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Critical Success Factors of Location-Based Services

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by

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Location-based services evolved with the advancement in mobile technology and wireless technology. Researchers have studied location-based services in terms of privacy, trust, and user acceptance. Statistics suggest the percentage of location-based services users is still relatively low. Therefore, the main objective of this study was to gain a comprehensive and holistic understanding of the critical success factors of location-based services. The electronic brainstorming approach was used to gather the opinions of an expert group of practitioners, researchers, and users on the critical success factors of location-based services. Through grouping similar factors together based on past literature, 15 categories of critical success factors were developed. These 15 categories were ranked and rated according to importance. The results showed that speed, real-time or up-to-date information, cost, usefulness or benefits, and simple or ease of use are the five most important critical success factors. The results of this research highlight potential areas of research, and research and development. The results of this study also provide guidelines for practitioners to create a competitive location-based services strategy to increase consumer adoption.

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CHAPTER 1

INTRODUCTION

In today's fierce market competition, businesses are constantly on the outlook for new opportunities or strategies to attract more customers and increase profits. Mobile phones are getting smaller, having more functionality, and becoming more affordable. The advancement in mobile technology coupled with the advancement in wireless technology that provides continuous Internet connectivity have open up new opportunities for businesses to leverage on, such as location-based services.

Location-based services use the location of mobile device users to bring location-specific and personalized services and information to them. These services allow users to receive up-to-date information about their surroundings, save time and money, and make better, informed real-time choices (Kaplan, 2011). It also enables businesses to build and maintain customer relationships, increasing their profit gain potential.

There have been arguments that location-based services are just a hype. In April and May of 2011, Pew Internet Research conducted a national telephone survey to 2277 adults regarding the usage of mobile location-based services and found that only about 28 percent of all American adults use location-based services (Zickuhr & Smith, 2011). According to Chris Treadaway, author of the book Facebook Marketing: An Hour a Day, for location-based services to be a reality, than just a hype, it needs a huge user base at each location, repeated check-ins, and repeated participation from businesses (Treadaway, 2010).

Therefore, to create business value, profitability, and sustainability, practitioners and researchers need a better understanding of factors that can increase the location-based

services user base. This study aims to provide a comprehensive list of critical success factors important towards a successful implementation of such services.

This paper is organized as follows. In Chapter 2, the literature review findings from previous studies regarding the definition of LBS and the critical success factors identified will be highlighted and discussed. Next, the research methodology used in this study and its supporting arguments are explained. Then the following chapter will highlight the findings, contributions and implications discovered through this study. Lastly, Chapter 5 will wrap up this paper by providing a summary of this study and provide future research directions.

CHAPTER 2

LITERATURE REVIEW

Location-Based Services (LBS)

Location-based services emerged from a mandate called the enhanced 911 (E911) mandate (Bellavista, Kupper, & Helal, 2008). The Federal Communications Commission (FCC) established this mandate to require mobile network operators to provide accurate location information of wireless 911 callers to emergency services personnel, enabling them to locate and respond quickly to these wireless 911 callers much more quickly (Federal Communication Commission, 2001). Because of this mandatory policy, mobile network operators (e.g., AT&T and T-Mobile) and mobile device manufacturers made large investments to incorporate advanced positioning capabilities into their mobile network and mobile devices (Bellavista, Kupper, & Helal, 2008).

Businesses began developing commercial location-based services to exploit the potential of these positioning capabilities. Location-based service is an information or entertainment service, which is accessible with mobile devices through the mobile network and uses geographical position information provided by the mobile devices (Quercia, Lathia, Calabrese, Di Lorenzo, & Crowcroft, 2010; Steiniger, Neun, & Edwardes, 2006; Wang, Min, & Yi, 2008). In other words, location-based services provide information that is specific to a given location (Rainer & Cegielski, 2012). Hence, location-based service is a form of mobile services, which is services provided through a wireless Internet-enabled device.

There are five necessary elements for location-based services: mobile devices, communication network (the mobile network which sends user data and service request from the mobile terminal to the service provider), the positioning component, service and application provider, and data and content provider (Steiniger, Neun, & Edwardes, 2006). The interaction of these five key elements of location-based services enable a mobile user to search for the nearest business or service in their location proximity (e.g., an ATM or a restaurant); receive alerts (e.g., traffic jams and accident warnings); find a friend; locate taxis, service personnel, doctors, and rental equipment; schedule fleets; track objects such as packages and train boxcars; find information such as navigation, weather, traffic, and room schedules; and automate airport check-ins (Rainer & Cegielski, 2012).

To date, researchers have identified six categories of location-based services applications – infotainment services, tracking services, selective information dissemination services, location-based games, emergency support services, and location-sensitive billing (Schiller & Voisard, 2004). Table 2.1 summarizes these six categories.

Service Category	Example Application
Infotainment services	Finder applications (e.g., route, location, friend, store, restaurant, gas station, and parking) Information requests (e.g., tourist, travel, news)
Tracking services	Goods, vehicle, and fleet People (e.g., child care, elderly, sick, and offenders) Security of entities (e.g., cars) Maintenance and assistance Workforce dispatching Supply-chain and inventory
Selective information dissemination	Targeted content dissemination (e.g., advertisements)
Location-based games	Treasure hunts Scavenger hunts
Emergency support services	Emergency 911 ambulance, fire, police dispatching Roadside assistance
Location-sensitive billing	Call billing Toll payment Purchase of goods and services

Table 2.1 Categorization of LBS application adapted from Schiller and Voisard (2004)

There are two types of information delivery mechanisms commonly used for LBS – pull or push (Xu H. , Teo, Tan, & Argawal, 2010). The pull-based LBS is a type of LBS which is user initiated. Users request for specific information or service by voluntarily providing their location information (Xu, Gupta, & Shi, 2009; Xu H. , Teo, Tan, & Argawal, 2010). For example, users provide their location information to receive real-time navigational requests to the nearest auto-teller machine (Xu, Gupta, & Shi, 2009).

In contrast, the push based LBS is a type of LBS which is service provider initiated. Through positioning technologies in mobile devices, a service provider is able to sense

the location of users and sends relevant information or service to the user based on the user's location (Xu H. , Teo, Tan, & Argawal, 2010). In other words, users receive location-specific information, either with prior consent (subscription-based) or without prior consent (non-subscription-based), without having to actively request for it (Schiller & Voisard, 2004). For example, location information is used to target and send related advertisements to the user when the user is near a store (Xu, Gupta, & Shi, 2009).

The LBS communication model consists of three layers – a positioning layer, a middleware layer, and an application layer (Schiller & Voisard, 2004) (see Figure 2.1). The positioning layer is responsible for calculating the position of a mobile device with the help of a position determination equipment and the geospatial data in a geographic information system. The calculated position is then passed directly to an application. Recently mobile network operators have introduced a middleware layer between the positioning layer and the application layer to reduce the complexity of service integration, saving operators and third-party application providers' time and cost for application integration. This middleware layer manages the interoperability between networks for location data.

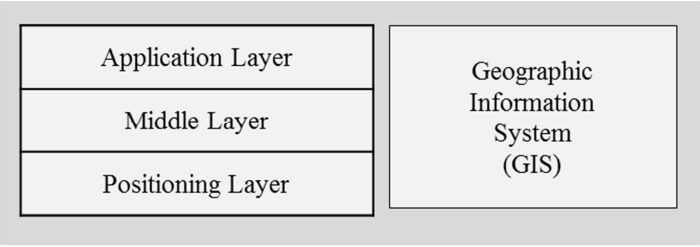

Figure 2.1 - The LBS Communication Model

Since its introduction in 2001, after the E911 mandate as a non-consumer application, location-based services are transitioning into a mature technology (Duckham, Mokbel, &

Nittel, 2007). However, location-based services have not been well received by consumers. There are several challenges that have affected the development and growth of location-based services (Dhar & Varshney, 2011). These challenges have slowed down the wide-scale adoption of location-based services, which is critical for its success.

To date, most of the research works related to location-based services have concentrated on privacy issue and very little comprehensive research has been done on critical success factors.

Another area of interest is gender differences. In related fields such as mobile commerce, several researchers have studied the influence of gender on adoption rates. For example, Li et al. (2008) studied the influence of gender on mobile commerce adoption and use. Li et al. (2008) found that there were no significant differences in the adoption rate of mobile commerce between males and females. Hyvonen and Repo (2005) studied the adoption challenges in the use of mobile services. They also found that there were no significant differences between genders in the use of mobile services. Many studies have found that the gender gap with respect to Internet use is narrowing significantly, especially with the younger age group (Rainer, Laosethakul, & Astone, 2003; Li , Glass, & Records, 2008; Ray, Sormunen, & Harris, 1999; Goodson, McCormick, & Evans, 2001; Odell, Korgen, Schumacher, & Delucchi, 2000). However, there is no study on the influence of gender differences on the adoption of location-based services, especially regarding critical success factors.

Therefore, this research aims to identify the factors that are critical to increase the adoption of location-based services. In addition, this research aims to study the impact of gender differences on these identified critical success factors.

Critical Success Factors

Critical success factors are defined as the limited number of areas that must go right to succeed (Digman, 2008). Particularly in this study, critical success factors are the factors that is prohibiting the growth of location-based services. Based on literature review of past research, several factors have been identified as prohibiting the growth of location-based services such as cost of wireless data services, information quality, industry-wide standards, pricing for LBS and its perceived value, customer trust, localization, personalization, and privacy concerns.

Cost of Wireless Data Services

Having wireless data services is crucial for users to access location-based services. According to Dhar et al. (2011), the use of wireless data services is far below the expectations of network operators (Dhar & Varshney, 2011, p. 128). They believed that this is due to the views of mobile users. Some mobile users view these services as 'nice to have' rather than 'must have'. They are not willing to pay for additional services other than the basic voice services. However, these users might reconsider their previous judgments if mobile network operators make these wireless data services more affordable or free for users. Therefore, the success of location-based services is affected by the cost of wireless data services.

Information Quality

Several researchers suggest that information quality is a critical success factor for location-based services (Lehrer, Constantiou, & Hess, 2010; Osman, Maquire, & Tarkiainen, 2003; Chang, et al., 2007; Xu H. , Teo, Tan, & Argawal, 2010).

Chae et al. (2001) studied the effects of information quality on the success of mobile Internet services. Chae et al. (2001) proposed a model of information quality (refer to Figure 2.2) that views information quality in mobile Internet services as four major dimensions: connection quality, content quality, interaction quality, and contextual quality (Chae & Kim, 2001). Connection quality is attained when user can access the mobile Internet service without any connection interruption and receive speedy responses. Content quality is achieved when the content is backed up with objective and credible arguments, and the information is useful and accurate to the user's task. Interaction quality is achieved when mobile Internet services provide easy and efficient methods of interaction in terms of the usability quality of the mobile Internet services – the structure, navigation and presentation on the mobile Internet services. In other words, the structure of information should be self-descriptive, the navigation should be easy to guide the user through the information space without making them feel lost, and the information presented should be clear and understandable. Contextual quality is achieved when users are able to use the information anytime and anywhere without spending much effort to access it; information is provided at the right time in the right place. All of these four dimensions have been found to have significant impact on user satisfaction. Among these four dimensions, they found that interaction quality and connection quality have a bigger impact on user satisfaction compared to content quality and contextual quality because connection failures and interaction difficulties can be a roadblock before the users can gain value from the information.

In addition, they studied the impact of these four dimensions on different users' goals – utilitarian and hedonic goals when using mobile Internet services (Chae & Kim, 2001). Users with utilitarian goals are those that pursue specific information while users with

hedonic goals are those that do not have a specific purpose in mind and are just using the mobile Internet services for fun. They found that users with utilitarian goals value more content quality of services while users with hedonic goals value more interaction quality in mobile Internet services.

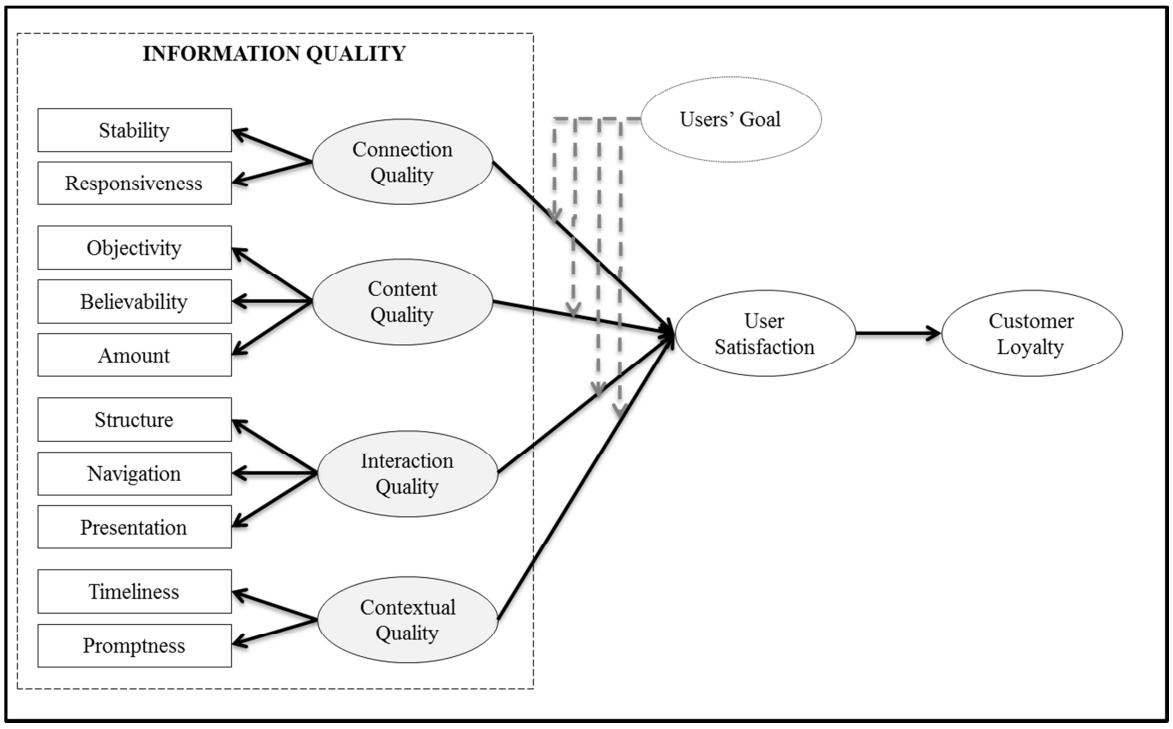

Figure 2.2 Information Quality Framework

Industry-Wide Standards

The lack of industry-wide standards in positioning technologies, services and interface among content and application providers, privacy-related procedures, and procedures for testing system accuracy is stifling the development of location-based services (Steinfield, 2004). This is a problem in the United States where there are many competing cellular networks (e.g., AT&T, Sprint, T-Mobile, and Verizon Wireless) that are using different air interfaces (e.g., 3G, 3.5G, 4G, 4G LTE) and network infrastructures to provide location-based services (Steinfield, 2004). This problem creates interoperability issue,

which inhibits the sharing of information and advancement of applications in the marketplace (Percivall, 2011). Hence, the lack of industry-wide standards can obstruct the success of location-based services.

