

DEVELOPMENT OF INTERFACE FEATURE-BASED M-TICKET FRAMEWORK FOR AIR TRAVEL INDUSTRY

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Abstract

The development of user-friendly mobile commerce (m-commerce) environment is crucial to the success of m-commerce. The current research develops a feature based mobile-commerce framework for air travel industry by studying the existing e-ticketing environments. Specifically, seventeen online air travel agencies are examined to find necessary features for online ticketing with a focus on user-friendly features. These features are further classified into three categories to develop a related feature pyramid. These features are crucial to the success of m-ticketing development. Multivariate cluster analysis is also conducted to classify these 17 agencies into 3 groups. The beneficiaries of the findings from the current research are existing on-line travel agencies, future m-ticket travel agencies, and the developers of mobile devices.

Keywords: mobile-commerce, mobile-ticketing, airline travel agent website, cluster analysis

1. INTRODUCTION

Mobile commerce (m-commerce) is defined as transaction via wireless device and data connection that results in a transfer of information, services, and/or goods (Jarvenpaa et al 2003). It is also an extension of electronic commerce (e-commerce) that allows users to interact with other users and businesses anytime, anywhere; therefore m-commerce and e-commerce have a lot in common since they involve much of the same functionality in terms of facilitating Internet (Coursaris et al 2003). From the user's point of view, the most significant difference is the Internet access device. While e-commerce is conducted mainly through desktop computers, m-commerce is facilitated via wireless devices such as PDA, palm, and

cell phones, giving the user freedom of mobility.

In the US, the growth of wireless industry peaked in 2000, with the total revenue of over 52 billion dollars and over 1 billion subscribers. Between 1996 and 2000, the wireless industry in US grew over 120% in revenue, while its growth slowed down to 67% between 2000 and 2003. Although the growth rate of the wireless industry has been decelerating since 2000, the industry experts are positive about the future growth of the wireless industry, since the economy is recovering from the recent recession, and the technological advances are making the mobile devices more ubiquitous (Leon, 2004).

The Standard & Poor's Survey indicates that the convenience of the

wireless devices is the biggest reason for the growing popularity of wireless services (Leon 2004). Other researches such as the one done by Lee & Benbasat (2003) also agrees with the S&P's survey finding. This finding coincides with the prominent sales increase in phone PDAs among various types of PDAs. Between the years of 2001 & 2003, total PDA sales has grown over 62%, with keyboard PDA and pen PDA sales growth of 50%, while phone PDA grew at an impressive rate of 2000% (Computer Industry Almanac, 2004). Although the PDA market has been on a constant growth last few years, growth of phone PDAs in the US has been conspicuous.

Owing to the fast acceptance of mobile technologies, individuals and organizations are now able to work at unconventional places. As Metcalf's Law suggests, the gaining popularity of mobile commerce provokes even greater usage of mobile technologies (Perry et al 2001).

However, debate on pros and cons of m-commerce is a little more complicated. An international survey done in 2003 clearly delivers the users' hesitation in embracing m-commerce (Jarvenpaa et al 2003). The survey shows that the users of mobile devices are mostly concerned about the limited functions of cell phones and PDAs, limited range of services offered by the providers, and the difficulty maneuvering within the limited size of the mobile devices. Uncertain technology standards, the complexities of interactive applications, and the threat of governmental regulations have contributed to the disappointing spread of m-commerce, too (Jarvenpaa et al 2003, Lee & Benbasat 2003).

Still, the growing popularity of the mobile devices attests that the benefits of the mobile technology far outweigh the limitations. The increasing acceptance of the mobile technology is conspicuous in the air travel industry, in particular. By default, air travelers are on the go constantly, and the mobile devices give the air travelers a tool to stay informative at all times. Almost all travelers own a mobile phone; three in ten leisure travelers own a laptop computer; and PDA ownership

among travelers is substantially higher than that of US average (Harteveldt 2004).

Hence, the current research launched to develop an m-ticket framework by examining the current e-ticket environment, especially, in terms of user-friendliness of the user interface. Consequently, the beneficiaries of the findings from the current research are; existing on-line travel agencies, future m-ticket agencies, and the developers and makers of mobile devices. The findings from the exhaustive study of the features on the on-line travel agencies' websites should give the existing on-line travel agencies an overview of how they pair up to their competitors. Also, the findings from the current research will give the future m-ticket agencies a guideline on which they may build their own m-ticket framework. The findings from the current study will also inform the makers and developers of mobile devices of what the core features should be on their future products.

