

# **Patterns, Opportunities, and Challenges in the Emerging Global M-Commerce Landscape**

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## **Abstract**

Mobile phones, mobile Internet access, and mobile commerce are growing much faster than their fixed counterparts. Several characteristics of mobile networks make them more attractive than fixed networks for less developed countries and for those countries that want to “leapfrog” the leading IT nations. To exploit the new mobile communications infrastructures, companies from developed as well as developing countries are rapidly integrating m-commerce technology into their business models. Countries around the world, however, exhibit considerable heterogeneity in their adoption of mobile phones and m-commerce technology. This chapter examines the current stage of mobile technology and m-commerce diffusion across the world and identifies and analyses the factors influencing the diffusion process. We review the ways in which the m-commerce landscape of a nation – defined by the penetration rate of mobile phones, the specific combinations of different generations of mobile technology, and the blending of various standards within a given generation – is shaped by politico-economic, socio-cultural, and policy related factors.

## **INTRODUCTION**

The rapid global diffusion of mobile telephones in the last two decades of the twentieth century laid the foundation for a new type of technology-aided commerce. Going beyond the computer-mediated electronic commerce or e-commerce<sup>1</sup> of the 1990s, this new type of mobile commerce – or m-commerce – was characterized by novel, location-based services delivered by a variety of handheld terminals (Dholakia and Dholakia 2003). By 2000, Japan’s NTT DoCoMo had already established a huge network of m-commerce service providers and users that relied on that company’s iMode platform (Bradley and Sandoval 2002).

Just as networked computers and browser-accessible content provided the preconditions for the take-off of e-commerce, mobile telephones that are data-ready and connected to digital communications networks provide the preconditions for m-commerce. In recent years, other handheld mobile devices such as Personal Digital Assistants (PDAs) and enhanced alphanumeric communicators (such as Blackberry devices) have supplemented mobile telephones. An increasingly diverse array of such mobile devices is anticipated from the research laboratories of telecommunications, computer, and electronic firms.

Drawing on comparative macro data from about 30 selected countries, this chapter explores the heterogeneity of factors that influence cross-national differences in the adoption of mobile communication infrastructure and m-commerce applications. It will be seen, in particular, that the distinction between developed, newly developed, and developing countries does not translate into a corresponding continuum of national leaders and laggards in mobile technology adoption. Instead, comparative analysis reveals interesting features of the m-commerce landscape like the following:

- Not all global leaders in land-based telecommunications or Internet access are the global leaders in mobile connectivity.
- In terms of mobile commerce applications, multiple dominant designs are likely to coexist and compete for an extended period of time. This is different from most IT fields where dominant designs have converged rapidly to one or two standards.
- Sources and reasons for national leadership in the evolution of mobile commerce applications are likely to be significantly different from the national leadership patterns in Internet, landline telecommunications, and computers.

This chapter provides a framework, derived from macro data and selected case studies, for understanding cross-national and cross-regional variations in the evolution of m-commerce applications. The remainder of the chapter: (1) provides background on the rapid diffusion of mobile technology (2) examines the global diffusion pattern of mobile phones and m-commerce technology (3) identifies a variety of economic, social, and technological factors impacting the diffusion patterns of mobile technology and m-commerce (4) develops a simple typology for tracking future developments in m-commerce.

## BACKGROUND: RAPID DIFFUSION OF MOBILE TECHNOLOGY

Mobile technologies – for communications, for accessing the Internet, and for mobile commerce transactions – are growing hyperbolically. Mobile devices have become the fastest adopted consumer products to date. In 2000, more mobile phones were shipped than automobiles and PCs combined (Chen, 2000; de Haan, 2000). In the 1990s, the number of mobile phones worldwide grew by 50 % annually compared to less than 10 % for fixed connections. The proportion of mobile phones increased from 1 out of 50 phone connections in 1990 to 1 out of 3 in 1999 (Wellenius et al. 2000). The number of mobile subscribers worldwide increased from 11 million in 1990 to 318 million in 1998 (Wai, 2001) and is estimated to reach 1.2 billion by 2005, with 450 million using some sort of location-based service (Secker, 2001). The fixed telecommunications industry took over 130 years to reach comparable levels of diffusion. An estimate suggests that by 2009, there will be more cellular subscribers in the world than fixed line subscribers (ITU 2000). Another estimate suggests that by 2005, Internet access through wireless devices will outstrip access via personal computers (UNDP, 2001). Furthermore, over 25 % of e-commerce will take place over handheld sets by 2005 (Shaffer, 2000).

