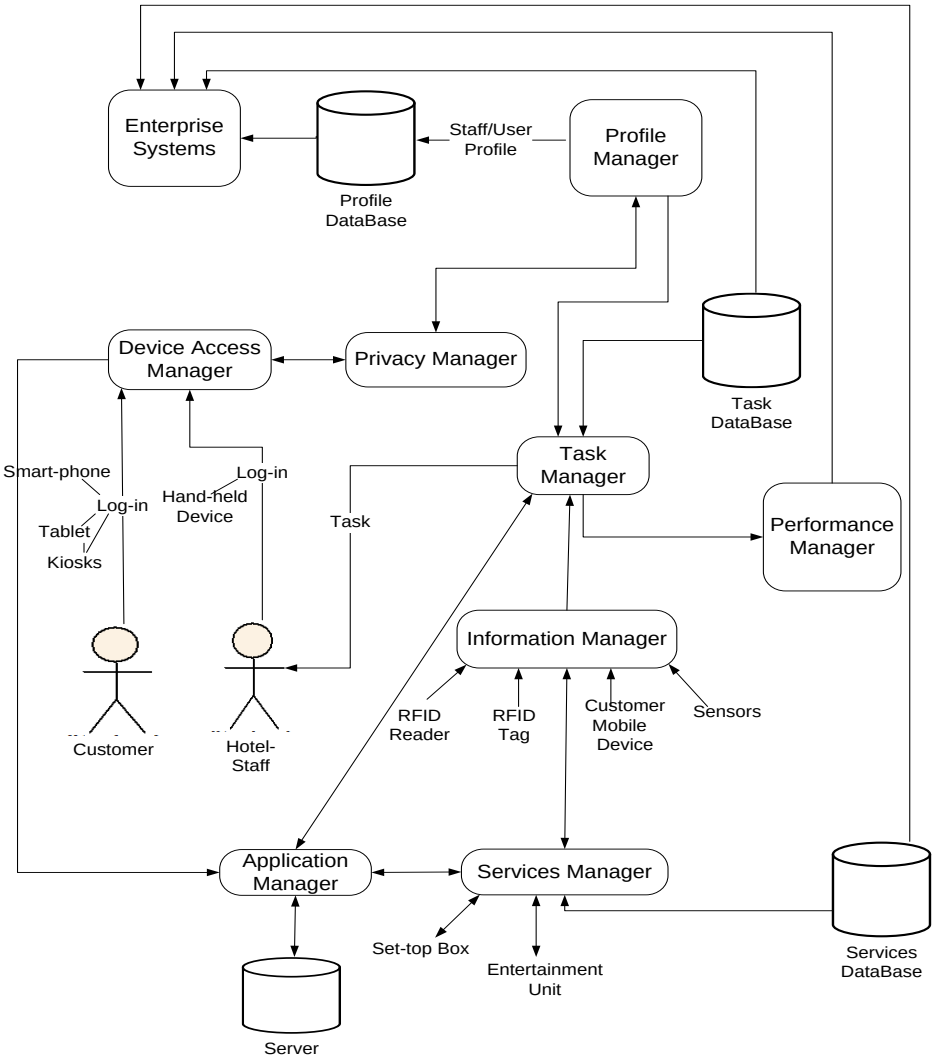

Figure 1. The Proposed Ubiquitous Computing Framework

The Device Access Manager (DAM) deals with devices such as smart phones, personal digital assistants (PDA), kiosks, and desktop computers, and resides on devices that the users utilize to access the ubiquitous system. It manages a set of software agents: Notification Agent, Session Agent and Service Agent. The Notification Agent manages announcements sent to and received by the current user of the device. The Session Agent manages the user activities during the session. The Service

Agent manages components needed to provide services to the current user's device. The utilized components are stored in a local cache, and provided on demand to the Session agent.

The Security and Privacy Manager (SPM) uses pre-defined security policies based on user profiles for preventing non-authorized access.

Task Manager is responsible for all tasks carried out by the hotel-staff. Based on the information collected from other manager modules, the Task Discovery Agent creates the tasks and assigns them to the corresponding hotel-staff based on their profiles.

