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# Where in the World on the Web Does Location Matter? A Framework for Location Based Services in M-Commerce

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# WHERE IN THE WORLD ON THE WEB DOES LOCATION MATTER? A FRAMEWORK FOR LOCATION BASED SERVICES IN M-COMMERCE

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**Abstract**

*This paper presents a framework defining applications for mobile commerce (m-commerce), a relatively new application that involves using wireless devices such as phones, PDAs, and similar technologies to access services and products via the Internet. Prior research and literature for m-commerce and location-based services (LBS) are reviewed and discussed. In addition, information about Location Theory and its relevance to m-commerce and LBS is presented and synthesized into an application specific framework. The paper ends with conclusions about, and implications resulting from, the framework and the technology.*

## Introduction

Mobile commerce (m-commerce) refers to e-commerce activities carried out via a mobile terminal such as a phone or PDA. While m-commerce applications have enjoyed considerable success in Europe for several years, these applications are only now beginning to appear in North America. Nevertheless, the use of m-commerce is expected to grow considerably over the next few years. For example, several analysts predict that over the next five years the market for m-commerce services will exceed $1 billion and transactions carried out via this technology will be more than $25 billion (Durlacher, 1999).

Although the potential for m-commerce to become a viable and widely used tool for commerce is real, there are many factors that create limitations to its use in North America. For example, issues related to standards, phone and PDA characteristics, security, distributed database development and management, user interface design, human factors, and other related issues represent important factors that will influence the adoption and diffusion of m-commerce applications. Because location is an integral component of many m-commerce applications, a location-based theoretical justification for "positioning" products and services in the location-based m-commerce marketplace is needed.

Location Theory is an economic model that has traditionally been used to predict and understand the location of product suppliers in relation to customers (Lösch, 1954; Valavanis, 1955). Inherent in this view is the notion that geography is a factor influencing location decisions. One aspect of Location Theory, the spatial demand cone, appears to have particular relevance for predicting and understanding the behavior of firms and customers in the context of m-commerce and e-commerce. The purpose of this paper is therefore to present a theoretical framework building on the implications of Location Theory that can be used to understand the role of location-based (LBS) m-commerce services in relation to e-commerce.

We begin with a review of the relevant terminology and theory associated with e-commerce, m-commerce, and location-based services. This is followed by a discussion of Location Theory and a presentation of a framework that describes the role of location-based m-commerce services. We end with our conclusions about the role of location in m-commerce and e-commerce.

# Literature Review

## *M-Commerce and How It Differs from E-Commerce*

M-commerce is a topic that has begun to garner significant attention in the trade literature (e.g., Mobilecommerceworld.com, eAI Journal, Mcommercetimes.com, eWeek) and even in financial and investment publications (The Wall Street Journal). While the trade literature does not usually contain specific information about academic research and theory development, it is often useful as a source of information about the status of current technologies, applications for these technologies, and commonly used definitions of key concepts and ideas. In this context, it is useful to draw upon this literature for a definition of m-commerce and its important functions. For example, a European investment firm, Durlacher, Inc. (Durlacher, 1999), provided a succinct and useful definition of m-commerce, " Mobile Commerce … is any transaction with a monetary value that is conducted via a mobile telecommunications network." We build on this definition by offering the following: m-commerce involves the delivery of products and services via wireless technologies to enable e-commerce activities at any time or location.

Given this definition of m-commerce, the primary difference between m-commerce and the evolving definition of e-commerce is the interface technology. E-commerce research studies are too numerous to identify, but implicit in the definition of e-commerce is the use of wired technologies such as a personal computer located in an individual consumer's home or business where access to the Internet is made through land-line connections. This includes the "any time" advantages of m-commerce, but not the "any location" advantages.

Any such definition of m-commerce, however, belies its more complex nature. For example, the Wall Street Journal (2000) provided a useful categorization of the primary functions of m-commerce that we adapt in this paper:

- Information-based Consumer Services: Applications that provide users with information or information products; includes email, instant messaging, product and services, etc.
- Transaction Services: Applications that enable users to engage in or complete a transaction; includes stock trading or investing, electronic payment, completion of online and/or local purchases, etc.
- Personalization Services: Applications that recognize the user's location and/or preferences and use this information to deliver customized products or services; includes proximity alerts (e.g., your favorite restaurant is 1 block away), e-coupons, location-based services, etc.

Because of the cutting-edge nature of this topic, only a few academic papers have appeared in conferences or as working papers that have reported on research or presented theoretical models in support of m-commerce research. The only paper that we are familiar with that has dealt with the issue of marketing applications or consumer behavior for m-commerce is a conference paper by Kannan, Chang, & Whinston (2001). In this paper, Kannan et al. discuss the implications of m-commerce for marketing and present several propositions for marketing research. Although this is a useful starting point for research on the application of m-commerce in marketing, much can be learned by applying an economic model such as Location Theory to understanding the role of location in marketing and delivering products and services.

