National Sources of Leadership in 3G M-Business Applications: A Framework and Evidence from Three Global Regions

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Abstract
Countries such as Finland and Sweden have exhibited long-established patterns of leadership in mobile telecommunications in general, while Japan's NTT DoCoMo provides an early national-level exemplar of a major m-commerce business system. The task of identifying and profiling the types of national leadership patterns that will prevail in 3G wireless networks of Europe, Asia, and elsewhere, however, is a challenging one. This is because new technological and other forces are coming into play in the post-GSM world. In this paper, we present a framework and some evidence to show the potential national leadership patterns in 3G m-business applications in Asia-Pacific, Europe, and Latin America.

Introduction

The sources of national leadership in third-generation (3G) wireless technologies are likely to be significantly different from those in regular cellular phones. First, new types of network externality effects could be selectively more important for 3G technologies than for cellular networks. Pre-existing fixed networks created network externality effects for cellular phones. For many 3G applications, however, communications may require end-to-end 3G connectivity, triggering new patterns of network externalities. Second, the penetration and growth rate of cellular phones, the base technology for 3G, varies widely across nations (Table 2). Conditions for migrating from cellular to 3G may not be uniform across various countries. Third, cellular networks across the world use a plethora of standards. Existing cellular standards across the world vary from first generation (1G) technologies such as Advanced Mobile Phone System (AMPS), Nordic Mobile Telephone (NMT), and Total Access Communication System (TACS) to 2G technologies such as Digital AMPS (D-AMPS), Global System for Mobile (GSM), Code Division Multiple Access (CDMA), and Personal Digital Communication (PDC). Technical difficulties and costs of upgrading these standards to 3G could vary dramatically. Fourth, uptake of data services and the availability of a range of industries that could benefit from 3G technologies are not uniform, even across countries with similar incomes. Fifth, the success of international level initiatives such as IMT-2000 (International Mobile Telecommunications at 2000 Mhz) in integrating different standards would influence the diffusion patterns of 3G technologies.

This paper draws evidence from the major economies of three global regions—Asia Pacific, Europe and Latin America—to explore the sources of national leadership in 3G mobile business (m-business) applications. Three sections of the paper follow. First, we contrast the potential sources of national leadership in cellular telephony and 3G applications. Next, we provide some empirical evidence on the influence of national leadership in the diffusion of 3G technologies. Finally, we provide some conclusions.

Sources of National Leadership: Cellular Telephony vs. 3G

While precise definitions vary, lead markets essentially entail localized patterns of demand that engender the development of especially innovative or high-quality products in anticipation of trends in other parts of the world. Various sources of national leadership mentioned in the literature can be consolidated into three basic dimensions: *demand and cost conditions* (Linder, 1961; Vernon, 1966), *industry structure and competitive rivalry* (Porter, 1990), and *export and transfer conditions* (Beise, 2001; Tilton, 1971). *Demand and cost conditions* include consumer preferences, income, and input costs as well as government procurement, regulatory regimes (affecting cost), and prior national experience with previous generations of technology. *Industry structure and competitive rivalry* are particularly important in fast-moving high-tech industries where pampered national champions rarely achieve international competitiveness. Competitive rivalry can of course include the participation of foreign firms. Finally, a variety of *transfer and export conditions* affect the capacity of dominant designs developed in the national market to supplant competing designs in global markets. These include trade policy, the export orientation of industry, strategic regulation, and market size. Table 1 contrasts the roles of various factors along these three dimensions in the diffusion of regular cellular phones and 3G technologies.

Table 1: Possible influences of various factors on the diffusion of cellular phones and 3G technologies

Factor affecting diffusion	**Role of this factor in:**	
	Diffusion of regular cellular phones	**Potential diffusion of 3G technologies**
Demand and cost conditions	• Pre-existing wired phone penetration influenced the demand of cellular phones • Early adopter countries discovered more market sectors and more applications • Relative price structures of fixed and cellular networks influenced the demand of cellular phones.	• Already achieved penetration rate of cellular phones • Uptake of data services • Diversity and size of industries likely to use 3G applications • Special network externality effects due to 3G-to-3G communications
Industry structure and competitive rivalry	• Pre-cellular and cellular competition influenced prices of calls and phones, and the availability new services and applications. • Promotional activities of competitors attracted new customers	• Compared to other standards, simpler/cheaper upgrades from existing CDMA-based 2G networks to CDMA2000-based 3G networks. • Rivalry in cellular networks and new rivalries in 3G applications
Export and transfer conditions	• Export orientation of firms (e.g., those from Nordic countries) facilitated the diffusion by lowering prices. • Linguistic and cultural contexts and physical conditions of a country influenced the suitability of cell phones designed in another country. • International roaming ability, features to address the needs of diverse countries, and non-proprietary status facilitated the diffusion of the GSM standard.	• Language, culture, and ties with rest of the world could influence 3G m-business applications. • ITU's IMT-2000 (International Mobile Telecommunication 2000) standard could ensure the compatibility and interoperability of different systems (such as CDMA, GSM, and TDMA) in 3G. • 3G technologies would eventually offer worldwide roaming facility.

Whereas cellular phones diffused faster in smaller Nordic countries than in bigger EU countries, there are reasons to believe that 3G technologies are likely to exhibit different diffusion patterns. First, the large number of possible uses for 3G – advertising, business data, email, information services, SMS, transactions, machine-to-machine, multimedia, voice – could favor large countries with diversified industrial bases (Johansson, 2001). Automobile and manufacturing applications in Germany, financial and service applications in the UK, Internet-based consumer electronics (games, music, etc.) in Japan – these could provide fertile contexts for 3G experimentation. Second, new network externality could be associated with the diffusion of 3G technologies. For instance, before global interoperability is achieved, only 3G devices would exploit combined voice/picture capabilities of 3G networks. Conventional mobile phones and many PCs could be excluded from such application networks. In EU, for example, Germany – the largest national market with 83 million inhabitants and very competitive industries (Pavitt and Patel, 1999) – could be the breeding ground for such new externalities. Third, 3G m-business potential is also a function of the cellular penetration rate. Diffusion of 3G technologies in low-income Asian and Latin American countries would be hampered by low penetration rates of cellular phones (Table 2).

Fourth, factors related to *industry structure and rivalry* will influence the diffusion of 3G technologies. For instance, *both* the UK and Germany are distinguished by *high rivalry* in 3G markets. Vigorous 3G license auctions in these two countries clearly reflect this. While NTT DoCoMo is the only significant 3G operator in Japan, it has promoted intense rivalry among m-commerce application providers and device makers. Also, countries that have based their cellular networks on CDMA – South Korea, Brazil, India and Mexico – could benefit from smoother, less expensive transition to one of the rival 3G technologies, CDMA2000 or W-CDMA (The Economist 2002). On the other hand, countries using GSM standard could be slowed down by the requirement to build new 3G networks from scratch.

Fifth, various *export and transfer conditions* play roles in the diffusion of 3G m-business. For instance, the English-speaking world is closely linked by language and cultural ties to the

UK. Also, given the extensive hosting of non-European multinational companies by UK, it will almost certainly serve as a beachhead for North American and Asian firms anxious to participate in and learn from European 3G networks. Similarly, international level initiatives such as IMT-2000 – designed to promote compatibility and interoperatibility of different cellular standards – are likely to have differential impacts on the diffusion of 3G technologies in various parts of the world.

Some Empirical Evidence

A comparison of the per capita 3G license fees for the countries shown in table 2 reveals several interesting trends. First, market size seems to play an important role in the potential diffusion of 3G technologies. The 3G license fees per capita are much higher in the bigger EU countries such as Germany, UK, France and Italy than in the smaller EU countries. In Asia, the fee is much higher in South Korea than in other smaller countries in the region. Moreover, transfer and export advantage of the UK (language and culture) and cellular market size of Italy (the largest cellular market in the EU) seem to play important roles.