To exploit the opportunity created by the meteoric growth of mobile phones, companies around the world are rapidly integrating m-commerce technology into their business models. This is happening as much in developed as in developing countries, often with fascinating cross-border differences in the most prominent initial applications. An exemplary developed-country m-commerce provider is the U.S. online book retailer Amazon.com, which signed deals with wireless providers Sprint PCS, Verizon, Airtouch, and Nextel to leverage m-commerce technology in the company's offerings (Lindsay 2000). Of fast-moving m-commerce firms in developing countries, a notable example is GWCom. This mobile wireless applications services provider in China launched its wireless portal byair.com in 1998 to provide timely information and e-commerce capabilities such as stock trading and banking to users with mobile phone or wireless palmtop devices in Greater China. By March 2000, byair.com had over 6,000 subscribers

with up to 3,500 daily stock trades and 250,000 page views. It handled over 30 million information requests and 200,000 wireless stock transactions<sup>2</sup> (Ebusinessforum.com 2000). Wireless users have been using GWCom's application platforms to conduct online trading since 1998 in Shanghai and since 1999 in Shenzhen. In March 2000, 3,000 investors in Shanghai and 100 in Shenzhen were trading stocks over the paging networks managed by GWCom. The average daily volume of 3,000 Shanghai users in early-2000 was \$3.6 million, about 30 times as much as the average trading volume on stockstar.com, the largest and most popular Web-based stock trading company.

Farmers and small business owners from developing countries are also making extensive use of m-commerce applications. They are utilizing the information gathered via mobile phones to eliminate or reduce the role of intermediaries in the value chain and to lower the risk of their profit margins being squeezed by larger firms or firms from developed countries. Bangladeshi farmers employ such phones to find the proper prices of rice and vegetables. Farmers in remote areas of the Ivory Coast share mobile telephones so they can follow hourly fluctuations in coffee and cocoa prices in the international market. Thanks to mobile phones, they can now choose the time to sell their crops when the world prices are in their favor. A few years ago, the only way to find out about market trends was to go to the capital city and the deal making was largely based on often-unreliable information from buyers (Lopez 2000). Similarly, fishermen in India use mobile phones to obtain information about the price of fish at various accessible ports before deciding where to land their catch (Rai 2001).<sup>3</sup>

## PATTERNS OF GLOBAL DIFFUSION OF M-COMMERCE TECHNOLOGY

While the statistics above indicate hyperbolic growth and proliferating applications of mobile technologies, global diffusion patterns vary widely. First of all, uses of mobile phones vary between low and high-income countries. People in the developing countries often use mobile phones because these may be the only kind of phones available readily (Wooldridge, 1999); and in many regions of Eastern Europe, the mobile phone network is

often much more technologically advanced than the older fixed-line network. Thus, while mobile phones represent *supplements* to fixed telephones in high-income economies, they are often *substitutes* for fixed telephones in lower-income economies (ITU, 1997). In other words, the developing countries are gravitating to mobile phones because of infrastructure issues (Zuckerman, 2000). In some developing countries such as Cambodia and Venezuela, mobile penetration already exceeds fixed line penetration.

For this and for additional reasons examined below, global leaders in mobile technology and m-commerce are not necessarily the richest economies or the leaders in fixed telecommunications and the Internet. Table 1 compares 25 major national economies in terms of mobile penetration, fixed line penetration, Internet usage, and per capita income. Portugal and Taiwan, for instance, have incomes that are less than one third of the incomes of Japan, Switzerland and USA, but are far ahead in terms of mobile penetration. Similarly, Italy has one of the lowest rates of fixed line penetration in Table 1 but ranks fourth in terms of mobile penetration. Hong Kong, the economy with the highest mobile penetration in the world, has a low rank in terms of Internet usage.

Nations vary considerably in the penetration of mobile Internet access compared to fixed-line telecommunications and fixed-line Internet access. Whereas USA has been a global leader in overall Internet access, it lags far behind Europe and advanced economies of the Asia-Pacific region in terms of mobile Internet access (Table 2). In other words, the adoption of mobile technology does not follow any single universal logic or pattern. While mobile technology is frequently a successor or supplemental technology to preceding generations of telecommunications, it represents an infrastructure alternative to fixed-line communications in many parts of the world (and in varying degrees).

