Information Kiosk for Use in Electronic Commerce: Factors Affecting its Ease of Use and Usefulness

Lai-Lai Tung

Information Management Research Centre (IMARC), Nanyang Business School,
Nanyang Technological University, Nanyang Avenue, Singapore 639798
alltung@ntu.edu.sg

Abstract

This study has several objectives, which includes understanding the differences amongst kiosks in terms of factors affecting ease of use and usefulness, as well as future improvements that kiosk users want. Towards that end, the three research questions of this study are: "What are the most important factors affecting a user's belief of ease of use and usefulness of kiosks?", "Are there differences in these factors for different types of kiosks?" and "What are users' desired improvements for the future?"

Results indicated that the top four determinants of ease of use and usefulness are ease of operation (ease of use factor), data security (reliability and security of data factor), convenience (location factor) and reliability of data (reliability and security of data factor). Further analyses of the results highlighted that the factor reliability and security of data differed significantly amongst the different types of kiosks. Finally, while users of kiosks are found to be receptive of information kiosks, they have noticeable contributions and suggestions as to how information kiosks can better serve their needs in future. The more significant suggestions include making kiosks operate faster, introducing more functions, and improving user-friendliness. The paper ends with a section on implications for EC practitioners who may be developing and implementing kiosk applications.

1. Introduction

Electronic Commerce (EC) has been fuelled by the increased availability of inexpensive computers and by ubiquitous Internet connectivity. The major means of accessing information and trading in EC has been through either personal or

company-owned computers. Research referring to B2B or B2C type of EC activities usually refers to purchases done through private computers, and not publicly available ones such as through kiosks. Yet, kiosks have been around for several decades, and they play a role that has differentiated them from private computers.

For EC, kiosks can cater to customers who either do not have access to computers at the time that commerce takes place, or do not have access at all. These customers find it convenient to go to the kiosks to perform their transactions electronically, rather than to complete it physically. Many applications available on the kiosks are not available through private computers. Examples include the dispensing of cash in ATM (Automatic Teller Machines) and stamps. Many kiosks also offer one-stop convenience and 24-hour access for multiple activities, which customers prefer because they do not have to go to several places to complete a range of transactions. Kiosks are also often preferred over shop assistants as they are knowledgeable, reliable, trustworthy, quick, patient and tireless [23].

From a firm's perspective, kiosk transactions are more economical [11, 13, 19, 23] as compared to branch services and kiosk applications can be more secure, as there are often more security features at the kiosks. Also, kiosks can offer "full marketing, promotional information/education and data gathering potential" [10, 23]. Finally, firms can use kiosk applications at their branches to complement their personal services to provide more efficient and effective services.

1.1   Objectives and Importance of the Study

Despite evidence that kiosks will continue to play an increasingly important role in the digital age, there have been only a few studies to date that examined the different types of kiosks and users' perception towards these different types of kiosks.

In an effort to add on to this stream of research, this study has three objectives. Firstly, to understand, from the users' perspectives, the most important factors that determine users' belief of ease of use and usefulness of kiosk. These beliefs will influence users' acceptance of kiosk technology via their effect on a user's attitude [6]. Secondly, to reveal differences in these factors for different types of kiosks as well as to explore the implications of these differences. Thirdly, to uncover improvements users would like to see in future kiosks.

In addition, this study is also important for the following reasons. Firstly, while previous research has classified kiosks according their transactional and informational dimensions [25, 27, 28], none has examined the differences amongst the different kiosks in terms of factors affecting end users' belief in the ease of use and usefulness of kiosk. This study is the first to look at these factors that affect the acceptance of kiosks. Secondly, in order for organizations to better understand kiosk acceptance, they need to be able to differentiate the important factors from the less important ones [27]. This study will determine and highlight the more important factors, and make recommendations to organizations with regards to

considering these factors in the implementation of kiosks. Finally, by highlighting future improvements which users of kiosks want, the results of this study will enable organizations to focus on improvements that meet end user requirements for kiosk usage going forward.

Two relevant pieces of literature for this research, namely, background on the classification of information kiosk and the technology acceptance model (TAM) are discussed in the next section. Following that, the development of the research model and description of the research questions are outlined. Next, the research methodology and the data analysis approach are described. The subsequent section presents and discusses the results of the study. In the final section, the implications of the paper for practitioners are examined.

2. Literature Review

2.1 Classification of Information Kiosks

There are many different types of kiosks, each used for a different purpose. To activate the kiosks, users often have to follow a series of instructions given on screen. Some kiosks permit the user to issue a structured query [25, 27, 28], while more advanced systems can handle unstructured queries. Recently, touch-screens are largely used as input devices instead of keyboards. Such touch input, with its user-friendly interface, provides untrained users with a simple communication link even to the most complex databases and powerful application systems [5, 16]. After the query has been entered, the system can draw information from its existing databases. The required information is projected through the output devices in the form of words, pictures or voices.