## *Location-Based Services*

As with the broader topic of m-commerce, there has recently been a significant increase in interest and activity relating to location-based services. LBS is generally considered to represent a subset of services relative to m-commerce. In our view, however, location services represent a core enabling technology for a continuously increasing number of m-commerce applications. Although LBS currently appears to have relevance to only a subset of m-commerce applications, as m-commerce and related wireless applications become more ubiquitous it is likely that information about location will play an increasingly more important role in providing customized products and services (Ferguson & Pike, 2001). This is because location is often a primary organizing framework that individuals and organizations use to structure their activities and relationships. In other words, location provides context that can be used 1) by individuals to organize their personal activities and 2) by organizations to coordinate their activities with the activities of individual employees and customers (Niedzwiadek, 2001).

Our review of the available literature on LBS did not lead us to a satisfactory definition of this technology. Therefore, based on our discussion thus far we offer the following definition of LBS: Location-based services are m-commerce activities that incorporate information about the user's location into the provision of products or services. This definition is broad enough to encompass the wide variety of products and services that currently fall under the category of LBS. Indeed, the spectrum of services that are classified under the umbrella of LBS is wide. For example, Gravitate, Inc., identified three broad classes of LBS (Gravitate, 2000):

- **First Generation:** Users manually input location information (e.g., zip code) and receive location information such as maps, driving directions, nearby amenities. Examples include Internet map sites (e.g., MapQuest.com), Store Locators, etc (see Mennecke, Dangermond, Santoro, & Darling, 1998).
- **Second Generation:** The device is able to identify some positional information from the communications network without user input. Examples include applications that identify which general area of a city you are in and feed general information to the user. These services generally require that users initiate transactions in response to information feeds.
- **Third Generation:** The users device has an accurate "location awareness" that uses precise positional information to trigger (i.e., initiate) service without the need for direct user intervention. Triggers can be based on proximity to an object, other users, or based on temporal associations (e.g., a user drives near a preferred restaurant during lunch time).

All of these services have in common one element; the spatial location of a user or an object that the user wishes to interact with. To understand the role of location in marketing products and services to customers, it is useful to have a framework upon which a research agenda can be built. The next section presents a framework for understanding the role of location in m-commerce and LBS that is built on Location Theory.

## M-Commerce and Location Theory

Location Theory is a broad term that encompasses a number of theoretical perspectives from regional economic and, more specifically, spatial economics. One of the key figures in this area is August Lösch. The following quote summarizes the main thesis of Location Theory as articulated by Lösch and as it pertains to e-commerce, m-commerce, and LBS.

> *With economies of scale and no transport costs whatsoever, all production would be concentrated in one, or a few, optimum-sized plants located at random. With transport costs and no economies of scale, a little of every product would be produced on every square inch of the earth's surface.* (Valavanis, 1955)

Lösch's observations, which were made half a century prior to the advent of e-commerce, predicted quite accurately the structure of both traditional and e-markets. For example, with e-commerce, although there are transport costs for some products and services, these costs are low or, quite often, nothing (e.g., often even for physical goods, e-venders absorb the shipment fees). The result is that many, if not most, e-commerce venders have aggregated their facilities to achieve economies of scale for distribution to a spatially distributed and, in many cases, worldwide customer base (e.g., recall Amazon.com's commercials involving the pyramids and mars). On the other hand, there are many products, goods, and services that do not lend themselves to this model of commerce. Whether because of customer preference, product characteristics (e.g., spoilage, size), scale (small businesses), the inability to digitize or reproduce the product (e.g., a local pub), or a number of other factors, many businesses cannot put some or all of their products up for sale in the e-commerce marketplace. A local eatery, for example, can advertise on the Web but it cannot deliver its services via this channel. Thus, the landscape is littered with local or regional businesses, just as predicted by Lösch's model. Of course, local businesses existed prior to the advent of e-commerce, so how does Location Theory help us understand the structure or application of m-commerce? To answer this question, it is important to first provide more detail about the tenets of Location Theory. Following this, we will introduce a framework that identifies those factors that influence e-commence and m-commerce consumer decisions in light of the implications of Location Theory.

### *A Primer on Location Theory*

Classical economics examines equilibrium pricing based on demand and price and ignores transportation costs or, in other words, costs based on distance. For example, Figure 1 shows a demand curve that illustrates how the demand for a product varies as the price of the product changes. If Point A represents the price of a product at the source for the product (e.g., the retail store), then consumers at that location will purchase a quantity of AB.