Pricing for LBS and Perceived Value

Several researchers found that the adoption of location-based services is affected by the pricing strategy for location-based services (Dhar & Varshney, 2011; Unni & Harmon, 2003). There are several different players when it comes to determining the pricing strategy for location-based services (Steinfield, 2004). It depends on (1) content providers who offer the mapping services and geographically oriented content; (2) service providers who aggregate the mapping services and other content to create services; (3) application vendors who package services for mobile operators; (4) mobile phone manufacturers; (5) location infrastructure providers who sell the mobile location centers to network operators; (6) mobile operators who manage the infrastructure, collect the position data, offer location-based services to end subscribers, and perform billing and collection services; and (7) location middleware providers who provide tools to facilitate mobile operators' use of various applications from different providers (Steinfield, 2004).

The price that users are willing to pay depends on the perceived value (i.e., benefits) derived from the location-based services (Unni & Harmon, 2003). Perceived value is defined as the consumer's overall assessment of the utility of a product based on what is received and what is given (Zeithaml, 1988). Pura (2005) introduced six dimensions of perceived value – monetary (good value for money and acceptable price level), convenience (ease and speed of achieving a task effectively and conveniently), social (social approval and enhancement of self-image among other individuals), emotional

(play or fun), conditional (circumstances which impact choice), and epistemic (curiosity, novelty, or gained knowledge) value. He then studied the effect of these six perceived values on commitment and behavioral intentions to use location-based services (Pura, 2005). The results of this study found that commitment and behavioral intentions were most influenced by conditional value (Pura, 2005). To some extent, behavioral intentions were influenced by monetary value. They did not find significant influence of social and epistemic value on behavioral intentions to use location-based services. Therefore, pricing of LBS affects perceived value of LBS and may hinder the success of location-based services.

Customer Trust

Siau and Shen (2003) have deemed customer trust as crucial for the growth and success of mobile commerce. According to Siau and Shen (2003), trust is a key component to develop profitable customer relationship. Several studies in the electronic commerce and mobile commerce context have shown that the major reason most customers refuse to provide personal information to a website is the lack of trust in the site (McKnight, Choudhury, & Kacmar, 2002; Siau & Shen, 2003).

Trust is defined as a state involving confident positive expectations about another's motives with respect to oneself in situations entailing risk (Siau & Shen, 2003) . The process of developing customer trust is time-consuming and ongoing. The life cycle of the customer trust development starts with building the initial trust, which is crucial in order to proceed to developing the continuous trust (Siau & Shen, 2003).

Siau and Shen (2003) proposed a framework for building customer trust in mobile commerce (see Figure 2.3). In this framework, trust in mobile technology and trust in

mobile vendor are equally important to build initial customer trust and develop continuous customer trust. To build initial customer trust in mobile technology, feasibility of the technology is important. Small screens, low-resolution displays, tiny multifunction keypads, limited memory, weak battery life, wireless connection instability, low bandwidth, and unsecure wireless connection are technological roadblocks to the promising benefits of mobile commerce. Without a proper improvement in current mobile device designs and wireless networks, it is difficult to gain customer's initial trust in mobile commerce. The mobile vendors also play an important role in building initial customer trust. Several ways for mobile vendors to do this include enhancing customer familiarity, building vendor reputation, delivering high quality information, eliciting third party recognition and certification, and providing attractive rewards (e.g., free trials or gift cards).

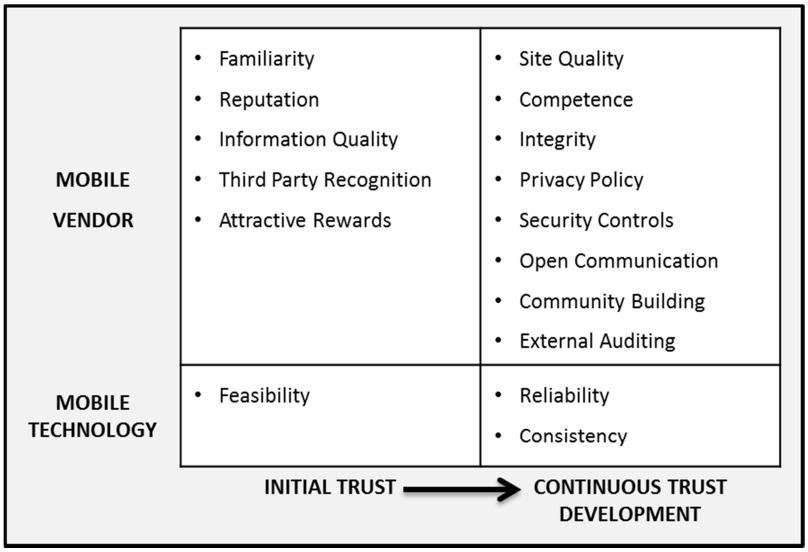

Figure 2.3 Customer Trust Framework

To maintain that initial trust, the mobile technology must prove to be reliable and consistent. Mobile vendors also must continue to improve site quality, sharpen business

competence (i.e., skills, technical knowledge, and expertise in operating mobile commerce applications), maintain company integrity, post privacy policy, strengthen security controls, foster a virtual community (create a sense of belonging for members to exchange experiences), encourage communication, increase accessibility, and use external auditing to monitor operations.

Based on this framework, the same also can be argued for location-based services, a form of mobile services. The factors influencing trust highlighted in Siau and Shen's (2003) framework are also the same factors that have been discussed in the literature review section. Hence, trust is a critical success factor in location-based services.

Localization

Localization reflects the location awareness of the mobile device; the technical capability to determine the current physical location of mobile devices (Zhong , Li , Yanbin , & Yang , 2004). The positioning technology used in LBS to determine the location of mobile users in outdoor environments can be divided into three broad categories: handset-based, cellular network-based, and hybrid approaches (Steinfield, 2004). Handset-based positioning technology refers to the mobile units that self calculates its location (Steinfield, 2004). Cellular network-based positioning technology is an approach in which the cellular network calculates the location (Steinfield, 2004). Hybrid approaches combine both handset-based and cellular network-based positioning technology (Steinfield, 2004).

The strategic consideration of these positioning technologies determines a number of factors: the degree of service quality, information quality, and perceived cost (Rao & Minakakis, 2003). Description, advantages, and disadvantages of each of these

positioning technologies are provided in Table 2.2, which is adapted from (Unni & Harmon, 2003). According to Steinfield (2004), the variety of positioning technologies might be prohibiting the development of location-based services and hence is a critical success factor for location-based services (Steinfield, 2004).

TECHNOLOGY	DESCRIPTION	ADVANTAGES	DISADVANTAGES
Cellular Network-Based			
Cell-of-origin	Information generated about the cell occupied by a user	• Inexpensive – uses existing network • No handset modification needed • Fast implementation	• Low resolution
Angle of Arrival	Measures angle of signal from mobile device to cell towers, minimum of 2 cell sites required	• No handset modification needed • No consumer behavior changes	• Expensive network modifications required • Resistance toward more antennas in neighborhoods • Line-of-sight constraint
Time Distance of Arrival	Triangulate at least 3 stations to measure and compare arrival time of signal from a user	• No handset modification needed	• Line of sight constraint • Expensive • Appropriate for CDMA devices
Enhanced Cell ID	Software-based solution that compares list of cell sites available to user and checks for overlaps	• Line of sight not required • Moderate cost to upgrade	• Works only with GSM • Some handset and network modification required
Handset-Based			
Global Positioning System (GPS)	GPS employs the triangulation method from satellites to provide location information	• Very accurate (1-5 meters) • Not dependent on network	• Need direct line of sight • Handset modification
Hybrid Technology			

Enhanced Observed Time Difference	Similar to Time Distance of Arrival technique, but handset calculates the location	• Accuracy of 50-125 meters	• Suited for GSM devices only • Need network and handset modification • Cell coverage necessary
Assisted Global Positioning Systems (aGPS)	A GPS receiver is embedded into both cell phones and the Assistance Server in the cellular network. This allows cell phones to exploit the high processing power and reference network of the server to provide the position of the user quickly without putting much burden on the processing power and battery life.	• Moderate modification to handset	• Need significant changes to network

Table 2.2 Localization Positioning Techniques

Personalization

Several researchers mentioned that personalization is a critical success factor for the adoption of location-based services (Diao & Lu, 2009; Osman, Maquire, & Tarkiainen, 2003). Personalization has been used interchangeably with customization and individualization. Personalization is defined differently according to the context it is used such as economics, marketing, information technology, and operations research. In the marketing context, personalization is about “building customer loyalty by building a meaningful one-to-one relationship through understanding the needs of each individual and helping satisfy a goal that efficiently and knowledgeably addresses each individual’s need in a given situation” (Riecken, 2000). In the user-centered design context, personalization is a “toolbox of technologies and application features used in the design

of an end-user experience" (Kramer, Noronha, & Vergo, 2000). The goal of personalization in this context is a design that brings value to end-users (Kramer, Noronha, & Vergo, 2000).

Similarly, in the LBS context, personalization is defined as the extent to which the LBS can be tailored to consumers' activity contexts, preferences, and needs (Xu H. , Teo, Tan, & Argawal, 2010). There are three aspects of personalization: time, identity and location (Diao & Lu, 2009). There are two factors that influence personalization: (1) vendor's ability to acquire and process consumer information, and (2) consumer's willingness to share information and user personalization services (Chellappa & Sin, 2005). These two factors are a challenge for mobile network operators and location-based services provider to provide the right content in the right format to the right person at the right time at the right location (Ho & Bull, 2010) and can hinder the progress or success of the LBS.

Privacy Concerns

One of the main factors that are inhibiting the growth of user adoption in LBS is privacy concerns. Several researchers have established that every technological innovation comes at a cost of information privacy (Xu, Gupta, & Shi, 2009; Stone & Stone, 1990). Privacy is defined generally as the moral right of individuals to be left alone, free from surveillance or interference from other individuals or organization, including the state (Laudon & Traver, 2001). In the information system field, privacy is defined as the right to control the collection and use of information about oneself, also called information privacy (Sheng, Nah, & Siau, 2008). A person's privacy concerns emerge if they feel that their information is exposed and they are not able to control their personal information (Sheng, Nah, & Siau, 2008). There are four dimensions of individuals' concern about

information privacy – collection of personal information, unauthorized secondary use of personal information, errors in personal information, and improper access to personal information (Sheng, Nah, & Siau, 2008).

To provide personalization in location-based services, a firm would like to acquire as much information as possible about a user before engaging in recommending resources. For example, this can be done by analyzing user's shopping history and personal history, and searching for shopping patterns and behavior. However, the user would like to obtain personalized services by providing minimal information (Murthi & Sarkar, 2003). This is because users are concerned about the confidentiality of location and personal information. While location and personal information could provide value-added personalized services to users, location and personal information could also be used to classify users and reveal their behavior (Xu H. , Teo, Tan, & Argawal, 2010). The piecing together of information, defined as combining pieces of innocuous data to create personally identifying information that the user does not wish to disclose (Van Dyke, Midha, & Nemati, 2007), can be used to identify a person's political attitude, personal interests, employer, circle of friends and acquaintances, or even health problems (Decker, 2008).

A number of adverse consequences can occur when the user's identity and location have been compromised. These consequences can range from minor irritants such as location-based spam (e.g., unsolicited proximity-based ads sent to mobile devices) to major life-threatening consequences, which can lead to grievous bodily harm (e.g., stalking, assault, rape, and robbery) (Duckham, Mokbel, & Nittel, 2007).

Xu, Gupta, and Shi (2009) conducted a study on the role of push and pull LBS through a privacy calculus lens using the Unified Theory of Acceptance and Use of Technology. From this study, they found that the level of user's privacy concerns were higher in push-based LBS than in pull-based LBS (Xu, Gupta, & Shi, 2009). They explained that privacy concerns are affected by the level of control a user have. Users have more control in pull-based LBS than in push-based LBS.

Privacy requires security (Perusco & Michael, 2007). Researchers have also looked into some of the privacy interventions as security measures. These privacy interventions include government regulation and industry self-regulation (Xu H. , Teo, Tan, & Argawal, 2010), third party privacy seals, Platform for Privacy Preferences Project (P3P) compliance (Xu, Teo, & Tan, 2005), pseudonymization (Decker, 2008); and the deliberate reduction in precision of measurement through spatial cloaking (ban-zone, mix-zone, k-anonymity) and temporal cloaking (Decker, 2008). Xu et al. (2005) found that all three of this service provider privacy and trust-related interventions could increase users' trust beliefs and reduce their privacy risk perceptions. Hence, privacy is a critical issue that may hinder the success of location-based services.

CHAPTER 3

RESEARCH METHODOLOGY

Electronic Brainstorming

The purpose of this study is to identify a comprehensive set of the critical success factors for location-based services and to study the impact of gender differences on these critical success factors. According to Digman (2008), one of the techniques for identifying critical success factors is to survey the opinion of experts in the industry. Surveying the opinion of experts in the industry is believed to provide subjective information that is very often not discovered in more objective formal and analytical approaches (Digman, 2008).

The opinion of users of mobile services and location-based services were surveyed to gain a holistic and complete view on the critical success factor of location-based services through electronic brainstorming (in addition to surveying the opinion of experts in location-based services). Electronic brainstorming is a structured technique used to generate ideas to address a specific problem (Dennis & Valacich, 1993; Gallupe, Bastianutti, & Cooper, 1991; Gallupe & Cooper, 1993; Valacich & Dennis, 1994). Electronic brainstorming is a computerized version of the traditional (face-to-face) brainstorming, a form of computer-mediated electronic communication (Dennis & Williams, 2007). In this study, a website-based electronic brainstorming was used.

Researchers have found that electronic brainstorming is able to eliminate some of the drawbacks faced in traditional (face-to-face) brainstorming such as social matching effect, production blocking, and evaluation apprehension (Gallupe, et al., 1992). In electronic brainstorming, ideas are entered simultaneously (Dennis & Valacich, 1993).

This eliminates the production blocking issue faced in traditional brainstorming. Electronic brainstorming promotes anonymous idea contribution (Dennis & Valacich, 1993). This mitigates the evaluation apprehension face in traditional brainstorming and the fear of negative reactions from other subjects (Dennis & Williams, 2007). Electronic brainstorming also allows the sharing of ideas in which subjects are able to view other subjects' ideas (Gallupe, et al., 1992). This creates synergy among subjects and has been found to be helpful especially in situations when subjects run out of ideas (Gallupe, et al., 1992). In situations like this, subjects can study the ideas generated by other subjects and build on them.

Pilot Study

A pilot study was conducted to ensure there are no software errors, system errors, and confusing questions before carrying out the actual research. A total of 54 students from the University of Nebraska-Lincoln were emailed to pilot test the website created to facilitate the electronic brainstorming. Out of these 54 students, 17 subjects responded and pilot tested the website.

From this pilot study, some ambiguities from the instructions were identified and these ambiguities were corrected. No software errors or system errors were found.

Subjects

Subjects for this study were recruited by sending invitations to experienced researchers, practitioners, and users of location-based services and mobile services through three LinkedIn groups (Location Based Services, Location Based Marketing, and Location-Based Services (LBS) Zone), AISWorld, and SIGHCI. A total of 50 subjects participated in the electronic brainstorming session.

Based on a meta-analysis of group size effects in electronic brainstorming, it was found that electronic brainstorming with group size larger than 10 members could generate more ideas than verbal and nominal brainstorming groups with the same group size (Dennis & Williams, 2007). In addition, the performance of electronic brainstorming increases as the group size increases (Dennis & Williams, 2007). Hence, a group size of 50 is adequate to gather a large number of critical success factors for location-based services.