Broadly, most information kiosks can be grouped into four groups that varies along 2 continuous dimensions - information dissemination capabilities and transactional capabilities (see figure 1 below, adapted from [25]. According to [25, 28], low information dissemination kiosks refers to kiosks for which the information provided requires infrequent changes or updates and has structured query, usually guided by screen buttons. High information dissemination kiosks, on the other hand, require frequent changes to the information provided to users and users can perform semi-structured query, usually via a keyboard. Low transaction capability kiosks perform no transactions at all or merely accept money during the transaction, e.g. car park kiosks. In contrast, high transaction capability kiosks enable users to access and update on-line databases in addition to transactions that may require personal identification. In line with the above definitions, the model in figure 1 below describes the 4 types of kiosks graphically.
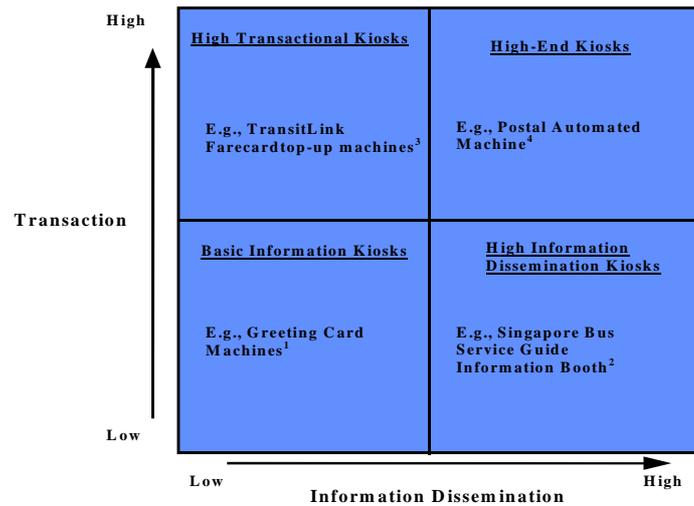
1. *Customize a greeting card. Limited querying capabilities, no updating of database.*

2. *Perform semi-structured query of what train/bus service to get to a destination of your choice.*

3. *TransitLink Farecard top-up by debiting ATM (automated teller machine) account-- bank database updated. A TransitLink farecard here refers to a travel farecard applicable to bus and train rides across the whole island of Singapore.*

4. *Perform postal related services (querying and database update) 24 hours a day.*

Figure 1: *Model Depicting the Various Types of Kiosks in Singapore* [28]

2.1.1 Basic Information Kiosks

A Basic Information Kiosk (BIK) has low transactional and information dissemination capabilities. The instructions and information are usually presented in textual form, with none or very little graphics. Users have to follow a series of simple structured instructions to complete their transactions or inquiries. Such kiosks are controlled by a stand-alone computer and are used for the purpose of disseminating items such as stamps, cards, product and service information and the like [25, 28].

BIKS are prevalent in the market today. One very common example is the HallMark card-making machine. Other examples include the ubiquitous drink-vending machines, juke-boxes and self-help postage service machines [25, 28].

2.1.2   High Information Transactional Kiosks

High Information Transactional Kiosks (HITKS), as the name suggests, have high transactional capabilities. Such kiosks require a personal identification number so that it can access a particular database and update it. Personal identification may include a personal identification number (PIN) or a card/book with a magnetic strip containing one's personal identification code [25, 28]. Uses of these information kiosks include the self-help borrowing service implemented in various libraries and also the fare card top-up machines found in bus and train stations.

2.1.3   High Information Dissemination Kiosks

High Information Dissemination Kiosks (HIDKS) have high information disseminating capabilities. It contains a great volume of information, which is constantly being updated, and can handle semi-structured queries. From the queries issued, a HIDK will search the database and present all the necessary information that the users require [25, 28].

With technological advancement, most HIDKS have multimedia features incorporated in them, so one can expect to see colorful graphics and hear sound and music from these systems [23]. An example will be the multimedia kiosks that help travelers navigate to places of interest and provide alternatives to queries about dining and hotels.

2.1.4   High End Information Kiosks

High End Information Kiosks (HEIKS) have high transactional and information dissemination capabilities. It is deemed to be more "intelligent" than the other three categories of kiosks. To qualify as a high-end kiosk, the kiosk should be publicly available and able to connect to more than one database. In other words, these kiosks are linked up with other databases not within the premise of the kiosk by some form of communication networks. Users can hence use HEIKS to obtain large amounts of information [25, 28].

To activate the system, the user needs to first provide a personal identification number, followed by a semi-structured query. The system will then retrieve all the required information and present it to the user. The system must be able to handle complex transactions. An example of a HEIK is a self-automated postal kiosk, which not only handles inquiries but also provides payment services, such as payment of bills and fines.

A summary of the four types of kiosks is presented in table 1.