The current paper is organized as follows. Section 2 presents a feature-based framework for mobile ticketing, with more focus on the user-friendliness of the interface. Section 3 explains the methodology used for the research; examining the existing e-ticket environment by studying 17 on-line travel agencies that offer electronic tickets for air travel and the features available on those websites. Section 4 discusses the findings from the research as well as the *Feature Pyramid* developed as a result. Section 5 presents the conclusions.

2. M-TICKET FRAMEWORK

Twenty-five features found on 17 on-line travel agencies' websites are studied for the current research, and those features are summarized in Table 1. These features are then grouped into five categories to fit into various segments of the m-ticketing flow, as illustrated in figure 1. This breakdown of the m-ticketing flow can allow on-line travel agencies to determine what features or functions to

target to differentiate themselves from their competitors.

Table 1. Features available on the On-Line Travel Agencies Websites

Flows	Features	
(1)	A	Search begins at the homepage
	B	Dropdown menu for the city code is available
	C	Dropdown calendar is available
	D	Specific travel time can be chosen
	E	Both one-way and round trip can be booked.
	F	Number of passengers can be picked
	G	Vacation packages are available
	H	Other services such as rental cars or hotels are available
	I	Phone numbers are available w/I one click from the homepage
	J	Both domestic and international travels are available
	K	Class of service can be chosen
(2)	L	Membership is required to book tickets
	M	"My Account" can be set up to view my travel profile
	N	Redeemable coupons are available
(3)	O	Bidding is available
	P	Multiple airlines can be searched
	Q	Other options on similar schedule are available
	R	Frequent flyer number for various airlines can be entered
(4)	S	Both E-ticket and paper ticket are available
	T	Flights are sorted by price
	U	Flights can be sorted by other than price, such as arrival time, flight duration, and airline
(5)	V	Payment option other than credit card is available
	W	Processing fee other than paper ticket delivery charge is applied
	X	Source of credit card security is available
	*Y	Collaboration with other websites is done
Note: Feature Y is not included in the framework, since it is not directly involved in the m-ticket flow: Rather, it has to do with the collaboration among vendors.		

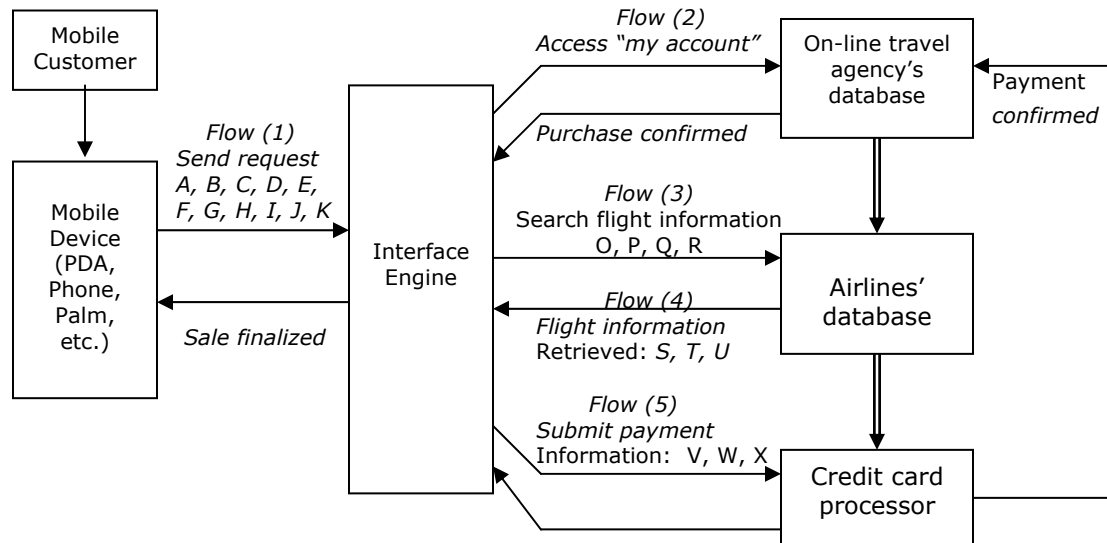
Shih & Shim (2002) developed a business-based m-commerce framework scenario. In their framework, Shih & Shim focused on the inside of the business that

utilizes m-commerce. The m-ticket framework developed in the current paper sprung from that of Shih & Shim, and more focus was put on the features of the websites through which transactions are exchanged. Twenty-five features found on 17 on-line travel agencies' websites are studied for the current research, as summarized in Table 1. These features are then grouped into five categories to fit into various segments of the m-ticketing flow, as illustrated in figure 1.

