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New Developments in Practice III: Riding the Wave: Extracting Value from Mobile Technology

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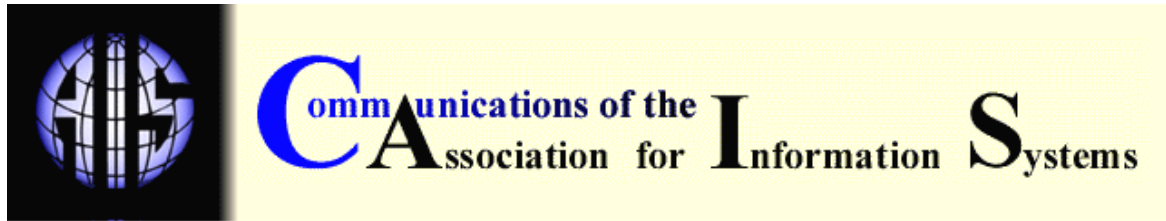*Boston University*, venkat@bu.edu

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DEVELOPMENTS IN IS PRACTICE III:
RIDING THE WAVE:EXTRACTING VALUE
FROM MOBILE TECHNOLOGY

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ABSTRACT

New mobile devices, combined with content digitization, promise the creation of a vast global communications network that will have enormous and far-reaching impacts on how we work and live. Who will benefit from this technology, where its real opportunities lie, and how it will impact our organizations and our personal lives is not yet clear. We know that changes *will* occur and that these impacts will likely vary by firm, industry, and segment of society. What we don't know is how and when these changes will happen. This uncertainty leaves business with the challenge of navigating between the opportunities presented by the new capabilities offered by mobile technology and the risks of being in the wrong place at the wrong time as their business ecosystem alters.

This paper is a tutorial for both the IS practitioner and the IS academic. It presents the issues faced in applying wireless technology in business and suggests areas in which research might be fruitful. It concludes that mobile computing is a new and unstable technology that potentially can change much about how organizations work. However, the uncertainty surrounding mobile computing can make decision-making a challenge for many senior executives who would like to see a clear business case for their investment. Unfortunately, this goal is not always possible. Instead, executives must learn to recognize a variety of options for the future and manage these effectively and dynamically while keeping a close eye on the value proposition.

KEYWORDS*:* mobile technology, telecommunications industry, options investing, strategic IT investment, impact of technology, new technology justification*.*

I. INTRODUCTION

Society typically under-appreciates the impact of new communications technologies. For example, few predicted the explosion of cell phone and Internet usage [Zimmerman, 1999]. History tells us that it is not easy to anticipate how and where new technologies will be used effectively. Comparing the growth of the telegraph to the growth of the Internet, Standage [1998]

asserts that the potential of a new technology to change things for the better is invariably overstated while the ways in which it will make things worse are usually unforeseen. We are entering another time of turmoil in telecommunications [Hillis, 2000]. If we believe the hype, new mobile devices, combined with content digitization promise the creation of a vast global network that will have such enormous and far-reaching impacts that it will make the changes wrought by the Internet seem pale in comparison [Tapscott, 2001].

Who will benefit from this technology, where its real opportunities lie, and how it will impact our organizations and our personal lives is not yet clear. We know that changes *will* occur and that these impacts will likely vary by firm, industry, and segment of society. It is fairly easy to predict some generic impacts over time:

- the pace of life will pick up,
- customer behavior will alter,
- middlemen will disappear, and
- corporate boundaries will change.

As a result,
- Traditional revenue streams and business models will be put at risk.
- Knowledge will likely become an even more critical resource.
- Government policies and regulations will need to be changed [Hillis, 2000; Standage, 1998; Tapscott, 2001].

What we don't know is how and when these changes will happen. This uncertainty leaves business with the challenge of navigating between the opportunities presented by the new capabilities offered by mobile technology and the risks of being in the wrong place at the wrong time as their business ecosystem alters.

Business clearly needs to learn more about mobile technology – either to benefit from its potential or to avoid its risks. To make effective IT investment decisions about it under such uncertain conditions, executives need to understand both how the mobile industry is evolving and how it might impact their particular business in their particular industry. They also need tools with which to approach investing in a technology that is simultaneously potentially beneficial and highly risky. To help them understand these challenges, the SIM Advanced Practices Council invited the authors and mobile industry experts to discuss how decisions about investing in mobile technology might be approached in order to realize its value and minimize its risks. This paper is the outcome of this discussion. The paper is intended as a tutorial for both the IS practitioner and the IS academic. For the latter, it presents the issues faced in applying wireless technology in business and suggests areas in which research might be fruitful.

Section I describes the current state of the mobile industry

- its scope, drivers and key trends,
- what the key risks and uncertainties are, and
- some of the issues with which it is dealing.

The paper then looks at what we know about mobile technology's impact on business (Section II). Section III examines the difficulties of justifying investments in an uncertain technology within a business and Section IV suggests ways in which a business case for this type of investment might be justified. Section V presents examples of how companies use mobile technology in different ways to enhance or change their business and then Section VI offers advice for CIOs derived from these experiences.

II. MOBILE TECHNOLOGY: AN INDUSTRY OVERVIEW

The global marketplace for mobile technology is clearly growing. Forecasts suggest that the number of worldwide mobile connections [voice and data] will grow from 727 million in 2001 to 1,765 million in 2005 [Ciriello, 2001]. A large part of this growth will occur in North America, although Europe and Asia will continue to lead the way in terms of absolute connections.

The mobile computing industry consists of many different technologies, some of which are well-developed [e.g., cellular phones], whereas others are still in their formative stages [e.g., wireless Internet]. As a result, current mobile applications represent just a few of the potential uses of mobile that are or will soon be possible. Five different types of technology must work together to enable mobile applications [Ciriello, 2001]:

- wireless devices
- consumer connectivity
- communications backbone
- content distribution
- user interface

1. Wireless devices. A number of these devices are available and their hardware is relatively inexpensive. They include handheld computers, pagers, PDAs, mobile phones, and laptop computers. A key feature of these devices is their ability to identify a user's location, if the user is connected, and, in the future, who the user is. While wireless devices are increasingly able to compute faster and store more data, they are not yet ready to bridge the gaps among the different uses of these devices [Henderson & Kulatilaka, 2001]. When integration occurs, the need to own different devices for different reasons [e.g., for voice, data, Internet access, email and applications] will be eliminated. A major inhibitor of these devices is power. Fuel cells are still inadequate and the technology is improving only slowly.

A Guide to Wireless Technologies by Generation

1G - analog wireless

2G - digital wireless. Data transfer at about 14Kbps. Users must initiate every connection. One-to-one switching required.

2.5G – always on connection. Data transfer at about 56 Kbps. Packet switching.

3G -- high speed connection at about 384 Kbps, enabling multimedia features.

2.   Consumer   connectivity. Individual device users are connected to a communications backbone via a rapid access network which provides the over-the-air interface. The network also provides the sensitivity to time, location and presence that is particular to mobile technology. This connectivity (known as 2G[1]) provides only an effective 14.4 baud rate for data transfer [Blodgett, 1999]. Limited bandwidth inhibits the amount and types of data which can be transmitted to mobile devices. Significantly improved bandwidth is clearly needed before new types of mobile applications, such as web access, video, document transfer and data base access can be implemented.

Bandwidth is expected to increase rapidly over the next few years with the introduction of 2.5G and 3G connectivity technology. By the end of 2002, 2.5G will be available and enable data transfer at speeds similar to a 56Kbps modem, about three to four times faster than with the current 2G technology [Jefferson & Orubeondo, 2000; Dunne, 2002]. However, while the first commercial use of 3G technology occurred in Japan in May 2001, the infrastructure is expensive to implement and it is not clear to investors how revenue will be generated to pay for it. It is therefore uncertain how fast the United States and other parts of the world will increase bandwidth.

3. Communications backbone. Switching technology sits behind and facilitates most mobile capabilities. 2G mobile communication uses switching that essentially locks in a connection between two users as in a telephone line. However, this form of communication is expensive. Packet switching as used on the Internet is a newer technology that breaks any given message or stream of content (e.g., a picture) into a series of small bundles which can be assembled at the other end of a transmission.

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[1] 2G stands for second generation, 3G for 3rd generation, and 2.5G for devices between 2G and 3G.

Packet switching allows data traffic to be fitted into other transmissions [Henderson & Kulatilaka, 2001]. Packets enable a user to be "always on" and have quick access, while allowing more users at much lower costs. Switching to packet networking will make a significant difference in mobile technology's cost structure and performance characteristics and is part of the transition to 2.5G and 3G connectivity.

4. Content distribution. Many technologies are needed to move content to to individuals and to do it quickly. Caching, content switching and multi-casting technologies are all used to improve this process.

5. User interface. Mobile devices provide very restrictive user interfaces (e.g., small, monochrome screens, tiny keypads) which limit possible consumer uses of mobile technology. As technologies improve this interface, with such features as voice recognition, voice synthesis and flat, flexible screens, increased usage will likely result. Machine-to-machine interfaces will also become increasingly possible e.g., for heart monitoring or elevator maintenance.

The technology of mobile communications is clearly in a state of flux. Two additional trends (digitization and convergence) are also major influences on how the industry is evolving:

- **Digitization.** To transmit different forms of information and communication across a variety of devices, voice, data and video information must be produced in digital form. Once digitized, information is no longer tied to a particular delivery channel, e.g., telephone, computer, television. Furthermore, the Internet can then be used as a universal, low cost mechanism to deliver widely different types of data to many different types of devices. Digitization erodes the traditional boundaries between content providers and content delivery mechanisms (e.g., newspapers, broadcasters, telephone companies) [Hillis, 2000]. It also drives the need for increasing amounts of storage.

- **Convergence.** As digitization progresses, and devices become more capable and user-friendly, the separation between different types of content providers, devices, connectivity providers, and network providers will disappear and new industry groups will develop. For example, mobile service providers will likely be subsumed into more generic infrastructure services providers; content providers will become device independent; and applications will cross device boundaries. Because their current positions of privilege in telecommunications are now threatened, the firms in this industry are evolving their business models rapidly as they experiment to find out what will work in the digitized, converged world. It is likely they will ultimately reorganize into a variety of different types of specialists that will include mobile services but not focus on them exclusively [Hillis, 2000].

The new telecommunications industry will probably consist of four major types of services [Ciriello, 2001]:

1. Infrastructure services such as storage, hosting, connectivity and data transport (traditionally the realm of the telephone companies), content distribution, and sensory networks (which will provide the ability to authenticate people and know where they are).

2. Business platform services such as payment and settlement (including micro-billing), advertising, purchase brokering and rating services.

3. Applications that provide integrated voice and data messaging and wireless and logistics management.

4. Content services that offer both original and syndicated content.

The same platform will be used for both applications and content delivery. Although most of the current large investments in mobile technology are being made in infrastructure, it appears that most of the revenues are being realized from applications and content services. In the future, as more applications are produced, the need for infrastructure investment will likely increase.

In a fairly stable marketplace, regulations can be established to oversee cost models to ensure that individual companies don't make too much money from the public. Hillis [2000] argues that in uncertain conditions, only the marketplace can fill this role effectively [Hillis, 2000]. The participants in the broader telecommunications industry are currently engaged in a strategic war to determine what these models will look like. In one possible outcome, content and applications service providers dominate, providing the middleware and business platform services. Infrastructure would thus become a "dumb pipe" through which these services are delivered. In another possible outcome, infrastructure services providers would offer middleware and business platform services, creating a "smart pipe" for consumers. It is unclear which view will prevail in the industry.

Because of this instability, it is difficult to establish industry standards that would enhance the interoperability of the different mobile technologies and services. Historically, different aspects of other telecommunications technology (e.g., the telegraph) co-evolved over a period of time before standards were established [Standage, 1998]. Initially, therefore it is expected that joint ventures and alliances between different service providers will partially drive standard setting. Eventually however, technology providers, investors, and the government will become involved in this process. In the meantime, while this industry develops, the uncertainties it faces provide the context within which businesses must make decisions about their own investments in mobile technology applications.

III. BUSINESS USE OF MOBILE TECHNOLOGY

INITIAL USES

Although businesses use mobile technology in a small way, it is clear that they have yet to discover a "killer app" that will galvanize them into action. Most businesses are proceeding cautiously. Some consumer applications (other than voice communication) are well-developed in Europe and Asia, e.g., to enable micro-payments for soft drinks or toll charges. However, in North America it is still unclear whether or not consumers will be willing to adapt their behavior and how companies can extract value from consumer applications. Therefore, most mobile applications implemented to date appear to be for business purposes -- extending or enhancing existing work processes and business models geographically [Jarvenpaa, 2001].

In fact, companies have been using wireless applications for quite some time to extend their reach in a flexible fashion. Grocery stores, utility companies, and couriers all routinely use wireless technology to capture information remotely. Some have added wireless transmission of data to a central processor [Blankenhorn, 2000]. More sophisticated mobile applications are being developed to redesign work processes. For example, healthcare services vendors have developed specialized applications to enable wireless prescription ordering, patient monitoring, and remote access to patient information, although only a few are at a stage where they can be widely adopted in healthcare [Turisco 2000]. Many organizations have also developed mobile applications to enable their sales staff to be more productive while working in the field [Blodgett, 1999].

STAGES OF USE

Although the applications are not yet developed, it is highly probable that in the future, mobile computing will lead to new classes of applications and users, generate new forms of revenue, and ultimately transform business processes and models [Dunne, 2002]. O'Shea [2001] suggests that internally, businesses will move through five stages in their use of mobile computing:

1. **Plaything.** A few people try out the technology and it is seen as essentially a toy. Data phones are currently at this stage.
2. **Substitution.** Mobile computing is used occasionally as a substitute for wired technology but use is heavily restricted and requires strong justification, e.g., using cell phones for data communication.

3. Enhancement. Mobile devices become normal equipment for certain workers because it is recognized that they extend availability and improve productivity. Work is carried on in much the same way as always but staff accessibility improves. The mobile voice phone is at this stage.

4. Transformation. Work (and living) is done differently as a result of mobile computing. Mobile computing has not yet had a genuine transformational effect.

5. Transparency. Mobile computing becomes ubiquitous and is so well integrated into how we live and work that it is no longer remarkable.

SANTA CLARA UNIVERSITY STUDY

We are only beginning to understand how mobility might begin to transform work and organizational processes. A Santa Clara University study [Koch & Caldwell, 1999] of ten firms currently using mobile computing in a variety of ways, found that:

- four were using it to enhance their existing processes;
- three were using it as part of a comprehensive redesign of work; and
- three were using it to provide their staff with greater access to information.

This study found that all ten firms believe mobile computing is advantageous in improving customer service, speeding operational decision-making and reducing cycle time. However, none was particularly successful in using mobile computing for aggregating and disseminating knowledge. Overall, the companies studied believe that mobile is an indispensable part of meeting their corporate goals. Thus, the business case for mobile is more closely linked to improving revenues, rather than generating operating efficiencies.

The same study showed that mobile computing generally leads, as one might expect, to changes in how work is accomplished. Increased mobility results in reduced interaction between individuals and their peers and supervisors. As a result, identification with the firm often decreases. People develop a greater sense of relationship with their profession, possibly contributing to greater employee turnover. Nevertheless, mobile communications generally affect the quality of working life positively and is leading to more fluid structures and flexible roles within the companies studied. Greater mobility also means "face time" is becoming a valuable commodity and "soft" skills, such as teamwork, communications, trust and trustworthiness tend to matter more [Koch & Caldwell, 1999].

CHALLENGES AND UNCERTAINTIES

While mobile computing is being used in companies in small ways, it is clear to most CIOs that a number of challenges and uncertainties still need to be overcome before a truly seamless mobile computing platform can be achieved on a larger scale. Businesses today face several obstacles in using mobile technology effectively:

- **Lack of standards.** 2G technology is based on a multiplicity of hardware, software, middleware and services. This situation created a highly fragmented, heterogeneous environment that is difficult and expensive to manage. The continued proliferation of mobile computing products without the adoption of industry standards means that many organizations view mobile computing as "a troublesome niche application for those who can afford to pay for it." [Vizard, 2000].
- **Security.** Wireless networks still lack many of the security controls that businesses feel are essential to their work processes. End-to-end wireless applications usually lack one or more of the following:
  - authentication,
  - data integrity,
  - data privacy, and
  - interoperability [Himmelsbasch, 2001].
  The "always on" feature is proving to be a major security challenge. Securing the hardware itself is another concern that companies must learn to address.

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- **Technology limitations.** In spite of the rosy future envisaged by the experts, today's mobile computing marketplace is still characterized by slow transfer speeds, high initial infrastructure costs, limited memory, and few graphical capabilities [Turisco, 2000].

These obstacles represent formidable hurdles to overcome for even the most dedicated business. Often, therefore, it is difficult for executives to see beyond these issues to visualize the true value mobile computing will represent to their organization in the future.

CULTURE

If mobile computing is to become a business platform from which new products and services can be delivered, then a cultural dimension must evolve at the same time as the technology [Henderson & Kulatilaka, 2001]. Companies, employees, and consumers must be willing to change their behaviors to accommodate mobile capabilities. As new norms, values and behaviors tend to develop *after* the technology enables new ways of working or consuming, introducing mobile can, at best, be unsettling internally as organizations scramble to adapt their processes, policies, expectations and incentives accordingly. At worst, firms can invest significant amounts in products and services for which consumers are unwilling to pay or don't want to use. Thus, business executives contemplating a mobile computing strategy is faced with a difficult, highly uncertain investment decision.

IV. INVESTING IN UNCERTAIN TECHNOLOGIES: THE OPTIONS APPROACH

Given all these uncertainties, a CEO or CFO would be highly skeptical about investing in mobile technology.

> *"The problem lies in that the value of platform investments are difficult to ascertain and [there is] considerable uncertainty as to who will actually capture the value."* [Henderson and Kulatilaka, 2001]

At present, no one understands the cost/benefit curve of mobile technology and it is unclear where on the curve we are and where the network effects will begin. As Figure 1 shows, costs must be incurred long before corresponding benefits are achieved. For consumer-based applications in particular, benefits are contingent on the ability of the technology to connect a large number of customers; in other words, the more people there are who use it, the more people there will be who want to use it. When a certain "critical mass" is reached the benefits curve will rise steeply.

Traditionally, CEOs and CFOs have looked for two things in building a business case for a technology investment.

1. Bottom-line savings, or
2. A steady projected return.

Where uncertainties exist, they are viewed as risks that will reduce the potential ROI. Using this method of investment analysis, it is unlikely that a firm would invest in a technology like mobile with a high cost and an uncertain return. Traditionally, too, once the decision is made not to invest, it will likely not be revisited for some time.

However, Kulatilaka and Venkatramen [2000] point out that if IT is expected to contribute to business value, such an approach can be limiting. They suggest that companies should invest strategically in IT to create a wide range of business capabilities. Such investments, which could vary from small experiments to "big bets", develop a variety of options a firm could pursue as the future becomes more certain. Given the inherent unpredictability of a technology such as mobile, it makes little sense they argue, to pursue a single business vision tied to a single possible outcome. Instead, businesses should consider a range of possible future scenarios and design an IT strategy that can be adjusted to respond to evolving market conditions. Over time, such IT investments should be continually revisited and their scale and scope modified appropriately.
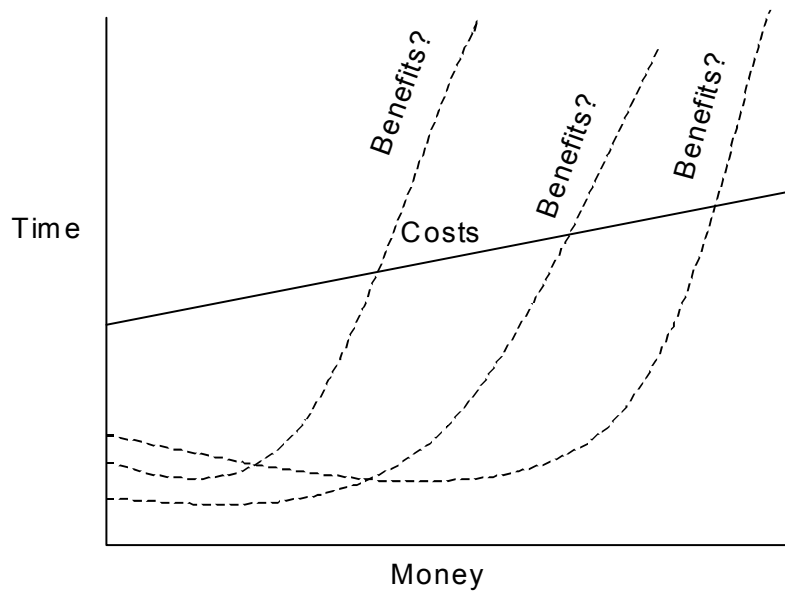
Figure 1. Possible Cost/Benefit Curves for Mobile Technology

They explain how this approach could benefit an organization:

"Of course, the actual shifting of scale or scope will entail substantial additional investments. But the cost of this response would be greatly reduced and its speed greatly increased when compared to not having made an initial strategic option investment." [Kulatilaka & Venkatramen, 2000].

In short, using an options approach, IT strategy can be designed to enable a richer set of future choices for a firm that are not static but which evolve dynamically based on the needs of the firm and the opportunities in the marketplace. This approach enables a company to maximize the potential of an opportunity while minimizing the risks involved; in other words, it creates flexibility for the organization [Kulatilaka & Henderson, 2001].

Adopting an options approach to IT strategy does not eliminate the need for careful analysis of the costs, benefits, and business case involved in each option. Investing in multiple options is also more expensive than developing a single path strategy. However, it does provide a framework within which to discuss the potential value of IT with business executives and helps the CIO to clarify how investments in IT can support change and act as insurance against the business' main strategy not working out [Kulatilaka & Henderson, 2001]. As a result, options can have value for a firm. Consider the costs incurred at a major retail chain that did not take out this "insurance".   A few years ago executives in the company rejected an IT request to install debit card technology in some of its stores because "it would never catch on". As a result, the firm developed no capabilities in this area. When debit cards became popular shortly thereafter, these same business people all wanted the technology yesterday and IT had to scramble to get it installed at significant expense. If the company had developed an option in this technology from the start, it would likely have anticipated the demand better and have had the skills to enable it to scale the technology upward much more rapidly [Smith & McKeen, 2001]. Options like these therefore involve both a cost and a value to a company which need to be carefully considered when developing an IT strategy.

IT options come in different flavors, thereby giving a company a variety of ways to invest in a particular future. Six possible types of options are [Amram & Kulatilaka, 1999; Kulatilaka & Venkatramen, 1999]:

- **Growth options.** Investing in a capability that can lead to a whole range of opportunities above and beyond the returns generated by the initial investment, e.g., Internet ventures that aim to develop a critical mass of subscribers who will form a base for future revenue streams.
- **Staging options.** A company can decide to invest in a technology in stages rather than all at once. At the conclusion of one stage it can determine whether to continue, delay, or abandon the project e.g., a phased in e-business strategy.
- **Exit options.** Exit options create the ability to minimize losses when anticipated strategic opportunities do not present themselves. Exit options can be developed by using standard technology, de-coupling a venture from mainstream operations and using alliances and partnerships.
- **Sourcing options.** These options develop the firm's ability to use multiple input sources, channels and platforms (e.g., supporting both Internet Explorer and Netscape Navigator as browsers).
- **Business Scope options.** These options enable a firm to add to or adapt the product/service mix of the firm quickly and efficiently as its business model changes (e.g., Amazon is creating alliances to offer additional types of products to its customers).
- **Learning options.** Learning options involve investments to learn about new technologies, (e.g., an alliance to understand how to deploy video streaming).

Options are especially valuable in periods of uncertainty and should be considered part of a larger strategic approach when the way forward is not clear.

"Strategy is not about imitation but about responding to weak signals.
Acquiring options is an effective way to translate … opportunities into actions."
Kulatilaka and Venkatramen [1999]

Kulatilaka and Venkatramen suggest that deciding to invest in an uncertain technology, such as mobile computing, should move through three steps:

1. Assessment of opportunities. At this stage, executives should recognize the full bandwidth of opportunity available and not limit themselves to a single point in the future. They should identify a broad cross-section of opportunities and consider different ways these might develop.

2. Acquisition of options. Ideally, a mix of options should be developed which reflect the likeliest opportunities and future scenarios for a company. For each option, executives should determine the level of investment they will make (Figure 2). Low levels of investment could range from an *entry stake* position that enables a firm to act but does not obligate it to do so, to *sharing stakes* where a company undertakes a venture with one or more external partners through an equity investment or other forms of contracts. High levels of investment could be big bets that involve significant resources and risk and alliance leverage in which a company develops a portfolio of alliances that positions them strategically to compete in an uncertain future.

3. Acting on options. To determine how to appropriate the best value from an option, a corporation must continually assess when to exercise and act on it. Acting on an option may mean deploying additional resources, restructuring contracts and agreements with external parties, reassessing other opportunities or even developing financial contracts. To facilitate the ability to act, it is particularly important that a firm's resource allocation procedures become more dynamic, moving away from annual budgets and reviews to a process that enables more rapid adjustments based on both external and internal forces.
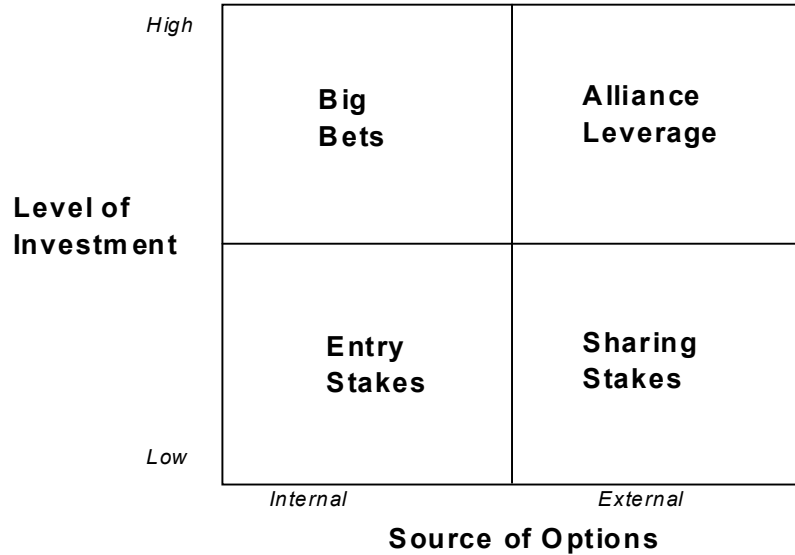
Figure 2. Firms May Invest Differently in Different Types of Options
[after Kulatilaka & Venkatramen, 1999]

To make options development more tangible, Kulatilaka and Venkatramen [2000] suggest that options be considered in three different contexts as shown in Table 1.

Table 1. Contexts for Business Model Options

BUSINESS MODEL OPTION	EFFECT	EXAMPLES
Augmentation	The business model and products are modified, not changed	Add new distribution channel or redesign supply chain
Transformation through technology	Change the nature of the product or service provided	
New model	Different value propositions; partners	Making a new market

Since an options approach to investment is a dynamic process, it is unlikely that all possible options will be clearly visible at any point in time. Instead, as the examples in the next section illustrate, it is more probable that transforming and innovating options will arise over time and as a company gains more awareness of the potential of the options it initially chooses to develop.