Service Manager is in charge of services available through the ubiquitous system. Service components are stored in a database, which the Services Manager will access when looking for a specific service. Upon demand, the Application Manager sends posts to Service Agents located on computing devices such as smart phones, tablets or kiosks, as well as to the Service Handler in the Services Manager module. The Services Manager communicates with the Information Manager, set-top box, and entertainment units in order to provide the service. Services are stored in the database communicating with the enterprise applications in the hotel such as ERP, CRM and SCM.

Profile Manager manages the user/hotel staff profiles database. It communicates with the Security and Privacy Manager in order to respond to requests on user profile information. It communicates with the service agent for providing users' preferences needed to adapt the services. Profile databases are communicating with the enterprise applications of the hotel such as CRM.

Information Manager handles data received from various sensors and contains algorithms which transcribe the data received from sensors and send this information to the Services Manager.

Application Manager manages applications installed on the computing devices with networking capabilities, e.g. smart phone, PDA, kiosks, desktop computer. The Notification Agent manages inputs sent to and received by the current user of the device. It communicates with the Service Manager if the input requires a service and with the server if updating data stored in the databases is necessary.

4 Hypothetical Scenario

A hypothetical scenario is sketched in order to help convey the ''look and feel'' of such a hotel managed with the proposed ubiquitous framework. We have deliberately chosen a scenario which appears feasible in the near future. Services provided in the hypothetical scenario are supported by the proposed ubiquitous framework. These services can be summarized as follows; self-check-in, concierge, identity recognition, personalization, in-room resource access, in-room ambience adjustment, in-room service access, tracking children via RFID-enabled wristbands, contactless payment, smart waitresses, information access, smart mini-bar, and employee performance management. Before starting to use these services, it is assumed that the user is authenticated, and the necessary profile information is loaded for adapting the services.

Fred and his wife Jane decide to go on vacation with their son, 4 years old. Fred uses his smart-phone to find the most suitable hotel. He completes the self-check-in process by selecting their room before coming to the hotel through the application installed on his mobile phone which provides functionalities of not only self-check-in, but also customized service interactions by offering different language options for foreign travelers. After a long journey, when they arrive at the hotel, they don't have to wait for availability of the receptionist, because Fred uses his NFC enabled mobile phone. Since all related information is already loaded on the phone securely through the mobile application, he uses the device as the key for the hotel-room. They find the room at the most desirable temperature, since in-room resource access intelligently adjusts comfortable temperature settings, and thermostat levels based on the outside temperature and their personal preferences as well as turning thermostat