The subjects' age range from 21 to 56 and above. Their experience with any kind of mobile services range from zero to 204 months, with an average of 95.94 months. On the average, they spend 12.64 hours a week using any mobile services. In addition, 32 of them use location-based services. The experience of these 32 subjects with location-based services as a user range from one to 168 months, with an average of 28.16 months. Interestingly, two of the 50 subjects work in the location-based services industry as a senior Oracle applications database administrator and researcher. Table 3.1 summarizes the demographic information of these subjects.

Age	16-20	0
	21-25	6
	26-30	5
	31-35	7
	36-40	11
	41-45	7
	46-50	3
	51-55	7
	56 and above	4
Gender	Female	22
	Male	28
Highest education level attained	High school	0
	Associate	2
	Bachelor	8
	Masters	8
	Ph.D.	32
	Other	0
Experience with any kind of mobile services (months)	Min	0
	Max	204
	Average	95.94
Number of hours a week that you spend using any mobile services	Min	0
	Max	140
	Average	12.64
Do you use any kind of location-based services?		
Yes		32
Experience with location-based services as a user (months)	Min 1 Max 168 Average 28.16	
Number of hours a week that you spend using location-based services (to the nearest hour)	Min 0 Max 45 Average 3.41	
No		18
Do you work in the location-based services industry?		
Yes		2
Experience working in location-based services industry (months)	Min 12 Max 168 Average 84	
Current job title in location-based service industry *1.* Senior Oracle applications database administrator *2.* Researcher		
No		48

Table 3.1 Electronic Brainstorming Subjects' Demographic Information

Data Collection

A website was created to facilitate the electronic brainstorming in our study. This website allowed subjects to enter their inputs anytime and anywhere, anonymously, simultaneously, and asynchronously. This website had four sections. The first section consisted of an introduction about location-based services, including the problem domain, a definition of location-based services as provided in the literature review section, and the purpose of this study (see Figure 3.1).

The second section provided two videos showing examples of location-based services. The first video is an example of location-based services used for marketing and advertising (http://www.youtube.com/watch?feature=player_embedded&v=FizN5m-Vh8A). The second video is an example of location-based services used for navigation, finding the nearest restaurant, and letting a person's friends knows where he/she is (http://www.youtube.com/watch?feature=player_embedded&v=84-wspPD40M) (see Figure 3.2).

In the third section, the subject would be asked to log into the brainstorming session by entering the last five digits of his or her phone number. If the subject were a new subject, he/she would be prompted to enter his/her demographic information (see Figure 3.3 and 3.4).

Once the subject logged in, the fourth section showed a current list of critical success factors generated by subjects displayed in a two-column table. These columns were titled as "critical success factors" and "descriptions". Below this table is a form with two text boxes that allow subjects to enter a new critical success factor and a short description of the critical success factors. Once the subject clicked on "submit", this new critical

success factor and its description will appear in the table at the top of the page for other subjects to see and build upon (see Figure 3.5).

Each brainstorming session took the subject approximately 5 to 10 minutes. The website was kept open for 28 days. Subjects were encouraged to return to the website multiple times to brainstorm. After each week, subjects were sent reminders to return to the website to generate more critical success factors.