**Table 1: Mobile and Fixed Penetrations, Per Capita GNP, and Internet Use**

Country	Mobile phones per 1000 (1999)	GNP per capita in US\$ (2000)	Fixed phones per 1000 (1999)	Internet users per 1000 people (1999)
Hong Kong	726	25950	576	205
Finland	667	24900	552	404
Sweden	578	26780	665	445
Italy	528	20010	462	158
Taiwan	521	16100	588	216

<b>Austria</b>	519	25220	472	203
<b>South Korea</b>	504	8490	438	213
<b>Denmark</b>	499	32020	685	394
<b>Singapore</b>	475	24740	482	289
<b>Portugal</b>	468	11060	424	80
<b>Japan</b>	449	34210	558	162
<b>Netherlands</b>	435	25140	606	258
<b>Switzerland</b>	420	38120	699	234
<b>UK</b>	408	24500	575	255
<b>Ireland</b>	378	22960	478	132
<b>France</b>	364	23670	579	121
<b>Australia</b>	344	20530	520	261
<b>Belgium</b>	315	24630	502	180
<b>Spain</b>	312	14960	418	91
<b>Greece</b>	311	11960	528	140
<b>USA</b>	312	34260	655	351
<b>Germany</b>	286	25050	588	149
<b>New Zealand</b>	230	13080	490	209
<b>Canada</b>	230	21050	682	369
<b>Argentina</b>	121	7440	201	14

Sources: International Marketing Data and Statistics, European Marketing Data and Statistics, The World Bank.

**Table 2: A comparison of fixed and wireless Internet users in Western Europe, USA and the World**

		2000	2002	2005
<b>World</b>				
	Internet users, million	414	673	1174
	Wireless internet users, million	40	225	730
	(Wireless as Proportion of Internet users)	(9.7%)	(33.4%)	(62.1%)
<b>U.S.</b>				
	Internet users, million	135	169	214
	Wireless internet users, million	2	18	83
	(Wireless as Proportion of Internet users)	(1.5%)	(10.7%)	(38.8%)
<b>Western Europe</b>				
	Internet users, million	95	148	246
	Wireless internet users, million	7	59	168
	(Wireless as Proportion of Internet users)	(7.4%)	(39.9%)	(68.3%)

Source: eTForecasts and authors' calculation

## FACTORS IMPACTING THE DIFFUSION PATTERNS OF MOBILE TECHNOLOGY AND M-COMMERCE

Table 3 lays out the primary factors responsible for the meteoric growth rate of mobile phones and m-commerce technologies as well as the highly heterogeneous adoption patterns just discussed.

**Table 3: Factors influencing the diffusion patterns of mobile technologies**

Factor	Elaboration and Explanation
<b>Inherent diffusion-accelerating attributes</b>	<ul style="list-style-type: none"> <li>▪ <b>Mobile technologies have inherent diffusion-accelerating attributes:</b> Potential to save time (relative advantage), ability to connect to existing telephone network (compatibility), operation method same as the “regular” phone (low complexity), status-conferral to potential buyers (observability), and possibility to borrow a friend’s cellular phone or handheld device for trial (trialability)</li> </ul>
<b>Mobile technology effects</b>	<ul style="list-style-type: none"> <li>▪ <b>Many factors lower the barriers to adoption:</b> Low fixed and operating costs of mobile networks, ability to operate in areas with no electricity, low social barriers to adoption, infrastructure resources less prone to theft and vandalism, geographical flexibility, and innovative pricing (such as prepaid services)</li> </ul>
<b>Rapidly deployable technology</b>	<ul style="list-style-type: none"> <li>▪ <b>Mobile networks can be deployed rapidly:</b> Ongoing reductions in fixed and operating costs due to progressively cheaper and increasingly powerful components enable rapid deployment.</li> </ul>
<b>Infrastructure effects</b>	<ul style="list-style-type: none"> <li>▪ <b>Large, established fixed-line networks create positive externalities:</b> First and second generation mobile phones in advanced nations benefited from such network externalities.</li> <li>▪ <b>Relative lack of fixed-line infrastructure favors cellular networks:</b> Mobile networks are more attractive than fixed networks in developing countries that lack fixed-line infrastructures.</li> </ul>
<b>Market size and industrial demand effects</b>	<ul style="list-style-type: none"> <li>▪ <b>Diversity and size of industries affects uptake of data services:</b> The uptake is rapid when there are large, diverse industries likely to use mobile communications and commerce applications.</li> </ul>
<b>Income and leapfrogging effects</b>	<ul style="list-style-type: none"> <li>▪ <b>Income levels influence mobile penetration rates and technology generations:</b> High-income countries adopt early but end up having mixed generations of mobile phones while low-income countries may adopt later with uniformly new generations of technology.</li> </ul>
<b>Cultural factors</b>	<ul style="list-style-type: none"> <li>▪ <b>Culture influences adoption rate and styles:</b> Cultural factors affect the preference for mobile phones over fixed phones. They also influence handset size and style preferences.</li> </ul>
<b>Policy related factors</b>	<ul style="list-style-type: none"> <li>▪ <b>Government policies influence the mobile sector:</b> Public investment often funds backbone networks. Telecom policy affects competition in and reorganization of the mobile telecom sector.</li> </ul>

