THE IMPACT OF WIRELESS AND MOBILE TECHNOLOGY ON THE SOUTH AFRICAN SOCIETY

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ABSTRACT

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The most revolutionary changes in the technology industry arena are occurring in homes, businesses and schools. It's a technological revolution, spurred by converting the world's knowledge into digital form through increasingly inexpensive means of performing the conversion; and the speed and ease with which the information can be processed and transmitted.

The primary objective of this study is to determine and understand the impact that wireless and mobile technologies have on the South African (SA) society. The study achieves an understanding of the impact of current wireless and mobile technologies on the SA society, specific to the enterprise, public and private sectors within SA.

A literature study was undertaken to understand the general wireless and mobile technologies available within SA and to determine their impact on the SA society. The literature presented the following results:

1. Mobile devices used by society
   - Cellular phone
   - Handheld computer/PDA
   - Smartphone
   - Laptop/notebook

2. Wireless technology used by society
   - Cellular network
   - Personal area wireless network (Bluetooth)
   - Short range Wireless network (WiFi)
   - Long-range Wireless network (WiMAX)

Some of the primary impacts of wireless and mobile technology on society, as indicated by the literature study are:

- Improvement in efficiency and productivity
- Improvement in product and service quality
- Improvement in cost efficiency

Empirical research was conducted through a structured questionnaire as measuring instrument to determine the impact of wireless and mobile technology on society within SA. The results from the questionnaire provided answers to the research objective within the South African context.

From the literature review and empirical study it was possible to make certain conclusions and recommendations on how to leverage off and optimise the benefits of wireless and mobile technology to the South African society.

SA needs to take cognisance of the tangible and intangible benefits of wireless and mobile technologies. A clear understanding of the benefits will improve acceptance and investment of such technologies. The SA society should increase the utilisation of wireless and mobile technologies to increase and leverage off the benefits of these technologies. This implies an increase the financial investment in such technologies.

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List of abbreviations:

1. CPU – Central Processing Unit
2. CEO – Chief Executive Officer
3. CRM – Customer Relationship Management
4. E-Commerce – Electronic Commerce
5. EDGE – Enhanced Data Rate for GSM Evolution
6. GCI –Global Competitiveness Index
7. GPRS – Global Packet Rate System
8. GSM – Groupe Speciale Mobile
9. HSDPA – High Speed Download Packet Access
10. ICT – Information and Communication Technology
11. IT – Information Technology
12. IVR – Interactive Voice Response
13. KPI – Key Performance Indicator
14. LAN – Local Area Network
15. LSM – Living Standard Measure
16. M-Commerce – Mobile Commerce
17. MD – Managing Director
18. MMS – Multimedia messaging System
19. PC – Personal Computer
20. PDA – Personal Digital Assistant
21. PIM - Personal Information Management
22. RAS – Remote Access Service
23. SA – South Africa
24. Sadag – South African Depression and Anxiety Group
25. SFA – Sales Force Automation
26. SLA – Service Level Agreement
27. SME – Small and Medium Enterprise
28. SMME – Small, Micro and Medium Enterprise
29. SMS – Short Message Service
30. USSD – Unstructured Supplementary Services Data
31. VoIP – Voice over Internet Protocol
32. WAP –Wireless Application Protocol
33. WASP – Wireless Application Service Providers
34. WEF – World Economic Forum
35. WiFi – Wireless Lan
36. WIG – Wireless Internet Gateway
37. WiMAX – Worldwide Interoperability for Microwave Access
38. WLAN – Wireless Local Area Network
39. WWRF – Wireless World Research Forum
40. 3G – 3rd Generation Services

CHAPTER 1
NATURE AND SCOPE OF THE STUDY

1.1 INTRODUCTION

The most revolutionary changes in the technology industry arena are occurring in homes, businesses and schools. It's a technological revolution, spurred by converting the world's knowledge into digital form through increasingly inexpensive means of performing the conversion; and the speed and ease with which the information can be processed and transmitted. According to Professor Sasse, Chair of the Wireless World Research Forum's (WWRF) Human Perspective and Service concepts working group, mobile technology affects all aspect of our lives: "People are increasingly seeing their mobile devices as an extension of themselves. People live increasingly complex lives. Their needs are constantly evolving but the one constant is the need for seamless mobile and wireless connectivity that is accessible, user friendly and secure" (Anon., 2005:1).

The terms wireless technology and mobility are generally used for mobile wireless IT devices. It encompasses cellular telephones, personal digital assistants (PDAs), laptops and wireless networking. Other examples of wireless technology include GPS units, garage door openers, wireless computer mice and keyboards, satellite television and cordless telephones.

Experts predict that by 2010, wireless and wired technologies (connection through a physical cable) will serve an equal number of users. "That forecast not only quantifies the massive outreach of the wireless revolution, but also draws attention to the everlasting presence of the wired technologies. While end-user devices may all one day be wireless, mainframes and high bandwidth systems in which mobility is not a priority concern will more than likely remain wired" (Javadi, 2001-2005).

The forecast quantifies the massive outreach of the wireless revolution. The wireless and mobile revolution is changing the way people interact among themselves, as well as the way businesses interface with customers. Raymond W Smith, CEO of Bell Atlantic (1996:8), states that there is a shift from Moore's Law to Metcalfe's Law, or the migration to

networked solutions. This means that, as with most new products, the more people use a wireless network the more valuable and effective such a network becomes. In South Africa (hereinafter referred to as SA) the early adopters are not many, due to cost and limited product knowledge, and to optimally utilise wireless technology within SA will still take several years.

Moore's Law (named after Gordon Moore of Intel) states that microprocessors double in power roughly every 18 months, while costs fall by half. There is evidence that Metcalfe's Law is beginning to supplant Moore's Law as the key value driver for the converged computer; communications and entertainment industries (Smith, 1996:8).

If Moore's Law is the law of the microchip then Metcalfe's Law (named after Bob Metcalfe, the inventor of Ethernet) is the law of the network. Metcalfe's equation demonstrates that a network's value grows in proportion to the number of users and information sources connected to it. Metcalfe's Law suits the new "network-centric" view of the computing and communications universe (Smith, 1996:8). The reasons are:

- The cost of high-bandwidth communications is dropping rapidly.
- "Networks of networks" like the Internet, will be the organising principle for communications of all sorts.
- Content and applications will be delivered "just- in-time," on demand.
- New computer languages like Java will be understandable no matter what kind of computer you use.

When Metcalfe's Law is ascending, connectivity is king. Computer users are no longer as hungry for more processing power, but want to marry it to communications power through more bandwidth, and faster and wireless connections. Greater bandwidth and faster connectivity through wireless and mobile communication channels have a major impact on the way society interacts, do business and function within their work and private life (Smith, 1996:8). We have seen a shift over the past few years from a need for processing power and hard drive space to a need for connectivity anywhere and anytime, especially to the Internet. The availability and accessibility of information has become the power and enabler within the enterprise and users' hands.

This will be seen in the banking industry, the retail sector, in education and pervasively in government. For example, electronic commerce shifts power to the user of information, not the collector. It rewards speed and instantaneous access, not bureaucratic waste and inefficiency (Smith, 1996:8). The web of interconnected networks reaches further into every corner of our society and Metcalfe's Law will revitalize the world.

Subsequently, there is Less' law that states that the cost of disk storage falls by half every twelve months, while capacity doubles. A corollary of Less' law is that the amount of stored data rises to fill the available space (we could call this Parkinson's commentary on Less' law). The more data there is, the more there is data traffic. The bottom line: more digital content (both privately and publicly on the Internet) and greater demand for broadband connections at faster and faster bandwidths [Quon, 2004].

In a wireless mobile world, employees will be working in a virtual office without physical boundaries. Woking at their homes, in the cafeteria, on a train or in a car will increase substantially. Information is communicated instantly and runs two ways, as wireless and mobile networked computers give people access to electronic databases full of crucial management information and enterprise applications. Decisions won't wait for data to trickle up and down the corporate hierarchy; they're made on the spot, by the person closest to the customer. Wireless and mobile technologies have already had a major impact on the South African (hereinafter referred to as SA) society through the increase of the availability of information anywhere, anytime. Comparing price and product features, when shopping for products before leaving for the stores, or on the way to town or within a store, give the consumer more bargaining power and flexibility as to where to buy. A consumer will have a wealth of information available at their fingertips to enable them to make an educated purchase with regard to the best price, features, availability and quality.

Another huge possibility exists to increase the effective use and availability of information, i.e., technology and educational material in classrooms. Wireless and mobile technology will increase the availability and accessibility of study material and study tools to especially the previously disadvantage communities in SA; even more so to those communities in rural remote areas that are to a large degree still inaccessible.

Technology is creating institutions based on the free flow of information and empowered, knowledgeable workers. This is ever so true of the fact that knowledge gives power and brings about a more effective, productive and skilled worker and workforce. This is especially valid within the SA context where there is such a huge skills shortage. Through mobile and wireless technologies so much more unskilled workers in SA can be reached and educated. A laptop, for example, that can be taken to any facility, hooking it up to a proxima (which is also a portable device) and training can start. Wireless and mobile technology has the ability to improve the quality of life within SA through the creation of business opportunities, improving competitiveness and reducing costs through accessibility and availability of information and systems.

1.2 PROBLEM STATEMENT

The revolution of mobile and wireless technology over the past decade has a major impact on the society of today. The availability of information anywhere, any time, has already changed the way people work, do business, socialize, interact (communicate), shop and thus the way South Africans live.

The cell phone is the single most technological advanced finding that changed the way of communicating forever. . Cellular phone technologies increases society's productivity, effectiveness and efficiency through the instant availability of information, access to business tools and applications anywhere and anytime (e-mail, e-commerce and other applications); and the availability of resources all over the globe.

Society in the past usually showed a resistance to rapid technological changes. Society at large will rather stick to the known (comfort zone) and avoid the unknown as long as possible. The pace at which the human race changes compared to technology changes is always slower. Society first wants to understand and test new technologies before accepting and implementing such technologies. The rate at which wireless and mobile technology changes creates tension on society to adapt to and utilise new technologies, especially wireless and mobile technologies. The speed at which the SA society can adapt to these technology changes will determine their survival and prosperity in the global

village. This is especially true in business: either the business society adapts and uses new technologies as a standard business tool, or they fall by the side and close their doors.

The question is how the SA society implements, utilizes and copes with current wireless and mobile technologies and its rapid changes, and what impact these technologies have on their personal and work life. There have been numerous studies all over the world that targeted the impact of a specific technology on a specific sector within society. World Wide Worx has embarked on the most comprehensive research yet undertaken within SA, namely the use of Internet, mobile and wireless technologies in the country. World Wide Worx researched specifically the use of mobile technologies and to a lesser degree the impact on the SA society. Their findings were made available in 2005.

What are then the impact and possible value add of wireless and mobile technologies within the SA society? In answering these questions one can leverage the findings to minimize the resistance to change and optimize the effective implementation and usage of these technologies. With this knowledge South Africans should be able to improve the country's ability to leverage off wireless and mobile technologies to enable people to increase responsiveness and competitiveness, be more productive, minimize resistance to and optimize the use of such technologies to collectively increase quality of life within a developing SA economy. SA was rated a meagre 44th out of 50 countries (Annexure D), by the World Economic Forum, when it comes to global competitiveness (Global Competitiveness Index, 2007-2008). The research will also assist with the prediction and understanding of the possible impact of future wireless and mobile technologies on the SA society.

1.3 OBJECTIVES OF THE STUDY

This study comprises primary and secondary objectives. The primary objective is an indication of the purpose and intention of the study. The secondary objectives are an indication of the state and degree of wireless and mobile technology's impact on certain sample sectors within SA.

1.3.1 Primary objectives

The primary objective of this study is to determine and understand the impact that wireless and mobile technologies have on the SA society.

1.3.2 Secondary objectives

- The state of wireless and mobile technologies within SA.
- The impact of wireless and mobile technologies on the business sector within S A.
- The impact of wireless and mobile technologies on a private or consumer level within SA.

1.4 SCOPE OF THE STUDY

The study will achieve an understanding of the impact of current wireless and mobile technologies on the SA society, specifically to the enterprise, and public and private sectors within SA. The study will determine which wireless and mobile technologies are used by South Africans and what the perceived benefits and drawbacks are on society. From the study, certain recommendations will be made to increase the benefit of such technologies to the SA society.

1.5 RESEARCH METHODOLOGY

Two techniques were used in the execution of the research namely a literature study (qualitative) and an empirical study.

1.5.1 Literature study

A literature study was undertaken to explore the general wireless and mobile technologies available within SA and to determine their impact on the SA society.

1.5.2 Empirical Study

An empirical study was undertaken in the form of structured questionnaires that were distributed through friends, family and colleagues. The purpose of the empirical study was to validate the statements and conclusions of other researchers and academics, as portrayed in the literature study in Chapter 2.

1.6 LIMITATIONS OF THE STUDY

This study is limited to the borders of SA and the SA society. The literature study concentrates on articles, journals and books found within South Africa and also material found on the public domain of the Internet.

Interviews were held with subject matter experts. This study is therefore further limited to the opinions and understanding of the persons interviewed as well as the interpretations of their opinions.

1.7 LAYOUT OF THE STUDY

This section seeks to explain and the contents and intentions of the chosen research study. This entails the format and chronology of chapters and contents as intended by the researcher.

Chapter One - This chapter briefly discusses the contents of and the nature and scope of the study. A concise review of this document includes a background to the study, the problem statement, objective of the study, scope of the study and the research methodology.

Chapter Two - This chapter discusses the body of knowledge captured by means of the literature study, leading to empirical research findings. The topics covered tests the objectives and the scope of the study undertaken.

Chapter Three - The research methodology is discussed and the results of the study are analysed and discussed comprehensively. The findings of the empirical study are used to confirm the concepts discussed in the literature review. The discussion of the research methodology used elucidates the results of the report and presents observations. This includes the procedures of data collection by means of a questionnaire, data analysis and tools used in the study.

Chapter Four -The value and expectation of the research results are contrasted, as discussed in the nature and scope of the study. A holistic approach is followed to present the recommendations for the study as emphasised in the nature and objectives of the study. The report is concluded by highlighting or demonstrating the essential catalysts, which serves as a reliable indication of the application suitable for the implementation of the main subject of this research.

CHAPTER 2
LITERATURE STUDY

2.1 INTRODUCTION

Mobile technology that can support computing on the move using portable devices through wireless networks (Varshney & Vetter, 2000; Malladi & Agrawal, 2002) has emerged as the next wave in the IT revolution. Mobile technology includes technological infrastructure for connectivity such as Wireless Application Protocol (WAP), Bluetooth, 3G, and General Packet Radio Service (GPRS) as well as mobile information appliances such as mobile phones, PDAs, and laptop computers (Varshney & Vetter, 2000; Nah, Siau & Sheng, 2005). By extending computing and the Internet into the wireless medium, mobile technology allows users to have anytime, anywhere access to information and applications, which provides greater flexibility in communication, collaboration, and information sharing.

Mobile technology is gaining importance and popularity in organisations (Siau & Shen, 2003). Examples of applications of mobile technology in organisations include mobile access to company Intranet (Nah et al., 2005), mobile brokerage services, mobile payment and banking services (Herzberg, 2003; Mallat, Rossi & Tuunainen, 2004), and electronic procurement application systems based on WAP using mobile phones and laptops (Gebauer & Shaw, 2004).

The strategic importance of mobile technology cannot be underestimated. The rapid pace of adoption and advancement of wireless and mobile technologies creates opportunities for new and innovative services provided through such mobile devices. The emergence of mobile technology is expected to drastically affect a number of industries and to impact their strategic management (Barnes, 2002). Therefore, this new phenomenon needs to be better understood and warrants more research.

Technology inventions and changes over the past few decades had a major impact on the SA society at large. Inventions in wireless and mobile technologies over the past decade have had arguably the biggest impact on society as we know it. Before and in the early

eighties the SA society mainly communicated through letters that were sent from one post office to another. Phoning family or friends were dependable on the availability of fixed land line telephone points; and the other person actually had to be present on the other side at the fixed land line point, for a message to be conveyed. To a lesser degree the two way radio was used as a wireless communication method by farmers, police, construction workers, manufacturers, etc.

Connecting to the Internet, Intranet, e-mail servers and other electronic applications and services was only done while connected to the office network during office hours. Slow land line dial up (RAS at 9.6Kbps) functionality existed in the nineties, and gave some form of limited mobile functionality to employees who wanted to work from home. Access to information and applications were available to a selected few that had access to a physical link onto an enterprise network. Only large to medium corporations could afford such infrastructures back in the day, limiting access to information.

Inevitable mobile and wireless technology changes are occurring in our lives due to the rapid changes in technology (Moore, Metcalfe's and Less' laws). Those who choose a digital means of communication experience the breakdown of boundaries of time and space as we used to know it. Mobile technology extends computing and the Internet into the wireless medium, and provides greater flexibility in communication, collaboration, and information sharing. The world seems to be a smaller place as the geographical boundaries are removed from our personal lives and our workplaces. Business may be conducted by and with individuals across the world as though they were in the same city. Now we really can be in two places at once. The concept of time and space continues to change as we are able to communicate with others uninterruptedly and at our own convenience. E-mail is becoming commonplace and proves to be very convenient. E-mail and the accessibility thereof anywhere and anytime, has become a necessity as a communications tool in today's business world.

The education system will also see drastic changes. Computer simulation techniques will allow children to explore, create and learn on a three-dimensional level, thereby diversifying their cognitive skills. Learning in such a manner will reach out to children of every learning style. Negroponte points out that successful learning still comes from "good

teaching and good teachers" but also from exploring and doing – concepts that can be achieved with the use of computers and their special programs.

E-commerce introduced an entire new way of doing business through the accessibility of business tools; applications and information such as online catalogues, instant quoting, pricing, ordering and tracking. Having the electronic ability to barter anytime anywhere, gave most businesses a competitive edge in the market.

The way consumers shop within SA is also changing because of wireless and mobile technology making commerce available anywhere, anytime. Some SA consumers are empowered through the accessibility of product information to make an educated choice when purchasing a product. Society in its capacity as consumers can decide what to buy when and where at which price. Information is available on the Internet to be able to purchase from any location within SA, e.g. Kalahari.net, without visiting the physical location. The easy accessibility of information moves the power of choice to the consumer.

The information age and availability of information have increased through wireless and mobile technologies which have proved to be crucial to the growth and prosperity of a society and their economy.

2.2 THE STATE OF WIRELESS AND MOBILE TECHNOLOGY IN SOUTH AFRICA

With mobile penetration in SA at over 60% and with always-on broadband penetration comparatively low, a huge opportunity has been created for mobile phones to become the preferred vehicle for the supply of digital content services to South Africans (Goldstuck, 2006:151). It is always said and has been recognized that Africa, and thus including South Africa, is behind the rest of the world when it comes to adopting and implementing technology. Although this is the case in many technology sectors within SA, the lagging time to adopt and implement new technologies has decreased over the past few years thanks to the expansion of the globalisation phenomenon.

South Africa also proved to be a cut above the rest in Africa through the pioneering and early adoption of certain technologies such as Mark Shuttleworth who became SA's first Internet billionaire. The rest of the world see SA as an investment opportunity on the African continent SA has an emerging economy and due to the relatively stable political environment and fair to good infrastructure, compared to the rest of Africa.

SA launched its first GSM (Group Spéciale Mobile) network in 1994 - only two years after the first GSM network operator went live in Finland. Vodacom and MTN were awarded the first cellular licenses within SA in 1994. Vodacom became the first GSM network operator in the world to allow fax and data transmissions across its network, beginning a tradition of SA technological leadership in cellular communications (Goldstuck, 2006:2). Pre-paid cellular contracts, which can be 'topped up' live on air, were first devised in this country; banking via SMS (short message service) was pioneered here, and MTN's SMS website was at one time the busiest of its kind in the world (Goldstuck, 2006:2). According to Craig Ehrlich, Chairman of the GSMA, GSM is the fastest growing technology ever witnessed. "While it took 12 years for the industry to reach its first billion connections, the second billion was reached in two and half years, boosted by the phenomenal take up of mobile technology in emerging markets such as China, India, Africa and Latin America, which accounted for 83% of the second billion subscribers" (Goldstuck, 2006:3).

In SA, an estimated 7 million people were using cellphones by the end of 2000, and that figure doubled by 2004 to more than 14 million. This figure represented almost one in every three South Africans having a mobile phone. In 2006 the claims by the three major networks put the total number of subscribers at more than 30 million – almost three out of four South Africans (Goldstuck, 2006:3). This means that the SA society at large is mobile and can communicate with most people anywhere, anytime. Due to the geographic spread and economic divide within SA, the second economy is limited with regard to their access to laptops and other IP-enabled devices that provide more mobility and accessibility to a wider range of ICT applications and functionalities. The poor will have a mobile phone, but access to a laptop or PDA will be limited, or totally out of the question.

Wireless communication devices are divided into four broad categories, which are slowly merging (the first three are slowly becoming one) (Goldstuck, 2006:10):

- **cellular phone**, the handheld device that rings when someone has tracked you down;
- **handheld computer,** also known as a personal digital assistant or palmtop computer;
- **smartphone,** usually a cell phone incorporating a handheld computer or vice versa;
- **laptop computer,** the portable version of a desktop or PC.

The wireless mediums across which communication travels can also be divided into categories, but these are expanding all the time (Goldstuck, 2006:2):

- **cellular network,** dependant on the base station network of the mobile provider, and the distance of the user from the wireless cells that give access to the cells;
- **personal area wireless network**, also known as Bluetooth, limited to a few metres;
- **short range wireless network**, also known as WiFi, extending to a few dozen metres or more;
- **long-range wireless network**, also known as WiMAX, extending to a few dozen kilometres.

In conclusion, most of the international mobile and wireless technologies are available within SA and are deployed to a degree.

2.3 IMPACT OF WIRELESS AND MOBILE TECHNOLOGY ON THE SA SOCIETY

2.3.1 Introduction

The growth of mobile business requires the ability to provide context-aware services when and where they are needed, the development of trust relationships between trading partners, and an ever-expanding capability to reconfigure value chains (Rousos, Peterson & Patel, 2003). These issues are becoming more prominent with the emergence of converged architectures for next-generation public and wireless networks. The integration of the Internet, traditional telephony networks, and consumer electronics brings mobile business to the forefront. It introduces a view of identity in mobile business and finds that this approach is useful in explaining some recent research findings in ubiquitous retailing.

Widening the discipline boundaries for future research on identity in mobile business will be essential for the development of effective mobile service provision systems (Rousos *et al.*, 2003).

The Gartner Hype Cycle report for 2006 (Annexure C), indicates two major themes in the mobile and wireless industry namely fixed-mobile convergence and the consumerisation of the enterprise (Gartner, 2006). These are well represented within the hardware, software and services Hype Cycle (Annexure C). As the standards and service technology matures, we are finally seeing devices, mobile operating systems and applications starting to catch up (Gartner, 2006). Microsoft has made significant strides, in the first half of this year alone, in maturing Windows Mobile and the .NET Application Framework in the next year. Early mobile video broadcasts are finding some criticisms based on cost, poor quality and lack of content. And although fixed mobile convergence is spoken by all, it will be some years before the recent wave of mergers and acquisitions and the implementation of convergence architectures will be mature enough to provide more strategic capabilities to support converged enterprise voice and data, mobile and fixed (Gartner, 2006).

Advanced wireless networks are finally rolling out worldwide; the priority matrix for enterprises will be dominated by application opportunities for field sales and general enterprise users, such as wireless e-mail and CRM (Gartner, 2006). There is nothing new here as far as the demand is concerned, but a continued drop in costs for devices, services and application development will drive growth. Even more challenging will be the support for procurement, deployment and management of these capabilities. That's where services, such as telecom expense management are going, moving from managed services with limited capabilities to a full business process outsourcing strategy, what Gartner calls "Mobile Life Cycle Management." Many companies fall in this area and include a maturing capability to support enterprise telecom needs (Gartner, 2006).

New mobile devices are the big news toward the end of 2006, and promised devices from last year are finally delivered. In the next year, significant price declines are predicted as a very competitive market appears, at last, for higher-end handhelds that support the high-speed networks (Gartner, 2006).

2.3.2 The impact on the South African enterprise

Enterprise mobility solutions encompass a wide range of devices and applications. The notebook/laptop is the typical entry point for most enterprises in their journey to mobility (Frost & Sullivan, 2006:5). At the most basic level, laptops provide users with access to company systems (stored on the device) while away from the office. By introducing wireless connectivity on laptops, using options such as GPRS and WiFi, enterprises enable employees to raise productivity. Dead time, such as waiting for flights, can then be better used for work activities such as responding to time critical e-mails. Mobile phones and PDAs form another step in the mobility device continuum. The rise in computing capability and connectivity options for these devices has enabled their use in a range of mobility solutions. Most commonly, these devices are used for e-mail and personal information management (PIM) such as contacts and scheduling (Frost & Sullivan, 2006:5).

"Corporate SA regards the laptop computer as the single most necessary mobile technology for deployment in business, edging out even the cellular phone, while emerging technologies like handheld computers and wireless networking will see strong growth in 2005". These were the key findings of a research study conducted by World Wide Worx as part of its Mobility 2005 project, which is backed by Cell C and First National Bank. The report on the latest leg of the project, entitled *The Impact of Mobile Technology on Corporate South Africa*, reveals a corporate world that intends to intensify its commitment to tried and tested mobile technologies, while beginning to embrace new options (Goldstuck, 2005b).

No less than 98% of corporations surveyed said they would have laptops deployed among staff during 2005, up from 94% in 2004. Cellular phones were a close second, with 93% intending to deploy them among staff in 2005, compared to 91% in 2004 (Goldstuck, 2005a:141).

Mobility is playing a key role in an ever increasing set of enterprise processes in today's world. From connecting field workers to central workflow systems to providing executives with up-to-date scheduling information on their PDAs, enterprises are deploying mobility

solutions that create business benefits. Another avenue for mobility involves the use of dedicated mobile devices (e.g. handheld terminals) for specific functions such as on-the-move data entry for field engineers/technicians; and real time work flow updates. The use of these devices eliminates the need for paper entries and makes vital information available in real time (Frost & Sullivan, 2006:5).

The decision to invest in mobility is typically borne out of the belief that the mobility applications are inherently beneficial (Frost & Sullivan, 2006:2). More than half the organisations interviewed could not judge the impact of various mobile technologies on their businesses. It appears that most corporations in SA struggle to understand and define the benefits and contribution of mobility in the workplace. As important as some of these technologies may seem to be, they are still in their early days of business use (Goldstuck, 2006:142).

2.3.2.1 What then drives mobility solutions in corporations?

The main drivers of mobility solutions in enterprises (Frost and Sullivan, 2006:7):

Increasing familiarity with mobile devices: Today's worker is exposed to more mobile computing devices than ever before. The proliferation of devices such as mobile phones, especially smartphones and PDAs in everyday life means that workers are more used to working with these devices than their counterparts of a decade ago. This familiarity, which extends to the CxO level, enables a stronger demand for and adoption of mobility solutions.

Increasing importance of IT strategy: The role of IT in today's enterprise has changed significantly from being seen as a support function to an enabler of company strategy. Enterprises are increasingly relying on their IT strategy to enable cost reductions, productivity improvements and innovation. This leads to more enterprises implementing mobility and other technology solutions to drive tangible business benefits.

Increasingly mobile workforce: As competitive pressures intensify in various industries, the need for a more responsive and mobile workforce increases. As a result, many people, at all organisational levels, need to work away from their offices. At the same time, alternative working practices such as home offices, "hot desking" and virtual teams are being adopted by an increasing number of enterprises. Many businesses, of various sizes, are gradually beginning to recognize the benefits of equipping workforces with wireless-enabled devices, like smart phones, PDAs and laptops to access corporate data in real time as well as accessing the Internet, e-mail, and CRM applications.

Advancement of wireless technologies: Advancements in wireless network technologies such as 3G, WiFi and WiMAX have increased the capability and availability of wireless networks. Consequently, sophisticated, targeted enterprise applications have been developed and have become a critical driver for enterprise adoption of mobility solutions. With the development of the wireless Internet, enterprises are able to extend enterprise solutions, such as Mobile Office applications, CRM, sales force automation (SFA) and numerous other applications to mobile workers on a host of wireless devices.

Advances in mobile device capabilities: Mobile devices are becoming more enterprise application friendly, as more vendors release smartphones with PDA capabilities like spreadsheets and PIM tools. Likewise, traditional PDA manufacturers are implementing communications capabilities into their devices, including voice calling and wireless Internet. This convergence of application handling and communications capabilities provides enterprises with lower cost alternatives to laptops for applications such as PIM.

Improving (1) staff efficiency and productivity, (2) quality of offering and (3) cost efficiency are the main driving factors for the implementation of mobile solutions within SA enterprises. Two of these driving factors are strongly reflected in the findings, which show that the benefits derived from their mobility solutions centred on efficiency improvements and cost savings: These benefits typically arose from the reduction in the time taken for processes and in information distribution costs (Frost & Sullivan, 2006:4).

2.3.2.2 Improving staff efficiency and productivity

Measuring increases in efficiency and productivity involve an analysis of the processes affected by mobility (Frost & Sullivan, 2006:17):

- In measuring efficiency improvements, enterprises can compare the time taken to complete a process before and after mobility. For example, Migros found that its update of software modules on its mobile devices (PDAs, smart- phones and tablet PCs) improved significantly after the implementation of iAnywhere's PIM management solution. The solution's central administration facility allows Migros to change things on the server and automatically update user devices when they synchronize. Prior to this solution the updates used to take 2 -3 hours, but currently take about one hour, leading to efficiency improvements of 50% - 66%. Associated with the improvements in time efficiency are cost improvements. These are typically expressed as a product of the cost of the employees involved in the process and the time savings to yield a cost savings for the process.

- Productivity measurement follows a similar line to efficiency measurements in that it requires a before and after analysis. The main difference is that rather than being based on time improvements the benefits will be based on staff output changes. Examples of such changes to measure include the number of site visits field technicians can achieve in a given day, and the number of devices supported by IT.

McDonald's experienced a wide range of direct and indirect benefits from its mobility solution (Frost & Sullivan 2006:20):

- A time saving of over two hours in the restaurant assessment process per
- Operational consultant. This has resulted in operational cost savings of over £140,000 pounds per year.
- iAnywhere's solution provided McDonald's with the ability to provide remote rebuilds, automated data back up, wipe data from stolen devices from data and centrally push document updates to all devices. In addition, the solution has provided McDonald's with the ability to cut its device upgrade time from 30 to 15 minutes.

- Operational consultants are now able to focus more time on analyzing trends, collaboration with restaurant owners to create workable action plans and focus on continuous improvement.

A fascinating element of corporate deployment of mobile technologies is the level in the business at which staff tends to be provided with cellular phones, PDAs and laptop computers, compared to PCs. As much as 78% of corporations surveyed provide cellphones to top management, and 52% supply them to sales or field staff, similar to the proportion of corporations supplying laptop computers to these levels of employee. PDAs go to top management among 63% of respondents, but to field staff among only 14% of respondents as per table 2.1 (Goldstuck, 2006:140).

Table 2.1: Level at which mobile devices are deployed in corporate SA

Level of business at which devices are provided to staff	Top Management	Middle Management	Junior Management	Sales/Field staff	All staff
Cellular phone	78%	65%	37%	52%	17%
PDA	63%	33%	7%	14%	2%
Laptop computer	81%	73%	32%	49%	17%
PC	11%	16%	19%	15%	94%

Adapted: Goldstuck (2006:140)

"Considering the relative immobility of top management versus sales staff, it seems that mobile gadgets are often a perk of the job rather than a need (Goldstuck, 2006:140). What is a concern is the lower level of deployment of mobile devices (table 2.1) amongst field staff compared to the deployment to top management. This indicates the level of 'nice to have' of top management and 'need to have' of sales and field staff.

The use of cellphones in the enterprise improves productivity through the elimination of unavailability of employees. Getting hold of people that is not in their office has become so much easier now that everybody is carrying a cellphone and is always available. Think of workers in a remote part of a plant, they can be reached anywhere anytime improving

availability through instant communication and also increasing productivity through the elimination of time wasted.

It is interesting to note that, when it comes to satisfaction with the performance of mobile technology, cellular phones slip from their normally high ratings for the first time, scoring only a 79% satisfaction rating, while laptop computers maintain high levels, at 86% satisfaction with performance. General messaging with SMS achieves a 66% satisfaction rating. All others fall below the 50% satisfaction mark – but this also reflects the status of their deployment (Goldstuck, 2005b).

Significant growth will be seen in the use of Personal Digital Assistants (PDAs) for calendar and contact purposes, up from 76% to 84% of corporations, and for e-mail purposes, up from 61% to 76%. 3G will come off a low base of 5% to reach 34% - one of the highest growth proportions, if relatively low in absolute take-up. Wireless networking will experience substantial growth, but Bluetooth networking will continue to languish (Goldstuck, 2005a:141). This research indicates the increasing use of mobile devices within the workplace.

Executives, managers and staff have their calendars, notes and e-mail on their phones and laptops. Having your calendar available all the time and being able to update it anytime, anywhere, makes time management much more effective and employers much more productive. PDA functionality can be found in most of the new cellular phones of today. The functionalities include a calendar, reminders, notes and e-mail that are used to assist users in managing their day- to-day activities.

It is convenient to carry a diary on your cellular phone with you everywhere you go (compact and convenient); receiving e-mail, while in a meeting, on the PDA or cellular phone; taking notes and making appointments while out of the office, which can be later synchronized with your notes and calendar in your office on the laptop or desktop. A smartphone is two things: one is a handheld device that combines PDA functions with cellphone capability; the other one has capability to add functions to a cell phone by downloading software, music or other files onto the device (Goldstuck, 2006:58).

Location and time restrictions are limitations of the past. Employees can sit in a meeting or in the cafeteria, schedule another meeting request on their mobile phone or wireless connected laptop, without having to first go back to the office and have a look on the desktop calendar or phone a secretary to find an opening.

E-mail has become the most used and efficient means of an enterprise's communication medium in the 21st century. Although the effectiveness of e-mail as a communication medium has been debated to length, compared to conventional face-to-face and telephone communication, it still stays the most frequently used business communication tool of the 21st century. Having e-mail available on a mobile device enables employers, from different levels within a corporation, to save on dead time and be more productive and efficient. E-mail is now available outside the office and not limited to a specific location due to the dependency on a fixed network connection or fixed office location. E-mail mobility enables employers to improve on responsiveness and availability, thus increasing productivity and effectiveness of employees. With information available on time and anywhere, quick and informed decisions can be made.

Field staff. Mobility solutions not only allow staff to put otherwise dead time, such as waiting for flights, to good use, they also eliminate process inefficiencies. For example, the provision of real time work flow information to field service engineers eliminates their need to return to their office to obtain updates. This means that field engineers or technicians are able to attend to more customers during a working day. By enabling workers to work in a more efficient manner enterprises can eliminate wasted time or resources leading to cost savings while also increasing output per employee or productivity (Frost & Sullivan, 2006:8).

GijimaAst, a leading South African ICT company, deployed smartphones to their entire field support staff. This enabled real time problem ticket updates and real time dispatching of problem tickets to the field support staff. This enabled the field staff to be more efficient and effective in time management, route planning, communication to their clients and service delivery. This also assisted GijimaAst with cost reduction as field staff is more productive and effective in the way they work.

Sales people are one of the most mobile teams in an organisation. To improve sales force effectiveness, organisations typically invest in tools to collect and analyze customer relationship information. These tools provide a wealth of information about customers, including the most recent interactions and requests. When the sales people have access to this information while out of the office, they are able to prepare very effectively for each visit. As sales are executed client sites, a sales force must be able to have access to all the relevant sales and contract information. Utilisation of such a mobile tool allows an enterprise to provide its field sales staff with the ability to (Frost & Sullivan, 2006:9):

a. Create new credit requests;
b. Create and communicate quick calculations;
c. View differences at approved credit requests and dispatched credit requests;
d. Create, copy or communicate new financial offers based on approved condition ranges; and
e. Dispatch financial contracts and request the sales provision.

Customers. Mobile solutions can make enterprises more responsive to customer issues. Customer issues can be quickly identified and the relevant staff member notified (e.g. via e-mail to a mobile device). Responsiveness helps enterprises improve customer satisfaction and retention. In one enterprise, customer complaints came in via e-mail, and stayed on the computer system for up to two days before being addressed. After the implementation of mobility solutions, including Sybase iAnywhere's management and security solution, the company was able to achieve a one-hour turnaround, enabling improved internal processes. Overall, the improved responsiveness led to better customer relationships (Frost & Sullivan, 2006:9):

The impact of implementing mobility on an enterprise's **customers** is less straightforward to identify than efficiency and productivity improvements. To be able to accurately assess the impact of mobility on customers the enterprise will need to analyze the effects on customer satisfaction levels, customer retention and customer spend (Frost & Sullivan, 2006:17):

- Measuring customer satisfaction levels will require enterprises to survey its customers (internal and external), before and after solution implementation, to determine the impact of the solution on satisfaction levels. In conducting the customer satisfaction surveys, enterprises should seek to identify the specific impacts of the mobility solution, e.g. higher satisfaction due to improved response times.

Customer retention and spend are more quantitative measures that can be used to determine the impact of mobility solutions. These measures relate strongly to mobility solutions deployed to improve customer care and sales force effectiveness. For instance, in the case of Orange Business services (see the following case study) the mobility solution is targeted at improving retention. As such, its effectiveness will be determined by the improvements in customer retention. In cases where the solution is not directly targeted to improving these metrics enterprises will need to analyze processes which contribute to these metrics to identify any improvements. For example, the availability of enterprise-wide e-mail on mobile devices could facilitate better account manager interactions with the client by enabling the manager to be kept abreast of important developments with the client from any location (Frost & Sullivan, 2006:18).

2.3.2.3 Improving the quality of a product and/or service

"The challenge for service providers, like banks, is going to remain how applications are integrated and made user-friendly for these new technologies," says Len Pienaar, CEO for Mobile and Transact Solutions at First National Bank. "The one million-plus inContact clients are telling us that people want short, to-the-point communication. Now, the challenge will be how we adopt technology to further assist the client online, especially with 3G on our doorstep." (Goldstuck, 2005b).

Mobility brings **banking** features such as balance enquiries, statements, transaction activity for security reasons and transactions like transfers and online payments, to bank clients anywhere, anytime. These functionalities can provide a competitive edge to banks with regard to client retention, increased revenue and reduction in operational costs. Clients always look out for ease of use and the availability of functionality at their finger

tips, e.g. why go to town and stand in a queue to get a statement or transfer money. The bank that does not offer these functions will definitely not retain or grow the technology-aware section of their market.

Another benefit from the improved information flow within the organisation is the improvement in overall product or service quality. For example, by using electronic data entry on mobile devices, enterprises eliminate inaccuracies that arise from double entry leading to better quality of information. Enterprises can improve the quality of service from frontline staff by providing them with all the necessary customer related information. In hospitals, physicians can access information on drug interactions and order prescriptions on their PDAs while still at the patient's bed side (Frost & Sullivan, 2006:25).

Take for example field support staff within the SA ICT service and support industries. The field technicians receive a Smartphone that connects to the helpdesk system. They are then able to receive up to date real time client faults or problem information to enable them to prioritize, plan and schedule their maintenance visits. The field support staff now also has the ability to update and close calls in real time, assisting business in effective reporting on user downtime and the contractual achievement of Service Level Agreements (SLA). In the past field support technicians could only update their calls and order spares whenever they got to a desktop connected to a fixed land line or network point or to a land line phone, or phone a central helpdesk with updates. Field staff mobility is especially beneficial in rural and large geographical areas where extensive travelling becomes costly and time consuming.

The mobile handheld device also enables direct access to the main system providing critical on time on site information such as:

- asset information to assist with onsite invoicing and warrantee details.
- problem history of devices that assist with trend analysis and better problem determination.
- user information that enables authentication and security checks.
- configuration of hardware and software.

The availability of user-, problem-, configuration-, site-, trend- and problem history information enables service staff to deliver a more effective, cheaper and improved quality of service to their clients.

2.3.2.4 Increasing cost efficiency

By introducing mobility into processes, enterprises can improve their cost positions by eliminating redundant and/or expensive activities. For example, the provision of data on-the-go for field staff eliminates the need for physical data sources such as manuals and product lists. The UK mobile operator was able to eliminate £35,000 in costs by pushing sales tariffs directly to its sales teams' mobile devices (Frost & Sullivan, 2006:25).

Shifting traditional activities performed by service providers such as balance enquiries, online bookings, online electronic payment, transfers and statement enquiries, to clients, takes the work load and activity from the business and transfers these to the client, saving cost on labour and infrastructure. Revenue increases due to the functionality and service products being readily and easily available at a price. Clients will do more balance and statement queries due to the availability of these functions anywhere, anytime on mobile devices.

Mobile solutions enable enterprises operating in commodity/low margin environments to provide differentiated offerings. From higher quality of products and services to increased customer contacts, the internal benefits of mobility can be used to improve their value proposition. A practical example of this can be found in logistics where mobility solutions enable enterprises to provide tracking systems with which customers can monitor the status of deliveries. By leveraging cost savings from mobility solutions (e.g. available from improved process efficiencies), enterprises can implement price cuts to ensure they remain competitive in their market (Frost & Sullivan, 2006:9).

In the case of McDonald's, the use of electronic data capture improves the speed and accuracy of the restaurant's assessment process. This enables operational consultants to

focus more of their time on ensuring the restaurants meet quality standards (Frost & Sullivan, 2006:8).

Impact:

- Improve sales efficiency and productivity by providing them with up-to-date information in an efficient manner. Information is pushed to their mobile devices automatically and does not require user intervention.
- Improve customer retention through better service and by having the sales force equipped with up-to-date competitive intelligence.
- Improve cost efficiency by eliminating the cost of CD generation.

In the past, companies selected employees to attend in-house courses and training within office hours. Training information was contained in manuals that were available to a selected few that were chosen to attend these courses. With the ability of wireless and mobile technology to make information (course material) available anywhere, anytime to anybody, the company can now provide these courses at lower cost to all employees even outside of working hours. Employees can log on to their company Intranet from home via Edge; 3G; 3G HSDPA or GPRS wireless technology and access this course material. They can even write exams from home. Employees do not even need to be in a class room at a specific location; they can attend a live interactive course from any location. Employees willing to do this in their own time can partake in the course at home after working hours. The company can save time and money as the employees do not need to be taken from their work environment thus preventing the loss of valuable working (production) hours.

2.3.3 The impact of mobile and wireless technologies on certain sectors within South Africa

2.3.3.1 Healthcare

The healthcare industry includes many different kinds of institutions from hospitals and clinics to blood banks and pharmacies (Frost & Sullivan, 2006:11).In each sector of the industry there are characteristic processes that stand to benefit from mobility (Frost &

Sullivan, 2006:11). In the pharmaceutical sector, the need for handheld devices to enable the capturing of electronic data by recording and uploading of patient information was identified. Other use of mobility revolves around ancillary operations such as medical equipment servicing and tracking (Frost & Sullivan, 2006:11). Table 2.2 indicates the benefits of mobility in the healthcare sector in Western Europe and the United States.

Table 2.2: Mobility in the healthcare industry abroad

Key Processes	Key Applications	Key benefits
Asset/Field force management	Electronic generation of work orders for timely response from mobile teams such as clinical staff, hospital maintenance and transport.	Extended life of valuable hospital assets because of streamlined maintenance processes. Increased worker productivity.
Medical supply management Prescription ordering/Sales	Managing medical supply inventory, tracking usage. Medical equipment repair and servicing.	Improved dispatch and scheduling efficiencies, reducing overtime and labour costs.
Medical records/History Patient management	Immediate access to patient records. Real time viewing of test results.	Improve responsiveness to unforeseen incidents. Enhanced customer service.

Source: Frost and Sullivan (2006:12)

In SA, a Cape Town based company SIMpill and telecoms partner Tellumat Communications have developed a solution for the wireless monitoring and support of patient on chronic medication (Goldstuck, 2006:80). "The SIMpill incorporates wireless technology to monitor and remind patients with chronic conditions to take their medication as prescribed, as well as enable health organisations to be more efficient and cost-effective in their patient care," says SIMpill inventor Dr David Green (Goldstuck, 2006:80).

Another example of the impact and use of mobility in the healthcare sector is the South African Depression and Anxiety Group's (Sadag) SMS initiative. Sadag launched a new SMS service to assist depressed teenagers and to curb the high levels of teenage suicides in SA. The new service allows teens in distress to reach Sadag by typing a message on their cell phones and sending it to 31393 (Goldstuck, 2006:81).

2.3.3.2 Transport and logistics

The transport and logistics sector includes rail transport, freight distribution and courier services (Frost & Sullivan, 2006:11). The segment is a key market for mobility solutions, given the mobile nature of its field service and staff. The deployment of mobility solutions, such as field service management and track-and-trace applications, has provided benefit to both the enterprises and end-users in this industry. Additionally customers benefit from the ability to track the status of their goods in transit. Table 2.3 is a summary of the benefits of mobility within the transport industry in Western Europe and the United States (Frost & Sullivan, 2006:11).

Table 2.3: Mobility in the transport industry abroad

Key Processes	Key Applications	Key benefits
Fleet/Workforce Monitoring, tracking	Automated work order distribution and updates from workforce.	Enhanced workforce and driver productivity.
Routing, mapping	Location management and monitoring, mapping.	Improved dispatch and scheduling efficiencies, reducing overtime and labour costs.
Scheduling and notification	Real-time alerts on schedule changes, updated customer status or weather/traffic.	Improve responsiveness to unforeseen incidents. Enhanced customer service.

Source Frost and Sullivan (2006:11)

2.3.3.3 Public services

The public service market accounts for all services provided by the state for its citizens outside of healthcare. Government agencies are under increasing pressure to provide efficient public services at lower costs (Frost & Sullivan, 2006:15). This is even more so within South Africa if we look back over the past decade and reflect on the deterioration of public services. There are occasional riots going on with regard to the dissatisfaction of the level of public service delivery within SA. Yet, no mobile tools are being used by the SA

public service department to assist with improved service delivery in SA. Table 2.4 is a summary of the benefits of mobility within the public services sectors in Western Europe and the United States of America (Frost & Sullivan, 2006:15).

Table 2.4: Mobility in the public services sector abroad

Key Processes	Key Applications	Key benefits
Fire, police and health inspections. Building and constructions. Permit management	Real-time capture of inspection data. Instant availability of thousands of documents, ordinances and regulatory guidelines.	Increased worker productivity and speedier data uploads.
Social service case management.	Immediate access to case histories and records.	Enhanced constituent service and reporting. Enhance capture and retrieval of required information for more productive and accurate case work.

Source: Frost and Sullivan (2006:15)

2.3.3.4 Small and medium enterprises

The picture of small and medium businesses in South Africa is very different from what we see in larger corporations (Goldstuck, 2006:145). Goldstuck states, "As part of the Mobility 2006 research project, we conducted telephonic interviews with more than a 1000 decision-makers at small and medium enterprises (SMEs) to get a picture of the extent to which they are embracing and using mobile technologies, and of the effect it is having on their businesses. The overwhelming conclusion: SMEs are struggling to get to grips with advanced mobile technologies, despite the advantage they offer" (2006:145). The most widely embraced mobile technologies amongst SMEs are laptops and cellular phones (Goldstuck, 2006:146). SMEs use these mobile devices primarily to do their banking and other financial services such as transfers and electronic payments. The findings of *The Impact of Mobile Technology on SMEs in South Africa 2006* study concluded that the South African SME is at a great disadvantage to large corporates in their ability to make new technologies work for them (Goldstuck, 2006:145).

Table 2.5: The level at which mobile devices are deployed within the SME sector in SA

Level of business at which devices are provided to staff	Senior Management	Junior Management	Sales/Field staff	All staff
Cellular phone	45%	8%	30%	6%
PDA	11%	2%	3%	1%
Laptop computer	53%	10%	20%	5%

Source: Goldstuck (2006:147)

Table 2.6: The importance of mobile technology within the SME sector in SA

Technology	Importance	Impact
Cellular phone	67%	74%
Laptop	63%	67%
PDA	42%	52%
WiFi	49%	55%
Bluetooth	31%	36%
Wireless broadband	47%	60%

Source: Goldstuck (2006:148)

With all the inherent benefits of Wireless and mobile technologies on the SA society, cognisance must also be taken of the negative impact on society. The increase in availability and accessibility of applications, systems and information has increased the working hours of individuals utilizing these technologies. People work longer hours especially at home thus neglecting their families, friends and other social responsibilities such as church or other social responsibilities or interactions. The increase in working hours and technology capabilities has a negative impact on an individual's family and social life. An increase in stress levels due to the lack of time out and rest can lead to burn-out and social dysfunctional behaviour. People leave their houses less often because they have more and more services and functions available at home, e.g. do not need to go to town to shop or do banking.

2.3.4 The impact of wireless and mobile technology on the South African consumer

2.3.4.1 Introduction

Since its inception in 1998, when it had as its sole focus chat lines based on interactive voice response (IVR), mobile commerce (**m-commerce**) in SA has evolved into a panoply of services (Goldstuck, 2005a:168). In the process, it had changed the face of consumer interaction with brands, competitions, digital content and e-government services (Goldstuck, 2005a:168). M-commerce in SA comprises the provision of services such as music downloads, competitions, information alerts, content such as ringtones, video games, tunes and images. These services are available through WAP, GPRS, and 3G technologies onto a mobile phone or laptop.

Nearly two thirds of all cellphone users have bank accounts (Goldstuck, 2006: 136). Just over 10% of users with bank accounts have ever used their cellphone to do banking (Goldstuck 2006:136). Cellphone services that are mostly used by the SA consumer are airtime purchases; balance enquiries; payments of accounts; pre-paid electricity and transfers between accounts. These mobile features make life much easier for the SA consumer who can eliminate wasted time that he or she would have spent standing in queues acquiring the above mentioned services. These mobile services improve the quality of life of those consumers using them through the elimination of wasted time in the queue, or on the road travelling to a specific service provider's office.

Starting up a laptop at home after hours (any place, any time), connecting to the Internet through GPRS; Edge or 3G; and quickly checking a bank balance or transferring money, has become a very useful and convenient tool for those who are fortunate enough to have access to such technology. South Africans, usually in the LSM 8 – 10 (Life Style Measure), with access to mobile banking, hardly ever visit the bank anymore.

As was mentioned earlier, the cellular phone has become the preferred vehicle of digital content delivery within SA. Leading the revolution in SA are Wireless Applications Service Providers (WASPs), who use special connections to the licensed mobile networks to

deliver mobile Value Add Services (VAS) and content to subscribers' handsets via SMS, USSD, WAP, GPRS and 3G (Goldstuck, 2006:151). WASPs have developed a plethora of innovative mobile value-added services (VAS) and content bouquets, ranging from music downloads, competitions, interactive TV and games to voting, locations services, business information services and information alerts (Goldstuck, 2006: 151). The SA teenage market has taken up these VAS products by storm and sees these products as necessities and fashion statements which they need to have and cannot live without.

Payment for these services has also evolved from the initial IVR-based billing to the short code system which is currently used as the common mobile payment method in SA. Prepaid and post-paid customers can pay for services or content bought via a code on their cellphone. Payment from a laptop is just as simple. Buying items of the Internet can easily be paid for through entering your credit card details and payment is done without visiting the bank.

Mobile identity management can play a central role in addressing usability and trust issues in mobile business. For this reason, it is being established as a core service for next-generation mobile telecommunications infrastructures. Mobile identity management is used to identify, acquire, access, and pay for services that follow the user from device to device, location to location, and context to context, and thus it is the network component that holds together novel services on novel networks using innovative business models. In contrast to previous-generation mobile business infrastructures, this represents a pivotal shift in focus from identification to identity (Gartner, 2006).

Shopping for bargains or the right product at the right price has become much easier through the availability of information anywhere, any place. This information available to the consumers makes informed buying decisions regarding product price, features, location, and so forth, possible. Consumers can view product or service catalogues on the Internet from their homes via their laptop and wireless connection. They can choose their holiday destination, book online and pay for it through their wireless Internet connection anywhere and at any time they prefer to do so. Gone are the limitations of working hours and visiting a travel agent (accessibility) and then going to the bank to arrange payment or writing a cheque.

This, however, opened an entire new world to marketers. An entire new medium can now be used to market services and products 24/7 anywhere.

SMS has also brought a vast new range of services and products available to the SA consumer. Consumers can SMS traffic to a short code and get a traffic update of the road ahead. They can SMS weather and get an update of the weather forecast on their mobile phone. Examination results, claims, pre-paid meter payment, mobile dictionary, Lotto results, market indicators, daily news and sport results are some of the services available through SMS.

2.3.4.2 Summary

The technology explosion and growth in wireless and mobile technologies brought an array of possibilities, benefits and opportunities to society. These possibilities, benefits and opportunities must be understood and utilized to its fullest. This will enable society to leverage off these technologies to make South Africa a better and more effective place for everybody. SA society's resistance to change and lack of understanding of these technologies will restrict and limit the inherent benefit to them. In the past, technology growth and uptake had certain technical bottlenecks; for instance, if software was upgraded then the hardware had to be improved. When the hardware was improved then the software capabilities had to be improved. Memory size, CPU power or hard drive space was always a problem. Currently, the technology is so advanced that the bottleneck shifted from technology capability to human acceptance, understanding and capabilities.

SA can definitely benefit from wireless and mobile technologies as was proven in other first and second world countries. Due to the lagging effect of SA compared to the rest of the first world, SA can learn from these countries' mistakes and lessons learned. This should enable SA to limit the problems and issues surrounding these technologies and increase the effectiveness and benefits of these technologies. The time to market will also be shorter and SA can pick and choose from the trial and tested technologies currently available.

CHAPTER 3
EMPIRICAL STUDY

3.1 INTRODUCTION

The empirical research on the impact of wireless and mobile technology on the SA society was done by means of a field study using a structured questionnaire. The questionnaire (Annexure A) was structured in such a way that the statements and conclusions within the literature study of chapter 2 were verified for validity, correctness and to see if the literature portraits the actual sentiments in practice.

The objective of this chapter is to set out the background to the design of the questionnaire, the processing of the data and the results of the field study. This chapter begins with a discussion on the development; the goal and selection method of the questionnaire. The second part of this chapter is devoted to the analysis of the data gathered and the results obtained.

3.2 STUDY POPULATION

The population can be seen as the entire SA society. This study is, however, limited to the borders of South Africa and also limited to the part of the population that could be reached.

3.3 GATHERING OF DATA

The questionnaire was compiled taking into consideration the primary and secondary objectives as set out in chapter 1. The objectives in chapter 1 were incorporated and aligned within the objectives of the questionnaire. The main objective of this study is to get an understanding of the impact of wireless and mobile technologies on the SA society. The objective of the questionnaire was to gather information depicting the impact of wireless and mobile technology on the SA society.

A draft questionnaire was sent to four friends, to get their views and recommendations, as a proof of concept. The final version of the questionnaire was distributed through e-mail using the network of friends; colleagues and family nationally, to gather data. Thirty questionnaires were sent to friends, family and colleagues who in turn requested their friends, family and colleagues to complete more questionnaires. A total of 49 questionnaires were received and used in the empirical study.

A convenience sample was taken, but the data was analysed as if it were obtained from a random sample.

The purpose for researching the impact of wireless and mobile technologies on the SA society is to understand and determine the actual impact on society; thus determining if there is a gap with regard to the level of usage, implementation and acceptance within the SA society; and how the SA society can leverage off the benefits of these technologies.

It is evident through the literature review that there are major benefits derived from wireless and mobile technologies to society. From increased productivity, increased cost efficiency, increased quality of service delivery and products, to increased economic benefits for society at large.

The empirical study will focus on the following:

- Identifying which wireless and mobile technologies are utilized by the SA society.
- The capacity and role in which they use Wireless and mobile technologies.
- The impact of Wireless and mobile technologies on the SA society.
- The perceived benefits and use of wireless and mobile technologies.
- Analysing the data gathered from the questionnaires and interpreting the results.

3.3.1 Selection method

The intended research study approach was primarily based on the gathering of the most recent data. This entails a survey using a questionnaire to collect the necessary data in order to draw certain conclusions with regard to the impact on and the state of wireless and mobile technologies on the SA society.

A convenience sample of the population was taken and the data were considered a small population for which statistical inference and p-values are not relevant. Statistical inference draws conclusions about the population from which a random sample was drawn, using the descriptive measures that have been calculated. Instead of only reporting descriptive statistics in these cases, effect sizes can be determined.

This must be taken into consideration when drawing conclusions and making recommendations.

3.4 RESULTS AND DISCUSSIONS

Statistical significance tests have a tendency to yield small p-values (indicating significance) as the size of the data sets increases. The effect size is independent of sample size and is a measure of practical significance (Ellis & Steyn, 2003). It can be understood as a large enough effect to be important in practice and is described for differences in means, for the relationships in frequency tables and also for a multiple regression fit.

3.4.1 Results of Section A

Section A consists of a table depicting general user information. The participants populated the table with their demographic information, i.e. age and gender. This was done to see if

there are any major differences or correlation between demographic groups within South Africa.

3.4.1.1 Age

Close to 80% of respondents were between the age group of 30 – 50 and the average age of respondents is 37.

Table 3.1: Age of the respondents

Age	Number of respondents	% of Respondents
Age < 30	10	20.4
30> Age <40	20	40.8
Age > 40	18	36.7
Total	**48**	**98.0**
Missing	1	2.0

Source: Annexure B (2006:16)

3.4.1.2 Gender

The frequency of men and women that completed the 49 questionnaires was 53% male and 45% female. A small 2% were incomplete and thus inconclusive.

Table 3.2: Gender of the respondents

Gender	Number of respondents	% of Respondents
Male	26	53.1
Female	22	44.9
Total	**48**	**98**
Missing	1	2

Source: Annexure B (2006:1)

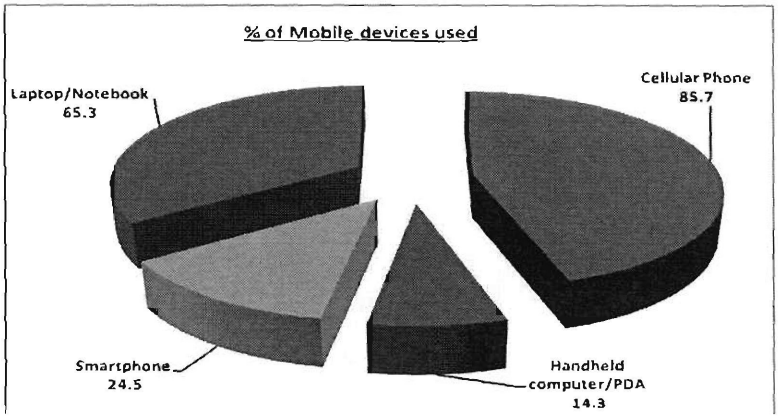
3.4.2 Results of Section B

The questions in section B were directed in such a way as to get an understanding of which wireless and mobile technologies are being used by the SA population and furthermore, within which capacity they utilize the technologies. A general question was asked to determine which general mobile applications are used.

3.4.2.1 Mobile devices

It is evident from the results (figure 3.1) that the cellular phone (86%) is the most used mobile device, followed by the laptop/notebook (65%). These results correlate with the research done by Goldstuck and confirm the conclusions in the literature study that cellphones are the number one mobile device used by South Africans, followed by the laptop or notebook. Smartphones and PDAs are used to a lesser extent. This can be due to the relative newness and costs of the Smartphone technology to the SA market. Smartphones will eventually replace PDA technology which is at the end of its product lifecycle, thus the low usage.

Fig. 3.1: Percentage of mobile devices used by respondents

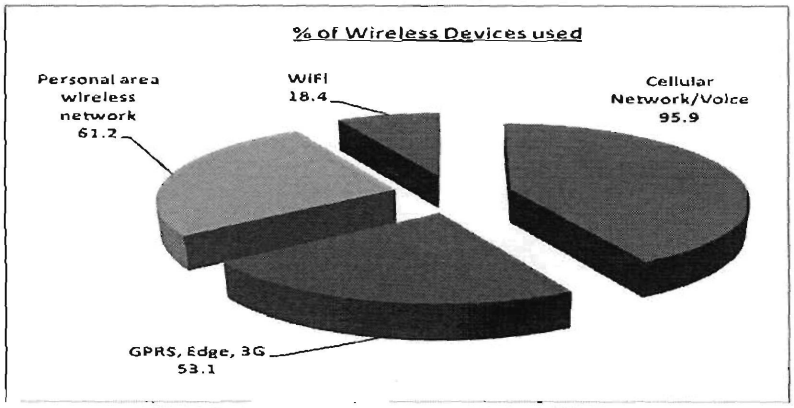


3.4.2.2 Wireless technologies

The number of users that utilize the cellular network (Figure 3.2) as a wireless technology scored the highest from all the respondents. This correlates with the type of mobile device used by respondents as depicted in Fig. 3.2. The cellular network usage actually includes the percentage of Edge, GPRS and 3G, as these are cellular technologies utilizing the cellphone network. Bluetooth and infrared technology, which forms part of the Personal Area Wireless Network technology, is the second highest wireless technology used. Bluetooth and Infrared technologies are used on laptops and cellphones.

The high usage can be explained because of the high number of cellphone and laptop users. WiFi and WiMAX are relatively new and costly wireless technologies that are predominantly a business-like technology. These technologies are in the beginning of their product lifecycle within South Africa and will be implemented by businesses as the costs decrease and the understanding of the benefit increases.

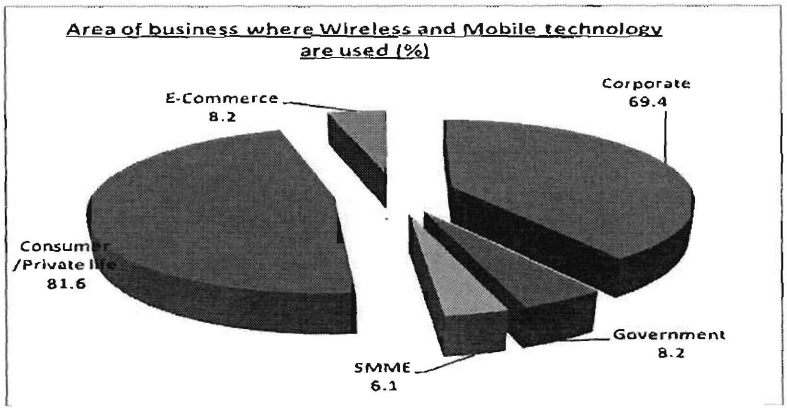
Fig. 3.2: Percentage of wireless devices used



3.4.2.3 Business area

Consumer/private life (81.6%) and Corporate (69.4%) received the highest score with SME (6.1%); Government (8.2%) and E-commerce (8.2%) scoring the lowest percentage.