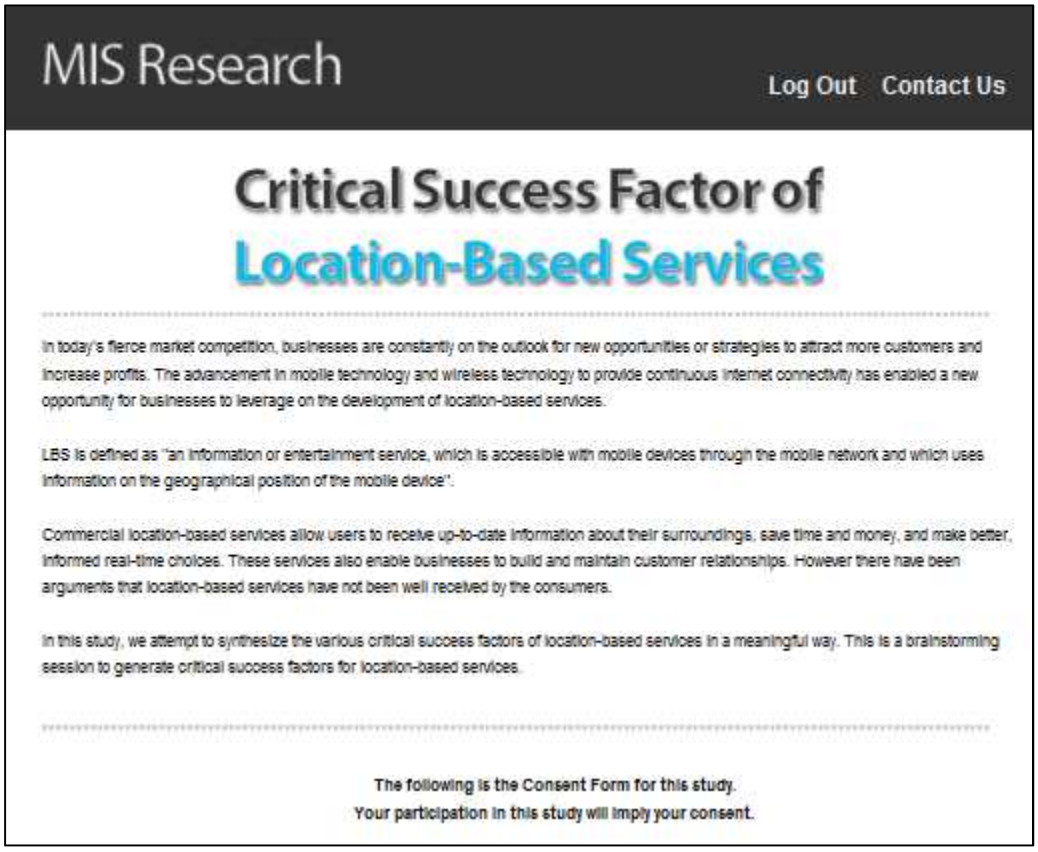

Figure 3.1 Screenshot of Introduction Page on Website

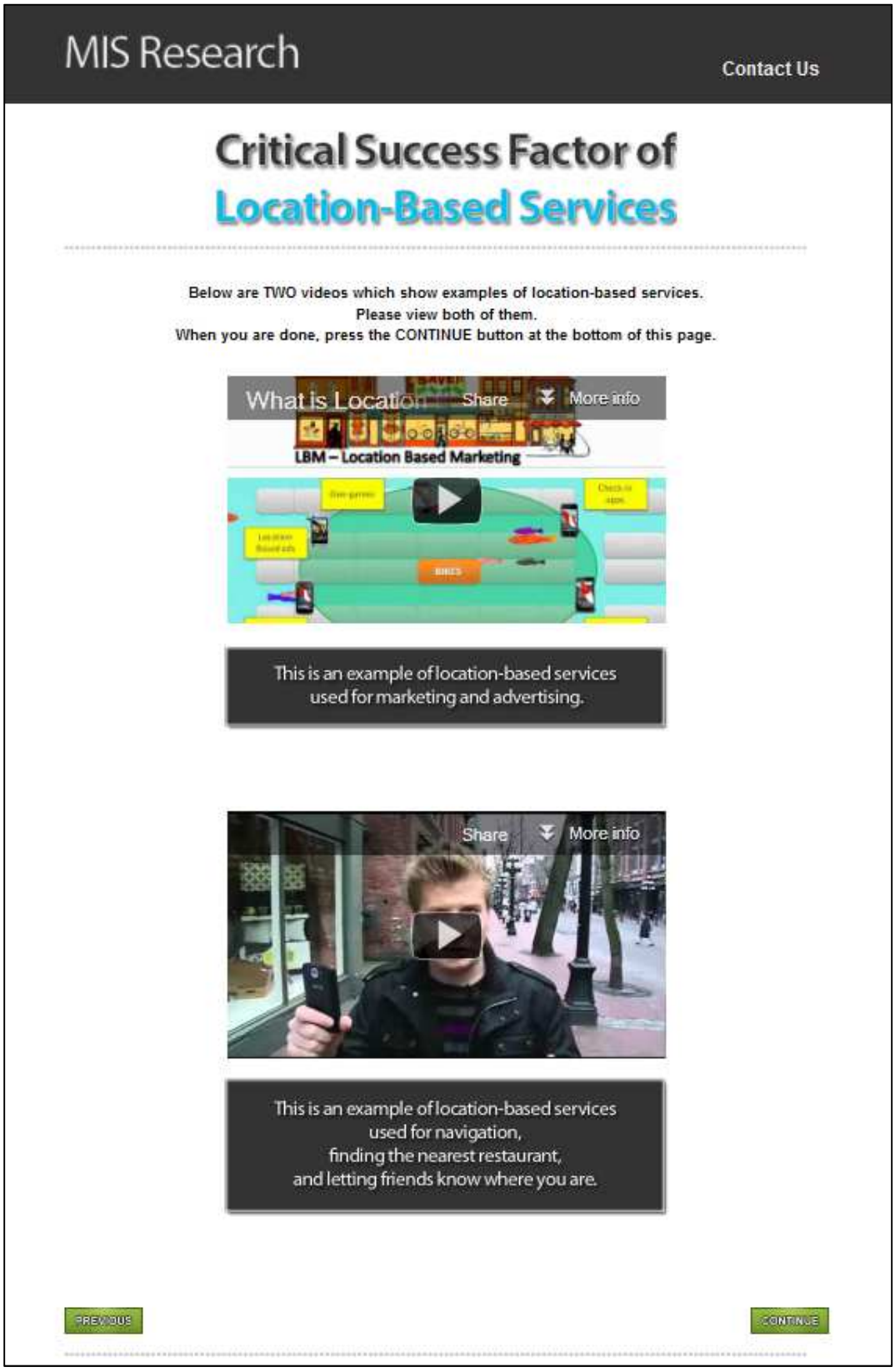

Figure 3.2 Screenshot of Video Examples Page on Website

Figure 3.3 Screenshot of Login Page on Website

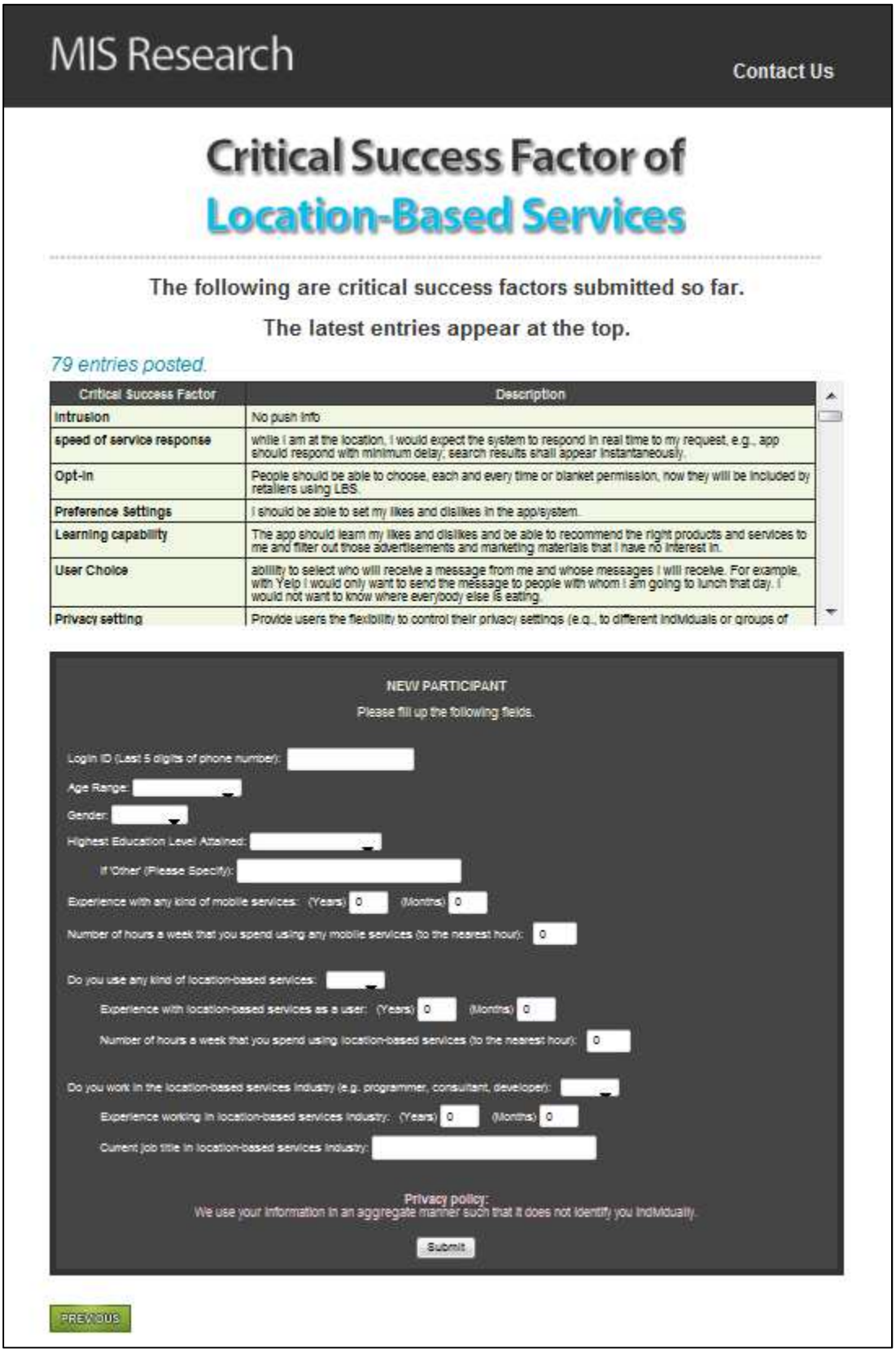

Figure 3.4 Screenshot of Page to Create a New Login ID

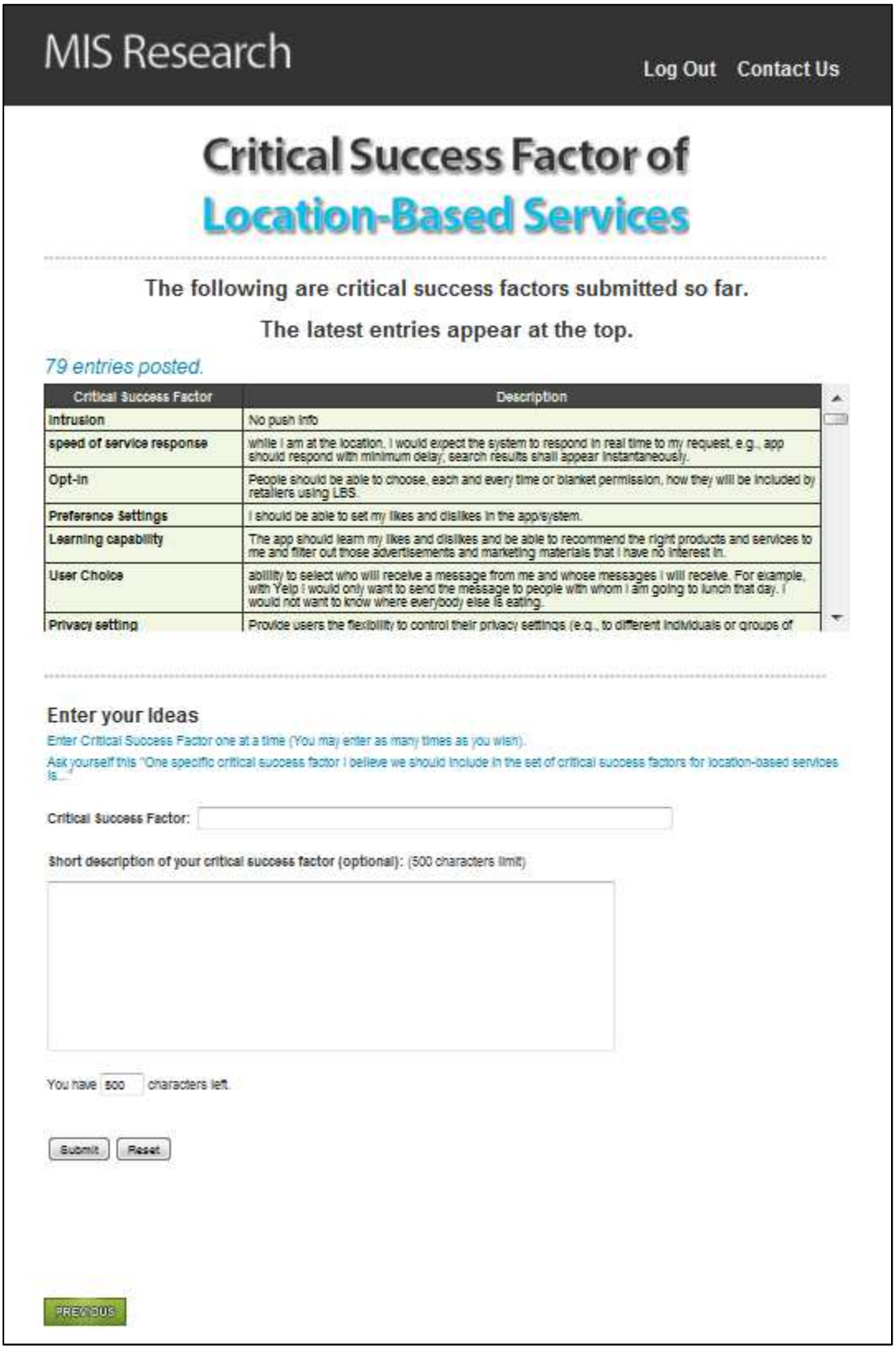

Figure 3.5 Screenshot of Page to Enter Critical Success Factors and Description

Data Analysis

After 28 days, 81 critical success factors were collected. Although from Figure 3.5, 79 entries were collected, the reason there were 81 critical success factors is because there were two of the entries had 2 critical success factors mentioned in each of them. Table 3.2 summarizes the critical success factors developed.

Critical Success Factor	Number of Times Mentioned
Real-time/Up-to-date Information	14
Personalizable/Preference Setting	12
Privacy	12
Simple/Ease of Use	9
Integrated Apps/Services	7
Usefulness/Benefits	4
Speed	4
Cost	3
Quality of Reviews	3
Standards and Platform Independence	2
Aesthetics	2
Smart LBS	2
Reliability	1
Size of application	1
Publicity of LBS	1
Scale Of Both Side Of Users	1
All Customers Must Own Smartphones	1
Credibility Of Customers	1
Changing Habits	1
Total	**81**

Table 3.2 Critical Success Factors Collected

The data analysis consisted of two phases. The first phase consisted of classifying the 81 factors generated into different categories by the primary and secondary researchers based on literature review. In this phase, the list of critical success factors generated was first separated into individual critical success factors. Then, each critical success factor was analyzed. Similar critical success factors were grouped together. Based on the description of the critical success factors in each group, the group was given a category name. From this first phase, four factors (i.e., scale of both side of users, all customers must own smartphones, credibility of customers, and changing habits) out of the 81 factors were excluded as these four factors were ambiguous and did not appear to be relevant to the research questions. The remaining 77 factors were classified into 15 categories, as shown in Table 3.3. Table 3.4 provides a short description of each category. See Appendix A for a thorough explanation of the categories and actual entries by brainstorming subjects.

Critical Success Factor	Number of Times Mentioned
Real-time/Up-to-date Information	14
Personalizable/Preference Setting	12
Privacy	12
Simple/Ease of Use	9
Integrated Apps/Services	7
Usefulness/Benefits	4
Speed	4
Cost	3
Quality of Reviews	3
Standards and Platform Independence	2
Aesthetics	2
Smart Location-Based Services	2
Reliability	1
Size of application	1
Publicity of Location-Based Services	1
Total	**77**

Table 3.3 Categories of Critical Success Factors after Analysis

Categories	Description
Real-Time/Up-To-Date Information	Information provided should be real-time, up-to-date, correct, accurate, complete, and relevant.
Personalizable/ Preference Setting	Ability to customize and personalize location-based services to user's preferences, set likes and dislikes, set when user wants information delivered to him/her, control which information to send, etc.
Privacy	Protection of users' information. Ability to control which entity has access to the users' information.
Simple/Ease of Use	Location-based services should be easy to use, convenient to use, and with easy and simple search interfaces.
Integrated Applications/ Services	Should have one or two applications that integrate all the services such as restaurants, buses, weathers, gas stations, hospitals, etc. instead of having multiple applications that provide different services.
Usefulness/ Benefits	Usefulness of the information and benefits to be gained from using location-based services such as special deals, discount coupons, restaurant suggestions, etc.
Speed	Ability to obtain information fast from location-based services.
Cost	Data roaming prices, cost of location-based services applications, etc.
Quality of Reviews	Specific, detailed, and useful reviews of products and services.
Standards and Platform Independence	Interoperability between devices, operating systems and applications.
Aesthetics	Interfaces are pleasant to view and information is layout nicely.
Smart Location-Based Services	Ability of devices and services to be aware of current locations, contexts, and/or learn the users' likes and dislikes.
Reliability	Applications should not crash and services should always be available.
Size of Applications	Applications should not take much memory space.
Publicity of Location-Based Service	Wider publicity of location-based services, its features, and usefulness.

Table 3.4 Short Description of Categories of Critical Success Factors

In the second phase, a total of 94 students from the University of Nebraska-Lincoln were recruited to complete a simple three-part questionnaire (see Appendix D). These students were volunteers from two sections of Introductory Management Information Systems class. Table 3.5 summarizes the demographic information of the subjects of the three-part questionnaire. According to Table 3.5, the majority of the students are aged 16 to 25. All of them have experiences with mobile services. They spend an average of 21.94 hours using mobile services a week.

According to Liu et al. (2011), consumers age 16 to 30 often adopt new technologies earlier, use the Internet more extensively, and use mobile value-added service more substantially compared to consumers who are older than 30 (Liu, Huang, & Wang, 2011). Hyvonen and Repo (2005) also asserted that young people were more likely to use mobile services compared to older people (Hyvonen & Repo, 2005). Several prior studies on internet-related behaviors used consumers aged 19 to 25 as their subjects because they closely resemble the online population (Li, Sarathy, & Xu, 2010). Therefore, the subjects for this part of the research who were mostly between the ages of 16 to 25 closely resemble the population of location-based services users and were appropriate for this questionnaire.

In the first part, the subjects were asked to rank the 15 critical success factors according to importance with 1 being the most important and 15 being the least important. While the number of times a critical success factor mentioned in the electronic brainstorming sessions may indicate the importance of the critical success factor, this may not be an objective measure as some factors may not be repeatedly mentioned by subjects when they saw that other subjects had mentioned it. Therefore, this first part of the

questionnaire collects data on the ranking of the various critical success factors to indicate the importance of the critical success factors.

In the second part, subjects were asked to rate the importance of each critical success factor on a Likert scale from 1 to 9, with 1 being unimportant, 3 being of little importance, 5 being moderately important, 7 being important, and 9 being very important. This part was performed to see if there was a correlation between the ranking and rating of critical success factors (i.e., the first and second part of the questionnaire).

These subjects were not the same subjects as the electronic brainstorming session subjects. Hence, in the third part of the questionnaire, the subjects were asked to answer a few demographic questions similar to the demographic questions asked in the electronic brainstorming session. In addition, these subjects were asked to rate on a Likert scale from 1 (strongly disagree) to 7 (strongly agree) on their opinion of whether location-based services is attractive, useful or valuable. This three-part questionnaire took the subjects approximately 10 to 15 minutes.

Then, the average scores for the questions from the first part and second part of the questionnaire were calculated. These average scores were analyzed as an overall group and according to gender. The average scores and standard deviations on subjects' opinions of whether location-based services are attractive, useful, or valuable were also calculated.

Age	16-20	46
	21-25	41
	26-30	5
	31-35	0
	36-40	1
	41-45	1
	46-50	0
	51-55	0
	56 and above	0
Gender	Female	30
	Male	64
Highest education level attained	High school	66
	Associate	8
	Bachelor	17
	Masters	2
	Ph.D.	0
	Other	0
Experience with any kind of mobile services (months)	Min	6
	Max	144
	Average	70.10
Number of hours a week that you spend using any mobile services	Min	1
	Max	168
	Average	21.94
Do you use any kind of location-based services?		
Yes		57
Experience with location-based services as a user (months)	Min 2 Max 60 Average 20.82	
Number of hours a week that you spend using location-based services (to the nearest hour)	Min 0.25 Max 24 Average 3.76	
No		37
Do you work in the location-based services industry?		
Yes		2
Experience working in location-based services industry (months)	Min 9 Max 12 Average 10.5	
Current job title in location-based service industry *1.* Developer		
No		92

Table 3.5 Questionnaire Subjects' Demographic Information

Research Rigor

The research rigor is important to ensure reliability and validity of the research results (Creswell, 1998; Sheng, Siau, & Nah, 2010; Corbin & Strauss, 1998). The following steps were taken to ensure research rigor.

First, we applied the electronic brainstorming approach to collect data, which is a structured approach to data collection (Siau & Tan, 2005). The electronic brainstorming approach has been used to generate ideas to address a specific problem, which is suitable in generating a list of critical success factors for location-based services that is as complete as possible. With the electronic brainstorming session being open for 28 days, the list of critical success factors generated could be regarded as a comprehensive list.

Second, a pilot study was conducted to test the electronic brainstorming website for clarity and system failure. The advantages of conducting pilot study before carrying out the actual study are that it can indicate where the main research would fail, where research protocols may not be followed, and whether the research instrument used to conduct the study is inappropriate or too complicated (Teijlingen & Hundley, 2001). Hence, pilot studies contribute to a good study design.

Third, the subjects involved in the electronic brainstorming session in this study were practitioners, researchers, and users in location-based services and mobile services. Based on their demographic information, their experiences with mobile services average about 95.94 months. Thirty-two of them used location-based services and two of the subjects worked in the location-based services industry. Therefore, there is a diverse background in the subjects recruited and this enhances the comprehensive set of critical success factors generated. Further, it is the norm to use expert subjects in brainstorming session

and in identifying critical success factors. The group of subjects for the electronic brainstorming session consisted of 32 Ph.D. holders, who worked in the IS/IT area and were knowledgeable about mobile services and location-based services.

Fourth, the subjects involved in the three-part questionnaire were students, mostly between the ages of 16 and 25. Prior studies have shown that consumers in this age group are born into the technology society and are early adopters of new technologies. For example, Liu et al. (2011) found that consumers age 16 to 30 use the Internet and mobile services extensively (Liu, Huang, & Wang, 2011). All of them had experiences with mobile services and a majority of them (57 subjects) used location-based services. Therefore, they are representative of the population of location-based services users and are likely early adopters of new location-based services.

Fifth, a systematic data analysis was performed to group similar factors together and to rank and rate the importance of the factors. When performing this data analysis, past literature review was used as a guide to validate the grouping of the factors and to compare the results of this study from results in prior studies.

CHAPTER 4

RESEARCH FINDINGS AND DISCUSSIONS

Findings

A comparison of the average scores of each critical success factors from the first part (ranking) and second part (rating) of the questionnaire were performed. Table 4.1 shows the ranking of critical success factors according to importance, from 1 being most important to 15 being the least important.

Ranking	Critical Success Factors	Part 1	Part 2
1	Speed	4.37	7.64
2	Real-Time/Up-To-Date Information	5.05	7.94
3	Cost	5.56	6.96
4	Usefulness/Benefits	5.61	7.38
5	Simple/Ease of Use	5.65	7.31
6	Reliability	6.77	7.62
7	Personalization/Preference Setting	8.21	6.26
8	Privacy	8.32	6.56
9	Smart Location-Based Services	8.36	6.72
10	Aesthetics	9.06	5.94
11	Quality of Reviews	9.13	6.13
12	Integrated Applications/Services	9.93	5.84
13	Standards & Platform Independence	10.80	5.23
14	Size of Applications	11.35	4.89
15	Publicity of Location-Based Services	11.82	5.47

Table 4.1 Comparison of the Average Scores of Each Critical Success Factor from Part 1 (Ranking) and Part 2 (Rating) of the Questionnaire

Figure 4.1 shows the order of importance for each critical success factor based on the average ranking scores from the first part of the questionnaire in an ascending order with speed being the most important and publicity of LBS being the least important.

Figure 4.2 shows the order of importance for each critical success factor based on the average rating score of each critical success factor from the second part of the questionnaire. Based on this comparison, we can see that the average ranking score for each critical success factor from the first part of the questionnaire was mostly consistent with the rating average score for each critical success factor from the second part of the questionnaire. However, from Figure 4.2, there were a few critical success factors that seemed to cause some variations in the trend, disturbing the order in the downward trend. For example, the average rating score for speed was 7.64 and the average rating score for real-time/up-to-date information was 7.94. Hence, from this rating, real-time/up-to-date information seemed to be more important than speed, with a small difference in average score of 0.03 (7.94-7.64). As another example, the average rating score for size of applications/space taken on the phone was 4.89 and the average rating score for publicity of location-based services was 5.47. Hence, from this rating, publicity of location-based services seemed to be more important than size of applications/space taken on the phone, with a small difference in average score of 0.58 (5.47-4.89).

Fourteen two-tailed paired t-tests were performed to test whether there are significant differences between each pair of rated factors (i.e., Part 2 of the questionnaire). For example, we compared the first rated factor with the second rated factor, the second rated factor with the third rated factor, and so on. From this two-tailed paired t-test, we found that the differences for some pairs were significantly different while some were not, as shown in table 4.2. For example, the t-test showed that the difference between speed and real-time/up-to-date information was not significantly different (0.0896). The difference between size of application and publicity of LBS was also not significantly different (0.1991).