Categories of Information Kiosks	Special Features
Basic Information Kiosks (BIKS)	Dissemination of tangible items (no PIN required)
High Information Transactional Kiosks (HITKS)	Dissemination of tangible items (PIN/ special identification required)
High Information Dissemination Kiosks (HIDKS)	Dissemination of complex, frequently updated information
High End Information Kiosks (HEIKS)	May be connected to more than one database

Table 1: *Summary of Types of Information Kiosks and their Applications in the Local Context*

The next section presents the literature background on TAM. It should be pointed out here that this research does not adopt the TAM directly, nor does it follow the strict guidelines for formulating the general questions for perceived ease of use and usefulness as set out in the TAM literature. Instead, the focus of this research is on discovering the specific factors that affect the beliefs of ease of use and usefulness, thereby providing readers with a better understanding of the context for these beliefs. Notwithstanding the above, the TAM literature serves an important role here as it forms the background for understanding the specific factors.

2.2 Technology Acceptance Model (TAM) and Users' Acceptance of Kiosks

The TAM attempts to explain and predict individual behaviors towards a system, as determined via the utilization of the system [1]. System success in this model is an indicator of systems acceptance [6, 7], and equated with actual utilization [1]. The important point highlighted here is that the beliefs about using the target system influence usage intentions and behavior via their effect on a potential adopter's attitude. Two beliefs central to TAM are perceived ease of use and perceived usefulness (see figure 2). These beliefs are instrumental in explaining the variance in attitude [1]. In other words, users will use kiosks to the degree that they find the kiosks easy to use and useful.

To determine the factors that will affect these beliefs, a literature review of secondary data from several sources was conducted. The review covered (i) textbooks, (ii) online library database (Proquest ABI/ INFORM), (iii) magazines, (iv) journals, (v) newspapers and (vi) the Internet. The background and the factors affecting the beliefs are outlined in the following sections.
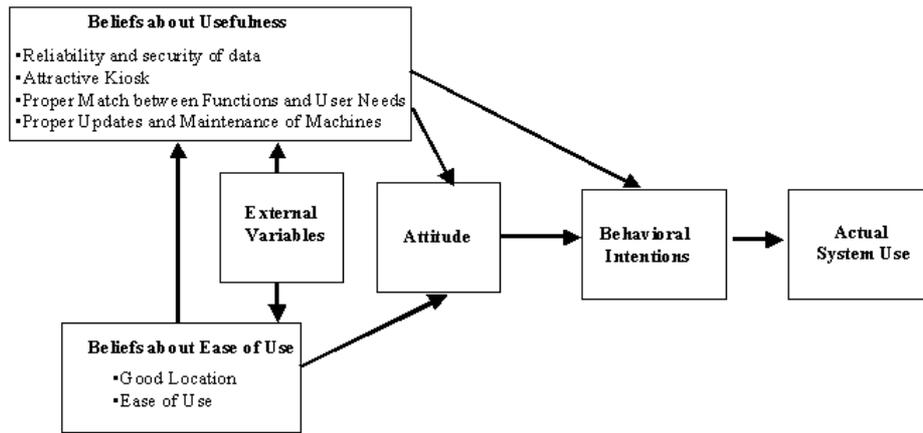
Figure 2: *Adaptation from the Technology Acceptance Model (TAM) [7]*

2.2.1 Determinants of Ease of Use

According to Robichaux and Cooper [21], perceived ease of use is affected by the of the technology, in turn measured by convenience, unrestrictedness and unobstructedness [24], as well as the cognitive, social, and behavioral skills required to use it [4]. The less accessible the kiosk or the more one lacks the required skills to operate the kiosk, the more difficult it is to use the kiosk. In other words, a good location and low usage complexity of a kiosk are extremely important factors. For good location, information kiosks should strategically situated to tap the flow of human traffic [23] as well as being conveniently located [13]. In terms of ease of use, operation can be made easy through the use of Graphics User Interface (GUI) [18] and different languages can be made available such as offering help in different languages so as to cater to the less IT savvy users [20].

2.2.2 Determinants of Usefulness of Kiosk

Perceived usefulness generally results from a mental ad hoc cost/benefit analysis of the value of using a technology [6, 9]. The more the perceived benefit of using the kiosk outweighs the cost, the more acceptable the kiosk is. When a user analyzes the value of the kiosk, two goals are desirable – personal outcome goals and task outcome goals [21]. Personal outcome goals relate to the individual's need for recognition and advancement, as well as minimizing negative feedback. The determinants of personal outcome goals in this context include having reliable and secure data and being seen to be using an attractively designed kiosk. Task outcome goals relate to the task being done, such as a proper match between functions and user needs, as well as the kiosks being properly maintained and updated.

Reliability and Security of Data

For reliable and secured data, data ought to be kept up to date, while security features, both physical protection as well as computerized controls embedded in the software, should be included (http://www.kioskstore.com/goodkiosk.htm). For example, every physical opening, including printer paper slots and credit card slots must be sealed in various ways. Further controls such as a self-activating alarm upon intrusion of the system could also be incorporated. Network software should be incorporated to monitor kiosk activities and in the even of unauthorized activities, the kiosk should either automatically shut down or trigger off an alarm to notify the relevant authorities (http://www.kioskstore.com/good kiosk.htm).