down at desired intervals and air conditioner off when no one is in the room. Fred can also control and monitor the room through his mobile device. When Fred opens the door of mini-bar, he finds their favorite drinks, since hotel management stores and uses past history of guests regarding TV, climate, mini-bar usage, and consumed services are stored in the profile database. When same guests enter the room next-time, the room environment settings are automatically adjusted, and the mini-bar orders drinks according to their preferences. As they start to plan the day, Fred uses voice commands to get information about entertainment activities in the hotel instead of calling reception desk. The smart-large display screens automatically start to show daily activities of the hotel, and breakfast/lunch time and menus. Then, the smart- large display screens turn into customized wall-papers and they go out of the room. Fred's son wants to go to the game-center in the hotel; Fred uses his mobile phone to find where the game-center is. Concierge service is provided within the mobile application in the form of a hotel guide including descriptions of different facilities in the hotel such as spa, pool, fitness room as well as touristic places nearby. Multimedia content is used in order to provide more comprehensive visualization. They leave their son wearing a RFID-enabled wrist-band at the game-center of the hotel which is a large and crowded area. Then, a dialog box pops up on Fred's mobile phone screen offering them to go to spa and they decide to go there while the boy is having fun in the game-center. Fred can track his son through his mobile device while getting a massage at the spa. They also give a smart card with predefined expense limits to the boy in order to control his expenses in the game-center. As his wife gets thirsty, Fred orders drinks from the bar and uses his NFC enabled mobile phone for the payment. After leaving the spa center, they are looking for their son before dinner; Fred uses his mobile phone to find his exact location. They find him easily and all go to a restaurant in the hotel for dinner. A waitress recommends them their favorite dishes by looking at his hand-held device. The hotel-staff in the restaurant uses the software installed on his hand-held device for recommending menu items to customer by using customers' past preferences for lunch and dinner selections as well as their demographic information. The orders arrive in a short-time with the help of the employee performance management which captures service and waiting times in the queues through real-time information retrieved from deployed sensors and the software installed in the hand-held devices used by the hotel-staff. After dinner, they take a walk around the hotel; Fred uses his mobile phone for viewing the hotel environment with virtual computer-generated overlay information in the form of sound and graphics, and accordingly the information about the surrounding hotel environment becomes interactive and digitally manipulatable. When they arrive to their room, they realized that consumed drinks in the mini-bar in the afternoon are replenished. Since RFID reader in the mini-bar which reads RFID tags placed on the bottles send consumed information and hotel staff has informed about consumption through their mobile device, the staff replenishes immediately. The real-time data for the inventory of each item are stored so that any guest doesn't face a problem such as running short of a drink. Jane realizes that although there is less number of hotel-staff in the hotel, service levels are incredibly high. Before going to bed, Jane wants to take a shower, she uses voice commands to adjust the water temperature and pressure and activates smart large display screens to show video which makes her feel like having shower under waterfall. After the shower, she enters the bedroom and the room is automatically lighted and after going to bed, the lights are automatically turned off. Sensors in the room track the conditions and send necessary messages to the air conditioner so as to balance temperature and humidity in the room even when they are sleeping. In case of an emergency case concerning the guests' health status, this system will be able to call the doctor. Moreover, sensors can be placed into toilet in order to measure blood and sugar in urine. By means of these sensors, measurement results can be supplied to the guest on a regular basis and if a problematic situation is sensed, then necessary first aid precautions will be immediately taken. When their vacation ends, Fred completes check-out process through his mobile phone, consumptions from mini-bar are added automatically to the bill and he pays the bill through the mobile application.

5 Benefits of the Proposed Framework

The components of the framework are developed with the intent to provide increased service quality, customer satisfaction, customer loyalty, and employee efficiency, as well as decreased costs for inventory, labor, and energy consumption. As a result, it is aimed that the business revenue will increase, and competitive advantage and brand differentiation will be achieved.

5.1. Improved Service Quality

This ubiquitous computing framework and the associated services improve the quality dimensions within the SERVQUAL model given in Section 2. When we consider each of these quality dimensions, it is seen that using this framework affects all of them positively, as explained below.

For the ***reliability*** dimension; using functional hotel equipment such as hand-held devices, kiosks, or smart mini-bars and in-room service access with voice recognition has a positive impact on this dimension. Services are provided automatically instead of being performed by the hotel staff, reducing human error. Automatic-billing before check-out or the concierge services obtained through the kiosks or the mobile application can be given as examples. Additionally, providing hotel services as promised also improves the *reliability* dimension due to reduction of denial of services (Paryani et al., 2010).

For the ***responsiveness*** dimension; offering services such as check-in, or concierge carried out by the customer himself instead of the hotel-staff, or the smart-waitress reduce work-load of hotel employees. Thus, they have more time to respond to vital customer requests and to give attention to guests' specific needs. Paryani et al. (2010) state that willingness to help the guest and always responding guests' requests have positive relationship with responsiveness. Thus, using the ubiquitous technologies improves the *responsiveness* dimension.

For the ***empathy*** dimension; the more work load exists on hotel staff, the more pressure is felt by them. The staff, whose stress level is decreased, can more easily put themselves into customers' shoes. Additionally, personalization service makes customers feel special by providing automatically adjusted room settings, filling mini-bar with drinks according to past preferences when the guest enters the room next time. Since these achievements help pay more attention to guests' specific needs, they improve the *empathy* dimension (Paryani et al., 2010).

For the ***assurance*** dimension; since the identity recognition service defines access permission of each guest beforehand, no one can enter a designated location without permission. This service makes guests feel safe and secure which is defined as a customer requirement for the *assurance* dimension by Paryani et al., (2010). Thus, using these technologies improves the *assurance* dimension of the SERVQUAL model.

For the ***tangibles*** dimension; using easy-to-use devices such as smart-phones, tablets or kiosks for almost all services, and deployment of smart large display screens for offering more comfortable room environment through in-room ambience adjustment service are related to the *tangibles* dimension defined by Paryani et al., (2010), hence improving this dimension.