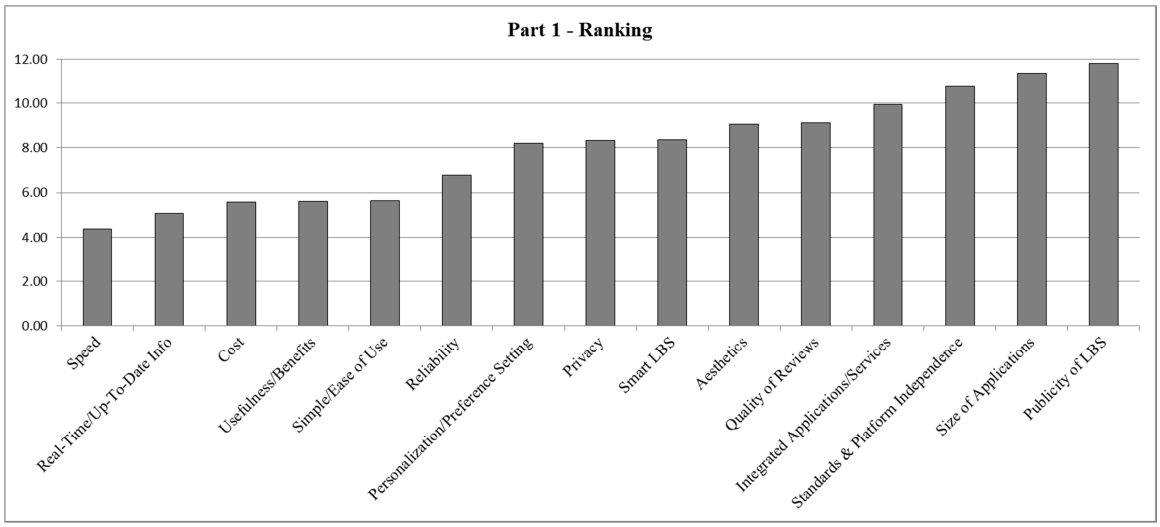

Figure 4.1 Order of Importance of Each Critical Success Factor from Part 1 (Ranking) of the Questionnaire

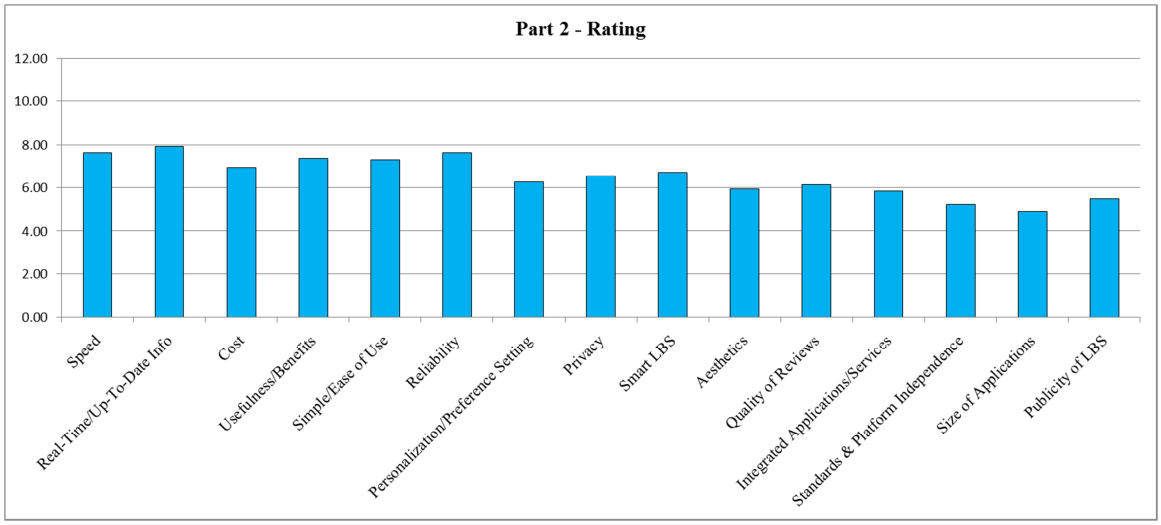

Figure 4.2 Order of Importance of Each Critical Success Factor from Part 2 (Rating) of the Questionnaire

Factor 1	Factor 2	Differences	T-Test	Significant Differences
Speed	Real-Time/Up-To-Date-Info	-0.30	0.0896	No
Real-Time/ Up-To-Date Info	Cost	0.98	0.0000	Yes
Cost	Usefulness/Benefits	-0.43	0.0969	No
Usefulness/Benefits	Simple/Ease Of Use	0.07	0.7267	No
Simple/Ease Of Use	Reliability	-0.31	0.0322	Yes
Reliability	Personalization/ Preference Setting	1.36	0.0000	Yes
Personalization/ Preference Setting	Privacy	-0.31	0.1921	No
Privacy	Smart Location-Based Services	-0.16	0.5272	No
Smart Location-Based Services	Aesthetics	0.79	0.0001	Yes
Aesthetics	Quality of Reviews	-0.19	0.4490	No
Quality of Reviews	Integrated Applications/Services	0.29	0.2778	No
Integrated Applications/Services	Standards & Platform Independence	0.61	0.0022	Yes
Standards & Platform Independence	Size Of Applications	0.34	0.1823	No
Size Of Applications	Publicity Of Location-Based Services	-0.57	0.1991	No

Table 4.2 T-Test Results from Part 2 (Rating) of the Questionnaire

In addition, from the three-part questionnaire, a comparison of the ranking average scores of each critical success factors between females and males from first part of the questionnaire were performed. Also, a comparison of the rating average scores of each critical success factors between females and males from second part of the questionnaire were performed. These comparisons are summarized in Table 4.3.

	Part 1 – Ranking				Part 2 – Rating			
Critical Success Factor	**Female**	**Male**	**T-Test**	**Sig. Diff.**	**Female**	**Male**	**T-Test**	**Sig. Diff.**
Real-Time/ Up-To-Date Information	4.94	5.06	0.97	No	7.90	7.94	0.99	no
Speed	5.16	4.05	0.14	No	7.42	7.70	0.50	no
Usefulness/ Benefits	5.32	5.67	0.80	No	7.35	7.42	0.72	no
Cost	5.42	5.78	0.46	No	7.19	6.78	0.19	no
Simple/Ease of Use	5.90	5.64	0.98	No	7.48	7.19	0.26	no
Personalization /Preference Setting	7.32	8.73	0.07	No	6.74	6.03	0.07	no
Reliability	7.45	6.50	0.31	No	7.77	7.53	0.31	no
Privacy	7.48	8.78	0.11	No	7.29	6.22	0.02	yes
Smart Location-Based Services	8.29	8.42	0.82	No	6.94	6.59	0.26	no
Quality of Reviews	8.81	9.20	0.81	No	6.39	6.02	0.45	no
Aesthetics	9.74	8.67	0.09	No	5.90	5.94	0.99	no
Integrated Applications/ Services	10.74	9.47	0.07	No	6.06	5.73	0.33	no
Size of Applications	10.87	11.45	0.71	No	5.68	4.55	0.02	yes
Standards & Platform Independence	10.94	10.70	0.65	No	5.45	5.16	0.55	no
Publicity of Location-Based Services	11.58	11.86	0.86	No	5.65	5.38	0.66	no

Table 4.3 Comparison of the Average Scores and T-test of Each Critical Success Factor between Female and Male Subjects from Part 1 (Ranking) and Part 2 (Rating) of the Questionnaire

Figure 4.3 shows a side-by-side comparison of the average ranking scores by the female subjects and the average ranking scores by the male subjects from the first part of the questionnaire. As can be seen in the figure, the average ranking scores by the female subjects were almost the same as the average ranking scores by the male subjects. However, there were some factors in which the average scores by female subjects and the average scores by male subjects had a bigger difference such as personalization/preference setting and privacy.

Fifteen two-tailed two-sample t-tests assuming equal variance (this was determine by performing the f-test to determine whether the variance is equal or unequal) were performed to test whether there were significant differences between the female and male average scores for each factor. From these two-tailed two-sample t-tests, we found that the differences between the female and male average scores for all the fifteen factors were not significantly different (see Table 4.3).

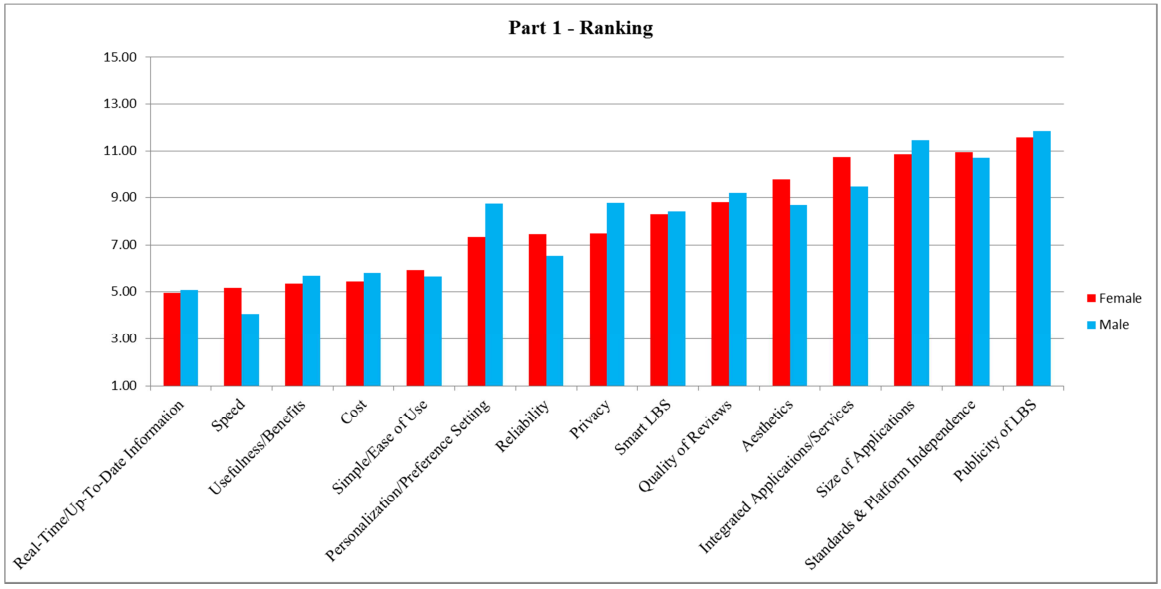

Figure 4.3 Side-By-Side Comparison of the Average Rating Score by Gender from Part 1 (Ranking) of the Questionnaire.

Figure 4.4 shows a side-by-side comparison of the average rating scores by the female subjects and the average rating scores by the male subjects from the second part of the questionnaire. Based on this comparison, the average rating scores by the female subjects were mostly almost the same as the average rating scores by the male subjects. However, there were some factors in which the average scores by female subjects and the average scores by male subjects had a bigger difference such as personalization/preference setting and privacy.

Fourteen two-tailed two-sample t-tests assuming equal variance and one two-tailed two-sample t-tests assuming unequal variance (this was determine by performing the f-test to determine whether the variance is equal or unequal) were performed to test whether there were significant differences between the female and male average scores of each factor. From these two-tailed two-sample t-tests, we found that the differences between the female and male average scores were not significantly different for all the factors except for privacy and size of applications (see Table 4.3).

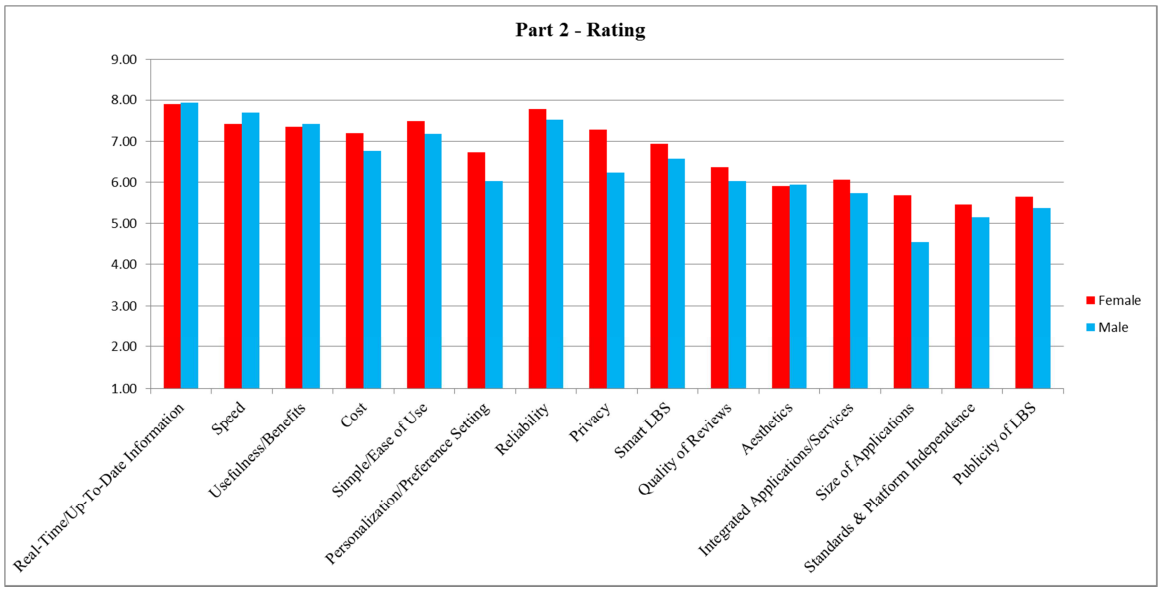

Figure 4.4 Side-By-Side Comparison of the Average Rating Score by Gender from Part 2 (Rating) of the Questionnaire.

Also, Table 4.4 shows the average score and the standard deviation on the level of agreement regarding whether location-based services are attractive, useful, and valuable. As shown in Table 4.4, subjects from the three-part questionnaire agreed that location-based services are attractive, useful, and valuable.

	Average (out of 7)	Standard Deviation
LBS is attractive	5.65	0.96
LBS is useful	5.97	0.82
LBS is valuable	5.73	1.00

Table 4.4 Results on the Opinion on the Attractiveness, Usefulness, and Value of Location-Based Services

Discussion of Findings

The main objective of this study is to identify a list of critical success factors for location-based services. Critical success factors generated such as personalizable or preference setting, real-time or up-to-date information, usefulness or benefits, speed, cost, standards and platform independence, simple or ease of use, quality of reviews, and privacy are consistent with past literature on location-based services. The other critical success factors generated such as aesthetics, smart location-based services, integrated apps or services, reliability, size of application, and publicity of location-based services were not mentioned in past literature. These are the new findings from this research.

There were also a few unexpected findings from the results of this study. Based on prior literature, trust has been mentioned as a crucial component for the success of location-based services. The lack of trust has been found by other researchers to be the reason most consumers refused to provide personal information to use a service. In our research, trust has not been mentioned as a critical success factor by any subject in the electronic brainstorming session. This is probably due to the nature of subjects, who are knowledgeable in the IT/IS area, from the electronic brainstorming. Also, trust is an artifact of the early days of mobile technology. As more people begin to adopt it and have positive experiences with it, the issue of trust will become less significant for the user population as a whole. A similar trend can also be seen in e-commerce and cloud-based services. Other plausible explanation for this is that the subjects were more concerned about other factors that they felt were more critical than trust for location-based services to succeed. In addition, the fact that privacy was the most mentioned critical success factors in the electronic brainstorming session (12 times) could be an indication of the lack of trust in location-based services.

The findings also suggest that the level of privacy concern is influenced by the age group and education level. The subjects in the electronic brainstorming session were mostly in the age range of 36 to 40 and most of them hold a Ph.D. degree (see Table 3.1). Based on the results from the electronic brainstorming session, privacy was one of the most mentioned critical success factor (see Table 3.2). This implied that these subjects were more concern about privacy compared to many other critical success factors. In contrast, the subjects from the three-part questionnaire were mostly between the age range of 16 to 25 and the majority of them were high school graduates. Based on the results from the second part of the three-part questionnaire, privacy was ranked number eight in the order of importance (see table 4.1). This implied that these subjects were less concern about privacy than those in the electronic brainstorming session. The subjects in the three-part questionnaire were more concern about other critical success factors such as speed and real-time or up-to-date information.