Location Theory and other spatial economic theories do not ignore transportation costs; instead, these costs are included as a key factor in the determination of demand. To do so, the price of the product is assumed to be held fixed and the total cost to the customer becomes a function not only of the price of the product but also of the transport cost involved in either bringing the product to the customer or in the customer traveling to the location of the product. Figure 2 represents this relationship by showing how the demand curve varies as a function of distance from the product source. This demand cone was created by flipping the demand curve by 90˚ and rotating the curve 360˚. The quantity demanded would therefore be a function of the price of the product at the source plus the transport cost at any given distance from the source. For example, at point A, the transport cost is zero and the quantity demanded is AB. This is exactly the same demand as is illustrated in the traditional demand curve (Figure 1). At a distance from A the price will be greater than 0-A by an amount proportional to the transport cost. Because the actual cost of

the product will be higher (i.e., the price to the customer rises due to transport costs), the demand will be lower. At point C, the transport cost, which is proportional to the distance A-C, will raise the price of the product to the point where demand is zero. Thus, AC is the extreme sales radius of the store located at point A and the total sales over this area is proportional to the volume of the cone shaped area and the population in the area.

Location Theory is the basis for gravity and other models that are used for site location and similar marketing analyses. As such, this is also a useful model for predicting the demand of products and services that can be delivered using m-commerce and LBS. The next section discusses a framework that takes into account this perspective and highlights the contexts in which m-commerce and e-commerce transactions are likely to take place.

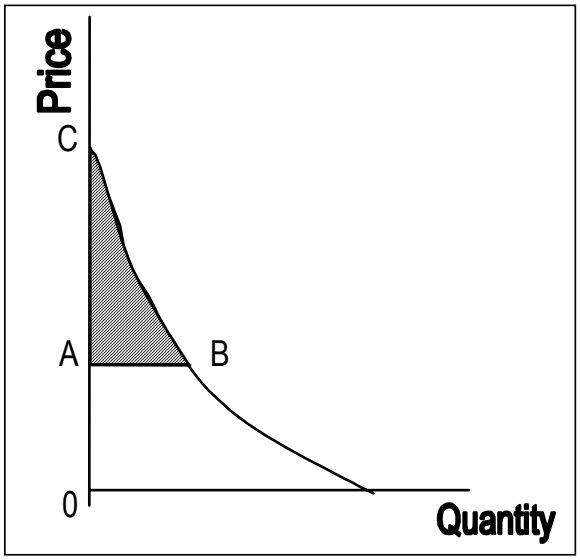


**Figure 1. A Demand Curve**

### *A Location-Based Framework*

The shape of the demand cone is determined by any costs that are imposed due to geography. If the geographic costs are positive, the demand cone will take on a shape similar to that shown in Figure 2. For many products and services, however, it is possible that the geographically imposed costs for the product may be zero. In such cases, the cone flattens out to a horizontal plane and demand remains steady (or near steady, depending on state taxes, shipping zone costs, etc.) regardless of distance (Figure 3). Thus, to determine the shape of the demand cone for a product being delivered or solicited using m-commerce LBS, it is important to define the geographically imposed costs that will be incurred by the customer.

One way to think about this relationship is to recognize that the demand for some products and services will be more elastic when the consumer is proximate to the location of the delivery of the goods or service (e.g., let's do lunch at Wendy's since it is across the street from our meeting). In other words, there are some products that are differentiated based on geography. In general, then, we would expect that those products and services that can be geographically differentiated would benefit from m-commerce applications. In addition, it is also important to recognize that this differentiation may be more or less pronounced during different stages of the purchase process. For example, buyer behavior models suggest that the purchase decision is multi-phased (Engel et al., 1990). These phases include need recognition, information search, alternative evaluation, purchase, and post-purchase evaluation. Furthermore, it is likely that the behavior that a consumer exhibits may change depending on whether the product is a major purchase (i.e., high involvement) or a trivial purchase (i.e., low involvement). When considered together, these factors suggest that we should be able to differentiate between consumer behavior for users of e-commerce and location-based m-commerce applications during different stages of the purchase process. To synthesize this relationship, we offer the framework shown in Table 1. In the next section we discuss some patterns found in the framework and identify the overall conclusions of this study.

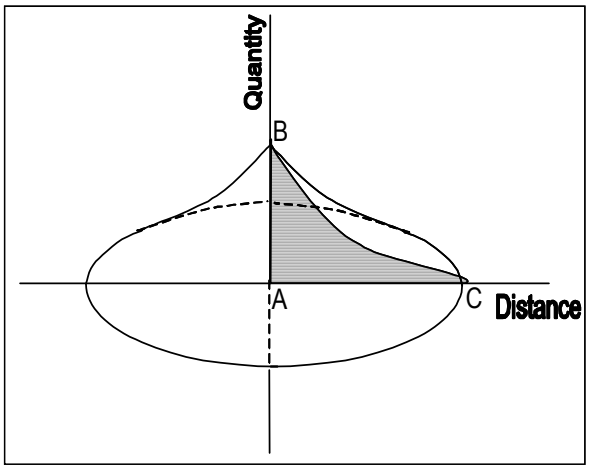


**Figure 2. Spatial Demand Cone in the Context of M-Commerce**

## Discussion and Conclusions

The framework shown in Table 1 allows us to identify several general patterns that distinguish likely e-commerce and m-commerce transactions. First, for high involvement purchases where a significant amount of time and effort is spent in information search and alternative evaluation, several patterns emerge. E-commerce is most useful for purchase of products and services where there is no geographic differentiation. Furthermore, m-commerce is the most useful when there is geographic