5.2. Increased Customer Satisfaction

Customer satisfaction is the key issue in the hospitality industry, and is increased by reducing waiting times in the queues with the deployment of the employee performance management service, by finding information about places in the hotel by using the augmented reality applications as part of the information access service, and by providing all preferred drinks in the smart mini-bar. In addition, personalization is achieved by capturing user preferences for the room environment (e.g. light,

temperature), TV, and mini-bar usage results so that when the same guests enter the room next-time, the room environment is adjusted automatically, and the mini-bar is filled with drinks they prefer. Menu options are recommended based on the guests' past preferences, as well. These collected preferences are used in the hotel CRM system for customer segmentation in order to offer highly demanded packets and inform customers about packets they prefer. This data are used for service innovation as well, which results in brand differentiation, competitive advantage, and loyalty.

5.3. Increased Profitability and Productivity

Data collected within this framework are used as part of the three main enterprise systems; one of them is CRM, collected data is transformed into meaningful information in CRM in order to provide brand differentiation, competitive advantage and loyalty. For instance; customers' profile information is used for appropriate customer segmentation, and offering different campaigns based on this information helps increase the number of customers, and the revenue of the hotel. Using data captured in the personalization service provides customer satisfaction and loyalty.

Data such as real-time consumption, replenishment time, and real-time stock levels are collectable through the integrated framework. For example; smart mini-bars reduce inventory levels of the drinks based on actual consumption, and trigger automatic ordering. Thus, inventory cost of the drinks is reduced. The SCM system transforms these data into meaningful information in order to help reduce inventory costs.

The last enterprise system using the data gathered through the integrated framework is ERP, where captured data such as service time and waiting time in the queues are used for improving operational efficiency and hotel-staff performance in the ERP system. For instance; the self-check-in service eliminates the process carried out by the receptionist. Thus, work-load on the employees and labour costs are reduced. Additionally, the smart mini-bars send messages for restocking to the hand-held devices of the employees, so that they don't have to physically enter every room. This reduces labour cost, as well. The in-room resource access service reduces energy expenses of the building. The employee performance management and the recommendation engine increase efficiency of the employees, and decrease labour cost.

6 Challenges Associated with the Proposed Framework

6.1. Affordability

In addition to mobile phones, tablets, and wifi connectivity, many new small devices such as sensors, RFID tags, need to be provided. As of now it may appear that only large establishments in the hospitality industry may be able to afford such a setup. Whether this would influence smaller players and remote locations is an important question that needs to be addressed.

6.2. Cost Justification and Feasibility

Performing cost justification and feasibility study is an important issue that needs to be addressed. Service operations provided by this framework not only provide a simplified approach, but also a whole new way of doing business. Similarly, the framework presents a whole new aspect of customer loyalty and satisfaction. For example, tracking children have been considered an issue of security and tried to be resolved with conventional surveillance approaches involving direct contact of personnel or camera systems. With the help of this framework, the same requirement is fulfilled by a novel customer-oriented approach.

Operation eliminations, reducing workloads as well as quantifying premises of customer loyalty should be taken into consideration for cost justification and feasibility analysis of the framework. This requires additional analysis and new approaches.

6.3. Privacy and Security

Westin (1967) defines privacy as ‘‘the ability of the individual to control the terms under which personal information is acquired and used.” The concern about privacy in ubiquitous computing is quite significant and also applicable to the hospitality domain. The constant tracking of hotel guests and the continuously collected data may pose potential privacy and security risks, if not handled properly. Improper access control is another related issue that needs to be tackled. In addition, it has to be taken into consideration that there may be an increased possibility of forgery at a large scale in ubiquitous computing, as everything becomes virtual.

7 Conclusion

Ubiquitous computing was envisioned in 1990s and developers still bring many innovative products to the market every day. In its product life cycle, it is seen that ubiquitous technologies are still in their early-adoption stages, and have not reached their maturity levels, yet. However, many enterprises have noticed the importance of these technologies due to the benefits they provide. Therefore, the idea of using ubiquitous technology in the hospitality domain brings many innovations as explained in this study. In the hypothetical scenario, the proposed integrated ubiquitous computing framework for the hotels provides reduced labour and inventory costs, as well as increased revenues, customer satisfaction, and employee efficiency. Data collected within this framework are used as part of the CRM system in order to provide brand differentiation, competitive advantage and loyalty. Additionally, since the framework supports the reliability, responsiveness, empathy, assurance, and tangibles dimensions of the SERVQUAL model, it improves service quality comprehensively.