In addition, the findings on the number of times a particular critical success factor was mentioned from the electronic brainstorming session were fairly consistent with the ranking results from the questionnaire. For example, in the electronic brainstorming session, real-time or up-to-date information was mentioned 14 times, making it the most mentioned critical success factor. In the three-part questionnaire, real-time or up-to-date information was ranked number two. This implied that subjects, regardless of age and level of education, value real-time or up-to-date information more than the other critical success factors.

The findings from the comparison of average ranking scores and average rating scores by female and male subjects showed that female and male subjects were mainly in

agreement on the importance of various critical success factors. This implied that there were no significant gender differences on the perceive importance of critical success factors and this was consistent with prior studies that reported no gender differences on the adoption of mobile commerce and mobile services. Hence, the finding from this part of the research agrees with other studies that the gender gap with respect to the use of new technology is narrowing significantly or not apparent.

CHAPTER 5

CONCLUSION AND FUTURE RESEARCH

Location-based services are still a relatively new concept that emerged with the advancement in mobile technology and wireless technology. Location-based services have tremendous potential in providing real-time information and aiding in making better choices anytime, anywhere. In this research, a comprehensive and holistic view of critical success factors of location-based services was gained using the electronic brainstorming approach. This approach provided deep insights from practitioners, researchers, and users of location-based services on their opinions of critical success factors for location-based services. The majority of the subjects (32 of them) for the electronic brainstorming session have Ph.D. degrees. Therefore, these subjects are highly qualified.

These critical success factors were then ranked according to importance. In addition, each of these critical success factors was rated on a Likert scale. The ranking and rating of the critical success factors according to importance can help practitioners focus on the most important critical success factor. The results showed that speed, real-time or up-to-date information, cost, usefulness or benefits, and simple or ease of use were the most important critical success factors that are top in the ranking. In the gender analysis performed, male and female were mainly in agreement on the perceived importance of critical success factors. The results of this study can help other practitioners create a competitive location-based services strategy to increase consumer adoption.

There were some limitations in this study. The critical success factors generated in this study were subjective in nature. The approach used to collect these critical success factors, electronic brainstorming, is generally used to generate subjective ideas or

opinions to address a specific problem. Therefore, it was difficult to completely eliminate the impacts of the research subjects' subjectivity on the results of this study. For future research, other research methods can be employed to supplement the existing method. For example, the triangulation method can be used where multiple methods are used in one study to collect data. It is also suggested that future research repeat this research in different environments (e.g., different institutions, different countries) to reduce subjectivity and enhance generalizability.

REFERENCES

Bellavista, P., Kupper, A., & Helal, S. (2008, April 11). Location-Based Services: Back to the Future. *IEEE Pervasive Computing, 7*(2), 85-89.

Chae, M., & Kim, J. (2001). Information Quality for Mobile Internet Services: A Theoretical Model with Empirical Validation. *Twenty-Second International Conference on Information Systems*, (pp. 43-54).

Chang, S., Hsieh, Y.-J., Lee, T.-R., Liao, C.-K., Wang, S.-T., & Ellis. (2007). A User Study on the Adoption of Location Based Services. In *Advances in Web and Network Technologies, and Information Management* (pp. 276-286). Berlin / Heidelberg: Springer.

Chellappa, R. K., & Sin, R. G. (2005). Personalization versus Privacy: An Empirical Examination of the Online Consumer's Dilemma. *Information Technology and Management*, 181-202.

Corbin, J., & Strauss, A. (1998). *Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory.* Thousand Oaks, CA: Sage Publications.

Creswell, J. (1998). *Quality Inquiry and Research Design: Choosing Among Five Traditions.* Thousand Oaks, CA: Sage Publications.

Decker, M. (2008). Location Privacy-An Overview. In M. Decker (Ed.), *7th International Conference on Mobile Business, 2008. ICMB '08.*, (pp. 221 - 230).

Dennis, A., & Valacich, J. (1993). Computer Brainstorms: More Heads are Better than One. *Journal of Applied Psychology, 16*(3), 531-537.

Dennis, A., & Williams, M. (2007). A Meta-Analysis of Group Size Effects in Electronic Brainstorming: More Heads are Better Than One. Idea Group Inc.

Dhar, S., & Varshney, U. (2011, May). Challenges and Buesiness Models for Mobile Location-Based Services and Advertising. *Communications of the ACM, 54*(5), pp. 121-129.

Diao, S., & Lu, T. (2009). U-Commerce Product Adoption: An Economic Model for Personalization and Privacy Concerns . *International Conference on Management and Services Science* (pp. 1-3). Wuhan: IEEE.

Digman, L. (2008). *Strategic Management: Competing in the Global Information Age.* Mason, Ohio: Cengage Learning.

Duckham, M., Mokbel, M., & Nittel, S. (2007). Special Issue on Privacy Aware and Location-based Mobile Services. *Journal of Location Based Services, 1*(3), 161-164.

Federal Communication Commission. (2001, January). *FCC Wireless 911 Requirements.* Retrieved from http://transition.fcc.gov/pshs/services/911-services/enhanced911/archives/factsheet_requirements_012001.pdf

Gallupe, R., & Cooper, W. (1993). Brainstorming Electronically. *Sloan Management Review, 35*(1), 27-36.

Gallupe, R., Bastianutti, L., & Cooper, W. (1991). Unblocking Brainstorms. *Journal of Applied Psychology, 76*(1), 27-36.

Gallupe, R., Dennis, A., Cooper, W., Valacich, J., Bastianutti, L., & Nunamaker, J. (1992). Electronic Brainstorming and Group Size. *Academy of Management Journal, 35*(2), 350-369.

Goodson, P., McCormick, D., & Evans, A. (2001). Searching for Sexually Explicit Materials on the Internet: An Exploratory Study of College Students. *Archives of Sexual Behavior, 30*(2), 101-118.

Ho, S., & Bull, S. (2010). Users' Adoption of Mobile Services: Preserence and Location Personalization. *2010 5th International Conference on Computer Sciences and Convergence Information Technology*, pp. 314-319.

Hyvonen, K., & Repo, P. (2005). The Use of Mobile Services in Finland: Adoption Challenges Diffusion Theory. *GESTS International Transactions on Computer Science and Engineering, 20*(1), 166-178.

Kaplan, R. (2011, June 28). Location-Based Services Forum. Washington D.C., Washington D.C., United States. Retrieved from http://www.youtube.com/watch?v=DIuZ8c0D-nY

Kramer, J., Noronha, S., & Vergo, J. (2000, August). A User-Centered Design Approach to Personalization. *Communication of the ACM, 43*(8), pp. 45-48.

Laudon, K., & Traver, C. (2001). *E-commerce: Business, Technology, Society.* Boston, MA: Addison Wesley.

Lehrer, C., Constantiou, I., & Hess, T. (2010). Exploring Use Patterns and Perceived Value of Location-Based Services. *2010 Ninth International Conference on Mobile Business and 2010 Ninth Global Mobility Roundtable (ICMB-GMR)*, (pp. 107-115). Athens.

Li , S., Glass, R., & Records, H. (2008). The Influence of Gender on New Technology Adoption and Use - Mobile Commerce. *Journal of Internet Commerce, 7*(2), 270-288.

Li, H., Sarathy, R., & Xu, H. (2010). Understanding situational online information disclosure as a privacy calculus. *Journal of Computer Information Systems*.

Liu, W.-L., Huang, K.-P., & Wang, C.-H. (2011). Age Cohort Analysis in COntinued Usage Intention of Mobile Value-Added Services: Generation Y and Baby Boomers. *African Journal of Business Management, 5*(14), 5863-5870.

McKnight, D., Choudhury, V., & Kacmar, C. (2002). Developing and Validating Trust Measures for e-Commerce: An Integrative Typology. *Information Systems Research, 13*(3), 334-359.

Murthi, B., & Sarkar, S. (2003). The Role of the Management Science Research on Personalization. *Management Science, 49*(10), 1344-1362.

Odell, O., Korgen, K., Schumacher, P., & Delucchi, M. (2000). Internet Use Among Female and College Students. *Cyberpsychology and Behavior, 3*(5), 855-862.

Osman, Z., Maquire, M., & Tarkiainen, M. (2003). Older Users' Requirements For Location Based Services And Mobile Phones. In *Older Users' Requirements For Location Based Services And Mobile Phones* (pp. 352-357). Berlin / Heidelberg.

Percivall, G. (2011, February 17). Increasing Market Opportunities for Augmented Reality through Collaborative Development of Open Standards. Retrieved from http://portal.opengeospatial.org/files/?artifact_id=42677

Perusco, L., & Michael, K. (2007). Control, Trust, Privacy, and Security: Evaluating Location-Based Services. *IEEE Technology and Society Magazine*, pp. 4-16.

Pura, M. (2005). Linking Perceived Value and Loyalty in Location-Based Mobile Service. *Managing Service Quality, 15*(6), 509-538.

Quercia, D., Lathia, N., Calabrese, F., Di Lorenzo, G., & Crowcroft, J. (2010). Recommending Social Events from Mobile Phone Location Data. *2010 IEEE International Conference on Data Mining*, (pp. 971-977).

Rainer, R. K., & Cegielski, C. G. (2012). *Introduction to Information Systems* (4e ed.). New Jersey: Wiley.

Rainer, R., Laosethakul, K., & Astone, M. (2003). Are Gender Perceptions of COmputing Changing Over Time. *Journal of Computer Information Systems*, 108-114.

Rao, B., & Minakakis, L. (2003, December). Evolution of Mobile Location-Based Services. *Communications of the ACM, 46*(12), pp. 61-65.

Ray, C., Sormunen, C., & Harris, T. (1999). Men's and Women's Attitudes Toward Computer Technology: A Comparison. *Office System Research Journal, 17*(1).

Riecken, D. (2000, August). Personalized Views of Personalization. *Communication of the ACM, 43*(8), pp. 27-28.

Schiller, J. H., & Voisard, A. (2004). *Location-based Services.* San Francisco, CA: Morgan Kaufmann.

Sheng, H., Nah, F.-H., & Siau, K. (2008). An Experimental Study on Ubiquitous Commerce Adoption: Impact of Personalization and Privacy Concerns. *Journal of the Association for Information Systems, 9*(6), 344-376.

Sheng, H., Siau, K., & Nah, F.-H. (2010). Understanding the Values of Mobile Technology in Education: A Value Focused Thinking Approach. *The DATA BASE for Advances in Information Systems, 41*(2), 25-44.

Siau, K., & Shen, Z. (2003, April). Building Customer Trust in Mobile Commerce. *Communications of the ACM, 46*(4), pp. 91-94.

Siau, K., & Tan, X. (2005). Evaluation Criteria for Information Systems Development Methodologies. *Communications of the Association for Information Systems, 16*, 860-876.

Steinfield, C. (2004). The Development of Location Based Services in Mobile Commerce. In B. Preissl, H. Bouwman, & C. Steinfield, *Elife after the dot.com bust* (pp. 177-197). Berlin: Springer.

Steiniger, S., Neun, M., & Edwardes, A. (2006). Foundations of Location Based Services.

Stone, E., & Stone, D. (1990). Privacy in Organizations: Theoretical Issues, Research Findings, and Protection Mechanisms. *Research in Personnel and Human Resources Management, 8*(3), 349-411.

Teijlingen, E. W., & Hundley, V. (2001). The Importance of Pilot Studies. *Social Research Update*(35).

Treadaway, C. (2010, May 26). *Are Location-Based Services All Hype?* Retrieved December 28, 2011, from Mashable: http://mashable.com/2010/05/26/location-hype/

Unni, R., & Harmon, R. (2003). Location-Based Services: Models for Strategy Development in M-Commerce. *Portland International Conference on Management of Engineering and Technology* (pp. 416-424). Portland, Oregon: IEEE.

Valacich, J. S., & Dennis, A. R. (1994). A Mathematical Model of Electonic Brainstorming. *Journal of Management Information Systems, 11*(1), 59-62.

Van Dyke, T. P., Midha, V., & Nemati, H. (2007). The Effect of Consumer Privacy Empowerment on Trust and Privacy Concerns in E-Commerce. *Electronic Markets, 17*(1), 68-81.

Wang, S., Min, J., & Yi, B. (2008). Location Based Services for Mobiles: Technologies and Standards. *IEEE International Conference on Communication* . Beijing, China.

Xu, H., Gupta, S., & Shi, P. (2009). Balancing User Privacy Concerns in the Adoption of Location-Based Services: An Empirical Analysis across Pull-Based amd Push-Based Applications. *iConference (iSociety: Research, Education, and Engagement).* University of North Carolina-Chapel Hill.

Xu, H., Teo, H.-H., & Tan, B. C. (2005). Predicting The Adoption Of Location-Based Services: The Role Of Trust And Perceived Privacy Risk. *Twenty-Sixth International Conference on Information System*, (pp. 897-910).

Xu, H., Teo, H.-H., Tan, B. C., & Argawal, R. (2010). The Role of Push-Pull Technology in Privacy Calculus: The Case of Location-Based Services. *Journal of Management Information Systems, 26*(3), 135-173.

Zeithaml, V. (1988). Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence. *Journal of Marketing*, *52*(3), 2-22.

Zhong , S., Li , L., Yanbin , G. L., & Yang , R. Y. (2004). Privacy-preserving location based services for mobile users in wireless networks.

Zickuhr, K., & Smith, A. (2011, September 6). *28% of American adults use mobile and social location-based services.* Retrieved from Pew Internet & American Life Project: http://pewinternet.org/Reports/2011/Location.aspx

APPENDIX A

Categorization of Critical Success Factors and Their Descriptions

Real Time/Up-to-date Information

Critical success factor	Description
List of available service must be current	Consumers may be frustrated when they attempt to access a service that is no longer available. For example, if a customer goes to a restaurant after reading a review about a particular dish, and then finds that the dish is no longer on the menu; that could be annoying.
Information update	For the location-based information, I think the information should be updated regularly. People who are using the location-based information are encouraged to join the information update.
Correctness of data	
Up-to-dateness of data offered	
Up to date info	I don't want to be directed to a restaurant which was closed two months ago.
Information should be up to date and accurate.	
Accurate	Data and info has to be correct.
Adequate sifting and relevancy of information	As time goes on there will be too much information, spammy
Up-to-Date Information	Example -- waiting time, special promotions, daily specials etc. for restaurants.
Real time, accurate information	Information offered need to be real time, accurate and up to date.
Real time updated data	Location-based service should be time-sensitive and accurate.
Real-time updated data	The service should be probably tapping on NFC principles.
Completeness of Information	It's not sufficient to just know the location of a place and what service it offers. I want to know that the service will be available when I want it or it is of no value. For example, the LBS may tell me there is a restaurant nearby and list some reviews, but I want it to tell me if there is an

	extensive waiting time. If I have to wait more than 30 minutes for a table, I won't stay.
Location based services should be tied into the vendor's information systems	For vendors providing location-based services, the location-based services should be tied into the vendor's information systems so that the location based services are dynamic and up-to-date. That will also enable vendors to change the information quickly with less maintenance and development costs.

Usefulness/Benefits

Critical Success Factor	Description
Uses must see a benefit to using a LBS	There must be an incentive for using a LBS. Services such as GPS for navigation, weather, and restaurants are useful and provide a benefit to its users. Other novelty uses of LBS, such as check-ins for gaming and Facebook, do not appeal to the masses. It is my belief that a proper incentive for use and a sense of secured privacy must be established for a LBS to be successful.
Functionality/usefulness	Whether the app can provide rich features, functions
Benefits from LBS	User should get benefits from location-based service, such as deals recommendation, friend recommendation, suggestions of a place, tips, etc.
* balance between user's privacy and usefulness	

* indicates that there are two critical success factors mentioned in one entry

Simple/Ease Of Use

Critical Success Factor	Description
* Ease of use and privacy respected	1. Ease of use of the app. 2. Do not like solicitation from vendors
Practicality and ease of use	The best LBS app I currently use is Strava, which I use when cycling in the woods. It's easy to use -- but it's not just the easiness that makes it practical. I mostly “use” the application before and after a ride. During a ride, I just record the track, so I’m not “using” the mobile phone in a sense that I would be touching the screen.
UID	Apps seem designed for impossible small fingertips!