This breakdown of the m-ticketing flow can allow on-line travel agencies to determine what features or functions to target to differentiate themselves from their competitors. Flow (1) is the most critical in attracting/retaining customers, since the user interface is the only medium through which mobile customers interact with the service providers and vendors. Flow (2) is also crucial to the success of m-ticketing, since order-fulfillment is another essential part of the mobile commerce. Flow (3) and (4) demonstrates the strength of supply chain management of the on-line air travel agencies, and flow (5) deals with supplier-customer relationship as well as the Electronic Fund Transfer (EFT) capability of the on-line travel agencies.

A possible flow of m-ticket transaction is as follows: Using his/her mobile device, a customer enters data, specifying his/her requirements. Request is sent via mobile device and user interface to the on-line travel agency (Flow 1), and the travel agency recognizes the customer (Flow 2) and transfers the request to multiple airlines' database (Flow 3). Airlines that have matching flights to the customers' requirements send back the information to the customer via the on-line travel agency's user interface (Flow 4). When the customer accepts the proposed itinerary and the fare, payment information is sent to the credit card processing company (Flow 5), and the credit card processing company credits the payment to the on-line travel agency's account. Travel agency confirms the flight, and the purchase is complete.

Figure 1. Feature-Based Framework for M-Ticket Processing



3. METHODOLOGY

The current study analyzes the features of 17 on-line travel agencies' websites that offer electronic airline ticket and develops an m-ticket framework that can be used for air travel industry. M-commerce itself is a relatively new area and, undoubtedly, mobile airline ticketing is not yet available worldwide. As many scholars and industry analysts have claimed, mobile commerce is derived from electronic commerce (Coursaris et al 2003, Ozok & Wei 2003, Lee and Benbasat 2003); therefore, electronic airline ticketing that is more widely and popularly used should provide good guidelines on how mobile airline ticketing may be approached.

3.1. Data Gathering

Total of 25 features were gathered and tallied from the on-line travel agencies' websites, and the results are summarized in Table 2. Most emphasis was put on the user-friendliness of the interface; namely, how easily and quickly can a customer get the information he or she needs and

completes a purchase. Unlike e-commerce participants, users of mobile commerce usually find themselves in an unfamiliar and unpredictable environment (Perry et al 2001). Therefore, developing a user-friendly interface can reduce the constraints put by the unpredictability of mobile environment.

The websites are listed in no particular order of significance; however, the features are listed in the order of how m-ticket may be processed. Please note that three websites allow customers to bid prices for the airline tickets. These three websites (Lowest Fare, One Travel, and Priceline) established collaborative relationship among them and direct the customers to the partners when the customers acquire services that are not of their core competency. "Lowest Fare" and "One Travel" simply direct their customers to "Priceline" when the customers want to bid the price, while "Priceline" directs its customers to "Lowest Fare" when the customers want to accept the advertised fare. Therefore, "Priceline" is the only website that allows customers to bid their own prices.