Attractive Kiosk

A good-looking and stylish information kiosk can certainly be more eye-catching. Kiosks with streamlined shapes and soft edges have been found to be more attractive (http://www.kioskstore.com/ goodkiosk.htm). In addition, color schemes are important. Subdued and midrange colors are deemed to be more attractive (http://www.kioskstore.com/goodkiosk.htm). To a large extent, the attractiveness of the kiosk exterior is of value to the end user as it satisfies the user's need for recognition.

Proper Match between Functions and User Needs

Proper matching of functions desired by the consumer with those available on the information kiosks will determine the user's acceptance of the machine. Therefore, a wide variety of operations should be made available [2]. Before deciding which functions to include, it will certainly benefit the organization if they find out the consumers' profiles and their corresponding expectations [12]. Otherwise, improper mismatch would render the kiosk as a white elephant - costing much to build but does not meet consumers' needs [22].

Proper Updates and Maintenance of Machines

System maintenance involves making changes to a system over the course of its useful life, including hardware, which may wear out or fail because of physical failure [18]. With preventive maintenance, consumers would expect the machines to be reliable and process transactions reliably [18]. Unavailability of kiosks due to breakdown will be minimized and the usefulness of the machine lengthened.

To sum up, the six factors that will determine the beliefs of kiosks' ease of use and usefulness are given in table 2 below.

Factors		Components
Ease of use	*Location*	Accessibility
		Convenience
	Ease of use	Easy to operate
		Different Languages Available
Usefulness	*Function*	Variety of functions
		Usefulness
		Efficiency
	Attractive kiosk	Design
		Color
		Brightness
		Eye-catching
	Proper updates and maintenance	Reliability of machine
		Effectiveness (with respect to breakdowns)
	Reliability and security of data	Reliability of data
		Security of personal data

Table 2: *Summary of Factors and their Respective Components*

3. Research Methodology

This study was carried out in Singapore, where a survey was administered at two locations where multiple kiosks can be found. The kiosks were located in two locations, outside a popular mall and a public library. The data was collected over two afternoons. The survey questionnaire was pilot tested for face validity before being administered at the two locations. The potential respondents were approached at random to fill in the questionnaires. Before the respondent fills in each questionnaire, he/she was asked about the kiosk that he/she had most recently used. The respondents then answered questions in the survey with respect to that kiosk. The respondents were asked to evaluate and answer questions pertaining to the one specific type of kiosk they have most recently used.

Each respondent used an average of five to eight minutes to complete the questionnaire. A total of 200 questionnaires were administered. One hundred and eighty-nine questionnaires are collected. The response rate for the survey was a good 94.4%.

4.   Results and Discussions

4.1   Determinants of Ease of Use and Usefulness

Questions to determine the importance of each component of the factors affecting ease of use and usefulness are measured on a five-point likert scale, with '5' being 'Very Important' and '1' the 'Not Important at all' (see Appendix A, question 1 for the full set of questions). This is done in order to obtain a list of important components that will affect ease of use and usefulness of kiosks. Based on the data collected from this set of questions, a mean rating for each component of every factor is computed. From the results, a ranking of the mean rating of the components is obtained.

Means and standard deviations of the individual components making up each factor are given in table 3 below. The most important component is ranked 1, and the least important ranked last.

Rank	Component	Factor	Mean	Standard Deviation
1	Easy to operate	*Ease of use*	4.68	0.56
2	Data Security	*Reliability/Security of data*	4.61	0.82
3	Convenience	*Location*	4.58	0.64
4	Reliability of Data	*Reliability/Security of data*	4.49	0.72
5	Efficiency	*Function*	4.44	0.68
6	Usefulness	*Function*	4.42	0.70
7	Accessibility	*Location*	4.40	0.73
8	Reliability of Machine	*Maintenance*	4.37	0.84
9	Effectiveness (refers to breakdowns)	*Maintenance*	4.31	0.84
10	Variety of function	*Function*	4.08	0.81
10	Different Languages Available	*Ease of use*	4.08	1.06
12	Eye Catching	*Attractive Kiosk*	3.46	1.11
13	Design	*Attractive Kiosk*	3.34	0.95
14	Brightness	*Attractive Kiosk*	3.13	1.09
15	Color	*Attractive Kiosk*	3.05	1.06

(The higher the mean, the more important is the variable)

Table 3: *Summary of the Means and Standard Deviations of Ratings of Components*

The top four ranked components, in decreasing order of importance, are, ease of operation, data security, convenience, and reliability of data (see table 3). They are

from three factors: the ease of use, reliability and security, and location factors. The top four ranked components, in decreasing order of importance, are discussed below.

Ease of Operation

The component - "easy to operate", was indicated as the most critical of all components. This finding is in-line with the future improvements to be elaborated in the later section, where users express that they would like to see more user-friendly information kiosks. This is logical because if the kiosk is easy to use, the public will not be averse to using it.