	Screen size is so small that either the “field of view” is tiny (a few streets) (yet readable) or huge (a district) (but unreadable). An iPad has an advantage in this respect.
Simple	People are usually driving or outdoor, so can only perform simple operation.
Simple to use	
Easy search	Proximity based search should be as easy as possible
Ease of use	It has to be easy to use or I’ll just keep doing what I’ve been doing
Convenience	
Convenience	

* indicates that there are two critical success factors mentioned in one entry

Personalizable/Preference Setting

Critical Success Factor	Description
User choice	User should control the process by which information is sent to them. Lots of filters needed.
Intrusion	No push info
Control	I feel like I’m controlling the app and the app isn't controlling me
Non-intrusive	No push info, only requested info will be sent when needed
Opt-in	People should be able to choose, each and every time or blanket permission, how they will be included by retailers using lbs.
Opt-in/opt-out/preference settings	Should be able to take into account users' preferences, otherwise it can become a nuisance.
User choice	Ability to select who will receive a message from me and whose messages I will receive. For example, with yelp I would only want to send the message to people with whom I am going to lunch that day. I would not want to know where everybody else is eating.
Control	Don't push content to my phone; only if I request the service.
Personalizable	Should be able to be personalized to my preferences

Preference settings	I should be able to set my likes and dislikes in the app/system.
Personalization	The service should know the personal preference and fill out a lot of non-relevant information to make recommendation.
Customizable	The service needs to be customizable by the user so they can incorporate their personal preferences.

Integrated Apps/Services

Critical Success Factor	Description
Integration of apps and devices	I don't want to use multiple apps nor indeed multiple devices. It is critical to integrate everything onto any one single device and app. Indeed, the notion of independent apps should go out of the window - they should simply be add-ons to an app-integrator/aggregator.
Integration to calendars and personal memos	Should be able to integrate with calendars and memos of the users so that it's coordinated and batter managed
Comprehensive service	I want to have one app that provides restaurants, buses, weathers, hotels, cafes, taxis, gas stations, hospitals, etc. I do not have to have a few dozen apps on my mobile devices.
Ability to push information/advertisements to consumers in vicinity of service location	Relying on customer's pulling/asking for information may be ineffective. Being able to push messages e.g. Via Bluetooth or Wi-Fi to phones in the vicinity might be useful. AFAIK there are currently no standards that allow this.
Interaction level with location-based services	Adding more usage of the location based services will add value to this facility. Restaurants and commercial outlets are already using these as an advertising medium for people who use location services to detect nearby attractions/services. I.e. if games that are developed based on location services (giving users more reason to use location services), this can further increase usage of this service, giving rise to greater advertising/promotional opportunities which are already location dependent
Augmented reality	Be able to integrate/map location-based services onto/with reality
Route planning and scheduling	I'm a bit skeptical to the idea of augmented reality, that i would search for a place to eat ad hoc by looking at the street through the screen. But I could easily see myself

	using an app that would allow me to pre-pinpoint places of interest in a new city. If the app would add value by giving an interesting/optimal route to go through all the places, that might be cool.

Privacy

Critical Success Factor	Description
Privacy preservation	Privacy preservation would mean the protection of user location information without revealing to other 3rd party without the consent of the user. This would also include enabling user to control which entity can have access to the user location information in a trusted environment.
Assurance of privacy	For me to adopt a location-based service, I need to be quite sure that my location (current and history) is used for me, not for tracking companies.
Security of own data	
Security	My personal information will not be accessed.
Privacy protection	I can control who and how I share my location with.
Personal privacy	My information will not be used for other purposes by the vendors.
Privacy policy	Vendors should have a good privacy policy and publish the policy online.
Privacy setting	Provide users the flexibility to control their privacy settings (e.g., to different individuals or groups of individuals)
Control over the data	I should have the right to remove my data from vendors' database -- so that my movement over time cannot be tracked.
My personal data is not tracked by vendors.	
* Ease of use and privacy respected	1. Ease of use of the app. 2. Do not like solicitation from vendors
* Balance between user's privacy and usefulness	

* indicates that there are two critical success factors mentioned in one entry

Quality of Reviews

Critical Success Factor	Description
If the review could be more detailed	To relate the ratings with specific details, i.e., products, services, convenience, etc.
Good reviews	Often people only post reviews when they are upset or disappointed. When they are satisfied, they do not post a review. Businesses may not wish to have their business listed and risk negative reviews.
Authentication	The reviews provided for the service need to be authenticated by filtering out reviews considered useless by other users.

Smart LBS

Critical Success Factor	Description
Context awareness	The device and service together must be able to define or guess what I'm interested in current situation. In remote locations, this is easy, but e.g. In shopping mall much more complex. This would help with spam and information overload
Learning capability	The app should learn my likes and dislikes and be able to recommend the right products and services to me and filter out those advertisements and marketing materials that I have no interest in.

Aesthetics

Critical Success Factor	Description
Flexibility of viewing	The devices these days are not good enough in supporting different views of information. For instance, chat and text needs small window display but email might need a bigger window. Devices are not flexible enough to support these different needs. When it comes to location-based applications, usually more information is needed to be shown such as search results of restaurants. Small screens are not suitable or not easy to identify these locations. Users get frustrated and may abandon the device.
Aesthetics	

Standards and Platform Independence

Critical Success Factor	Description
Standardized data and application	Multiple devices/operating systems/apps require interoperability via standardized formats, otherwise vendors have to work with multiple standards (expensive) and/or the reach of services is limited.
Mass and seamless participation by retailers and service providers	There must be lots of content for access. One also cannot be limited by data non-sharing across different telco providers

Cost

Critical Success Factor	Description
Availability of data at a cheap price when travelling abroad	Location based services are most useful in an unfamiliar situation. Data roaming prices are extortionate.
Cost on data access	
Free service	No cost to the customer - ever.

Speed

Critical Success Factor	Description
Efficient	Since the service has a purpose, it needs to complete its purpose in an efficient manner. I don't want to have to navigate unnecessarily.
Fast	People can get the fast information from location-based services.
Fast	People don't have time to wait for lbs.
Speed of service response	While i am at the location, i would expect the system to respond in real time to my request, e.g., app should respond with minimum delay; search results shall appear instantaneously.

Others

Critical Success Factor	Description
Reliability	Whether the app would crash, or make my phone crash
Space taken on phone	Considering how much memory space it would take, and

	whether the app could move from internal memory to SD card
Scale of both side of users	There are two sides of user networks in the LBS applications. One uses it as a consumer who wants to find useful information and the other one use it as a platform to advise their products or services. People would like to adopt a LBS if the scale of both side are big enough.
All customers must own smartphones	While most people have cell phones, not everyone has a smartphone. The LBS should be available in different formats, such as computer or tablet as well.
Publicity of LBS	Wider publicity of LBS, its features and usefulness will help to ensure that more people are aware of such service availability in the area or location and thus to try the service initially and later to use it more frequently, once they are familiar with the service and can see the many benefits of lbs.
Credibility of customers	
Changing habits	Somehow, people have to change habits - from not using to using lbs. People who naturally like to try every gadget may find that easier. I have never used LBS and I am not attracted by the idea in any circumstance - the opportunity for serendipity and surprise is much greater when you just wander around. I'd rather develop my internal mental map of places, not rely on a smart phone's LBS to do so. Friends who use LBS tell me that maps are often out of date in any case.

APPENDIX B

Categorization of Critical Success Factors and their Descriptions Based on Subjects' Experience with Location-Based Services

Subject's Experience with Location-Based Services = Yes

Critical Success Factor	Description
Convenience	
Cost on data access	
Functionality/usefulness	Whether the app can provide rich features, functions
Reliability	Whether the app would crash, or make my phone crash
Space taken on phone	Considering how much memory space it would take, and whether the app could move from internal memory to SD card
User Choice	Ability to select who will receive a message from me and whose messages I will receive. For example, with Yelp I would only want to send the message to people with whom I am going to lunch that day. I would not want to know where everybody else is eating.
Adequate sifting and relevancy of information	As time goes on there will be too much information, spammy
Availability of data at a cheap price when travelling abroad	Location based services are most useful in an unfamiliar situation. Data roaming prices are extortionate.
Aesthetics	
Control	I feel like I'm controlling the app and the app isn't controlling me
Mass and seamless participation by retailers and service providers	There must be lots of content for access. One also cannot be limited by data non-sharing across different telco providers
Control	Don't push content to my phone; only if I request the service.
Ease of use	It has to be easy to use or I'll just keep doing what I've been doing
Authentication	The reviews provided for the service need to be

	authenticated by filtering out reviews considered useless by other users.
Assurance of privacy	For me to adopt a location-based service, I need to be quite sure that my location (current and history) is used for me, not for tracking companies.
Real time updated data	Location-based service should be time-sensitive and accurate.
My personal data is not tracked by vendors.	
Information should be be up to date and accurate.	
Efficient	Since the service has a purpose, it needs to complete its purpose in an efficient manner. I don't want to have to navigate unnecessarily.
Context awareness	The device and service together must be able to define or guess what I'm interested in current situation. In remote locations, this is easy, but e.g. In shopping mall much more complex. This would help with spam and information overload
Easy search	Proximity based search should be as easy as possible
Uses must see a benefit to using a LBS	There must be an incentive for using a LBS. Services such as GPS for navigation, weather, and restaurants are useful and provide a benefit to its users. Other novelty uses of LBS, such as check-ins for gaming and Facebook, do not appeal to the masses. It is my belief that a proper incentive for use and a sense of secured privacy must be established for a LBS to be successful.
Information update	For the location-based information, I think the information should be updated regularly. People who are using the location-based information are encouraged to join the information update.
Flexibility of viewing	The devices these days are not good enough in supporting different views of information. For instance, chat and text needs small window display but email might need a bigger window. Devices are not flexible enough to support these different needs. When it comes to location-based applications, usually more information is needed to be shown such as search results of restaurants. Small screens are not suitable or not easy to identify these locations. Users get frustrated and may abandon the

	device.
Up to date info	I don't want to be directed to a restaurant which was closed two months ago.
Speed of service response	While I am at the location, I would expect the system to respond in real time to my request, e.g., app should respond with minimum delay; search results shall appear instantaneously.
Customizable	The service needs to be customizable by the user so they can incorporate their personal preferences.
Opt-in	People should be able to choose, each and every time or blanket permission, how they will be included by retailers using LBS.
Benefits from LBS	User should get benefits from location-based service, such as deals recommendation, friend recommendation, suggestions of a place, tips, etc.
List of available service must be current	Consumers may be frustrated when they attempt to access a service that is no longer available. For example, if a customer goes to a restaurant after reading a review about a particular dish, and then finds that the dish is no longer on the menu; that could be annoying.
Balance between user's privacy and usefulness	
Intrusion	No push info
Credibility of customers	
Interaction Level with Location-based Services	Adding more usage of the location based services will add value to this facility. Restaurants and commercial outlets are already using these as an advertising medium for people who use location services to detect nearby attractions/services. I.e. if games that are developed based on location services (giving users more reason to use location services), this can further increase usage of this service, giving rise to greater advertising/promotional opportunities which are already location dependent
Scale of both side of users	There are two sides of user networks in the LBS applications. One uses it as a consumer who wants to find useful information and the other one use it as a platform to advise their products or services. People would like to adopt a LBS if the scale of both side are big enough.

Real-time updated data	The service should be probably tapping on NFC principles.
Practicality and ease of use	The best LBS app I currently use is Strava, which I use when cycling in the woods. It's easy to use -- but it's not just the easiness that makes it practical. I mostly “use” the application before and after a ride. During a ride I just record the track, so I'm not “using” the mobile phone in a sense that I would be touching the screen.
Route planning and scheduling	I'm a bit skeptical to the idea of augmented reality, that I would search for a place to eat ad hoc by looking at the street through the screen. But I could easily see myself using an app that would allow me to pre-pinpoint places of interest in a new city. If the app would add value by giving an interesting/optimal route to go through all the places, that might be cool.
If the review could be more detailed	To relate the ratings with specific details, i.e., products, services, convenience, etc.
Ease of use and privacy respected	1. Ease of use of the app. 2. Do not like solicitation from vendors
Learning capability	The app should learn my likes and dislikes and be able to recommend the right products and services to me and filter out those advertisements and marketing materials that I have no interest in.
Preference Settings	I should be able to set my likes and dislikes in the app/system.
Privacy Policy	Vendors should have a good privacy policy and publish the policy online.
Free service	No cost to the customer - ever.
Up-to-Date Information	Example -- waiting time, special promotions, daily specials etc. for restaurants.
Location based services should be tied into the vendor's information systems	For vendors providing location-based services, the location-based services should be tied into the vendor's information systems so that the location based services are dynamic and up-to-date. That will also enable vendors to change the information quickly with less maintenance and development costs.
Comprehensive service	I want to have one app that provides restaurants, buses, weathers, hotels, cafes, taxis, gas stations,

	hospitals, etc. I do not have to have a few dozen apps on my mobile devices.
Personalizable	Should be able to be personalized to my preferences
Personal Privacy	My information will not be used for other purposes by the vendors.
Security	My personal information will not be accessed.
Control over the data	I should have the right to remove my data from vendors' database -- so that my movement over time cannot be tracked.
Augmented reality	Be able to integrate/map location-based services onto/with reality
Opt-in/opt-out/preference settings	Should be able to take into account users' preferences, otherwise it can become a nuisance.
Privacy setting	Provide users the flexibility to control their privacy settings (e.g., to different individuals or groups of individuals)

Subject's Experience with Location-Based Services = No

Critical Success Factor	Description
Security of own data	
Simple to use	
Up-to-dateness of data offered	
Correctness of data	
Non-intrusive	No push info, only requested info will be sent when needed
Fast	People don't have time to wait for LBS.
Accurate	Data and info has to be correct.
Simple	People are usually driving or outdoor, so can only perform simple operation.
Real time, accurate information	Information offered need to be real time, accurate and up to date.
Integration to calendars and personal memos	Should be able to integrate with calendars and memos of the users so that it's coordinated and batter managed
Convenience	
Completeness of Information	It's not sufficient to just know the location of a place

	and what service it offers. I want to know that the service will be available when I want it or it is of no value. For example, the LBS may tell me there is a restaurant nearby and list some reviews, but I want it to tell me if there is an extensive waiting time. If I have to wait more than 30 minutes for a table, I won't stay.
Standardized data and application	Multiple devices/operating systems/apps require interoperability via standardized formats, otherwise vendors have to work with multiple standards (expensive) and/or the reach of services is limited.
Ability to push information/advertisements to consumers in vicinity of service location	Relying on customer's pulling/asking for information may be ineffective. Being able to push messages e.g. Via Bluetooth or Wi-Fi to phones in the vicinity might be useful. AFAIK there are currently no standards that allow this.
Fast	People can get the fast information from location-based services.
Changing habits	Somehow, people have to change habits - from not using to using LBS. People who naturally like to try every gadget may find that easier. I have never used LBS and I am not attracted by the idea in any circumstance - the opportunity for serendipity and surprise is much greater when you just wander around. I'd rather develop my internal mental map of places, not rely on a smart phone's LBS to do so. Friends who use LBS tell me that maps are often out of date in any case.
UID	Apps seem designed for impossible small fingertips! Screen size is so small that either the “field of view” is tiny (a few streets) (yet readable) or huge (a district) (but unreadable). An iPad has an advantage in this respect.
Integration of apps and devices	I don't want to use multiple apps nor indeed multiple devices. It is critical to integrate everything onto any one single device and app. Indeed, the notion of independent apps should go out of the window - they should simply be add-ons to an app-integrator/aggregator.
All customers must own smartphones	While most people have cell phones, not everyone has a smartphone. The LBS should be available in different formats, such as computer or tablet as well.