Table 2. Distribution of Features among Websites

On-Line Travel Agencies	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Total Number of Features
1800 cheap seats	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			Y	Y	Y	Y	Y			Y	Y		19
Airfare	Y			Y	Y	Y	Y	Y	Y	Y			Y			Y	Y			Y				Y		13
Airtrek	Y	Y	Y						Y			Y	Y			Y	Y			Y	Y		Y	Y		12
All cheap fares	Y		Y	Y	Y	Y	Y	Y	Y		Y		Y			Y	Y	Y		Y			Y	Y		16
Cheap air	Y		Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			Y	Y	Y		Y		Y	Y	Y		18
Cheaptickets	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y				Y	Y	Y	Y	Y	Y		Y	Y		18
Expedia	Y		Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y		Y		Y		Y	Y		Y	Y		18
Hotwire	Y		Y	Y	Y	Y	Y	Y		Y	Y	Y	Y			Y	Y			Y			Y	Y		16
Lowest fare	Y		Y	Y	Y		Y	Y		Y			Y		Y	Y	Y	Y		Y	Y		Y	Y	Y	17
One Travel	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y	Y		Y	Y	Y			Y	Y		Y	Y	Y	19
Orbitz	Y		Y	Y	Y	Y	Y	Y	Y	Y		Y	Y			Y	Y		Y	Y	Y		Y	Y		18
Priceline	Y		Y	Y	Y	Y	Y	Y		Y		Y	Y		Y	Y	Y	Y		Y	Y		Y	Y	Y	19
Travelhub			Y	Y	Y	Y	Y	Y		Y	Y					Y	Y	Y		Y			Y	Y		14
Travelocity	Y		Y	Y	Y	Y	Y	Y		Y		Y	Y			Y	Y	Y	Y	Y			Y	Y		17
Travelselect		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y			Y	Y	Y		Y				Y		17
Travelworm		Y	Y	Y	Y	Y	Y	Y	Y				Y			Y	Y			Y			Y	Y		14
Tripfox	Y		Y	Y	Y	Y	Y	Y		Y			Y			Y	Y	Y		Y	Y		Y	Y		16
Total number of websites offering each feature	14	6	16	16	16	15	16	16	9	14	1	10	16	1	3	17	16	11	4	17	8	1	15	17	3	

4. FINDINGS

In this section, the features gathered from 17 on-line travel agencies' websites are tallied and categorized for further analysis and discussions. First, the numbers of websites that provide each feature are tallied to figure out what the most widely used features are. Second, the numbers of features that various websites provide are tallied to analyze the versatility of those websites. The results from the multi-variant analysis are also discussed.

4.1. Analysis of Website Features

The numbers of websites that provide each of the 25 features from Table 2 are tallied to separate the most widely used features from those that are not. Careful attention must be paid, however, in translating the tallied numbers. As many of us, as Internet users, may know already, some features are more hindrance than assistance to

the user. At the same token, some of the features that are not as widely used as others can be of great assistance to the mobile customers.

For example, all websites that we studied, except for "Airfare," have a dropdown calendar to choose desired travel dates. But only six websites (1-800 Cheap seats, Airtrek, Cheaptickets, One Travel, Travelselect, & Tripfox) offer dropdown city codes to choose the origination and destination of the travel. When misspelled city is entered, none of the websites that do not have dropdown menu for city codes searches for the cities that have similar names. Instead, a new window for more advanced search pops up or an error message gets generated. Fail-safing the search function by adding a dropdown menu for city code will not only save customers' time but also keep the customers from leaving the website out of frustration.

Table 3. Number Distribution and Percentage Distribution of Website Features

Features	Number of Websites with this Feature	% of Websites with this Feature
A	14	82.35%
B	6	35.29%
C	16	94.12%
D	16	94.12%
E	16	94.12%
F	15	88.24%
G	16	94.12%
H	16	94.12%
I	9	52.94%
J	14	82.35%
K	4	23.53%
L	10	58.82%
M	16	94.12%
N	1	5.88%
O	3	17.65%
P	17	100.00%
Q	16	94.12%
R	11	64.71%
S	4	23.53%
T	17	100.00%
U	8	47.06%
V	1	5.88%
W	15	88.24%
X	17	100.00%
Y	3	17.65%

The most widely used features (Features C, D, E, F, M, and Q) are usually found in the first search page, whether it is the homepage of the website or not. This observation clearly validates the importance of user-friendliness of the website's interface. The least commonly used features such as "class of service selection" or "payment option other than credit card" do not seem to be directly related to the immediate need of travel, explaining why those features are not very popular among websites studied. "Redeemable

coupon" is not as ubiquitous as other features, but it may attract mobile customers, as both e-commerce and m-commerce get more popular.