Although there are many predicted advantages of using these systems, cost justification should not be ignored. Cost-benefit analysis of the proposed framework should be performed in order to assess the feasibility of deploying these technologies. Other obstacles for the proposed framework are privacy and ethics related issues which should be taken into consideration as part of the implementation of these systems. Finally, interviews with hotel managers, staff-members, customers and technology professionals should be carried out for a realistic case study.

References

McKee, D. (2008). Services, growth poles and advanced economies. Service Business: An International Journal, 2(2), 99–107.
IMF (2013), International Monetary Fund, World Economic Outlook Database, World Development Indicators http://databank.worldbank.org/data/download/WDI-2013-ebook.pdf (Accessed on 22-02-2014)
Lorde T., Francis B. & Drakes R. (2011), Tourism Services Exports and Economic Growth in Barbados, The International Trade Journal, 25:2, 205-232
Burrill, C.W., Ledolter, J., (1998). Achieving Quality Through Continual Improvement. Wiley, New York.
Collins J. (2004), Lost and Found in Legoland, RFID Journal, http://www.rfidjournal.com/article/view/921 (Accessed on 22-02-2014)
Victorino, L., Verma, R., Plaschka, G., Dev, C., (2005). Service innovation and customer choices in the hospitality industry. Managing Service Quality 15 (6), 555–576.
Olsen, M.D. and Connolly, D.J. (2000), Experience-based travel, Cornell Hotel and Restaurant Administration Quarterly, Vol. 41 No. 1, pp. 30-40.
Buhalis, D., (1998). Strategic use of information technologies in the tourism industry. TourismManagement19/5,409–421.
Stephen, M.O., Ocholla, D.N., (2005). Information and communication technologies in small and medium scale tourism enterprises in Durban, South Africa. Information Development 21 (4), 283–294.Korzay, M., Chon, J., 2002. Impact of information technology on cultural tourism. Annals of Tourism Research 29, 264–266.
Karmarkar, U., (2004). Will you survive the services revolution? Harvard Business Review 82 (6), 100–108.
Reid, R.D., Sandler, M., (1992). The use of technology to improve service quality. Cornell Hotel and Restaurant Administration Quarterly 33, 68–73.
Murakami, T. (2004). Ubiquitous networking: Business opportunities and strategic issues. Nomura Research Institute Papers No. 79.
Murakami, T., & Fujinuma, A. (2000). Ubiquitous networking: Towards a new paradigm. Nomura Research Institute Papers No. 2
Weiser M. (1991), The Computer for the 21st Century, Scientific American, Vol. 265, No. 3, 94-104.
Oke, S. A., C. E. Ofiabulu, A. A. Banjo, O. G. Akanbi, and F. A. Oyawale (2008) The combined application of quality function deployment and Pareto analysis for hotel services improvement. International Journal of Productivity and Quality Management 3, no. 2:241-262.
Berry T.H., (1991), Managing the Total Quality Transformation, McGraw-Hill, New York, NY.
Cronin, J.J., Taylor, S.A., (1992). Measuring service quality: a reexamination and extension. Journal of Marketing 56 (3), 55–68.
Erto, P., Vanacore, A., (2002). A probabilistic approach to measure hotel service quality. Total Quality Management 13 (2), 165–174.
Franceschini, F., Rossetto, S., (1997). Design for quality: selecting products' technical features. Quality Engineering, 9 (4), 681–688.
Parasuraman, A., Zeithaml V. A., and Berry L. L. (1985), A conceptual model of service quality and its implications for future research. Journal of Marketing 49, no. 4:41-50.
Philip, G., Hazlett, S., (1997). The measurement of service quality: a new P–C–P attributes model. International Journal of Quality & Reliability Management 14 (3), 260–286.
Teas, R.K., (1994). Expectations as a comparison standard in measuring service quality: an assessment of a reassessment. Journal of Marketing 58 (1), 132–139.
Gilbert, D., Wong, R.K.C., (2002). Passenger expectations and airline services: a Hong Kong based study. Tourism Management 24, 519–532.