Good reviews	Often people only post reviews when they are upset or disappointed. When they are satisfied, they do not post a review. Businesses may not wish to have their business listed and risk negative reviews.
Privacy protection	I can control who and how I share my location with.
Privacy Preservation	Privacy preservation would mean the protection of user location information without revealing to other 3rd party without the consent of the user. This would also include enabling user to control which entity can have access to the user location information in a trusted environment.
Publicity of LBS	Wider publicity of LBS, its features and usefulness will help to ensure that more people are aware of such service availability in the area or location and thus to try the service initially and later to use it more frequently, once they are familiar with the service and can see the many benefits of LBS.
Personalization	The service should know the personal preference and fill out a lot of non-relevant information to make recommendation.
User choice	User should control the process by which information is sent to them. Lots of filters needed.

APPENDIX C

Categorization of Critical Success Factors and their Descriptions Based on Subjects' Work Experience in the Location-Based Services Industry

Subject's Work Experience in the Location-Based Services Industry = Yes

Critical Success Factor	Description
Benefits from LBS	User should get benefits from location-based service, such as deals recommendation, friend recommendation, suggestions of a place, tips, etc.
Ease of use and privacy respected	1. Ease of use of the app. 2. Do not like solicitation from vendors

Subject's Work Experience in the Location-Based Services Industry = No

Critical Success Factor	Description
Security of own data	
Simple to use	
Up-to-dateness of data offered	
Correctness of data	
Non-intrusive	No push info, only requested info will be sent when needed
Fast	People don't have time to wait for LBS.
Accurate	Data and info has to be correct.
Simple	People are usually driving or outdoor, so can only perform simple operation.
Convenience	
Cost on data access	
Functionality/usefulness	Whether the app can provide rich features, functions
Reliability	Whether the app would crash, or make my phone crash
Space taken on phone	Considering how much memory space it would take, and whether the app could move from internal memory to SD card
Real time, accurate information	Information offered need to be real time, accurate and up to date.

User choice	Ability to select who will receive a message from me and whose messages I will receive. For example, with yelp I would only want to send the message to people with whom I am going to lunch that day. I would not want to know where everybody else is eating.
Integration to calendars and personal memos	Should be able to integrate with calendars and memos of the users so that it's coordinated and batter managed
Adequate sifting and relevancy of information	As time goes on there will be too much information, spammy
Availability of data at a cheap price when travelling abroad	Location based services are most useful in an unfamiliar situation. Data roaming prices are extortionate.
Aesthetics	
Control	I feel like I'm controlling the app and the app isn't controlling me
Mass and seamless participation by retailers and service providers	There must be lots of content for access. One also cannot be limited by data non-sharing across different telco providers
Control	Don't push content to my phone; only if I request the service.
Ease of use	It has to be easy to use or I'll just keep doing what I've been doing
Authentication	The reviews provided for the service need to be authenticated by filtering out reviews considered useless by other users.
Convenience	
Assurance of privacy	For me to adopt a location-based service, i need to be quite sure that my location (current and history) is used for me, not for tracking companies.
Real time updated data	Location-based service should be time-sensitive and accurate.
My personal data is not tracked by vendors.	
Information should be up to date and accurate.	
Efficient	Since the service has a purpose, it needs to complete its purpose in an efficient manner. I don't want to have to navigate unnecessarily.
Context awareness	The device and service together must be able to define or guess what I'm interested in current situation. In

	remote locations, this is easy, but e.g. in shopping mall much more complex. This would help with spam and information overload
Easy search	Proximity based search should be as easy as possible
Uses must see a benefit to using a LBS	There must be an incentive for using a LBS. Services such as GPS for navigation, weather, and restaurants are useful and provide a benefit to its users. Other novelty uses of LBS, such as check-ins for gaming and Facebook, do not appeal to the masses. It is my belief that a proper incentive for use and a sense of secured privacy must be established for a LBS to be successful.
Information update	For the location-based information, I think the information should be updated regularly. People who are using the location-based information are encouraged to join the information update.
Completeness of Information	It's not sufficient to just know the location of a place and what service it offers. I want to know that the service will be available when I want it or it is of no value. For example, the LBS may tell me there is a restaurant nearby and list some reviews, but I want it to tell me if there is an extensive waiting time. If I have to wait more than 30 minutes for a table, I won't stay.
Flexibility of viewing	The devices these days are not good enough in supporting different views of information. For instance, chat and text needs small window display but email might need a bigger window. Devices are not flexible enough to support these different needs. When it comes to location-based applications, usually more information is needed to be shown such as search results of restaurants. Small screens are not suitable or not easy to identify these locations. Users get frustrated and may abandon the device.
Up to date info	I don't want to be directed to a restaurant which was closed two months ago.
Standardized data and application	Multiple devices/operating systems/apps require interoperability via standardized formats, otherwise vendors have to work with multiple standards (expensive) and/or the reach of services is limited.
Ability to push information/advertisements to consumers in vicinity of service location	Relying on customer's pulling/asking for information may be ineffective. Being able to push messages e.g. Via Bluetooth or Wi-Fi to phones in the vicinity might be useful. AFAIK there are currently no standards that allow this.

Speed of service response	While I am at the location, I would expect the system to respond in real time to my request, e.g., app should respond with minimum delay; search results shall appear instantaneously.
Fast	People can get the fast information from location-based services.
Customizable	The service needs to be customizable by the user so they can incorporate their personal preferences.
Opt-in	People should be able to choose, each and every time or blanket permission, how they will be included by retailers using LBS.
Changing habits	Somehow, people have to change habits - from not using to using lbs. People who naturally like to try every gadget may find that easier. I have never used LBS and I am not attracted by the idea in any circumstance - the opportunity for serendipity and surprise is much greater when you just wander around. I'd rather develop my internal mental map of places, not rely on a smart phone's LBS to do so. Friends who use LBS tell me that maps are often out of date in any case.
UID	Apps seem designed for impossible small fingertips! Screen size is so small that either the “field of view” is tiny (a few streets) (yet readable) or huge (a district) (but unreadable). An iPad has an advantage in this respect.
Integration of apps and devices	I don't want to use multiple apps nor indeed multiple devices. It is critical to integrate everything onto any one single device and app. Indeed, the notion of independent apps should go out of the window - they should simply be add-ons to an app-integrator/aggregator.
All customers must own smartphones	While most people have cell phones, not everyone has a smartphone. The LBS should be available in different formats, such as computer or tablet as well.
Good reviews	Often people only post reviews when they are upset or disappointed. When they are satisfied, they do not post a review. Businesses may not wish to have their business listed and risk negative reviews.
List of available service must be current	Consumers may be frustrated when they attempt to access a service that is no longer available. For example, if a customer goes to a restaurant after reading

	a review about a particular dish, and then finds that the dish is no longer on the menu; that could be annoying.
Balance between user's privacy and usefulness	
Intrusion	No push info
Privacy protection	I can control who and how I share my location with.
Credibility of customers	
Interaction Level with Location-based Services	Adding more usage of the location based services will add value to this facility. Restaurants and commercial outlets are already using these as an advertising medium for people who use location services to detect nearby attractions/services. I.e. if games that are developed based on location services (giving users more reason to use location services), this can further increase usage of this service, giving rise to greater advertising/promotional opportunities which are already location dependent
Scale of both side of users	There are two side of user networks in the LBS applications.one uses it as a consumer who want to find useful information and the other one use it as a platform to advise their products or services. People would like to adopt a LBS if the scale of both side are big enough.
Privacy preservation	Privacy preservation would mean the protection of user location information without revealing to other 3rd party without the consent of the user. This would also include enabling user to control which entity can have access to the user location information in a trusted environment.
Real-time updated data	The service should be probably tapping on NFC principles.
Publicity of LBS	Wider publicity of LBS, its features and usefulness will help to ensure that more people are aware of such service availability in the area or location and thus to try the service initially and later to use it more frequently, once they are familiar with the service and can see the many benefits of LBS.
Personalization	The service should know the personal preference and fill out a lot of non-relevant information to make recommendation.
User choice	User should control the process by which information is sent to them. Lots of filters needed.

Practicality and ease of use	The best LBS app I currently use is Strava, which I use when cycling in the woods. It's easy to use -- but it's not just the easiness that makes it practical. I mostly “use” the application before and after a ride. During a ride, I just record the track, so I'm not “using” the mobile phone in a sense that I would be touching the screen.
Route planning and scheduling	I'm a bit skeptical to the idea of augmented reality, that I would search for a place to eat ad hoc by looking at the street through the screen. But I could easily see myself using an app that would allow me to pre-pinpoint places of interest in a new city. If the app would add value by giving an interesting/optimal route to go through all the places, that might be cool.
If the review could be more detailed	To relate the ratings with specific details, i.e., products, services, convenience, etc.
Personal privacy	My information will not be used for other purposes by the vendors.
Security	My personal information will not be accessed.
Control over the data	I should have the right to remove my data from vendors' database -- so that my movement over time cannot be tracked.
Personalizable	Should be able to be personalized to my preferences
Comprehensive service	I want to have one app that provides restaurants, buses, weathers, hotels, cafes, taxis, gas stations, hospitals, etc. I do not have to have a few dozen apps on my mobile devices.
Up-to-Date Information	Example -- waiting time, special promotions, daily specials etc for restaurants.
Location based services should be tied into the vendor's information systems	For vendors providing location-based services, the location-based services should be tied into the vendor's information systems so that the location based services are dynamic and up-to-date. That will also enable vendors to change the information quickly with less maintenance and development costs.
Privacy policy	Vendors should have a good privacy policy and publish the policy online.
Free service	No cost to the customer - ever.
Learning capability	The app should learn my likes and dislikes and be able to recommend the right products and services to me and filter out those advertisements and marketing materials that I have no interest in.

Preference settings	I should be able to set my likes and dislikes in the app/system.
Augmented reality	Be able to integrate/map location-based services onto/with reality
Opt-in/opt-out/preference settings	Should be able to take into account users' preferences, otherwise it can become a nuisance.
Privacy setting	Provide users the flexibility to control their privacy settings (e.g., to different individuals or groups of individuals)

APPENDIX D

Three-Part Questionnaire

Part 1

*Please rank the importance of the following **critical success factors** for location-based services from 1 to 15, with 1 being the most important, 2 being the second most important, etc. You can use the number 1 to 15 ONLY once.*

	Personalizable/Preference Setting Ability to customize and personalize location-based services to user's preferences, set likes and dislikes, set when user wants information delivered to him/her, control which information to send, etc.
	Real-Time/Up-To-Date Information Information provided should be real-time, up-to-date, correct, accurate, complete, and relevant.
	Usefulness/Benefits Usefulness of the information and benefits to be gained from using location-based services such as special deals, discount coupons, restaurant suggestions, etc.
	Speed Ability to obtain information fast from location-based services.
	Cost Data roaming prices, cost of location-based services applications, etc.
	Standards and Platform Independence Interoperability between devices, operating systems and applications.
	Aesthetics Interfaces are pleasant to view and information is layout nicely.
	Simple/Ease of Use Location-based services should be easy to use, convenient to use, and with easy and simple search interfaces.
	Smart Location-Based Services Ability of devices and services to be aware of current locations, contexts, and/or learn the users' likes and dislikes.
	Quality of Reviews Specific, detailed, and useful reviews of products and services.

	Privacy Protection of users' information. Ability to control which entity has access to the users' information.
	Integrated Applications/Services Should have one or two applications that integrate all the services such as restaurants, buses, weathers, gas stations, hospitals, etc. instead of having multiple applications that provide different services.
	Reliability Applications should not crash and services should always be available.
	Size of Applications Applications should not take much memory space.
	Publicity of Location-Based Service Wider publicity of location-based services, its features, and usefulness.

Part 2

Please rate the importance of the each of the following critical success factors for location-based services.

Personalizable/Preference Setting

Ability to customize and personalize location-based services to user's preferences, set likes and dislikes, set when user wants information delivered to him/her, control which information to send, etc.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Real-Time/Up-To-Date Information

Information provided should be real-time, up-to-date, correct, accurate, complete, and relevant.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Usefulness/Benefits

Usefulness of the information and benefits to be gained from using location-based services such as special deals, discount coupons, restaurant suggestions, etc.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Speed

Ability to obtain information fast from location-based services.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Cost

Data roaming prices, cost of location-based services applications, etc.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Standards and Platform Independence

Interoperability between devices, operating systems and applications.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Aesthetics

Interfaces are pleasant to view and information is layout nicely.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Simple/Ease of Use

Location-based services should be easy to use, convenient to use, and with easy and simple search interfaces.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Smart Location-Based Services

Ability of devices and services to be aware of current locations, contexts, and/or learn the users' likes and dislikes.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Quality of Reviews

Specific, detailed, and useful reviews of products and services.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Privacy

Protection of users' information. Ability to control which entity has access to the users' information.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Integrated Applications/Services

Should have one or two applications that integrate all the services such as restaurants, buses, weathers, gas stations, hospitals, etc. instead of having multiple applications that provide different services.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Reliability

Applications should not crash and services should always be available.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Size of Applications

Applications should not take much memory space.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Publicity of Location-Based Services

Wider publicity of location-based services, its features, and usefulness.

1	2	3	4	5	6	7	8	9
Unimportant		Of Little Importance		Moderately Important		Important		Very Important

Part 3

In this part of the survey, we are interested in your demographic information. Please answer the following questions by circling the appropriate answers.

1. Your age

____ 16-20	____ 26-30	____ 36-40	____ 46-50
____ 21-25	____ 31-35	____ 41-45	____ 51-55
			____ 56 and above

2. Your gender

____ Female ____ Male

3. Highest education level attained

____ High school	____ Bachelor	____ Ph.D.
____ Associate	____ Master	____ Other :_____

4. Please indicate the number of years and months of your experience with any kind of mobile services : _____ years _____ months

5. Please indicate the number of hours ***per week*** that you spend using any mobile services (to the nearest hour): _____ hours/week

6. Do you use any kind of location-based services? ____Yes ____No
   If Yes:
   - Please indicate the number of years and months of your experience with any kind of location-based services _____ years _____ months
   - Please indicate the number of hours ***per week*** that you spend using any location-based services (to the nearest hour): _____ hours/week

7. Do you work in the location-based services industry? ____Yes ____No
   If Yes:
   - Please indicate the number of years and months of your experience working in the location-based services industry _____ years _____ months
   - Current job title in the location-based services industry (e.g., programmer, consultant, developer): _____

Please indicate your level of agreement or disagreement with the following questions:

8. In general, location-based services are attractive.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

9. In general, location-based services are useful.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree

10. In general, location-based services are valuable.

1	2	3	4	5	6	7
Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree