



# Critical Factors for Mobile Business Success

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## ABSTRACT

*This research looks at mobile business (mBusiness) from different macro perspectives. The issues that surround mBusiness and hence, influence its success at the wider scale in the long run are dependent on significant factors addressed in this research. The current research defines mBusiness and looks at different mobile technologies and standards that enable mBusiness. The research then looks at the different factors and contexts that would influence mBusiness success at a broader level highlighting issues, gaps, and challenges. It is emphasised that unless such implications are addressed, the wide diffusion of mBusiness will not materialise in the near future. Despite the rapid technological development and the enthusiasm about the mBusiness innovation among researchers and professionals, the road toward true mBusiness is still a long one. What exist now in the market are just complementary solutions. At this level, at the lower end, mBusiness is the toy of the teenagers; at the higher end it is the toy of the rich or the executive who cannot tolerate to be away from his/her email. There are indeed some useful business applications for mBusiness especially in logistics and distribution but the remaining potential masses that have tasted the beauty of Internet browsing are not yet prepared to compromise that with ill-specified mobile technologies, e.g., devices, wireless communications, and deficient and stripped down contents. Still, mBusiness stands strong as a futuristic direction and one day we will be there, wearing mBusiness.*

## MOBILE COMMERCE

Mobile commerce or mobile business (mBusiness) is defined as "content delivery (notification and reporting) and transactions (purchasing and data entry) on mobile devices" (Leung & Antypas, 2001) or mobile networks. That is to enable mobile users to compute, to engage in commerce and access information from anywhere and any time (Samaras, 2002). All of the preceding should be exchanged within a convenient environment and settings. mBusiness provides rich, personalised, localised, and real-time content on handheld mobile technologies to users (usually very busy) anywhere anytime, thus providing more convenience to traditional electronic commerce buyers and suppliers existing in the wired marketplace. The users would be individuals or businesses and hence, mobile commerce enables business-to-business (B2B, e.g., businesses tracking shipments) and business-in-business (BiB, sales force automation, remote log in) transactions as well as business-to-consumers (B2C, e.g., purchasing, browsing for information, location based marketing activities) transactions. mBusiness involves different stakeholders in the mobile industry such as mobile hardware manufacturers, mobile applications and portals developers, middleware developers and integrators, and wireless network providers and carriers, intermediaries, and finally services and content providers. In view of the different technologies that provide mobile commerce functionality, the following taxonomy depicts five main categories: Interactive or two-way pagers, which exchange short SMS (Short Message Systems) messages; mobile phones that provide access to the Web through the Wire-

less Application Protocol (WAP's WML Vs. DoCoMo's i-mode) or to SMS services; Personal Digital Assistants (PDA) with wireless modem (e.g., Palm); wireless Internet access on laptop computers using IEEE 802.11a,b (802.11a (High-speed 54Mbps, 5GHz band), 802.11b (or called Wi-Fi; Low-speed 11 Mbps, 2.4GHz band) radio frequencies (CSMA/CA not CD) standards; and wireless network devices such as those offered by Cisco, Symbol (e.g., wireless barcode reader/transmitters), and Proxim using, e.g., infrared and radio frequencies and other wireless technologies including satellite, cellular and microwave communications.

Although it is expected that the number of mBusiness subscribers will increase rapidly in the near future, and the profit margins of wireless and voice communications is plummeting drastically, such positivism among carriers and operators about mBusiness success is plagued by the following major impediments (McCarthy et al., 2000):

- 1- Bit rate: 9.6 Kbps: speed so far is the major barrier for the wide success of mBusiness and this relates directly to the existing operator/carrier (O/C) telecommunication infrastructure that exists in the different countries.
- 2- Subscribers' interests and needs: despite the push from O/C for contents over mBusiness, recent statistics indicate that: (a) 82% of mobile consumers have shown no interest in mobile data services – Then, how about selling products and services over mobile technologies! (b) Small processing power and small mobile browsing screens which are very hard to navigate, which makes the mobile browsing experience not enjoyable to subscribers (Anonymous, 2000).
- 3- Cost: ridiculous-costing schemes enforced by O/C to charge high profit margins, driven mostly by fast Mobile Internet return-on-investments plans and this in turn was encouraged by the lack of competition in the field (earlier players make most of the profits and dictate the roles of the game).

Therefore, this research attempts to introduce and investigate the main issues influencing mBusiness success at a broader level. The purpose of this research is to identify the main contexts and factors influencing mBusiness success and discuss ways where mBusiness could be progressed forward. The research outcomes could assist researchers, professionals and policymakers in understanding the main impending issues pertaining to mBusiness success. In the following, each section attempts to address a unique aspect pertaining to mBusiness in greater detail.

## FACTORS INFLUENCING M-BUSINESS SUCCESS

### Mobile Consumers

Driven by its digital nature, it is very easy to digitise products, services, processes and even the delivery process within the electronic business (eBusiness) scenario. The mass customisation aspect is unique to the eBusiness field. mBusiness is offering the same but on a stripped-down version of the wired mBusiness, at least for the time being with the

different technical limitations that plague mBusiness functionality. In addition, the uniqueness of the mBusiness perspective is that mobile applications and models could be designed to create a relationship with individual consumers (personalised services) existing within a certain region, city, village, block, etc., in accordance with the coverage provided by the wireless provider - Thus, providing mBusiness businesses with more opportunities and hence, pushing the mass customisation perspective to a climax.

However, the biggest challenge for mobile businesses, manufacturers, and developers in grasping such immense opportunities and in developing a killer mobile application is how deeper insights about consumers' behaviour and tastes could be generated. This requires a complete change in the mindset of the different businesses working in the mBusiness arena in that they would need to optimise their marketing strategies to define consumers by their fundamental life intentions. Thus, in order to succeed in such a task, mBusiness businesses would require the assistance of different businesses that might not relate essentially to their businesses in the first place (network providers, wireless services providers, mBusiness providers, content providers, market research consultants) (Nohria & Leestma, 2001). Such open opportunities provided by mBusiness could lead to the creation of different players in the mBusiness area.

### **Intermediation, Disintermediation and Re-intermediation**

As they control the underlying infrastructure and mobile subscriber-base (equipped with their mobile devices as well), network operators and carriers are confident that they will not be dis-intermediated as in the case of the Internet earlier by e.g., Internet services providers (ISPs) or by any new forms of intermediaries emerging in the new mBusiness arena (McCarthy et al., 2000). On the contrary, O/C envision making more profits as they know how and when their networks are being used and even charge traditional eBusiness vendors over the Internet commissions for sales executed over their mobile systems and networks. Further, mBusiness operators and carriers expect to generate further revenues from mBusiness vendors by marketing their products over the mobile technologies. However, Geng and Whinston (2001), McCarthy, Zohar, and Dolan (2000), and Nohria and Leestma (2001) are highly suspicious of that. With more convergence in mBusiness, it is expected that O/C will loosen their grip on their services to other parties involved with mBusiness.

### **The Road to Mobile Business**

The low speed/bandwidth of the second-generation telecommunication infrastructure and the tedious services provided to mobile subscribers resulted in having small and infrequent users and therefore, there was a need for a new technology that provides high-speed data service (Anonymous, 2000). Thus, migrating from the second-generation (2G) voice networks to the third-generation (3G) systems is what telecommunication companies are working on to build new broadband networks to transport data at high speed. For instance, Europe has selected the wideband W-CDMA as the preferred air interface for its proposed third generation system (Tade, 1999). Third generation (3G) network infrastructure has been in Japan since 2001. Versions of 2.5G and 3G are rolling out across Europe and Asia during 2002. In Canada, the first phase of 3G has been introduced. It is expected to start in the US by 2003 (Turban et al., 2002, [backbonemag.com](http://backbonemag.com)). However, it should be noted here that each country has its own: macro circumstance (e.g., regulatory, social, political, economical, etc.); existing telecommunication infrastructure; and subscribers' needs, which would ultimately influence the selection of an optimal telecommunications infrastructure for that country. A number of wireless paths have been suggested and introduced in the marketplace to provide surrogates to the envisioned mobile subscribers. However, upgrading/replacing the existing wireless telecommunication infrastructure to support mBusiness efficiently would require a huge investment and this would reflect on the existing regulatory procedure pertaining to providing and to billing wireless services. On the other hand, it should be noted here that the development of "killer mobile" applications might not require 3G-bandwidth in the first place.

Further, time and location specific services are likely to be low in value and this makes the huge investment on 3G-communication infrastructure for small countries with small population unjustifiable (Anonymous, 2000).

Even with the high speed and bandwidth expected in these wireless systems, applications with extensive frames, colours, graphics, and animations will always be difficult to support in the near future. Due to these limitations and impediments, there is a need to design mBusiness applications that require minimal bandwidth and have a simple and friendly interface. One solution for content providers is to plan their applications to be character-based terminal applications with cursor and entry forms. One possible path is to migrate applications designed as an Interactive Voice Response (IVR) system to mBusiness, because it is designed for the phone keypad with minimal bandwidth (Leung & Antypas, 2001). There are future trends aiming at developing Vortals, which change data to voice and communicate the information to us through our cell phones, however this technology will not be readily available in the near future (Shulman, 2000; Turban et al., 2002).

### **Mobile Strategies**

There are three basic differentiation strategies: horizontal (diversification), vertical (niche), and cross market differentiation by tying. With the expected revolutionary enhancement in 3G wireless and mobile devices and with the increase in number of subscribers in the near future, it is expected that wireless providers will not be able to differentiate their communication infrastructure services. Thus, providers are expected to adopt the third strategies and provide integrated services by tying with value added wireless application services providers (WASP) (Geng & Whinston, 2001), thus further endorsing the disintermediation perspective highlighted earlier. Geng and Whinston (2001) summarises the forms of competition that might take place between wireless providers into three types:

- 1- The first option is that providers engage in price wars, which ultimately would leave sellers without any profits.
- 2- Engage in collusion activities, which are illegal and a highly penalised practice in many countries.
- 3- Accumulate a large enough cash reserve to ride out a price war and bankrupt their competitors.

The preceding authors however, envision that unless providers introduce different solutions and varied user experience so that consumers find it extremely difficult to switch to another service, they will not be able to survive, especially in the light of the new mBusiness technology.

### **Mobile Prices**

Wireless telecommunication providers have monthly plans that charge a flat rate based on restricted time usage of the radio spectrum. Prepaid flat-rate plans may tie consumers and hence, most of the current plans would deter many consumers from freely going into/out of the service. However, most of the mobile phone services are usage based. Usage-based pricing refers to charging subscribers based on connection time or traffic volume (e.g., email and text messaging). The promise of the 3G-technology is that it will enable the delivery of various services at the same transaction-completion time but through different bandwidths. The preceding make the connection time fee uneconomical to wireless providers, as it does not reflect the actual use of the bandwidth (radio spectrum usage, e.g., downloading video requires far more bandwidth than wireless Web access) (Geng & Whinston, 2001).

### **Location Based Mobile Business**

The promise of mBusiness is that the emerging applications of mBusiness could target specific geographical regions. Thus, mBusiness applications could be developed and localised/customised easily to meet the needs of the different buyers/suppliers existing in a specific geographical region. Further, knowing the location of the mobile user in relation to a nearby trading outlet<sup>1</sup> or vending machine, more marketing and promotional messages (or a newly customised one based on the

prior knowledge of the user's preferences) could be sent to that user encouraging him to grasp that bargain from that nearby outlet (c.f. Varshney, 2001). The preceding would provide a more secure trading arena where O/Cs have more control over their mobile subscribers and hence, could trace misuse/fraudulent activities more easily. Further, the current legislative/legal systems in place in that region could be extended or adapted easily to suit the mBusiness commercial perspective. Convenient shopping would be at its best driven by the above assurances and hence, many businesses would be attracted to the mBusiness arena.

mBusiness is considered as distributed computing where users execute mBusiness applications while they are moving (Samaras, 2002). However, mobility, location of mobile users and sustaining the location of the mobile user at all times and with adequate accuracy levels (e.g., moving from one cell to another) still represent a big challenge for researchers (Samaras, 2002; Varshney, Vetter & Kalakota, 2000; Varshney & Vetter, 2001). Most of the existing location management schemes used in wireless networks deal with location information that is precise at a location area level (accuracy levels: existing networks: several kilometres and clusters: around one kilometre). This may not be sufficient for numerous mBusiness applications that require high precision location, e.g., let's say, within a few meters (U.S. law that forces (called E-911) local O/C to identify the telephone number and location of a mobile phone caller to 911 emergency number within 100 meters). Some possible solutions include the use of global positioning satellite systems (GPS), which use several base stations for triangulating the location, and mixed handset-network protocols for location determination (Varshney, 2001).

Another challenge is the ability to retain the association between the mobile user and his connection with the information source while he/she is moving from one location to another (Samaras, 2002). Accordingly, the preceding implications would influence the developed middleware applications (content providers, services providers, developers, tools, technologies, etc.) and its success in hiding the underlying complex processes involved in tracking mobile users while delegating seamless mBusiness content and services.

### Mobile Protocols

In overcoming bandwidth barriers, limited memory and processing power of mobile devices, and other bottlenecks as explained earlier, O/C, mBusiness researchers, hardware manufacturers and applications developers are adopting different mBusiness standards and protocols to deliver content more efficiently to mobile users. On the other hand, dealing with different protocols and standards will only impede the rapid development of the mobile technology.

WAP is a new advanced intelligent messaging service for digital mobile phones and other mobile devices. WAP facilitates interoperability among different wireless networks, devices and applications. WAP is expected soon to support video streaming but so far, most of the WAP applications are text based and simple black and white graphics. Another variant is the DoCoMo wireless technology in Japan. According to recent statistics, subscribers of DoCoMo mobile Internet access service "i-mode" exceeded 27 million in 2001 (Kinoshita, 2002). The reasons behind the success of the i-mode in Japan is contributed to the C-HTML (subset of HTML Vs. WAP's WML) that enable services providers to develop mBusiness applications and contents easily, charge is based on packet data volume instead of duration charge, and DoCoMo provides a billing system for services providers that reduces their billing cost. I-mode phones allow mobile users to send/receive graphics and photos, play music, and download/run small pieces of software. Thus far, none of the above protocols are widely recognized as a *de facto* standard in the industry.

### Social and Environmental Impacts

There are many advantages of introducing mBusiness to our daily activities as highlighted in this research. People could work or execute large parts of their work from their offices (even between floors, out of the office, break, etc.), home, and even while driving from/to office during the rush hours in the morning and afternoon. On the other hand,

there are several disadvantages that come along with mBusiness. The lack of convergence in the mobile devices represented here by displaying ads on mobile phones will prevent the user from using the mobile phone effectively. Issues like privacy and security, represented here by the ability to know the exact location of the mobile user anytime, anywhere, will put great strain on our personal lives. Since the mobile services provider or carrier already knows our profiles and personal details as subscribers this will open up a large venue for customer profiling and direct personalised marketing campaigns. Intercepting the wireless communication spectrum by hackers is much easier than tapping into the wired medium. Stealing the mobile device with its valuable contents is another challenge. Unless a complete regulatory framework is put in place to regulate the mBusiness industry (national/international) and to protect consumers' rights, the preceding impediments would stand high and wide against mBusiness progress. Learning from the earlier eBusiness experience is highly recommended here. There are developments aiming at increasing mobile devices security by using smart cards (DoCoMo's smart phone) and a portable version of the Public Key Infrastructure (PKI) encryption solutions (c.f. Turban et al., 2002).

Still, serious issues like viruses are starting to surface on the mobile arena and need to be resolved. As the mobile devices get more sophisticated and multimedia enabled, more viruses will be able to penetrate the mobile arena threatening to freeze the whole mobile network. How much overhead the mobile device can accommodate to guarantee confidentiality and integrity of transactions, authenticity of mobile users, and hedge against fraudulent activities among sellers and buyers, represents the biggest challenge for manufacturers and developers. Still we expect the mobile device to have a convenient display, longer battery life, faster performance, buffer and bigger storages, support multi-features (colours, tones, digital camera, voice recognition, roaming, etc.). With the proliferation of different mobile technologies in the market and advancement in mobile technology, more business processes could be integrated very easily, enabling workers to squeeze more jobs within the one day. This "burnout" effect will create an environment of high expectations and hence, puts greater strain on employees to increase their productivity and this will have devastating social impacts on our lives in the long run, e.g., social ties, psychological problems, etc.

Recent research shows great health hazards to the human brain as a result of the radio spectrum and waves used by the different mobile operators and how receiving a mobile call by a user will increase the amount of waves around the mobile phone reception end, which is located near the user's head. Turban et al. (2002) confirmed the same and pointed to cellular RF emissions and to radiation emitting from mobile devices and how these effects could endanger our health and cause cancer. On the other hand, issues like getting rid of, or recycling, old or used mobile stocks are very important as it represents a great threat to the environment. However, getting rid of these stocks is very costly and requires conscious handling by the different countries.

### DISCUSSION AND CONCLUSION

There are many drivers for mBusiness success as highlighted in this research. mBusiness business provides convenient communications and business services to mobile users anytime (24X7), anywhere (on the move) and everywhere (provided there is global coverage, roaming). On the other hand, there are still many technical, psychological, social, and environmental challenges to overcome for mBusiness to succeed in the long run. It is expected that more challenges will surface as the technology diffuses in organisations highlighting further organisational and managerial challenges. The wide macro political, economical, social, and technological (PEST) impacts are not yet fully identified. The micro impacts in relation to the nearby environment of the organisation are still not widely reported as yet. Forces like competition, rivalry, suppliers and buyers, substitute products and services and new entrants (Porter & Miller, 1985) are not widely explored as well and would prove to be quite challenging to researchers in revisiting the existing IS and eBusiness theories in relation to the new mobile technology perspectives.



The investments needed to upgrade the existing telecommunication infrastructure in the different countries to support the mobile environment are very high. The changes that are needed to go alongside such upgrades are enormous and expected to impact on the regulatory framework that runs the business of the different O/C, thus making the mobile experience across the different countries quite different. Recalling the earlier cries by the different researchers (Kalakota & Robinson, 2001; Turban et al., 2002) about the need to change our mindset and to think differently when appraising eBusiness, the same argument applies here to mBusiness. Complementary mBusiness solutions provided by the different O/Cs, manufacturers and developers in the different countries, provide short and narrow bridges between eBusiness and mBusiness. The current biggest risk for those investors in mBusiness is that their initiatives would not materialise unless each country provides the 3 G infrastructures in order to satisfy their subscribers and increase the mobile subscriber base. Even then, as highlighted in this research this is not sufficient as there is no way to predict customers' behaviour toward the yet not fully blown wireless bandwidth and whether the customers are willing to compromise the rich Internet browsing from their PCs to mBusiness devices. Thus, limiting the mBusiness device and its applications to supplementary tasks to the wired marketplace but not a replacement as such. It is agreed that with greater convergence in mobile technologies and a critical mass of mobile users occurring that mBusiness may flourish in the different countries. However, each country has its own circumstances and hence, needs to carefully assess the strategic importance of mBusiness to their country setting and to the potential wireless subscribers' base.

The same preceding argument applies to equipment and mobile device manufacturers. Looking at the huge drive for mBusiness by mobile technology vendors and manufacturers, the different markets are flooded with different mobile devices that work with the different existing wireless telecommunication infrastructure, protocols, etc. Some are providing an external interface for a larger keyboard; others are providing Bluetooth capability, smart card integration, etc. Surprisingly, thus far there is no unified protocol that governs the interface between mobile devices and the Internet content. There is no widely accepted standard for mobile applications as well and hence, developers need to customise their applications to suit the operating systems and the browsing needs of the different mobile devices (e.g. PalmOS, Windows CE) and to work with the different wireless infrastructures. This "shooting in every direction" needs to be resolved and unless there are agreed upon standards to guide the conduct of business via mobile devices, valuable time, money and effort will be wasted and indeed could be directed to focus on more impending issues pertaining to mBusiness.