Table 3 incorporates insights from prior literature on the diffusion of mobile technology and mobile commerce. For example, the inherent diffusion-accelerating attributes are

factors underlined by Rogers (1995: 245-6) who sees mobile phones as having an “almost ideal set” of product characteristics:

- Rapidly falling cost and the potential to save time offer *relative advantage*
- Ability to connect to existing telephone network increases *compatibility*
- Same method of operation as the “regular” phone results in *low complexity*
- Status-conferral aspects of mobile phones boost their *observability*
- Possibility to borrow a friend’s cellular phone for trial increases the *trialability* of mobile devices.

These classic diffusion-accelerating factors help explain the exceptionally rapid rate of cellular phone adoption. Similarly, Dholakia and Kshetri (2001, 2003) argue that several “mobile technology effects” also act as spurs to mobile technology provision and adoption. These include:

- Low fixed and operating costs of mobile networks
- Ability to have mobile service even in areas with no electricity
- Low social barriers to adoption
- Compared to the expensive copper wiring that is lucrative for thieves, mobile infrastructure is less prone to theft and vandalism
- Geographical flexibility, in terms of covering difficult terrain without the need to lay copper wire
- Innovative pricing such as prepaid service plans.

Rapid developments in mobile technology have made the “mobile technology effects” more prominent and the perceived attributes of mobile phones closer to ideal. A study conducted by Yankee Group found that worldwide wireless prices fell by an average of 38 % between late 1996 and early 1999 (The Economist 1999). Reductions in fixed and operating costs have been more dramatic in some countries. In China, for example, connection fees as well as handset prices halved during 1997-99 (The Economist 1999). These costs are declining further. As James Bond, the head of the World Bank's telecommunications division, points out:

(T)here is a limit to how much cheaper fixed lines can get because they involve heavy investment in labor and materials. Conversely, mobile phones share the propensity of all digital technologies to become both cheaper and more powerful over time (Economist 1999).

Furthermore mobile sets are becoming hybrids between computers and phones. Third and fourth-generation cell phones are bundling the functionalities of a phone, a computer, the Internet and a credit card. These mobile sets allow high-speed data transmission and the costs are likely to be lower than that of a personal computer, making the adoption more attractive for broad groups of potential users. In the Asia-Pacific region, for instance, the launch of 3G services has potential to fuel the growth of mobile phones:

In the fixed-line network, it is market liberalization among the emerging giants of the [Asia-Pacific] region which is promoting growth; in the mobile network it is the launch of 3G services which promises growth, while for the Internet it is the development of more local language content which will spur growth (ITU 2000).

The emergence of pre-payment pricing structures, one of the “mobile technology effects” mentioned in table 3, has been a major factor driving the diffusion of mobile telephones. In 2000, prepaid subscribers of Millicom International increased by 70% with a 79% increase in prepaid minutes (MIC, 2000). Similarly, in 1999, 70 % of new users in Thailand and 100 % in Malaysia were prepaid users (The Economist, 1999). In the Czech Republic, Eurotel Praha, a mobile service company is overcoming the lack of a credit culture by providing prepaid services via their mobile phones for shopping online (ITC Executive Forum, 2001).

### **3G and Other Mobile Technologies**

The influence of technological, political, and other environmental forces on recent m-business technologies differs significantly from the mechanisms that influenced the diffusion of earlier cellular phones. While small Nordic nations such as Sweden and Finland pioneered in mobile telephony, large (and affluent) European and Asian nations – Germany, UK, Japan – will probably spearhead the innovation process for next generation mobile technology and business applications. In a cross-sectional study of major economies from Asia, Europe and Latin America, Lehrer, Dholakia and Kshetri (2002) found that the penetration rate of fixed phone has a significant effect on the diffusion of first and second-generation mobile phones but not on leading indicators of m-business technologies, especially investment in 3G infrastructure. Market size (measured by population), on the other hand, does appear to correlate with strong investment in 3G infrastructure. The wide range of possible applications for 3G –

advertising, business data, email, information services, SMS, transactions, voice (Johansson 2001) – appears to favor large countries with diversified industrial bases. At the same time, several factors inhibit the move to 3G and 4G technologies. These include customer behaviors anchored strongly in PC usage and easy availability of “free” or low cost services including voice and Internet access.