This is exemplified by the surge in the number of kiosk providers introducing multimedia touch-screen kiosks. Simple instructions are given to prompt the user on how to operate the kiosks. These features greatly facilitate the use of information kiosks and could possibly eliminate the fear of machines some people have.

Data Security

Also, the survey results indicated that data security is the second most important component for kiosks to be successful. This could be especially so with machines such as ATMs, where users are highly sensitive about the details of their bank accounts. Also, with the advent of electronic commerce via the use of information kiosks, users would expect a higher level of data security with regards to all credit card transactions.

Convenience

The third most important variable revealed by the study is convenience. In this regard, kiosks ought to be located in convenient locations so as to maintain a satisfactory usage level.

Reliability of Data

Reliability of data is the fourth most important component. This could be attributed to the higher level of education of today's users. With innovations such as the Internet, a wide range of timely and dependable information can be retrieved at one's fingertips. Thus, we can expect consumers to hold similar expectations towards information kiosks. As buying online and electronic commerce become more widespread, the introduction of more high-end kiosks can be expected in the next few years. These kiosks will cater to users' needs by providing them with updated and reliable information.

To summarize the above discussion, overall recommendations to organizations for improving the top-ranked determinants that will lead to higher acceptance of information kiosks are given in table 4 below.

Rank	Factor	Description
1	Reliability and security of data	Data that is provided to users ought to be constantly updated to satisfy their information needs. Security features should be installed in kiosks -- especially those that process transactions.
2	Location	Kiosks should be located at an accessible and convenient location to attract users and increase usage.
3	Ease of use	Multilingual interface ought to be made available in kiosks in order to enhance the usage level of more people groups. Kiosks should have on-line help and interface that is easy to understand and use. To cater to future needs, we can envisage more user-friendly kiosks, which have very user-friendly interfaces such as the touch-screen interface.
4	Proper updates and maintenance	Kiosks should process transactions reliably and disseminate reliable information with minimal disruptions. Kiosk providers ought to strive to reduce the rate of breakdown of kiosks, perhaps by providing more frequent maintenance.
5	Function	Kiosks should not end up as white elephants that do not serve any purpose. Rather, they should be able to provide a variety of functions at a reasonably prompt speed. Hence, not only do we envisage future kiosks to be multi-functional, the use of fast speed processors would help to reduce the waiting time at queues and reduce frustration amongst users.
6	Attractive Kiosk	Packaging the kiosk to make it attractive was not found to be important as compared to the rest of the factors.

Table 4: *Discussion of Factors*

4.2   Differences amongst Different Types of Kiosks

To find out if the factors differ significantly in importance amongst the 4 categories of kiosks, we compared the means of each component of the factors across the different categories of kiosks using a **two-tailed t-test,** where $\alpha= 0.05$. Table 5 below presents the means and standard deviations while table 6 shows the results of the t-test analyses. Against an alpha value of 0.05, the p- values that exceed this value will cause the null hypothesis *not to be rejected*. Conversely, p-values less than 0.05 will cause the null hypothesis to be rejected.

Factors	HIDKS		HEIKS		BIKS		HITKS		Aggregate	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Reliability and Security if Data										
Data Security	4.65	0.77	4.87	0.47	4.29	1.04	4.67	0.80	4.61	0.82
Reliability of Data	4.65	0.62	4.54	0.64	4.21	0.84	4.58	0.78	4.49	0.72
Location										
Accessibility	4.51	0.64	4.03	0.81	4.29	0.74	4.73	0.54	4.40	0.73
Convenience	4.63	0.49	4.31	0.73	4.50	0.77	4.84	0.42	4.58	0.64
Ease of Use										
Easy to operate	4.83	0.38	4.69	0.52	4.64	0.69	4.58	0.58	4.68	0.56
Different Languages Available	4.15	1.08	3.90	0.97	4.07	1.24	4.18	0.96	4.08	1.06
Maintenance										
Reliability of Machine	4.50	0.78	4.51	0.68	4.02	0.92	4.44	0.87	4.37	0.84
Effectiveness (refers to breakdowns)	4.28	0.91	4.41	0.75	4.05	0.88	4.51	0.76	4.31	0.84
Functions										
Variety of function	4.02	0.76	4.10	0.75	3.86	0.95	4.31	0.73	4.08	0.81
Usefulness	4.46	0.60	4.18	0.88	4.48	0.59	4.53	0.66	4.42	0.70
Efficiency	4.39	0.67	4.46	0.64	4.26	0.77	4.64	0.61	4.44	0.68
Attractive Kiosks										
Design	3.50	0.82	3.15	1.01	3.36	0.91	3.33	1.04	3.34	0.95
Color	3.25	0.98	2.90	1.17	3.12	1.04	2.96	1.04	3.05	1.06
Brightness	3.25	1.08	3.08	1.18	3.10	1.03	3.09	1.08	3.13	1.09
Eye Catching	3.75	0.95	3.21	1.15	3.62	1.06	3.29	1.20	3.46	1.11