Finally, let's not forget that the strongest point in the mobile device is its portability and voice capability. The amount of overhead needed to support efficient and secure mBusiness transactions is quite large and this would increase the mobile device size and weight by incorporating more electronic components and circuitry into it, such as memory chips, processors, smart cards, storage, bigger battery, larger screen and keyboard, more provision for interfaces, etc. Compromising the size and the weight of the mobile device will only deter many of the existing and potential mobile buyers from buying into the technology. The solution is in the voice power of the mobile device and hence, providing efficient voice solutions in conjunction with data will eliminate the need for most of the complementary and inefficient solutions that will only aggravate the mobile savvy and muster his/her resistance to the oversized and heavy mobile device. Some mobile devices are equipped with basic voice recognition systems to execute basic commands. However, the technology is still developing and has not matured as yet. Further development in this direction and further integrating voice recognition technology with intelligent software agents could prove a highly significant retrieval tool.

However, providing rich and fast content on lightweight devices will represent the biggest challenge toward the wide success of mBusiness in the long run. There are indeed significant applications for mBusiness in B2B scenarios or in integrating internal activities and processes where mobility is the norm, e.g., sales force automation, courier, logistics and dispatching but thus far, at the lower end, mBusiness is the toy of the teenagers; at the higher end it is the toy of the rich or the executive who cannot tolerate to be away from his/her email. With the witnessed development pace in technology, there is no doubt that mBusiness will have great impact on our lives where eventually business will drive mBusiness technology not teenagers!

## REFERENCES

- Anonymous. (October 14, 2000). "Leaders: The wireless gamble." **The Economist**, 357(8192), 19-20.
- Geng, X. & Whinston, A. (2001). "Profiting from value-added wireless services." **IEEE Computer**, August, 87-89.
- Kalakota, R. & Robinson, M. (2001). **eBusiness 2.0: Roadmap for Success**. MA: Addison-Wesley publishing company, Inc.
- Kinoshita, M. (2002). DoCoMo's vision on mobile commerce. **Proceedings of the 2002 Symposium on Applications and the Internet (SAINT'02)** (Retrieved June 31, 2002 from IEEEExplore database).
- Lee, H. (2002). Mobile commerce: Vision and challenges. **Proceedings of the 2002 Symposium on Applications and the Internet (SAINT'02)** (Retrieved June 31, 2002 from IEEEExplore database).
- Leung, K., & Antypas, J. (Sep/Oct 2001). "Improving returns on M-commerce investments." **The Journal of Business Strategy**, 22(5), 12-13.
- McCarthy, A., Zohar, M., & Dolan, T. (May, 2000). **Mobile Internet Reality**. The Forrester Report. Forrester Research Inc.
- Nohria, N. & Leestma, M. (Spring 2001). "A moving target: The mobile-commerce customer." **MIT Sloan Management Review**, 42(2), 104.
- Porter, M. & Miller, E. (1985). "How information give you competitive advantage." **Harvard Business Review**, 63(4), 149-160.
- Samaras (2002). "Mobile commerce: Vision and challenges (Location and its management)." **Proceedings of the 2002 Symposium on Applications and the Internet (SAINT'02)** (Retrieved June 31, 2002 from IEEEExplore database).
- Schneider, G. & Perry, J. (2001). **Electronic Commerce (2nd edition)**. Canada: Course Technology.
- Shulman, R. (Dec 15, 2000). "Is m-business ready for the world?" **Supermarket Business**, 55(12), 27-28.
- Tade, D. (February, 1999). "Evolving wireless systems: Choosing a migration path." **Telecommunications Online**.
- Turban, E., King, D., Lee, J., Warkentin, M. & Chung, H. (2002). **Electronic Commerce: A Managerial Perspective 2002**. Upper Saddle River, New Jersey: Prentice Hall
- Varshney, U. (2001). "Location management support for mobile commerce applications." **Proceedings of the ACM, First International Conference on Mobile Commerce**, July 2001.
- Varshney, U. & Vitter R. (2001). "A framework for supporting mobile commerce applications." **Proceedings of the 34 Hawaii international conference on systems sciences (HICSS)**, IEEE Computer society. Jan 2001.
- Varshney, U., Vetter, R. & Kalakota, R. (2000). "Mobile commerce: A new frontier." **IEEE Computer: Special Issues on E-commerce**, October 2000.

## FOOTNOTES

- <sup>1</sup> Coca-Cola help customers with wireless Web phones find the nearest outlet that sells coca-cola. Retrieved April 15, 2002 from the Web: [www.computerworld.com/storyba/](http://www.computerworld.com/storyba/).

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