Akbaba A., (2006), Measuring service quality in the hotel industry: A study in a business hotel in Turkey, Hospitality Management 25, 170–192

Ekinci, Y., Prokopaki, P., Cobanoglu, C., (2003). Service quality in Cretan accommodations: marketing strategies for the UK holiday market. International Journal of Hospitality Management 22 (2003), 47–66.

Juwaheer, T.D., (2004). Exploring international tourists' perceptions of hotel operations by using a modified SERVQUAL approach: a case study of Mauritius. Managing Service Quality 14 (5), 350–364.

Mei, A.W.O., Dean, A.M., White, C.J., (1999). Analyzing service quality in the hospitality industry. Managing Service Quality 9 (2), 136–143

Knutson, B., Stevens, P., Wullaert, C., Patton, M., Yokoyama, F., (1990). LODGSERV: a service quality index for the lodging industry. Hospitality Research Journal 14 (2), 227–284.

Tatai P. (1997) "Open Vocabulary Speech Recognition - Brief State Report on a Research Project", Proceedings of the Polish-Czech-Hungarian Workshop on Circuits Theory, Signal Processing and Applications, September 3-7, 1997, Budapest, pp. 52-57.

Roska T. and Chua L. O., (1993) The CNN Universal Machine: An analogic array computer, IEEE Transactions on Circuits and Systems-II, Vol. 40, pp. 163- 173.

O'Connor, M.C., (2006). Great Wolf Water Park launches RFID. RFID Journal, http://www.rfidjournal.com/article/view/2211 (Accessed on 24-02-2014)

Swedberg, C. (2008). To teach bartenders how to make cocktails, just add RFID. RFID Journal. http://www.rfidjournal.com/article/view/4089 (Accessed on 22-02-2014)

Swedberg, C. (2011). Beverage Metrics serves up drink-management solution. RFID Journal. http://www.rfidjournal.com/article/view/8237 (Accessed on 22-02-2014)

O'Connor, M.C., (2008). Alta opts for RFID lift ticket. RFID Journal. http://www.rfidjournal.com/article/print/4110 (Accessed on 22-02-2014)

Kugler, L. (2011). Hotel employs RFID to woo guests. RFID Journal. http://www.rfidjournal.com/article/view/8427 (Accessed on 22-02-2014)

Collins, J. (2006), NFC-enabled Phones to Unlock Hotel Rooms, RFID Journal. http://www.rfidjournal.com/article/view/2451/ (Accessed on 22-02-2014)

Swedberg, C. (2010). World's largest cruise ship launches RFID-based passenger tracking system. RFID Journal. http://www.rfidjournal.com/article/view/7415 (Accessed on 22-02-2014)

Vail Resorts. (2010). Vail Resorts announces EpicMix™ a new online and mobile application, allowing skiers and riders a seamless and effortless way to digitally capture and share their mountain experience. http://news.vailresorts.com/article_display.cfm?article_id=1181 (Accessed on 22-02-2014)

Schvaneveldt, S.J., Enkawa, T., Miyakawa, M., (1991). Consumer evaluation perspectives of service quality: evaluation factors and two-way model of quality. Total Quality Management 2 (2), 149–161

Event Solutions. (2007). New hotel signage uses RFID to customize message to your attendee. http://www.event-solutions.com/breaking_news/new_hotel_signage_uses_rfid_to_customize_message_to_your_attende e (Accessed on 22-02-2014)

Oztaysi B., Baysan S. Akpınar F. (2009), Radio frequency identification (RFID) in hospitality, Technovation, 29 (2009), pp. 618-624

Westin, A., (1967). Privacy and Freedom. Antheneum, New York.

Parasuraman, A., Zeithaml V. A., and Berry L. L. (1988), SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. Journal of Retailing 64, no. 1:12-40.

Paryani, K., Masoudi, A. and Cudney,E. (2010) QFD application in the hospitality industry: a hotel case study, Quality Management Journal, Vol 17, No. 1, pp7-28