'1' is 'Not Important at all' and '5' is 'Very Important'

Note:

BIKS = Basic Information Kiosks

HIDKS = High Information Dissemination Kiosks

HITKS = High Information Transactional Kiosks

HEIKS = High End Information Kiosks

Table 5: *Summary of Mean Ratings and Standard Deviations for Each Category of Kiosks*

Factors	Variables	P-value	Conclusion (α=0.05)
Location	Accessibility	0.0621	Do not reject H_0
	Convenience	0.0715	Do not reject H_0
Function	Variety of functions	0.0706	Do not reject H_0
	Usefulness	0.0983	Do not reject H_0
	Efficiency	0.0655	Do not reject H_0
Attractive kiosk	Design	0.5494	Do not reject H_0
	Colour	0.4945	Do not reject H_0
	Brightness	0.7168	Do not reject H_0
	Eye-catching	0.1313	Do not reject H_0
Ease of use	Easy to operate	0.2300	Do not reject H_0
	Different languages	0.6382	Do not reject H_0
Proper updates and maintenance	Reliability of machine	0.0580	Do not reject H_0
	Effectiveness	0.0602	Do not reject H_0
Reliability and security of data	Security of data	0.0116	Reject H_0
	Reliability of data	0.0213	Reject H_0

Table 6: *Summary of Statistical Test Results - A Comparison of Different Kiosks*

The results reveal that the null hypotheses relating to the factors of **Security** and **Reliability of Data** were rejected. This indicates that the differences between the mean ratings of the above factors for the different types of kiosks are statistically significant. Following the significant differences described above, further analyses are conducted using multiple pair-wise t-test comparisons of mean ratings. A summary table of the 2 sample t-tests (assuming equal variances) results is presented in table 7:

Attribute/Factors	Hypotheses	P-value (2-tailed)	Conclusion ($\alpha = 0.05$)
Security of Data	H_o: $\mu_{BIKS} >= \mu_{HTIKS}$ H_1: $\mu_{BIKS} < \mu_{HTIKS}$	0.0482	Reject H_o
	H_o: $\mu_{BIKS} >= \mu_{HEIKS}$ H_1: $\mu_{BIKS} < \mu_{HEIKS}$	0.0019	Reject H_o
	H_o:$\mu_{HIIDKS}>=\mu_{HTIKS}$ H_1: $\mu_{HIDKS} < \mu_{HTIKS}$	0.0132	Reject H_o
	H_o: $\mu_{BIKS} >= \mu_{HIDKS}$ H_1: $\mu_{BIKS} < \mu_{HIDKS}$	0.0768	Do not reject H_o
	H_o:$\mu_{HTIKS}>= \mu_{HEIKS}$ H_1: $\mu_{HTIKS} < \mu_{HEIKS}$	0.1629	Do not reject H_o
	H_o:$\mu_{HIDKS}>= \mu_{HEIKS}$ H_1: $\mu_{HIDKS} < \mu_{HEIKS}$	0.1272	Do not reject H_o
Reliability of Data	H_o: $\mu_{BIKS} >= \mu_{HTIKS}$ H_1: $\mu_{BIKS} < \mu_{HTIKS}$	0.0312	Reject H_o
	H_o: $\mu_{BIKS} >= \mu_{HIDKS}$ H_1: $\mu_{BIKS} < \mu_{HIDKS}$	0.0140	Reject H_o
	H_o: $\mu_{BIKS} >= \mu_{HEIKS}$ H_1: $\mu_{BIKS} < \mu_{HEIKS}$	0.0087	Reject H_o
	H_o:$\mu_{HTIKS}>=\mu_{HIIDKS}$ H_1: $\mu_{HIDKS} < \mu_{HTIKS}$	0.7587	Do not reject H_o
	H_o:$\mu_{HTIKS}>= \mu_{HEIKS}$ H_1: $\mu_{HTIKS} < \mu_{HEIKS}$	0.6925	Do not reject H_o
	H_o:$\mu_{HIDKS}>= \mu_{HEIKS}$ H_1: $\mu_{HIDKS} < \mu_{HEIKS}$	0.9385	Do not reject H_o

Table 7: *Summary Results for Pair wise T-tests*

The above results narrow down the specific pairs of information kiosks groups that have shown a statistically significant difference between their mean ratings. Significant differences between the four types of kiosks for two variables were noted, namely **Data Security** and **Reliability of Data**. This is an important finding because it delineates the differences of the kiosk types and stresses the importance of reliability and security of data to certain groups of kiosk users, especially users of the high-end machines.

Data Security

Three combinations have shown statistically significant results. Firstly, the mean ratings of High Information Transactional Kiosks (HITKS) are higher than that of Basic Information Kiosks (BIKS). One reason may be that a HITK requires a personal identification number so that it can access a particular database and update it. A case in point is the withdrawal of cash from ATMs. For BIK, transactions like buying of stamps or service information rarely involve confidential information. Therefore, the security of data is more important to users of HITKS than BIKS.