Fig. 3.3: Area of business where wireless and mobile technologies are used

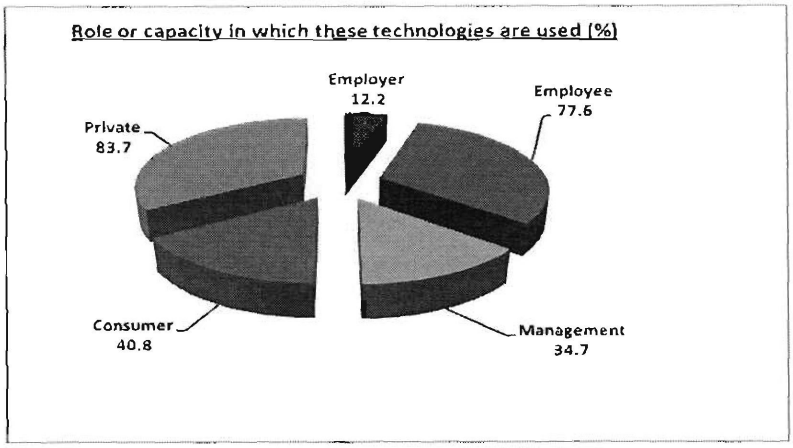


3.4.2.4 Capacity or role

As much as 87% of respondents utilize wireless and mobile technologies (Figure 3.4) within a private capacity and 78% in an employee capacity. This is in direct correlation with the usage of cell phones and laptops. A total of 86% of respondents use a cell phone and these are mostly privately owned. Laptops are used by 65% (Fig. 3.1) of respondents, thus the correlation with the role or capacity of employees of 78% in fig. 3.3. In certain instances laptops and cell phones are supplied by employers to their employees.

Management (34.7%) and employer (12.2%) scored low percentage scores. The 40.8% usage of wireless and mobile technologies in the role or capacity of a consumer is low compared with the total benefits offered though these devices and technologies.

Fig. 3.4: The capacity or role within which wireless and mobile technologies are being utilised in

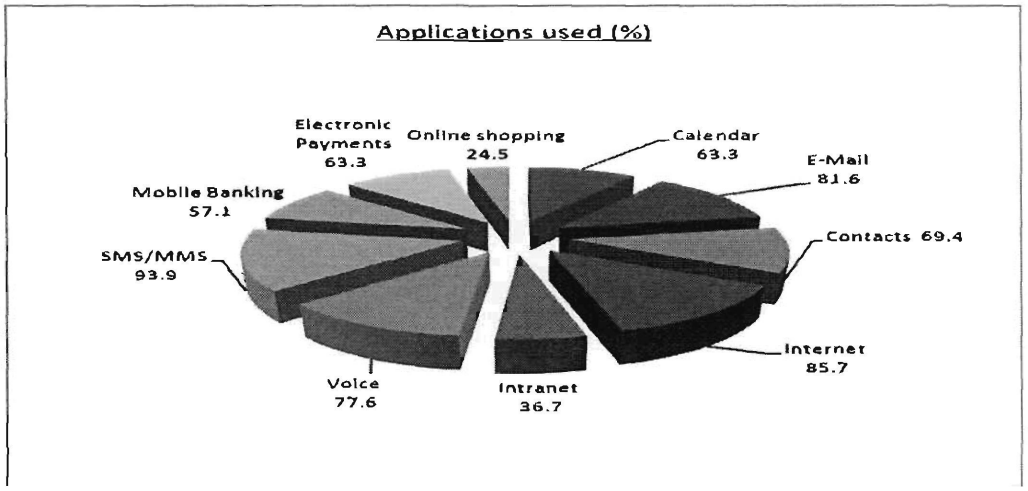


3.4.2.5 Applications

These applications (figure 3.5) can be split between cell phone and laptop or Smartphone devices. SMS/MMS are the application that is the most widely use at 93.9%. This just confirms the number one use of a mobile device, which is the cell phone. The high voice usage (77.6%) is expected if we consider the cell phone's place in today's society. Electronic payments are at 63.3% and mobile banking at 57.1% indicating the growing use of wireless and mobile applications and technologies and the increase in the product life cycle to a maturity stage. More and more people are accepting and are using these technologies available to them.

E-mail is the second highest application used at 81.6% followed by the Internet at 85.7%. This correlates with previous findings of the laptop as the second most frequently used mobile device. Most of the applications have a high percentage of use except company Intranet (36.7%) and online shopping (24.5%). The low Intranet usage can be due to the size of the business as only the medium and large enterprises implement them. The low online shopping could be due to the low maturity of the concept and perceived security issues.

Fig. 3.5: Applications used though wireless and mobile technologies



3.4.3 Results of section C

The questions in section C were directed in such a way as to get an understanding of the impact of Wireless and mobile technologies on the SA society. This section is also the main section of the questionnaire. It attempted to get an understanding of the main problem statement.

Factor analysis, *standard deviation* and *Cronbach alpha* measurements were used to analyse the empirical data and the reliability thereof. *Factor analysis* provides an effective method for estimation of maximum likelihood. A reliability coefficient is proposed to indicate quality of representation of interrelations among attributes for a population. The reliability coefficient could indicate a very close representation in this case and be a better indication as to whether to accept or reject the factor solution. Constructs are the hypothetical variables that are being measured.

After factor analysis, it is a common practice to attach a descriptive name to each common factor once it is extracted and identified. The assigned name is indicative of the predominant concern that each factor addresses.

Cronbach's alpha is an index of reliability associated with the variation accounted for by the true score of the construct. Alpha coefficient ranges in value from 0 to 1 and may be used to describe the reliability of factors extracted and the higher the score, the more reliable the generated scale is (Cronbach's Alpha, 1999).

The measurement of the mean per factor indicates the average score of all constructs for the specific factor measured. Efficiency and effectiveness has the highest factor mean of 4.06 on a scale of 1 to 5 (Table 3.3). Negative impact scored the lowest mean of 3.19.

Standard deviation (S) is a measure of variation and gives information on the spread or variability of the data values (Levine *et al*, 2005:117). Standard deviation shows the variation around the mean (Table 3.3). Investment driver has the smallest standard deviation indicating a small spread and variability of data around the mean. Negative impact scored the highest standard deviation indicating a larger spread of data around the mean and thus a larger variability.

Cronbach alpha measures the reliability of the factors and the closer the measurement to 1 the more reliable the measure and the closer the score to 0 the less reliable the factor (Cronbach's Alpha, 1999). All factors scored a high Cronbach alpha score indicating a high measure of reliability (Table 3.3).

Table 3.3: Variability and reliability measurement

Descriptive Name	**Mean**	**Standard Deviation**	**Cronbach Alpha**
Investment driver	3.89	0.632	0.849
Efficiency and productivity	4.06	0.704	0.870
Product and service quality	3.80	0.721	0.705
Cost efficiency	3.37	1.018	0.836
Negative impact	3.19	1.084	0.869

Source: Annexure B)

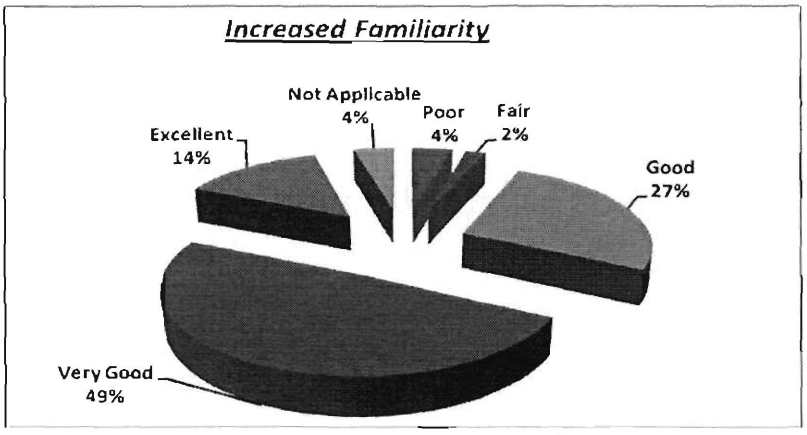
3.4.3.1 What then drives society's investment in wireless and mobile technology?

There was a clear line of thought throughout the literature study with regard to the impact and perceived benefit of these technologies. The following figure depicts the response from the questionnaire in this regard.

3.4.3.1.1 Familiarity

Increased familiarity was positively identified by about 90% of respondents. This is the total count of good; very good and excellent rating. This proves that the learning curve with regard to these technologies are getting to a maturity stage where people readily accept and invest in these technologies because they understand it better.

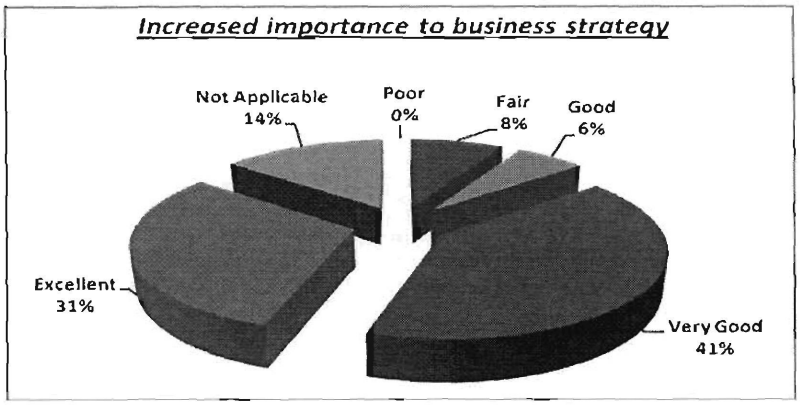
Fig. 3.6: Familiarity with wireless and mobile technology



3.4.3.1.2 Importance to business strategy

Increased importance of wireless and mobile technologies to business strategy also received a high score if the good, very good and the excellent percentages scored in the feedback are counted. More and more people see these technologies as an integral and necessary part of their business strategy.

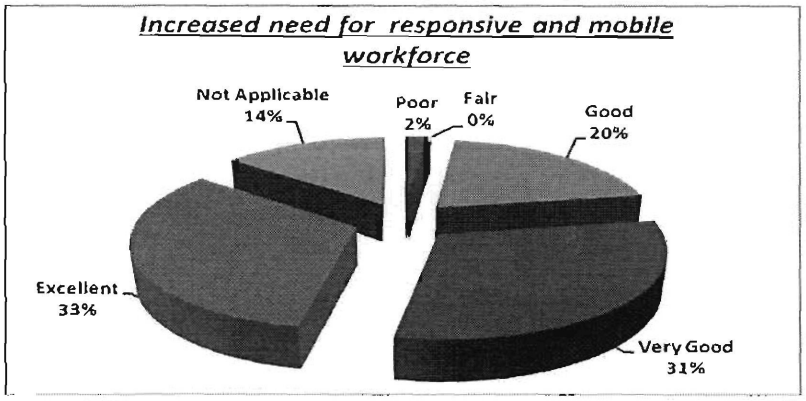
Fig. 3.7: Importance to business strategy



3.4.3.1.3 The need for a more responsive and mobile workforce

Figure 3.8 shows a very high score as an investment driver with regard to the need for a more responsive and mobile workforce. This shows direct correlation with the need for wireless and mobile technology to be part of business strategy as seen in Fig.3.8.

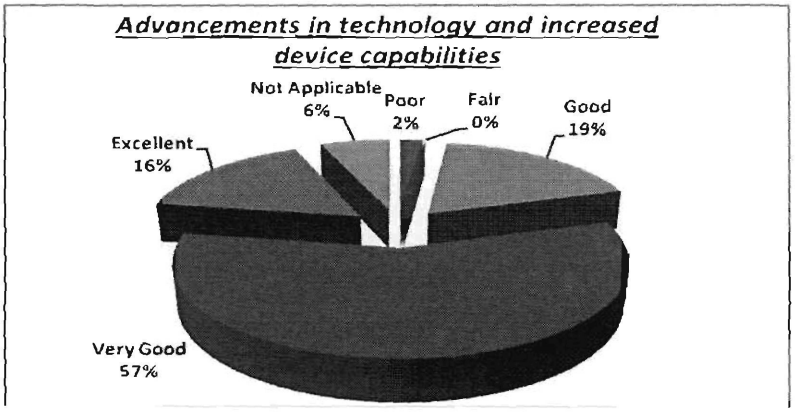
Fig. 3.8: Need for a more responsive and mobile workforce



3.4.3.1.4 Advancement in wireless and mobile technology and increased device capabilities

Advancement in wireless and mobile technology and increased device capabilities are indicated as a major driver for investment in these technologies. Fig.3.9 shows an above 90% positive response towards this driver.

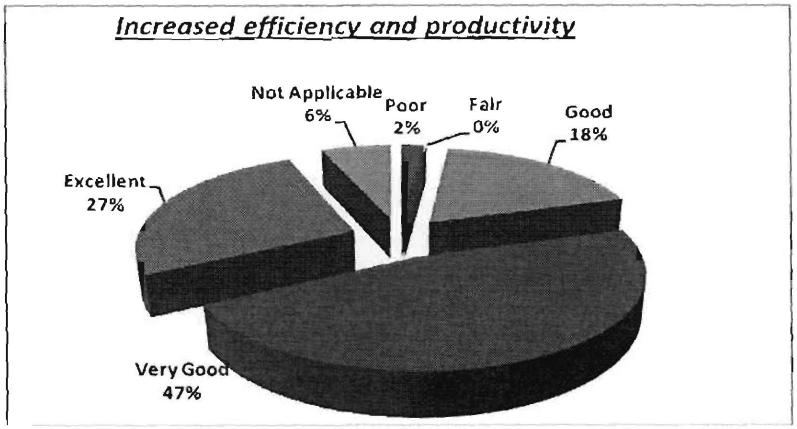
Fig. 3.9: Advancements in technology and increased device capabilities



3.4.3.1.5 Efficiency and productivity

Increased efficiency and productivity are also indicated as a major driver for investment in wireless and mobile technology. Over 90% of respondents believe that the increase in efficiency and productivity is worthwhile for them to invest in such technologies.

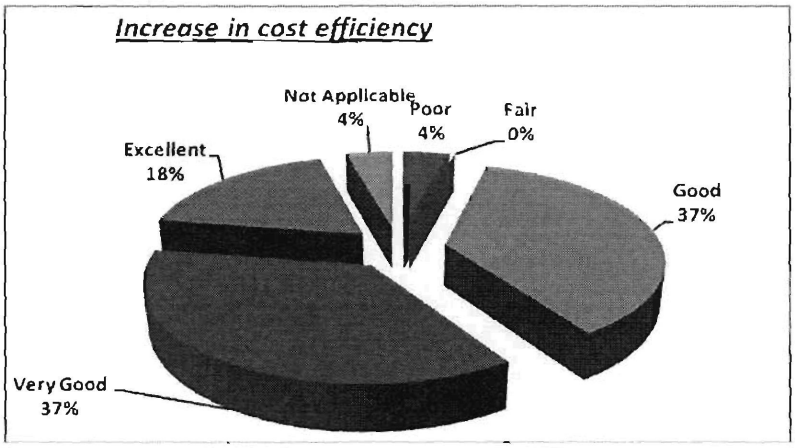
Fig. 3.10: Efficiency and productivity



3.4.3.1.6 Cost efficiency

The increase in cost efficiency also received a very high score as a driver for investment in wireless and mobile technology.

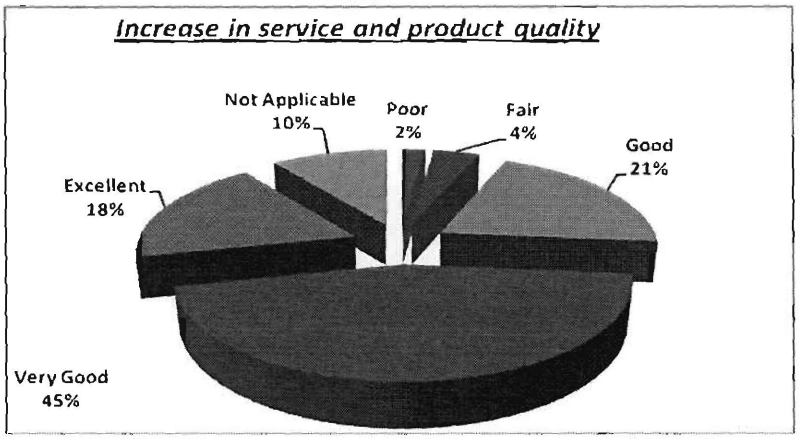
Fig. 3.11: Cost efficiency



3.4.3.1.7 Service and product quality

The increase in service and product quality (figure 3.12) also received high scores, but below the 90% total score of the good, very good and excellent responses. This can be due to the fact that measuring quality and the perception thereof, is very complex as people see quality differently.

Fig. 3.12: Service and product quality



Increased familiarity; device capabilities; efficiency and productivity, and cost efficiency received an above 90% score with regard to the good, very good and excellent responses. Increase in service and product quality, importance to business strategy and a more responsive and mobile workforce received less than 90%, although still a very high score. All the above measurements of drivers for investment in wireless and mobile technology received very positive ratings and the conclusion can be made that all of these are drivers for investment in these technologies.

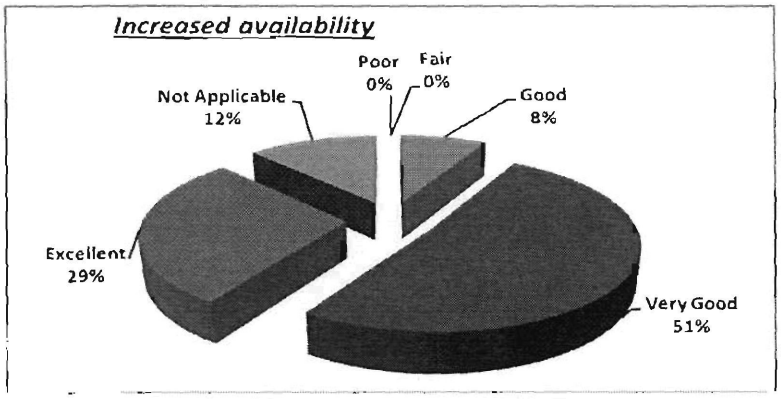
3.4.3.2 Efficiency and productivity

The possible increase in efficiency and productivity, if any, was measured through the sections below. A positive response or agreement with a statement is indicated through the view of good, very good and excellent responses.

3.4.3.2.1 Availability

Increased availability of staff anywhere, anytime (figure 3.13) was indicated by the respondents as one of the factors that increases the efficiency and productivity of people. A total of 88% positive responses were captured from the questionnaire.

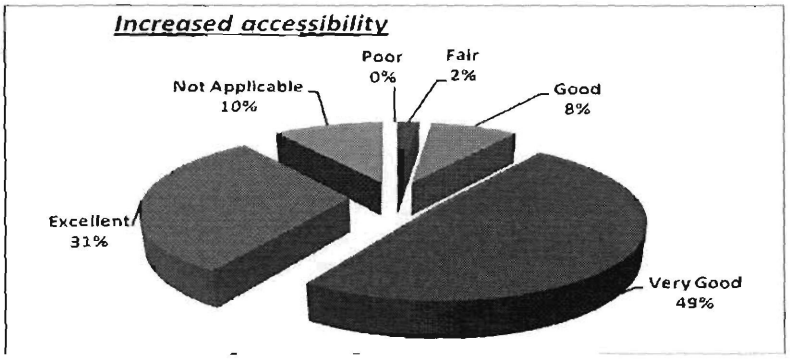
Fig. 3.13: Availability



3.4.3.2.2 Accessibility

Increased accessibility of information (figure 3.14) by people also scored a total of 88% positive responses, indicating accessibility as a key factor to improved efficiency and productivity. Only 10% of people indicated that increased accessibility did not have an impact on increased efficiency and productivity; or were not applicable to their environments.

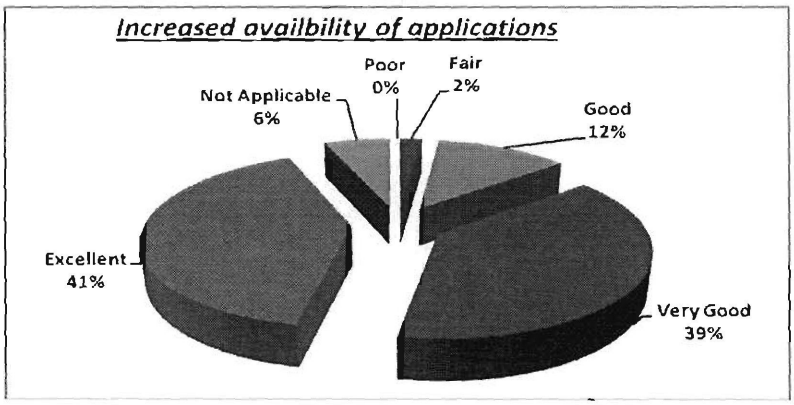
Fig. 3.14: Accessibility



3.4.3.2.3 Availability of applications

Increased availability of applications (figure 3.15) such as e-mail, calendar, contacts, etc. received a very high total score of above 90%. This factor also received the highest excellent score (41%) of all measured within this section. An 8% negative response, or not applicable was captured.

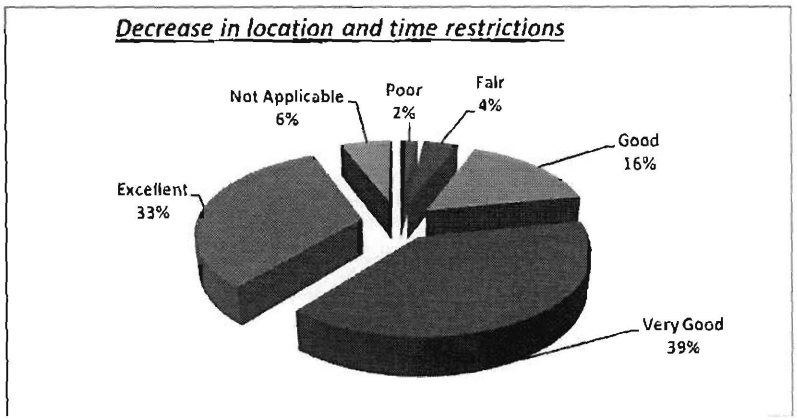
Fig. 3.15: Availability of applications



3.4.3.2.4 Location and time restrictions

Decrease in time and location restriction received a total of 88% positive responses and 12% negative or not applicable responses.

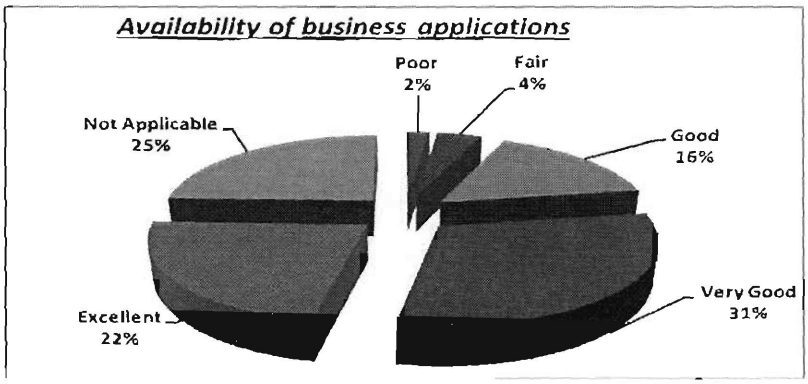
Fig. 3.16: Location and time restrictions



3.4.3.2.5 Availability of applications to field staff

Increased availability of business applications (figure 3.17) to field staff, i.e. quote and invoice generation at customer site, received a 70% positive or agreed with rating and a 30% negative rating. The lower positive response might be due to respondents not being familiar with field staff service delivery principles. This can be seen in the high percentage of not applicable or do not know responses (25%).

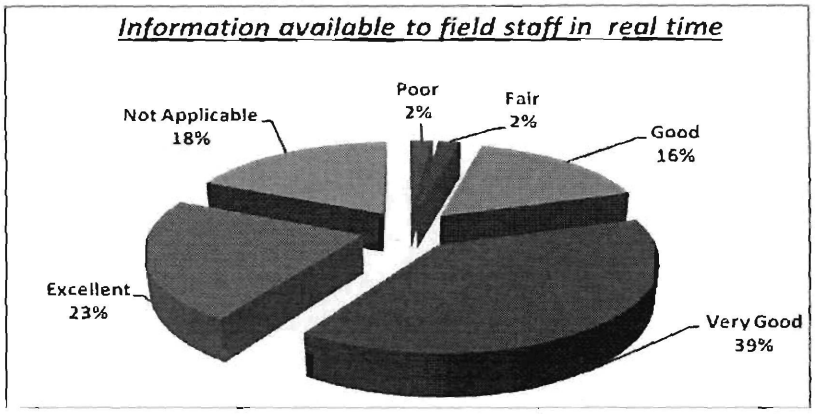
Fig. 3.17: Availability of business applications



3.4.3.2.6 Availability of information to field staff

Increased availability of information to field staff to increase efficiency and productivity, received 78% agreed or positive response compared to a 22% negative or 'disagree' response.

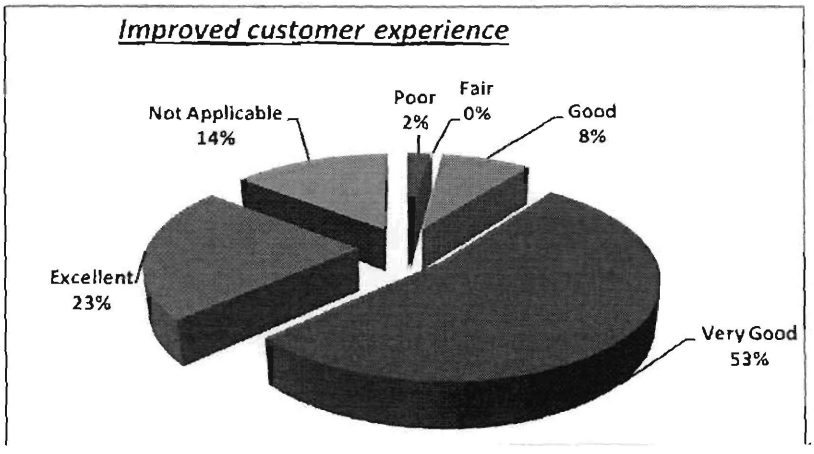
Fig. 3.18: Availability of information to field staff



3.4.3.2.7 Customer experience

Improved customer experience is perceived to have an 84% contribution to increased efficiency and productivity and 2% poor contribution with a 14% no or not applicable response.

Fig. 3.19: Customer experience



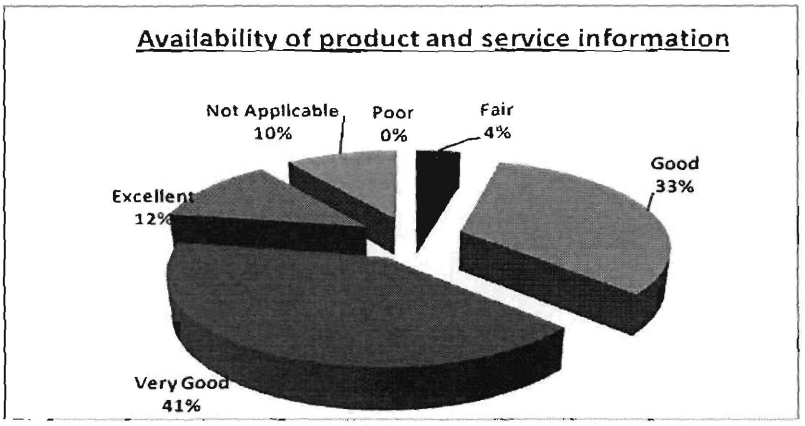
3.4.3.3 Product and service quality

The improvement and the perception thereof, if any, in product and service quality were measured through two statements and one question below.

3.4.3.3.1 Product and service information readily available

Having product and service information readily available, i.e. price; features; location of shipment to customers; received an 86% agreed or positive response and only a 14% disagree or not applicable response (Figure 2.9). This implies that 86% of respondents anticipate that having the product and service information readily available will increase the quality of products and services.

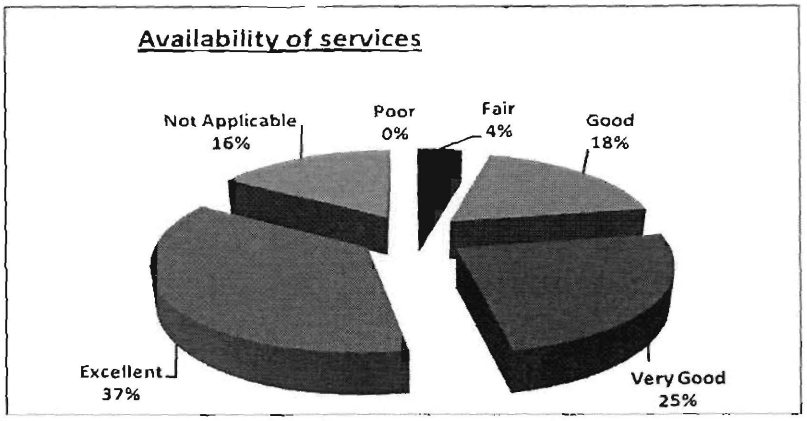
Fig. 3.20: Product and service information readily available



3.4.3.3.2 Service availability

Availability of services such as balance enquiries; money transfers; online support; etc. received an 80% positive response compared to 20% of people believing that service availability will have no impact on improving the quality of product and service delivery. This response clearly indicates the positive impact of service availability on product and service quality.

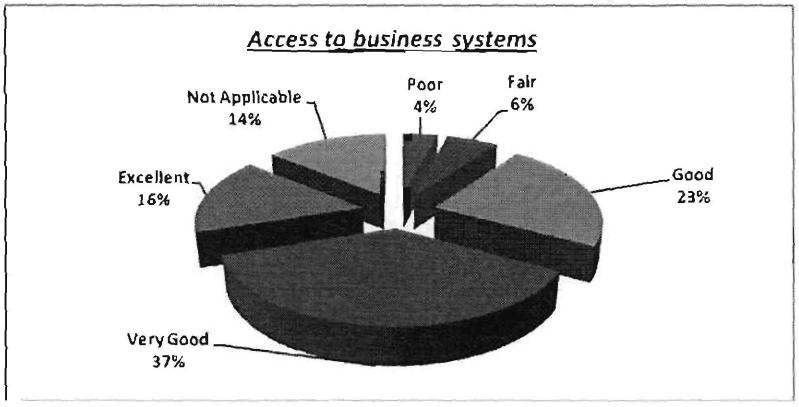
Fig. 3.21: Service availability



3.4.3.3.3 Direct access to business systems

Direct access to business systems such as Intranet; Internet; billing system; SAP; etc. received a 76% positive or agreed response compared to a 24% negative or disagree response. Direct access to business systems thus improves product and service availability.

Fig. 3.22: Direct access to business systems



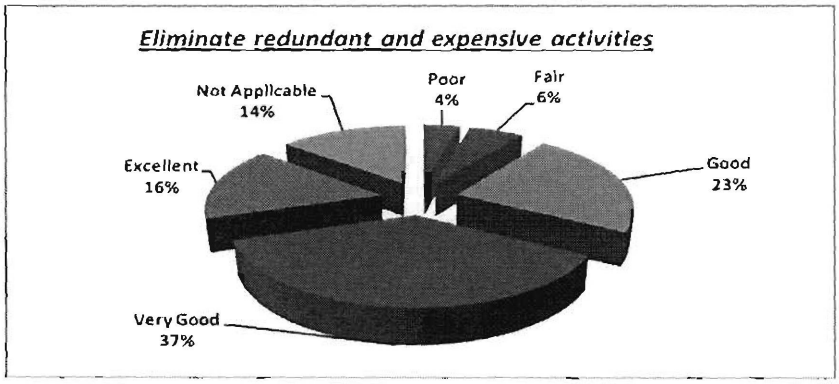
3.4.3.4 Cost efficiency

In this section an analysis was done to determine the effect on cost efficiency through the use of wireless and mobile technology.

3.4.3.4.1 Elimination of redundant and expensive business activities

Paper based activities, documents, price lists, meetings, and so on are but some business processes and activities that can be replaced through wireless and mobile technologies. For example, having a conference call with anybody, anytime, anywhere without calling a meeting at a specific location saves a lot of time and money. A total of 66% of respondents agree that wireless and mobile technology increase cost efficiency through the elimination of redundant and expensive business activities. 34% disagree with the statement (Figure 3.23).

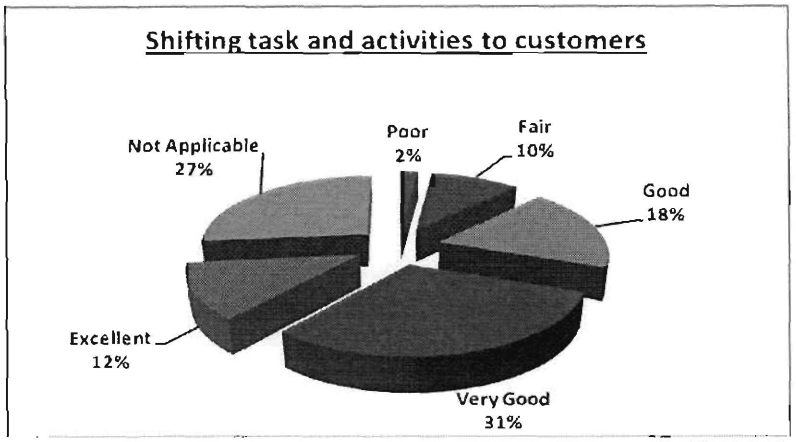
Fig. 3.23: Eliminating redundant and expensive business activities



3.4.3.4.2 Shifting tasks and activities to the customer

Shifting traditional workload activities or tasks performed by personnel, such as balance or product enquiries, money transfers, electronic payments, etc. to customers, a steady 61% agreed that shifting these activities increase costs efficiency and 27% did not know or stated not applicable, and 12% negative response (Figure 3.24).

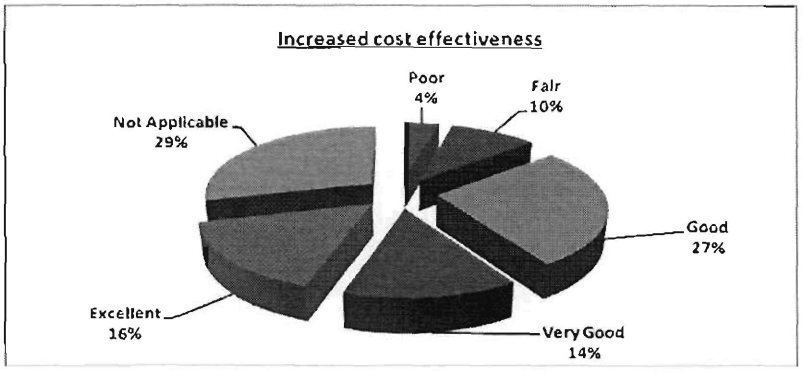
Fig. 3.24: Shifting task and activities to users



3.4.3.4.3 Cost effectiveness

Increase cost effectiveness (figure 3.25) through wireless and mobile training solutions, e.g. virtual classrooms; access to interactive web base training; etc. that can be done at home or any location. A total of 57% responded positively and agreed, whereas 29% said not applicable. It appears that such practices are not fully implemented as yet.

Fig. 3.25: Cost effectiveness



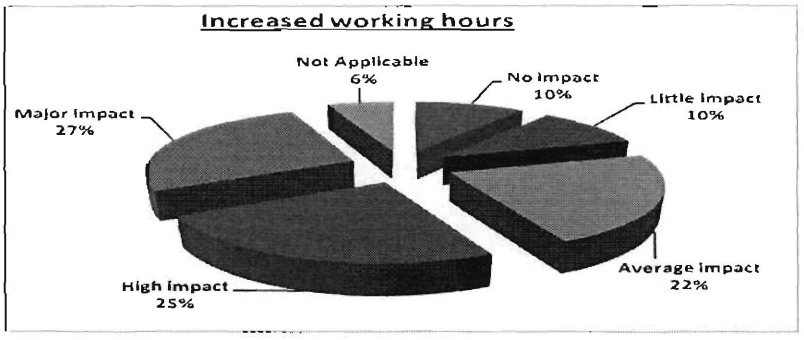
3.4.3.5 Negative impact of wireless and mobile technology

The impact of wireless and mobile technology can also negatively impact society. Some of these are sociological of nature and difficult to determine.

3.4.3.5.1 Working hours

Working hours increase as more and more people have access to wireless and mobile technology and are able to work from home. As much as 74% of respondents said that their working hours have increased compared to 20% saying it had little or no impact. An increase in working hours also indicates an increase in employee productivity.

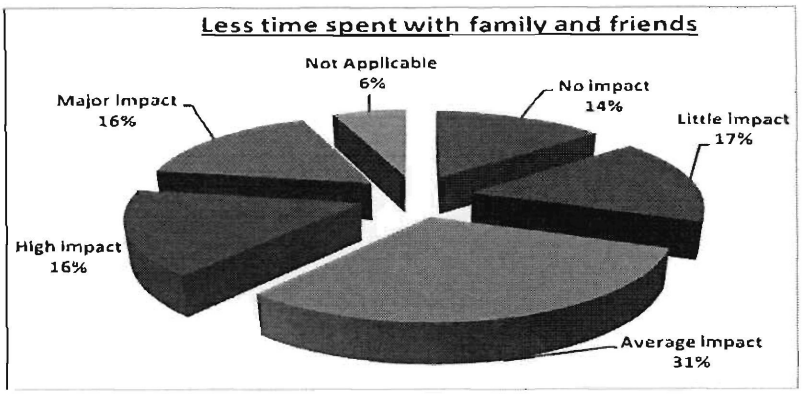
Fig. 3.26: Working hours



3.4.3.5.2 Time spent with family and friends

This was the question pertaining to people spending less time (figure 3.27) with family and friends, because people work more from home and perform more activities from home. A total of 63% of respondents said that the statement is true and that they spend less time with family and friends. Nearly a third (31%) said no or little impact.

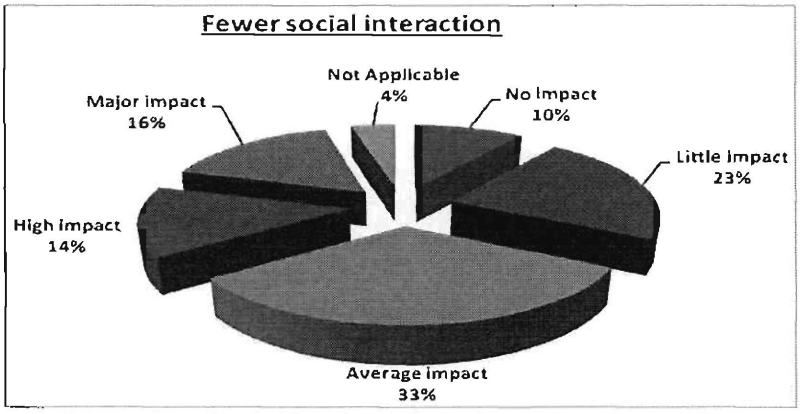
Fig. 3.27: Time spent with family and friends



3.4.3.5.3 Social interaction

People leave their houses less often as most services such as banking, product information and certain shopping functions are available from home through wireless and mobile technology. Nearly two thirds (63%) of respondents (figure 3.28) said that they had less social interaction and 33% said little or no impact.

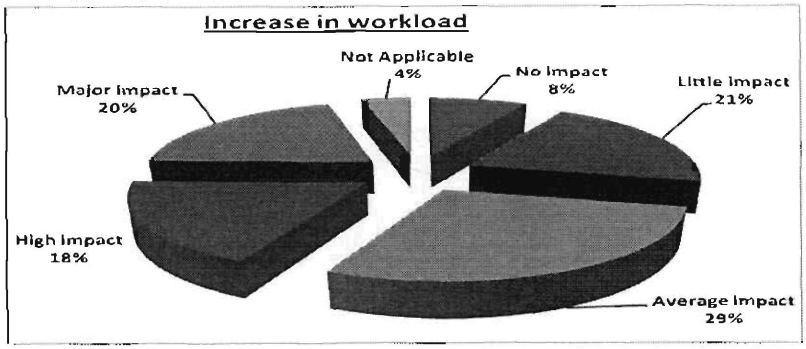
Fig. 3.28: Social interaction



3.4.3.5.4 Workload

Concerning workload increases (figure 3.29) due to people being increasingly available outside of office hours and office walls, 67% of respondents said that their workload had increased compared to 29% that indicated no or little impact to an increase in workload. The increase in workload also indicates an increase in employee productivity.

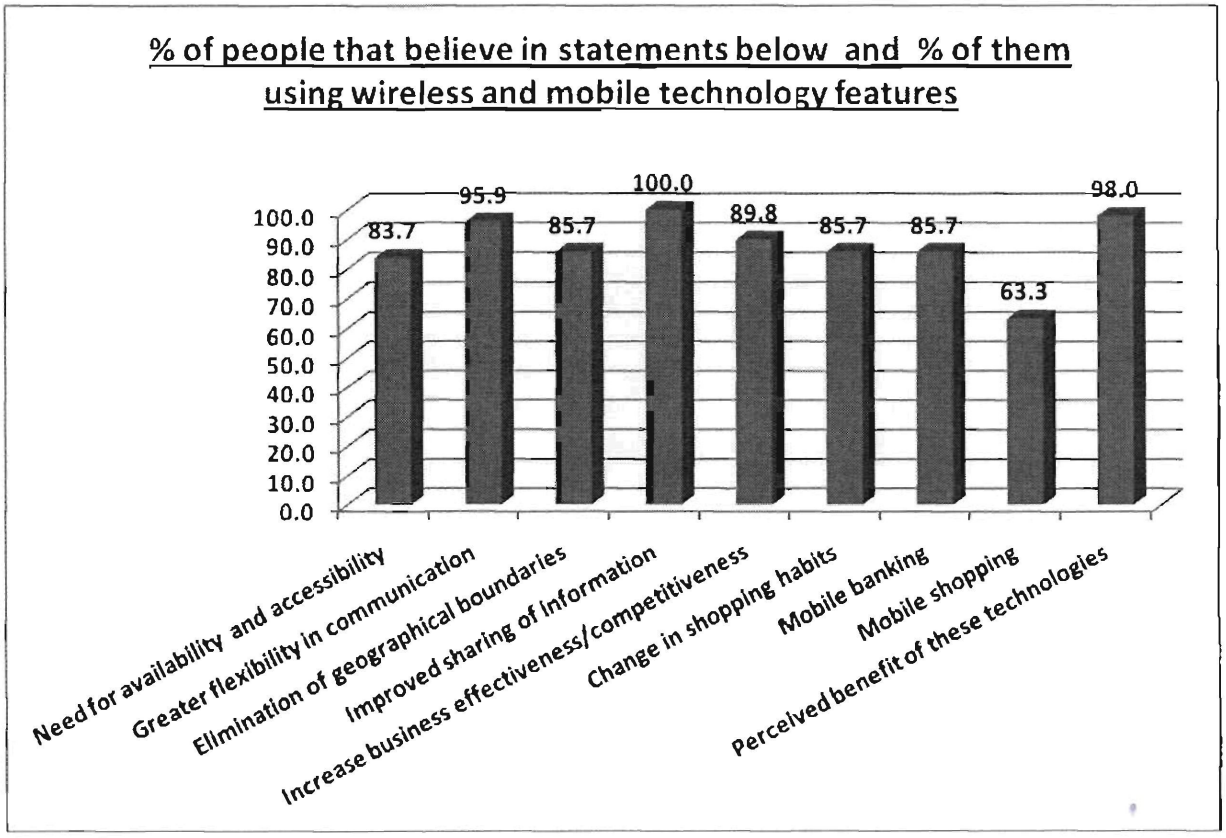
Fig. 3.29: Workload



3.4.4 Results of Section D

The questions in section D were directed in such a way as to get an understanding of the beliefs and perceptions of South Africans regarding wireless and mobile technologies.

Fig. 3.30: Percentage of people that believe in the statements below and the percentage of them using wireless and mobile technology features



The following statements scored very high marks with regard to the responses received:

- Greater flexibility in communication - 95.6%
- Improved sharing of information - 100%
- Perceived benefits of wireless and mobile technology to the South African society - 98%
- Increased business effectiveness and competitiveness - 89.8%

This indicates a very high perceived score with regard to the benefits and impact of wireless and mobile technologies to the South African society at large.

The following statement scored low marks with regard to the response received:

- Mobile shopping – 63.3% This is the lowest of all scores and indicates that people do not utilize this function and that businesses in South Africa may have not matured or marketed these features aggressively. This can be due to many factors which are outside of the scope of this study.

The following statements scored high marks from respondents:

- Need for availability and accessibility – 83.7%
- Elimination of geographical boundaries – 85.7%
- Change in shopping habits – 85.7%
- Mobile banking – 85.7%

3.5 SUMMARY

The cellular phone and the laptop are the most commonly used mobile devices. The cellular network and personal area network are the top wireless technologies used. It is also evident that the private and corporate environments are the two main areas within which these technologies are utilized.

SMS, E-Mail, Internet and Voice are the applications that are mostly used. The drivers identified for investment in wireless and mobile technologies are increased familiarity, increased device capabilities, increased efficiency and productivity, and the increase in cost efficiency.

There is ample proof from the empirical study that the use of wireless and mobile technology increases:

- Efficiency and productivity
- Product and service quality
- Cost efficiency
- Negative impact on people

The increase in working hours and workload has a negative impact on a personal level but it increases an employee's productivity. This is a major advantage to any employer and suggests that the investment in wireless and mobile technology is beneficial to employers.

CHAPTER 4
CONCLUSIONS AND RECOMMENDATIONS

4.1 INTRODUCTION

In this final chapter recommendations and conclusions are presented based on the literature study in chapter 2 and the empirical study in chapter 3. The most important findings of the literature study and the empirical findings are indicated and discussed. Conclusions and recommendations about the research are made with regard to the impact of wireless and mobile technology on the SA society.

4.2 CONCLUSIONS

Technology plays a strong role in modern society and even more so wireless and mobile technology. Society finds itself at the dawn of the information age and the impact of technology on society is and will be huge. The empirical data that was analysed had a low variability (standard deviation Table 3.3) and a high reliability (Cronbach alpha Table 3.3) score. This indicates that the statements and findings are reliable and does not vary much.

4.2.1 Utilising wireless and mobile technology

The most common used wireless and mobile technology (figure 3.1) is the cell phone (85.7%) followed by the use of laptops or notebooks (65.3%). This is also evident from the research that Arthur Goldstuck conducted. There is also a direct correlation between this finding and the role within which these technologies are being utilized, i.e. private (cell phone) and employee (laptop) as indicated in figure 3.1 and figure 3.4. These findings also correlate with the empirical findings where the consumer environment has the highest usage followed by the corporate environment.