Income influences the penetration level of mobile technology as well as the optimum combination of different generations of mobile phones. High income allows potential adopters to afford higher prices while embracing an innovation (Dekimpe, Parker and Sarvary 2000). In an international context, it can be argued that an economy’s standard of living and the level of economic development influence the adoption timing as well as diffusion speed (Antonelli, 1993; Gatignon and Robertson, 1985; Dekimpe, Parker and Sarvary, 2000; Gruber and Verboven, 2001). A certain minimum level of income is therefore a pre-requisite for effective penetration level of mobile technology. For example, third and fourth generation mobile phones are likely to be more attractive for high-income economies than for low-income economies.<sup>4</sup>

In addition to income, the cellular standards adopted by a country are also likely to influence its national m-commerce potential. Given the variety of mobile standards worldwide today<sup>5</sup> (Table 4), multiple dominant designs can be expected to coexist and compete for an extended period of time in m-commerce applications. Yet adoption of specific standards creates a trajectory of change and growth. South Korea, for instance, with its CDMA standard of 2G will find it less costly to upgrade to the CDMA-based 3G standard than Spain (with its non-CDMA 2G standard) and will therefore be able to adopt 3G more rapidly. CDMA-based networks in the U.S. will benefit similarly.

**Table 4: A comparison of different standards of mobile phones in use today**

Standard	Description	Where used?	Remarks
<i>First generation (1G)</i>	<ul style="list-style-type: none"> <li>Based on analog technology</li> <li>Became available during the late 1970s and early 1980s.</li> </ul>	Worldwide	
Nordic Mobile Telephone (NMT)	<ul style="list-style-type: none"> <li>First commercially available analog system</li> <li>Introduced in 1979</li> </ul>	Sweden, Norway	
Advanced Mobile Phone Service (AMPS)	<ul style="list-style-type: none"> <li>Considered to be the “most successful” analog standard</li> </ul>	Worldwide	

Total Access Communications System (TACS)	<ul style="list-style-type: none"> <li>Introduced in 1982</li> <li>Based on AMPS.</li> </ul>	Originally specified for the UK	<ul style="list-style-type: none"> <li>Extended TACS (ETACS) is primarily used in Asia Pacific.</li> </ul>
<b>Second generation (2G)</b>	<ul style="list-style-type: none"> <li>Digital wireless standards that concentrated on improving voice quality, coverage, and capacity.</li> <li>Designed to support voice</li> </ul>	Worldwide	
Global System for Mobile phone communications (GSM)	<ul style="list-style-type: none"> <li>First commercially available digital standard</li> <li>Relies on circuit-switched data</li> <li>The basic development that supports data at low rates (&lt; 9.6 kbps) has been used for e-mail from laptops.</li> </ul>	Europe, Asia	<ul style="list-style-type: none"> <li>USA accounts for 3% of the worldwide GSM market.</li> <li>USA introduced GSM in 1995.</li> <li>GSM customers estimated to reach 1.4 billion by 2005</li> </ul>
Time Division Multiple Access (TDMA)	<ul style="list-style-type: none"> <li>Introduced in 1992</li> <li>Also known as "North American" digital standard.</li> </ul>	North America, Latin America, Asia, Eastern Europe.	<ul style="list-style-type: none"> <li>Originally it was known as IS-54. Now IS-136 (TDMA IS-136)</li> </ul>
Personal Digital Communications (PDC)	<ul style="list-style-type: none"> <li>Primary digital standard in Japan</li> </ul>	Japan	
IS-95	<ul style="list-style-type: none"> <li>Based on "narrowband" Code Division Multiple Access (CDMA) technology.</li> </ul>	South Korea, North America	
<b>Enhanced Second-Generation (2.5G)</b>	<ul style="list-style-type: none"> <li>Builds upon the 2G standards by providing increased bit-rates and bringing limited data capability.</li> <li>Data rates range: 57.6-171.2 kbps.</li> </ul>		
High-speed Circuit-switched Data (HSCSD)	<ul style="list-style-type: none"> <li>Provides access to four channels simultaneously, providing four times the bandwidth (57.6) of a standard circuit-switched data transmission rate (4.4 kbps).</li> </ul>		<ul style="list-style-type: none"> <li>Marks the first step towards 3G services</li> <li>Predecessor of GPRS</li> </ul>
D-AMPS IS-136B	<ul style="list-style-type: none"> <li>Introduced in 1999.</li> <li>The first phase of D-AMPS will provide up to 64 kbps.</li> <li>The second phase will provide up to 115 kbps in a mobile environment.</li> </ul>	North America, Latin America, Australia and parts of Russia and Asia.	
General Packet Radio System (GPRS)	<ul style="list-style-type: none"> <li>Supports data rates up to 171.2 kbps (about three times faster than today's fixed telecom networks and ten times as fast as current circuit-switched data services on GSM).</li> </ul>	Europe	<ul style="list-style-type: none"> <li>Standard from the European Telecommunications Standards Institute (ETSI).</li> </ul>
<b>Third-Generation (3G)<sup>6</sup></b>	<ul style="list-style-type: none"> <li>Will provide wide-area coverage at 384 kbps and local area coverage up to 2 Mbps.</li> </ul>		<ul style="list-style-type: none"> <li>Each packet contains a destination address and a</li> </ul>

	<ul style="list-style-type: none"> <li>• Supplement standardized 2G and 2.5G services with wideband services.</li> <li>• Use packet switching instead of circuit switching and hence no need to establish a continuous connection that dedicates a circuit for each call.</li> </ul>		sequence number so it can be independently routed and reassembled into a complete message
IMT-MC	<ul style="list-style-type: none"> <li>• CDMA Multi-carrier</li> <li>• Also known as CDMA2000 or IS-2000).</li> </ul>	U.S.A.	Expected to be compatible with CDMA and GSM/TDMA.
IMT-DS	<ul style="list-style-type: none"> <li>• CDMA Direct Spread</li> <li>• Also known as Wideband CMDA Frequency Division Duplex (WCDMA-FDD)</li> <li>• Intended for public macro-cell and micro-cell environments.</li> <li>• For symmetrical applications.</li> </ul>	Canada, France, Japan	<ul style="list-style-type: none"> <li>• Supported by Japan's ARIB and GSM network operators/ vendors.</li> <li>• NTT DoCoMo's FOMA (Freedom of Mobile Multimedia Access) is based on the W-CDMA format.</li> </ul>
IMT-TC	<ul style="list-style-type: none"> <li>• Also known as Wideband CMDA Time Division Duplex (WCDMA-TDD)</li> <li>• Intended for public micro-cell and pico-cell environments.</li> <li>• Intended primarily for indoor use.</li> <li>• Optimized for symmetrical as well as asymmetrical applications.</li> </ul>		<ul style="list-style-type: none"> <li>• In Europe, W-CDMA is known as UMTS (Universal Mobile Telephony System)</li> </ul>
IMT-SC	<ul style="list-style-type: none"> <li>• Also known as TDMA Single Carrier</li> <li>• UWC-136 (Universal Wireless Communications) and EDGE (Enhanced Data Rates for GSM Evolution) fall in this standard.</li> <li>• Will provide higher speed without changes in channel structure, frequency, or bandwidth.</li> </ul>	North America	<ul style="list-style-type: none"> <li>• EDGE is a radio-based high-speed mobile data standard with aggregate transmission speeds of up to 384kbps when all eight timeslots are used.</li> <li>• Initially developed by Ericsson.</li> </ul>
IMT-FT	<ul style="list-style-type: none"> <li>• TDMA Multi-carrier</li> <li>• Also known as Digital Enhanced Cordless Telecommunication (DECT)</li> </ul>		
<b>Fourth- Generation (4G)</b>	<ul style="list-style-type: none"> <li>• Planned to have higher transmission rates (up to 20 mbps)</li> </ul>		

Sources: [http://intel.com/technology/itj/q22000/articles/art\\_6.htm](http://intel.com/technology/itj/q22000/articles/art_6.htm),  
[http://www.etsi.org/frameset/home.htm?/pressroom/Media\\_Kit/GSM.htm](http://www.etsi.org/frameset/home.htm?/pressroom/Media_Kit/GSM.htm),  
[http://www.mobileinfo.com/3G/3G\\_Wireless.htm](http://www.mobileinfo.com/3G/3G_Wireless.htm), <http://www.mobile3g.com/GetContracts.asp>,  
<http://www.cellular.co.za/technologies/3g/3g.htm>, [http://www.refreq.com/WAPTech/wap\\_glossary.htm](http://www.refreq.com/WAPTech/wap_glossary.htm),  
Lehrer, Dholakia and Kshetri (2002), and authors' research.