4.2. Feature Pyramid

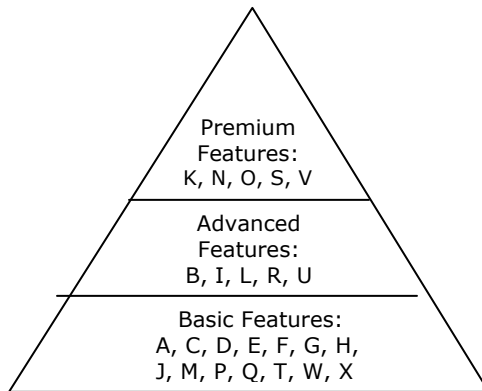
Based on the result from the analysis in section 4.1, the *Feature Pyramid* is constructed. The features that more than 75% of the websites provided are categorized as "Basic Features." Advanced features are those that between 25% and 75% of the studied websites provided. The features that less than 25% of the websites offered are under "Premium Features" category. Basic features are A, C, D, E, F, G, H, J, M, P, Q, T, W, and X; Advanced features are B, I, L, R, and U; and features K, N, O, S, and V fall into Premium Feature category.

Notice that only four websites (1-800 Cheat seats, Cheaptickets, Orbit, and Travelocity) give option to choose paper ticket over electronic ticket (Feature S in Table 3), unless paper ticket is the only option. Except for the international flights where paper tickets are more prevalent than electronic tickets, e-ticket is the airlines' preference for all US domestic flights. Even the ones that offer paper ticket impose a separate delivery charge for paper ticket on top of their regular processing fees. This observation supports the trend of paperless business environment found in many other industries such as banking, insurance, mortgage, to name a few. Credit Cards are the primary method of payment in all websites studied, which clearly enhance the mobility and speed of the m-commerce. Currently, all websites provide the security source of the credit card processing they utilize.

The *Feature Pyramid* is based on the quantitative figures and that those figures do not represent any qualitative aspects. Therefore, the Basic Features simply mean the most frequently available features, while the Premium Features are those that are the least frequently available. Although the Basic Features are those features available at most websites, the high availability of certain feature does not necessarily translate to the effectiveness or usefulness of the feature. Therefore, further study must be done on the

usefulness of these features to validate them.

Figure 2. Feature Pyramid



Even though the argument about the usefulness of the features may be valid, one would safely assume that the basic features are relevant to most customers. At the same token, an on-line travel agency might consider adding more premium features to distinguish its website from those of the competitors. The more important concern is, however, is the user-friendliness of these features. Considering the limited size of the most mobile devices, careful consideration must be given on choosing the website features and how they are linked to each other.

Notice that approximately half of the basic features (Features A, C, D, E, F, and M) are to fasten the search process and fail-safe user's data entry. Unlike e-commerce device, m-commerce device has many limitations such as limited size, limited display window, limited processing power, and low bandwidth (Tarasewich 2003, Lee & Benbasat 2003). Coupled with these limitations are human characteristic of many mobile device users. M-commerce participants are usually on the go; therefore they usually have less time, less patience, and less attention span, and many other activities compete for the user's attention. Consequently, not only getting but also keeping the user's

attention has to be a critical factor in designing successful user interface.

4.3. Analysis of Websites and their versatility

Seventeen on-line travel agencies that are studied for the current research are listed in Table 4 in a descending order of total number of features available. In average, these websites have about 17 features available, and all websites studied have at least 12 or more of the features that are examined. The on-line travel agencies that offer more than the average number of features are: 1-800 cheap seats; One Travel; Priceline; Cheap air; Cheaptickets; Expedia; Orbitz; Lowest fare; Travelosity; and Travelselect. The following on-line travel agencies offer less than the average number of features: All cheap fares; Hotwire; Tripfox; Travelhub; Travelworm; Airfare; and Airtrek.

"1-800 cheap seats," "One Travel," and "Priceline" have the most features available (19 features), while "Airtrek" has the fewest number of the features available (12 features). Most of these websites handle both domestic and international flights and carry similar services. The websites that specialize in international flights such as "Airtrek" have a slightly different feel and lack features that are common in other websites. For example, those features that are used to help specify the itinerary, such as dropdown menu for travel cities and number of passengers, are not available on "Airtrek." Nor does "Airtrek" offer hotels and rental car services as many other websites do. However, it offers many discount fares to international travels and overseas package tours.