V. INVESTING IN MOBILE TECHNOLOGY

Much investment in mobile technology is based on a "build it and they will come" strategy and often lacks a credible business plan [Anonymous, 2000; Kulatilaka & Henderson, 2001]. As a result, consumer response to many mobile offerings, such as wireless Internet access or infotainment is "underwhelming" [Anonymous, 2000]. On the other hand, many companies are beginning to see an advantage in mobile and geographically-dispersed processes and work and feel there is a much stronger business case to be made with these types of mobile applications. In fact, Kulatilaka and Henderson [2001] argue that, much as PCs were adopted first by business and then by consumers [contrary to predictions at the time], mobile computing will likely be adopted first by businesses themselves and gradually migrate out to consumers later. In this

section therefore, we look at some types of mobile applications that are in use in businesses today to illustrate the different value propositions that mobile computing has in an organization.

BUSINESS MODEL AUGMENTATION

As might be expected, extending or enhancing existing business processes is the most common application of mobile technology since it does not significantly change a company's business. Some examples of the ways organizations are using mobile technology to extend and restructure their businesses include:

- **Bank of Montreal.** This bank recognized early that mobile computing was a potential platform for growth. It partnered with 724 Solutions to develop a number of mobile banking and investment transactions. The bank invested in this technology because

  > *"wireless services are rapidly becoming 'table stakes' in the financial services industry."* (Bank of Montreal Vice President Mark Dickelman)

  Because its mobile initiative is designed to reach both existing and new customers, the bank sees its investment as a growth option. It does not charge for mobile services since it is trying to understand the value proposition involved better and to build up a critical mass of customers. To benefit from its learning, the bank also took an equity position in 724 Solutions so that it will profit from whatever wireless business that that firm undertakes [Smith, 1999].
- **London Police Services.** London (Ontario)'s Police Services (LPS) installed laptops in its police cars that are wirelessly linked to its central computer in real time. Initially, the plan was to eliminate the need for duplicate data entry by having officers key their own incident reports. However, over time the CIO realized that additional functionality could be added to enhance the scope of the information available to officers on the job to make them more effective and improve their safety. LPS used its initial mobile platform to continually reassess its opportunities and to expand the scope of its mobile functionality several times. Today, a police officer can instantly access mugshots, court documents, and background information from wherever they are needed. He or she can also dynamically update investigation information, making it available to all officers in real time. These things used to take days or even weeks to accomplish previously. In the near future, the London system will be integrated with the provincial and national crime databases, giving officers instant access to a much broader range of information than any other police service in North America [Smith, 2001].
- **Schwab.** This investment firm created a "fifth channel" to provide anytime, anyplace access to customer accounts from a number of different devices. It created a separate organization for this channel, kept content device independent and compressed technological complexity into a very small layer of code. Wireless not only gives Schwab a number of new sourcing options, it also enables the company to maintain its core applications separately from an ever-growing number of devices. This approach gives the company a number of exit options and enables it to easily add new devices as the field evolves. Schwab used its venture into mobile computing as a learning option to find out what its customers want from mobile and to test incremental aspects of its strategy [Jarvenpaa, 2001].

BUSINESS MODEL TRANSFORMATION

Fewer companies have moved to the next level with mobile computing and developed options that will fundamentally change both their products and their revenues and margins. Two companies that are trying to do this are General Motors and TST Expedited Services:

- **General Motors.** Through its OnStar system installed in its cars, GM created a mobile computing service for consumers that provides mobile navigation, information and emergency services and, in the future, mobile email and Internet access. For an annual

fee, subscribers can access this service which turns their car into a "Java browser with tires" [Hart, 2000]. Because GM is betting that over a million people will subscribe to this service, it invested in installing the technology in many of its high-end vehicles. If it wins its "big bet", GM will transform both its product (changing the automobile from a standalone mechanical device into an Internet platform) and its value proposition. To pool the risks involved in establishing a nationwide network to support the expansion of OnStar's services, GM entered into partnerships with AOL, Bell Atlantic, and GTE Wireless (now Verizon Wireless). However, the OnStar model is by no means complete. GM is undertaking a range of experiments to learn about the pace and direction of its development. Since the outcomes cannot be predicted, learning options are essential [Kulatilaka & Venkatramen, 2000].

- **TST Expedited Services.** This emergency freight expediting firm implemented an extensive mobile computing functionality both to improve the internal management of its shipping fleet continually and to act as a customer-enabling tool to help their customers track shipments in real time as the freight moves to its destination. As a result, TST substantially augmented its existing business model. However, TST soon realized that this mobile platform also offered the company a chance to do business in a substantially different way. The company recognized that selling access to the new capabilities it had created to other independent freight expediting firms would enable TST to create a network of alliances that could serve a broader geographic area and provide greater availability to its customers. In addition, it could also turn its mobile monitoring capability into a service that would enable customers to track and manage *all* their orders on *any* carrier (including its competitors), enabling them to generate load efficiencies. Both options would provide TST with valuable information about their competition and help it build new relationships with its customers as well as earning the company new sources of revenue. TST thus created a mobile computing platform that has the potential to create a completely different set of products and services for the organization. At present, TST is exploring both options in stages to make sure it understands the new value proposition.