The second observation is that the mean ratings for High-End Information Kiosks (HEIKS) are higher than that for BIKS. A HEIK has higher transactional and information dissemination capabilities as compared to the rest. It is connected to more than one database and is able to handle complex transactions and this requires the users of HEIKS to have a Personal Identification Number (PIN). In this regard, security of data is of greater importance to HEIKS than any other type of information kiosks.

The last observation, derived from the rejection of the null hypothesis, is that the HITK has a mean rating that is significantly higher than High Information Dissemination Kiosk (HIDK). A plausible reason would be that HIKDS have high information disseminating capabilities, which usually comprise of performing transactions like handling semi-structured queries and releasing useful information to the public. In this light therefore, security of data is not as critical to HIDKS as compared to HITKS, which perform transactions involving confidential information.

Reliability of Data

The mean ratings of reliability of data for High Information Transaction Kiosks (HITKS) are statistically higher than that of Basic Information Kiosks (BIKS). This may be because HITKS perform vital transactions that require data to be more reliable and accurate as compared to BIKS which generally perform more petty transactions, as seen from machines that convert dollar notes into coins at bus or train stations, for instance.

Also, the mean ratings for both High Information Dissemination (HIDKS) and High End Information Kiosks (HEIKS) are greater than that of BIKS, for reasons similar to those presented in the above argument. HIDKS distribute valuable information to the public at large to aid decision-making and hence the information presented must be reliable. Also, HEIKS like PAM handle non-postal related transactions, often in the line of payment services, such as the payment of fines and bills, which require higher data reliability than BIKS.

4.3 Desired Future Improvements of Kiosks

To facilitate future developments and improvements of information kiosks, the respondents' opinions on desired future improvements are gathered. Each respondent is asked to select one future improvement he/she would like to see most. The full question can be seen in question 2 of Appendix A. Figure 3 illustrates the results from the questions on future improvement of kiosks.
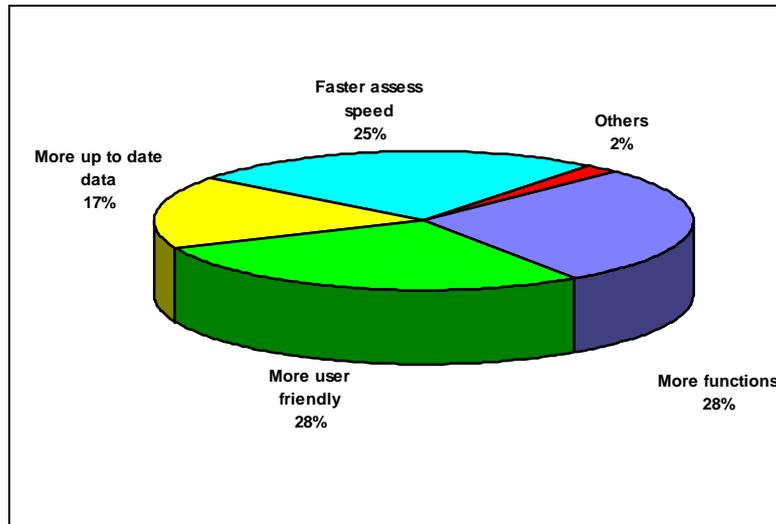

Figure 3: *Summary of Future Improvements Desired*

Results (see figure 3) showed that more than a quarter of the respondents wanted kiosks to be more user-friendly, which further substantiate the results indicated in the previous subsection, and could be of special importance to the more sophisticated kiosks. In this regard, providers of kiosks may want to consider making kiosks more user-friendly, in addition to improving the capabilities of the kiosks, so that people will not shy away from using them. Therefore, it is important that kiosk developers improve on the kiosk interface in order for the general public, even those with limited computer skills, to be able to use kiosks effectively.

Another 28% of the respondents would like the existing kiosks to include more functions. As information kiosks become more common in the market, consumers logically would tend to have higher expectations. As they become more accustomed to using kiosks to perform their transactions, the natural tendency is to turn to kiosks to serve more of their needs.

The next most popular idea was to improve the access and processing speed of the kiosks. Most users disliked the existing kiosks in the market because of slow access speeds. At present, the general feedback is that kiosks remain rather slow. As a result, there is always a long queue behind ATMs during peak periods such as the

lunch hour, where a large number of working people find time to withdraw money or check their bank accounts. Considering the faster pace of living today as compared to a decade ago in most places, this is one important area to improve on since a slow response rate may become instrumental in deterring people from using the kiosks. This is especially true for ATMs if the waiting time at the kiosk is not significantly different from that at a physical bank branch.

Only about a fifth of the respondents suggested having more up-to-date data. This could be a reflection of the kiosks' current ability to provide reasonably updated data. However, this suggestion also serves as a reminder for the firms to always update their data. This is critical because users may shun the machines if they find the same outdated data each time they use the information kiosks. Other minor suggestions, such as more music, brighter and more modern kiosks form a minority 2% of the responses.