Adoption patterns of mobile technology also depend on socio-cultural factors. In newly industrialized Asian economies, for instance, people are more comfortable with smaller electronic devices and mobile handsets (Wilson, 2001). In China, on the other hand, the really small wireless phones initially did not sell well because they were “too inconspicuous” – and did not offer adequate opportunity to show off (low “observability” attribute). Later, the public attitude toward these wireless devices changed in China as well. Among the world’s English-speaking countries, commonalities of language and close cultural links appear destined to elevate the UK to a “lead market” for 3G applications (Lehrer, Dholakia and Kshetri 2002).

As with other technologies, policy related factors play an important role in the diffusion of mobile technology and m-commerce applications. For instance, government investment in the telecom sector, government initiatives to encourage mobile phone purchases, and intense competition in and reorganization of the telecom sector are found to be the major causes of China’s rapid mobile telecom network growth (Kshetri and Cheung 2002). The experiences of countries such as South Korea and Sri Lanka confirm the general rule that competition among mobile operators leads to lower prices and rapid mobile network growth (UNDP 2001).

## A FRAMEWORK OF FUTURE DEVELOPMENT

The future direction of mobile commerce development is surrounded by considerable economic and technological uncertainty. As the recent history of PCs and the Internet has shown, the growth and success of IT *hardware* depends critically on the availability of attractive *software* packages. Such packages range from specific software applications (so-called “killer apps”) to portal designs that facilitate the user’s overall interface with the technology. Particularly in developing economies, the development of the m-commerce landscape requires the emergence of country-specific mobile portals with specialized sites for Web phones. The evolution of m-commerce in such economies has been hampered to date by the lack of such portals. In developed countries, on the other

hand, a frequent lament is that the key “killer application” for m-commerce has yet to be identified, again hampering the penetration of the new technology.

With the caveat of such uncertainties in mind, the framework in Table 5 summarizes some of the major regional differences that emerge from comparative analysis. Turning first to the vertical dimension (the global centrality of nations in developing m-commerce applications), a dichotomy between core (active developers) and periphery (passive adopters) nations seems likely. As shown in the upper right corner of Table 5, countries in the economically most developed regions (North America, Western Europe, Japan) possess ideal supply and demand conditions for pioneering m-commerce applications. On the supply side, they possess the financial and technological resources to invest in high-risk ventures. On the demand side, they possess the high levels of income and sophisticated industrial users to afford and demand novel applications.

Nonetheless, the considerations explored in our prior analysis give some reason to expect an “expanded core” of pioneering nations in m-commerce, including in particular East Asia (upper left corner of Table 5). This is due in part to the mobile Internet handicap of the United States. Traditionally the world’s leader in IT innovation, the U.S. is now saddled with such extensive sunk investments in fiber cables that investment in mobile Internet infrastructure (particularly in 3G) is lagging. The reasons are more general than just the U.S. lag, however. These reasons are captured in the horizontal dimension of Table 5, the distinction between countries where mobile telephony supplements fixed lines and those where it genuinely substitutes for fixed lines. In the latter, especially certain developing countries in Asia and South America, mobile penetration is much higher than Internet access. Can this be turned to advantage for business and development through m-commerce (ITC Executive Forum 2001)? Particularly in the East Asian Tigers, with their specialization in consumer electronics and computing products, there is good reason to think that it can.

<b>Table 5: Comparative Regional Environments for M-Commerce Development</b>	
	<b>Infrastructure Role of Mobile Telephony</b>

<b>Global Centrality in M-Commerce Innovation</b>	<i>Substitute for Fixed Lines</i>	<i>Supplement to Fixed Lines</i>
<i>Active Developer</i>	<b>East Asian Tigers</b> (e.g., South Korea, Taiwan)	<b>North America, Europe, Affluent Asia-Pacific</b> (e.g., U.S., Japan, Germany)
<i>Passive Adopter</i>	<b>Developing Countries</b> (e.g., China, Sri Lanka)	<b>“Null Set”</b> (but may be filled for 4G)

Source: Authors' research

Recent contracts awarded by some developing Asian economies to telecom vendors in the United States and Europe indicate that many of the advances in wireless communications are likely to be installed in Asia before North America and Europe. Fiber optic and cable networks enjoyed by consumers in the USA simply do not exist in most Asian countries. Furthermore, contrary to the popular belief that the wireless Internet will only be successful in markets with lower PC penetration, economies with very high PC penetration such as South Korea are also showing phenomenal success in m-commerce<sup>7</sup>. For example, Korea Telecom Freetel launched 1X technology<sup>8</sup> at the end of 2001 and achieved a 35% penetration rate of wireless Internet use within five months, with 1X users consuming twice as much airtime as other mobile users (Luna 2002). Furthermore, after introducing Binary Runtime Environment for Wireless (BREW)<sup>9</sup> applications, data revenue increased by 60%.