Table 4. Total Number of Available Features and the Percentage of Available Features

Websites	Total Number of Features	Percentage of Available Features
1800 cheap seats	19	82.61%
One Travel	19	82.61%
Priceline	19	82.61%
Cheap air	18	78.26%
Cheaptickets	18	78.26%
Expedia	18	78.26%
Orbitz	18	78.26%
Lowest fare	17	73.91%
Travelocity	17	73.91%
Travelselect	17	73.91%
All cheap fares	16	69.57%
Hotwire	16	69.57%
Tripfox	16	69.57%
Travelhub	14	60.87%
Travelworm	14	60.87%
Airfare	13	56.52%
Airtrek	12	52.17%
Average	17	71.87%

Cluster analysis is also conducted to analyze the classifications of on-line travel agencies' websites. There are several cluster analysis methods exist, including HIERARCHICAL cluster method, FASTCLUS cluster method, and MODELCLUS cluster method. FASTCLUS cluster method is used to find disjoint clusters of observations using a k-means method. This method is especially suitable for large data sets (SAS, 2003). Therefore, FASTCLUS is selected in the current research to analyze 17 travel agencies' websites.

Overall, there are 25 variables related to all these interface features with 17 observations. A total of 30 iterations have been conducted for FASTCLUS analysis (SAS, 2003). The resulted three clusters from SAS are showed in Table 5.

5. CONCLUSIONS

The exhaustive research from the current study suggests that the m-commerce is indeed promising, as the mobile devices are becoming more popular and getting more acceptances from the customers. However, some doubts and concerns arose when high hopes and anticipation of m-commerce deflated last few years (Jarvenpaa et al 2003, Stafford & Gilleson 2003). Hence, the current study began to develop a successful m-commerce environment in the air-travel industry by study the existing e-commerce environment. The findings from the current research indicate that developing user-friendly m-commerce framework is crucial to the success of m-commerce. The major findings from the current study are as follows:

Table 5. Cluster Analysis on Airline Travel Agent Websites

Cluster Numbers	Number of Websites	Websites
1	8	Expedia, Orbitz, Travelocity, Travelselect, All cheap fares, Hotwire, Travelhub, Airtrek
2	8	1800 cheap seats, One Travel, Cheap air, Cheaptickets, Lowest fare, Tripfox, Travelworm, Airfare
3	1	Priceline

First, it is not the number of features but the usefulness of the features that is critical to the success of the m-commerce. Although all features were available in average of 67% of the websites, most widely used features were available at over 80% of the websites, while certain web features (K, N, O, S, V, & Y) were available at less than 25% of the websites. All on-line travel agencies studied in the current research have at least 12 features, and almost all of them, except for "Airfare" and "Airtrek," have the Basic Features of the "Feature Pyramid." However, some on-line travel agencies streamlined the features better than others so that the users can get the

information they want faster than they could have done on other websites.

Second, a well-developed m-commerce framework should provide not only the Basic Features but also some of the Advanced Features and Premium Features. Also, the Advanced and Premium features must be developed to enhance the user-friendliness of the framework and to distinguish and separate one's user interface from those of competitors.

Currently, advanced features (K, N, O, S, V, Y) are available at less than 25% of the websites (24%, 6%, 18%, 24%, 6%, 18% respectively). Redeemable coupons (Feature N) that are available at only one website (Expedia.com) may become more prevalent once e-ticketing and m-ticketing gain more popularity. Also, "drop down menu for the city code" is categorized as an Advanced Feature, since only six out of 17 websites (35%) provide this feature. However, the dropdown menu for the city code would help the users to fasten the search process, thus assuming less chance to lose the customers.

Third, understanding socio-psychological aspects of m-commerce customers is essential to the success of m-commerce (Palen & Salzman 2002, Lee and Benbasat 2003). To coincide the speed and the ubiquity of m-commerce, the users/customers of m-commerce are almost always on the go and less patient than those of e-commerce. Therefore, the ideal m-commerce framework must be able to not only attract new customers but also beat the distractions that are also competing for the user's attention. As discussed earlier, among all PDA sales increase, phone PDA sales increase (over 2000% between the years of 2001 and 2003) was noticeably higher than those of other segments of PDA, which averaged at around 50%.

To reiterate, significant amount of attention must be paid to the user friendliness of the m-commerce framework to ensure the successful venture of m-commerce. Also, not only

the technical aspect of m-commerce but also the socio-psychological aspect of the m-commerce customers should be studied in depth for m-commerce to be incorporated into the every day businesses of the world. Clearly, the ease of operation, the convenience, and the user-friendliness of mobile devices must be one of the top priorities for developers and makers of mobile devices.

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