5.   Conclusions: Some Implications for Practitioners

The results of this study indicated that the top four determinants of ease of use and usefulness are ease of operation (ease of use factor), data security (reliability and security of data factor), convenience (location factor) and reliability of data (reliability and security of data factor). Further analyses of the results highlighted that the factor reliability and security of data differed significantly amongst the different types of kiosks. Finally, while users of kiosks are found to be receptive of information kiosks, they have noticeable contributions and suggestions as to how information kiosks can better serve their needs in future. The more significant suggestions include making kiosks operate faster, introducing more functions, and improving user-friendliness.

To add on to the above results, we have also reviewed the literature to come up with additional implications to EC practitioners for developing, using and managing information kiosks. These suggestions are summarized below:

Multilingual Interfaces

As cities and businesses become increasingly global, multi-cultural and multi-racial, it is important that information kiosks are developed with a multilingual interface. This will allow others who are not so comfortable with English to be comfortable in using the machines [17]. At present, very few types of kiosks provide interfaces in more than one language. For instance, of the various existing types of information kiosks in the Asia Pacific region, only certain ATMs provided by established banks have multilingual interfaces.

Multimedia

With advancement in technology, multimedia kiosks are becoming very popular. They have the capability to produce life-like motion pictures as well as project

voices and music, which are more captivating than mere text presentations often used in the more traditional and basic kiosks. Furthermore, the graphical interfaces would ease its usage and could reach out to a greater mass of people [23], [17]. Many companies are moving towards multimedia media kiosks that perform a multitude of functions, including facilitating access to resources on Internet and to telecommunication services. For instance, there are multimedia pay phones that offer e-mail services, Internet surfing and sending messages to mobile phones and pagers [8]. In addition, at an airport, passengers with laptops or Personal Digital Assistants (PDAs) equipped with infra-red ports may be able to walk up to Internet kiosks to check their e-mail and surf the Internet while waiting for their flights [14]. We can hence witness many advantages of multimedia kiosks. At the same time however, these kiosks are not without their limitations, and it is important for kiosk providers to consider the "need to weigh the costs and benefits because multimedia kiosks are expensive to develop" [3].

Multi-database Interoperability

Future kiosks should look towards being connected to various databases instead of being just a simple stand-alone system. This amplifies the value of the kiosk by permitting the user to retrieve information from different databases at a single point in time from one location, which greatly enhances the user's convenience. In this regard, in order to facilitate multi-database interoperability, it is very important that the different operational systems have compatible architecture [17].

Sufficient Technical Requirements

As user demands increase, technical requirements are becoming increasingly challenging, yet essential. In the future, kiosks must have sufficient bandwidth if it were to incorporate video conferencing [3]. The speed of the machine is also an important consideration. The minimum requirement would preferably be at least a 32-bit microprocessor. To make more information available, it would require a satisfactory amount of hard disk space [26]. On top of that, to capitalize on high-end kiosks, we ought to have reliable communication networks [17]. Also, the computer system must have sufficient RAM to carry out the user's inquiry quickly and to support the graphical output [23].

Good Network Management

Finally, as we step into a new century where the networked system becomes increasingly pervasive, security of information becomes crucial. Various techniques must be employed to prevent unauthorized access to private and confidential data. Networks should not be made vulnerable to hackers, computer viruses and security breaches. For example, the designer may wish to install sensors and alarms in the kiosks. If an intrusion is attempted, a loud alarm should sound [25, 28] (http://www.kioskstore.com/goodstore.htm). Another security system is to install

network software to monitor the system for any unauthorized activities from a central facility so that the network to that kiosk shuts itself down and a remote alarm is triggered (http://www.kioskstore.com/goodstore.htm). Firms must also ensure that they have disaster recovery plans in the event of network crashes. Furthermore, the service providers ought to provide a reliable machine to prevent inconvenience caused by breakdowns [15].

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Appendix A: Questions from Survey Questionnaire

1. Here is a list of attributes of an information kiosk. Please rate them on a scale of 1 to 5 -- 1 being not important at all and 5 being very important.

Factors	Not important at all 1	Not so important 2	Average importance 3	Important 4	Very Important 5
Location					
Accessibility					
Convenience					
Functions					
Variety of functions					
Usefulness					
Efficiency					
Attractive Kiosk					
Design					
Color					
Brightness					
Eye Catching					
Ease of Use					
Easy to operate					
Different Languages available					
Reliability and Security of data					
Reliability of Data/Service					
Security of personal data					
Maintenance					
Reliability of Machine					
Effectiveness (refers to breakdowns)					

2. Are there any improvements that you would like to see in the future information kiosks? Choose ONE improvement you would like to see most.

More user-friendly _____

More up to date (data) _____

Faster access speed _____

More functions _____

Others _____ please specify _____