Both demand and supply factors influence the potential of East Asian countries to become “lead markets” for m-commerce innovation. The use of wireless communications as a substitute for fixed-line access to the telephone and Internet network creates a demand advantage to the extent it translates into earlier and higher diffusion rates in the population’s use of the new technology than in other advanced countries. Just as important, however, are supply side factors. Like Japan, East Asian “Tiger” countries

feature a large number of producers specialized in innovative, high-technology products for global IT markets. Such East Asian countries therefore have the means to translate feedback from behavior in their domestic markets into novel product designs. Having already climbed the ladder from technology imitators to active technology developers, these countries have the requisite understanding of global markets to pioneer innovative m-commerce products, especially in components and hardware.

In contrast, not all developing countries using wireless telephony as a substitute for fixed lines can be expected to be global innovators in the use of the new technology. Developing countries using mobile networks as a cost-effective alternative to fixed lines in large rural areas (Sommermeyer, 2001), for example, will not necessarily be major innovators in using and developing the technology. In the context of the Asia-Pacific region, analyst Frank Yu of Ion Global argues that developing markets like China do not have a need to broaden their existing wireless penetration base by adding more services. He argues: “They have other basic needs they want to work on before they start experimenting with prototype systems. They’ll just let Japan and Korea do that.” (quoted in Stout, 2001). At the same time, the proximity of the huge Chinese market may provide advantages to Japanese and Korean producers in their exploration of new m-commerce applications.

## DISCUSSION AND CONCLUSIONS

Mobile technology, mobile Internet access, and mobile commerce are growing rapidly on the global stage; however, growth rates vary widely across economic regions. The penetration rate of mobile phones, the optimum combination of different generations of telecommunications, and the combination of different technical formats vary according to a wide array of economic, socio-cultural, and policy related factors. The ways in which companies integrate m-commerce applications into their business models depend upon numerous environmental factors, particularly the combination of communications technologies previously adopted and the mobile technologies currently diffusing in their

domestic economies. Given the scope for technological leapfrogging and alternative national mixes of fixed lines and wireless infrastructure, global heterogeneity in national patterns of m-commerce development – and hence of business models in m-commerce – appears to be a likely prospect for the foreseeable near future.

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#### Endnotes:

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<sup>1</sup>To simplify usage, we will employ the term "e-commerce" for electronic commerce transactions carried out via fixed, wired terminals and the term "m-commerce" for electronic commerce transactions carried out via mobile, wireless terminals. In the larger sense, both are variations of electronic transactions, but using the prefix "e" for fixed/wired and "m" for mobile makes it easier to contrast these two types of electronic transactions.

<sup>2</sup> See <http://www.gwcom.com/html/news0303.htm>

<sup>3</sup> The examples in the foregoing paragraph are of using mobile phones as aids for regular commerce. The step to m-commerce, however, is a short one – when reliable and easy-to-use data-ready phones become widely available.

<sup>4</sup> Leapfrogging effects of developing countries adopting the latest mobile technologies are going to taper off as the developing countries accumulate sizable segments of mobile users. With 3G, and especially with 4G, only the poorest and most backward developing nations are apt to engage in leapfrogging. In other developing nations, the "mixed generation" pattern of the affluent economies will begin to take hold.

<sup>5</sup> A variety of standards can be found even in a continent. For example, at the end of the first quarter of 2001, Latin America had 32 million TDMA subscribers, 15.9 million users had CDMA handsets and 4.9 million had GSM handsets (Petrazzini and Hilbert, 2001).

<sup>6</sup> The standards mentioned here are from the recent IMT-2000 (International Mobile Telecommunications-2000) recommendation.

<sup>7</sup> PC penetration in South Korea is about 50%, similar to levels in the USA (Luna 2002).

<sup>8</sup> 1X (or CDMA2000 1X) is the name that identifies the 3G technology that upgrades CDMA networks and wireless devices to 3G features and services.

<sup>9</sup> BREW platform, designed by QUALCOMM, is a thin application execution environment providing an open, standard platform for wireless devices. Carriers' BREW-based services enable wireless users to customize their handsets by downloading applications over the air from a carrier's application download server.