differentiation but it is not very useful for information search and alternative evaluation when there is no geographic differentiation. For example, it is easier to use a PC at home to compare information about cars or homes than it is to do the same comparison using a PDA standing on a street corner. Second, several patterns can be identified for low involvement (impulse) purchase scenarios. M-commerce is useful to some extent for all phases of low involvement purchases whether they are for geographically differentiated products/services or not. Also, e-commerce is not very useful for need recognition, alternative evaluation, or purchase when products and services are geographically differentiated. When visiting a city, for example, it is more likely that, when comparing lunch restaurant alternatives, a PDA would be more useful than a wired PC.

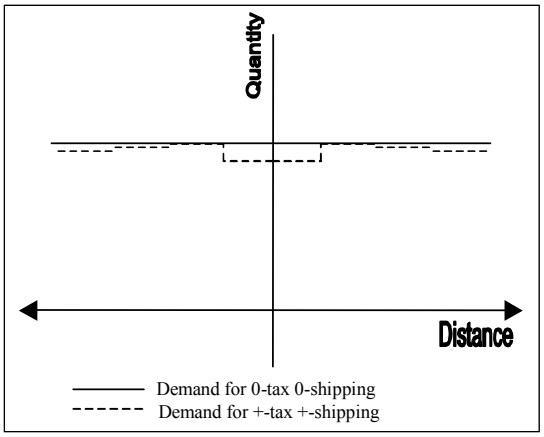


**Figure 3. Spatial Demand Cone in the Context of E-Commerce**

**Table 1. M- and E-Commerce Applications Framework**

| | | High Involvement | | Low Involvement | |
|---|---|---|---|---|---|
| **Behavior** | | **e-commerce** | **m-commerce /LBS** | **e-commerce** | **m-commerce/ LBS** |
| Need Recognition | No Geographic Differentiation | 👍 | 👍 | 👍 | 👍 |
| | Geographic Differentiation | 👍 | 👍 | 👎 | 👍 |
| Information Search | No Geographic Differentiation | 👍 | 👎 | 👍 | 👍 |
| | Geographic Differentiation | 👎 | 👍 | 👍👎 | 👍 |
| Alternative Evaluation | No Geographic Differentiation | 👍 | 👎 | 👍 | 👍👎 |
| | Geographic Differentiation | 👍 | 👍 | 👎 | 👍 |
| Purchase | No Geographic Differentiation | 👍 | 👎 | 👍👎 | 👍👎 |
| | Geographic Differentiation | 👎 | 👍 | 👎 | 👍 |

👍 = Likelihood of use is high 👎 = Likelihood of use is low 👍👎 = Likelihood of use is conditional

High Involvement, No Geographic Differentiation: Tend to have high purchase price, electronic or digitized product, tactile characteristics are not important, high impact on well being, may have short time horizon
High Involvement, Geographic Differentiation: Tend to have high purchase price, physical objects, tactile characteristics are important, high impact on well being; may have short time horizon that interacts with location
Low Involvement, No Geographic Differentiation: Tend to have low purchase price, electronic or digitized product, low impact on well being, relevance of time horizon varies
Low Involvement, Geographic Differentiation: Tend to have low purchase price, physical objects, tactile characteristics can be important, low impact on well being; relevance of time horizon varies

Based on these findings we can make two overall conclusions: With the state of current m-commerce and e-commerce technologies, e-commerce is the technology most useful for high involvement purchases where there is no geographic differentiation and m-commerce is the technology of low involvement purchases. The implications of these results suggest that software and hardware developers should focus on incorporating capabilities into m-commerce devices that facilitate the strengths

of this technology. For example, it is not enough to have accurate information about location (something that is already becoming a reality in many m-commerce terminals), it is critical that the content that facilitates the delivery of accurate and relevant information that takes advantage of this positional information is developed. For example, for many years geographic information systems (GIS) technology has been used by many types of organizations to address location-related problems. This technology, particularly the software and data, is an ideal tool for supporting not only content delivery, but also follow up analyses of customer actions and behaviors. In many ways, m-commerce is the "silver-bullet" application for GIS that the GIS industry has been looking for during the last decade. It is important that these two technologies be leveraged to improve the delivery of quality location-based m-commerce applications.

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