> *"this business model has many hidden benefits to our company above and beyond the fees charged for the product. The more it is used, the more competitive information we have. It also opens doors into new customer organizations in ways that would not have been possible previously, giving the firm options to bid which didn't exist previously."*
> (TST CIO Stuart Sutton) .

BUSINESS MODEL INNOVATION

This third stage of investment in mobile technology will eventually enable firms to innovate new business models and venture into new avenues.

> *"this [type of] market innovation is in its infancy… in digital markets."*
> [Kulatilaka and Venkatramen 2000]

Innovation requires a "creative interplay between business and IT strategies shaped by financial engineering and the power of real options." As yet there are no successful examples of innovation in the mobile telecommunications market. Enron tried and failed spectacularly to use this approach to create a new market to trade Internet bandwidth. Other companies are also envisioning sharing computing power, storage, and applications in this way but have yet to actually bring this approach to market [McKeen et. al., 2002]. These approaches suggest the type of discontinuities and market making options that may well arise in the mobile marketplace before too long – particularly in the industries most affected by telecommunications change, digitization and convergence [Kulatilaka & Venkatramen, 2000].

VI. ADVICE TO CIOS

The following guidelines for investing in mobile technology were derived from what we know about mobile technology and investing under uncertain conditions.

- **Consider using mobile technology to improve business processes.** Mobile computing appears to offer many more immediate benefits as a business tool than as a channel for new consumer products and services. Business mobility is more easily managed and the benefits of speeding up processes and decisions are more apparent, making a business case for this type of mobility easier to justify.
- **Look for new opportunities as your mobile strategy evolves.** Because mobile computing is a relatively new technology, its value proposition is still limited by the strategic vision in a company and by the available technology. However, as described in this article, new business opportunities often become clearer as the capabilities of the platform become clearer. Hence, any investment in mobility should be seen as a stepping stone to a variety of future scenarios, not as an end in itself. Many options will not be anticipated at first. Therefore, mobile strategy should be revisited continuously.
- **Build the platform, but don't sell the vision.** Marrying good strategic options with a practical, tactical approach makes it easier to justify an uncertain project. It is important to come up with a compelling vision and strategy for a mobile product [Dickelman, 2000]. However, it may not always be desirable to communicate this vision fully, because it doesn't "speak to where people live now." Therefore, it may be better to look for small steps along the way that will both help the organization deal with its current challenges and move the project along [Smith, 1999].
- **Use partners to help bear the risks.** Most organizations understand that good partnerships bring new skills and expertise to an uncertain venture as well as investments to offset the costs involved. However, as in any other area, good partners require a combination of good contracts and good relationships. With mobile computing, the chaotic and constantly changing environment can make trust and teamwork between partners a critical success factor.
- **Insist on performance.** If mobile computing is being used for business-critical applications, it is essential that a wireless service provider deliver the same level of service that users are used to. The London Police Service insisted on actually testing wireless service providers' performance against pre-established benchmarks – something that was a foreign concept to most mobile service providers. Creating a contract the organization was comfortable with took "seven months of miserable negotiations" but the satisfactory throughput and service quality made the effort worthwhile [Smith, 2001].
- **Make sure you can act on mobile opportunities.** Many mobile initiatives are set up as experiments or learning ventures. However, if an organization cannot act on what it learns, then it will be useless. Alliances, staffing, finances, and decision-making must be established to enable flexibility of direction as technological developments and opportunities become clear.

VII. CONCLUSION

Mobile computing is a new and unstable technology that potentially can change much about how organizations work. It holds out great opportunity for extending and transforming many businesses and, in some cases, may even lead to new markets and new business models. However, the uncertainty surrounding mobile computing can be offputting for many senior executives who prefer to make technology decisions in a more stable environment and who would like to see a clear business case for their investment. Unfortunately, in today's business and technical environment, this is not always possible. Instead, executives must learn to recognize a variety of options for the future and manage these effectively and dynamically while keeping a close eye on the value proposition. At present, mobile computing appears to have more potential for business rather than consumer applications. While these opportunities are certainly the "low hanging fruit" of mobile technology, it would be a mistake for managers to

believe they represent this was the full potential of mobile computing. Savvy executives will recognize that the capabilities they develop within their business may well be only the first steps of what this technology can do when fully-evolved and therefore should act with an eye towards keeping multiple future opportunities open.

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