Second, examination of 3G license fees per capita in comparable-sized countries (in population terms) such as New Zealand and Singapore, and Spain and South Korea, indicates that penetration rates of regular cellular phones, income levels, and prior cellular standards may influence the 3G potential of the country. For example, South Korea's substantially higher licensing fee than Spain's is possibly due to its high-penetration 2G network that uses the CDMA standard – easily upgradable to CDMA-based 3G standards[1]. Similarly, Singapore's

[1] The 3G rivalries are comparable in these two economies. For example, South Korea awarded three 3G licenses (winners: KTICOM, SK telecom and LG Telecom) whereas Spain awarded four (winners: Telefonica Spain - Airtel, Amena, and XFERA).

substantially higher licensing fee than New Zealand's is probably due to substantially higher per capita income and cellular penetration in the former[2].

Third, low-income countries in Asia and Latin America have very low penetration rates

Table 2: 3G related indicators in major countries of Asia Pacific, Europe and Latin America

untry	Population (mil) (2000)	GNP per capita (2000)	Internet users per 1000 people (1999)	Internet hosts per 1000 people (2000)	Mobile phones per 1000 (1999)	Fixed phones per 1000 (1999)	3G license issue date	3G license fee per capita US$
Japan	126.5	34210	161.60	26.92	449	558	Jun-00	Free
ew Zealand	3.8	13080	209.42	80.79	230	490	Jan-01	15.7
Singapore	4.15	24740	289.01	38.57	475	482	Apr-01	42.6
Australia	19.16	20530	260.89	68.32	344	520	Mar-01	30.3
Malaysia	21.8	3380	55.06	2.755	101	203	Jul-02	-
outh Korea	47.5	8490	212.8	10.06	504	438	Aug-01	60.8
Hong Kong	7.3	25950	205.47	18.29	726	576	Sep-01	No auction
Taiwan	22.2	16100	215.85	19.12	521	588	Feb-02	62.5
China	1261.8	840	5.54	0.07	34	86	Late-02	-
Thailand	61.2	2010	10.61	0.88	33	86	Jun-03	-
Philippines	81.2	1040	4.68	0.22	24	39	TBA	-
India	1014.4	460	2.46	0.03	1	27	TBA	-
Finland	5.2	24900	404.20	135.89	667	552	Mar-99	Free
Spain	40.0	14960	90.63	13.65	312	418	Mar-00	11.2
UK	59.5	24500	255.42	34.83	408	575	Jun-00	594.2
Netherlands	15.9	25140	257.99	67.98	435	606	Jul-00	158.9
Germany	82.8	25050	148.55	23.33	286	588	Aug-00	566.9
Italy	57.6	20010	157.89	27.30	528	462	Oct-00	174.2
Austria	8.1	25220	202.92	43.17	519	472	Nov-00	86
Sweden	8.9	26780	445.17	70.39	578	665	Dec-00	5.7
Portugal	10.0	11060	79.617	11.72	468	424	Dec-00	3.5
Switzerland	7.3	38120	234.09	58.22	420	699	Dec-00	16.5
Belgium	10.2	24630	179.65	35.21	315	502	Mar-01	35.1
Greece	10.6	11960	139.59	10.04	311	528	Jul-01	4.9
Denmark	5.3	32020	393.55	69.23	499	685	Sep-01	108.3
uxembourg	0.4	44340	171.62	-	-	724	Q4-01	-
France	59.3	23670	121.35	16.71	364	579	Jun-02	503.4 (est.)
Ireland	3.8	22960	131.68	22.74	378	478	Mid-02	36 (est.)
Argentina	36.9	7440	14.07	4.73	121	201	Oct-01	15
Uruguay	3.3	6090	95.98	10.73	95	271	Jan-02	-
Brazil	172.9	3570	39.33	3.89	90	149	Late-02	-
Colombia	39.7	2080	11.33	1.02	75	160	TBA	-
Mexico	100.4	5080	20.92	5.06	78	112	TBA	-

Sources: International Marketing Data and Statistics, European Marketing Data and Statistics, The World Bank, http://www.3gnewsroom.com/country/index.shtml

Conclusions

The analysis of this paper indicates that the mechanisms by which technological, political, and other environmental forces influence 3G m-business are significantly different from the mechanisms that influenced the diffusion of lower generation 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 3G devices and applications.

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