The cellular network is the most used wireless technology (95.9%) amongst the sample group, followed by the personal network (61.2%). GPRS, EDGE and 3G received the third highest score (53.1%) with regard to the usage of wireless technologies (figure 3.2).

4.2.2 Demographics

The average age of respondents were 37 (table 3.1), of which 53% were male, 45% female and 2% non-responses (table 3.2). As much as 83.7% of people utilize these technologies in their private life and 77.6% in their role as employee (figure 3.4). The role of employer, consumer and management scored 40% and lower. This is indicative of people using cell phones and laptops.

4.2.3 Mobile applications

SMS and MMS (93.9%) are the most often used applications reflecting the use of cell phone technology as the number one mobile technology (figure 3.5). Internet (85.7%) and E-mail (81.6%) are the next most commonly used applications, supporting the finding that the laptop is the second most used mobile device. This is evident through the literature study and supported by the empirical data. Mobile banking (57.1%) and electronic payments (63.3%) also received relatively high scores if one keeps in mind the security concerns and perceived risk of the SA society (figure 3.5). Online shopping (24.5%) received the lowest score. This can be due to the low level of maturity of such features provided by retailers and consumer shopping preference.

4.2.4 Drivers of investment in wireless and mobile technology

The main drivers of investment in wireless and mobile technology are the importance to business strategy (figure 3.7) and the increased need for a more mobile and responsive workforce (figure 3.8). As we are in the information and technology age, utilizing technology has become an integral part of day-to-day life and business strategies. The increased familiarity of wireless and mobile technology (figure 3.6) is the least of the investment drivers. This implies that the average user of such technology are better

educated today compared to a decade ago. Increased efficiency and productivity (figure 3.10) and increased cost efficiencies (figure 3.11) received a 92% positive rating and indicates that these are major drivers for investment in wireless and mobile technologies. The improvement of service and product quality (figure 3.12) received a 84% positive measure as a driver towards investment in wireless and mobile technologies, which is also a very high contributing factor. These drivers received high reliability scores (table 3.3) in the empirical study, also supporting the findings from the literature study in chapter 2.

4.2.5 Efficiency and productivity

Efficiency and productivity improve through the use of wireless and mobile technology and have a major impact on the SA society. This is supported by the literature study and empirical data. The research shows that the availability of applications (figure 3.15) such as e-mail, calendar and contact have a huge impact and benefit on the improvement of people's efficiency and productivity, especially in the work environment. Increased availability (figure 3.13) and accessibility (figure 3.14) indicates an improvement in society's efficiency and productivity with positive responses of 88%.

By minimizing location and time restrictions (figure 3.16) through the use of wireless and mobile technology, efficiency and productivity are enhanced. Gone are the limitations of an eight-hour working day and the restrictions of the availability of a physical location, i.e. an office-building.

Customer experience improves (figure 3.18) through an increase in responsiveness and the availability of applications anywhere, anytime. There are fewer location restrictions, improving efficiency and productivity from business and consumers when utilizing wireless and mobile technology. This is evident through the literature study in chapter 2 and supported by the empirical data from chapter 3.

4.2.6 Product and service quality

Product and service information that are readily available (figure 3.20) anywhere, anytime, hugely improves the quality of services and products to the SA society. Wireless and mobile technology provides access to products and services without time or location restriction, improving product and service quality. This increases the exposure of such products and services to the consumer market.

Availability of services (figure 3.21) such as balance enquiries; money transfers; market indicators updates, etc., also improves the quality of services and products to the SA society as indicated by the literature study and supported by the empirical findings.

4.2.7 Cost efficiency

Cost efficiency improved through the use of wireless and mobile technology. This puts more money in the pockets of business and consumers within SA. Redundant and expensive business activities (figure 3.23) are eliminated, thus increasing cost efficiency. Shifting traditional labour-intensive and time-consuming activities (figure 3.24) such as balance enquiries; money transfers and so forth to consumers, also improve cost efficiency. Virtual classrooms and interactive web based training through wireless and mobile technologies improve cost efficiency (figure 3.25). Training can happen anywhere, anytime to a bigger audience, saving time and money. Cost efficiency has a positive impact on society as it improves their ability to be economically more competitive and increases operational efficiencies.

4.2.8 The negative impact of wireless and mobile technology

Wireless and mobile technology does not only have a positive impact on the SA society, but there are also some negative effects on society. Increased working hours (figure 3.26) and work load (figure 3.29), due to the accessibility of information, tasks and applications from home through wireless and mobile technology, have a major negative impact on society. This improves an employee's productivity, but it also decreases the time spent with

family and friends and leisure time. People spend less time with their families (figure 3.27) depriving the family of quality time and interaction. People also leave their homes less often (figure 3.28) due to convenient services such as banking features being available at home. Online shopping adds to this and people are socializing less and doing more from home. People thus go out less into society, decreasing interaction with society.

4.2.9 General perceptions of people

Most people agree that they have a need for wireless and mobile technology and that such technology have a positive impact on society. It improves communication as users of such technologies can communicate from any location at any preferred time. It also improves productivity from which SA can benefit tremendously considering the country's poor international productivity rating.

4.3 RECOMMENDATIONS

It is evident from the research that wireless and mobile technology has many possible benefits to the South African. How, then, can South Africans benefit and leverage off these technologies?

4.3.1 Business area

The research conducted in this paper indicates and proves the benefit of wireless and mobile technology. The question thus should not be if, but rather what type of wireless and /or mobile technology investment should be made and to what extent.

Businesses, corporations, SMEs and Government sectors within SA need to take cognisance of the *tangible and intangible benefits* of wireless and mobile technologies. A clear understanding of the benefits will improve acceptance and investment of such technologies. These entities should *increase the availability* of such technologies to their workforce to increase and leverage off the benefits of wireless and mobile technologies. This implies that business will have to *increase their financial investment* in such

technologies. Some of the benefits and return on investment of wireless and mobile technologies are not tangible and are difficult to justify the investment.

Business should *combine the features* and abilities of different wireless and mobile technologies to improve, increase and optimize the benefits from these technologies. *Research and development departments and technology specialists* should be tasked to assist business entities with their understanding; investment choice and implementation of wireless and mobile technology. Get experts in the technology field to assist with the choice and implementation of such technologies. Best practises and case study information are readily available to assist with choice, understanding and optimizations of such technologies.

The research indicated that cell phones (Voice) and laptops are readily used and deployed. Optimising the benefits of these existing technologies still requires attention and can be achieved through the utilization and integration of technology features and business specific applications. This implies that there must be a fit between technology functionality and business requirement through design. Integration of wireless and mobile technology into the entity's value chain will save time and money through the increase in productivity; efficiency; effectiveness; quality and availability.

The following process should be followed:

1. *Understand* - Get an understanding of the features and benefits of wireless and mobile technology.

2. *Align* – Align wireless and mobile technology with the entity's business strategy.

3. *Determine fit* - Identify which technology and features will benefit and fit your specific environment and where in the value chain it should be incorporated.

4. *Identify areas* - Identify areas where optimal benefit and possible synergies can be achieved.

5. *Implementation* – Engage with subject matter experts to ensure seamless implementation.

6. *Measure* – Measure the ROI through the implementation of a measurement tool. This will enable comparison of before and after investment. It will also highlight areas that require improvement or adjustment.

7. *Optimize* - As soon as ROI and benefits are evident, expand the technology and leverage off the existing technology foundation.

4.3.2 Consumer or private life

Cell phone technology and cell phone applications have the biggest impact on consumer and private life. Banking, shopping and communicating are the primary usage of wireless and mobile technologies. *Educating* people to understand the functionality and benefits of wireless and mobile technology will overcome the biggest stumble block with regard to acceptance and utilization of such technologies. One of the biggest challenges is the pace at which societies will accept and go through any change. Technology changes are happening at such a tremendous rate that the rate at which people or society changes, will always lag behind and thus determine the success of these technologies. Education and knowledge brings acceptance and in the end the level of implementation and usage of wireless and mobile technology in society.

Another aspect and more so within the SA society, is security and the perceived risks of wireless and mobile technology. This can be overcome through knowledge and awareness of the security technologies available and their capabilities to secure, for example, online banking or shopping transactions.

Within the SA society at large, education of people is the most important factor when trying to improve the standard of living for all South Africans. Wireless and mobile technology brings infinite information and possible educational value to the SA society. The utilization

of these features and availability of information must be explored and must be readily available to all of society.

This can be achieved through:

1. *Awareness* – Marketing of such products and their benefits and features to the South African society.

2. *Education* – Educate society through private and government initiatives.

3. *Availability* – reduce the price of these technologies to increase usage and fast track acceptance (rate and tax reduction). Legislation plays a major role in the current SA Telecoms and ICT industries. Legislation can decrease the price of these technologies and thus increase the usage and acceptance levels.

4. *Synergise* – Synergise between wireless and mobile technology's benefits and features to achieve optimal usage and benefits. This also implies that care must be taken not to use these technologies in isolation.

4.4 ACHIEVEMENT OF THE STUDY OBJECTIVES

The success of the study can be measured in terms of the objectives formulated in chapter 1.

4.4.1 Primary objectives of the study

The primary objective is an indication of the purpose and intention of the study. The secondary objectives are an indication of the state and degree of wireless and mobile technology's impact on certain sample sectors within SA.

The primary objective of this study was to determine and understand the impact that wireless and mobile technologies have on the SA society. This was achieved through the literature and empirical study that indicated the benefits and also the negative impact of

wireless and mobile technology on the SA society. The primary effects on society are increased efficiency and productivity; improved product and service quality and increased costs efficiency.

4.4.2 Secondary objectives of the study

The secondary objectives formulated in chapter 1 were:

- The state of wireless and mobile technologies within SA.
- The impact of wireless and mobile technologies on the business sector within SA.
- The impact of wireless and mobile technologies on a private or consumer level within SA.

These objectives were also achieved through the outcome of the literature and empirical study in chapters 2 and 3. Cell phones (Voice) and laptops are respectively the most and second most used wireless and mobile technology within South Africa. Associated applications such as Internet, e-mail, calendar, and so forth. are frequently used by users of these two technologies. The impact on business and private sector was analysed within the primary objective.

4.5 RECOMMENDATIONS FOR FURTHER STUDY

The number, capability and convergence of wireless and mobile technologies are on the increase and the impact thereof will become increasingly important to society. The effective use and implementation of these technologies will become a necessity for businesses especially in an ever increasing competitive global market place. These technologies are already an integral part of our private and day to day lives. Additional research is required to study the effective and optimal implementation of these technologies. A better understanding of the benefits and leverage thereof is also required and additional research should be able to answer these questions.

4.6 SUMMARY

Society at large is finding itself in the midst of a technological and information revolution, spurred by converting the world's knowledge into digital form and the speed and ease with which the information can be processed and transmitted. The strategic importance of mobile technology cannot be underestimated. The rapid pace of adoption and

advancement of wireless and mobile technologies creates opportunities for new and innovative services provided through such mobile devices. "People are increasingly seeing their mobile devices as an extension of themselves. There needs are constantly evolving but the one constant is the need for seamless mobile and wireless connectivity that is accessible, user friendly and secure." (Anon., 2005:1).

There has been a shift over the past few years from a need for processing power and hard drive space to a need for connectivity anywhere and anytime, especially to the Internet. The availability and accessibility of information has become the power and enabler within the enterprise and users' hands.

Most people agree that they have a need for wireless and mobile technology and that such technology have a positive impact on society. It improves communication as users of such technologies can communicate from any location at any preferred time. It also improves efficiency and productivity; product and service quality and cost efficiency, from which SA can benefit tremendously considering the country's poor international productivity rating. Research has shown that there is a correlation between the level of technology usage within a country and its economic strength and growth. It is thus of paramount importance for SA to improve the level of usage and implementation of such technologies within society to improve the standard of living and to make them more competitive in the current global village (globalisation).

Education with regard to the benefits of these technologies will increase awareness, acceptance and usage of such wireless and mobile technologies. Optimising the benefits and leveraging of these existing technologies still requires attention and can be achieved through the optimal utilization and integration of technology features and business specific applications.

Cognisance must be taken with regard to the human factor and our ability to adapt or resist change. People will never be able to change at the same pace that technology is changing. This implies that careful planning must be done and consideration must be taken when implementing new technology. If not, failure is imminent, not because of the technology's capabilities but rather because of humanity's inability to change at a faster rate.

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ANNEXURE A

WHAT IS THE IMPACT OF WIRELESS AND MOBILE TECHNOLOGIES ON THE SOUTH AFRICAN SOCIETY?

In the face of the technology boom over the past decade, wireless and mobile technologies have become more robust, an everyday tool used by society. What is then the impact of having these wireless and mobile technologies at your finger tips? The purpose of this questionnaire is to get an understanding of the impact of these technologies on the SA society at large.

Your participation regarding this research is highly appreciated.

Regards

Kobus Potgieter

Section A:

Please complete the fields below with your personal details:

Name and Surname	
Gender (Male or Female)	
Age	
Telephone number	
Company	
Questionnaire no.	0001

After completion, please return the questionnaire to kpotgieter@cellc.co.za before the 20/09/2007.

For any queries or questions please contact Kobus Potgieter at 084 777 9072 or 011 324 9072.

Section B:

Please complete the questionnaire by indicating your choice through an X mark in the empty box.

1. **Which of the following *Mobile devices* do you use? Can be more than one.**

- Cellular phone ☐
- Handheld computer/PDA ☐
- Smartphone (cell phone with handheld computer abilities or a handheld computer with Cell phone capabilities) ☐
- Laptop/Notebook ☐

2. **Which of the following *wireless mediums* do you use?**

- Cellular network - voice/cell phone (Cell C, Vodacom, MTN) ☐
- Edge, GPRS, 3G ☐
- Bluetooth or Infra Red on your laptop or cell phone ☐
- WiFi (eg. Hotspots, Wireless LAN at home) ☐
- WiMAX (Wireless broadband network spanning up to 50km) ☐

3. **In which of the following *areas of business* do you utilise wireless and/or mobile technologies?**

- Corporate Business ☐
- Government Sector/institution ☐
- SME ☐
- Consumer/Private life (Internet banking, communicating) ☐
- E-commerce (trading, selling, buying) ☐

4. **In which *capacity or role* do you utilise wireless and/or mobile technologies? Can be more than one.**

- As **employer** owning a business or partner of a business ☐
- As an **employee** ☐

- As **management** within a business ☐
- As a **consumer** in the SA market ☐
- In my **private life** for private purposes ☐

5. **Which of the following *applications* do you use *through* wireless and mobile technologies? Can be more than one.**

- Calendar ☐
- E-mail ☐
- Contacts ☐
- Internet ☐
- Intranet ☐
- Voice (Telephone) ☐
- SMS or MMS ☐
- Mobile Banking ☐
- Electronic payments ☐
- Online shopping ☐
- Private/Personal life ☐

Section C:

Section C investigates the impact of wireless and mobile technologies on you within your business and/or private life. Keep in mind that these technologies include cell phone usage.

Please underline your choice

1 = Poor 2 = Fair 3 = Good 4 = Very Good 5 = Excellent *Blank = NA*

Leaving a question blank will mean that it is not applicable in your current role or environment.

6. **What drives your investment, if any, in wireless and mobile technology? Why will you buy wireless or mobile devices or technology?**

Increased familiarity of mobile and wireless technologies compared to a decade ago. The technologies are becoming easier to understand and use.	1	2	3	4	5
Increased importance of technology has been part of your *business strategy*. Need to have to survive in business.	1	2	3	4	5
Increased need for a *more responsive and* mobile workforce in the market.	1	2	3	4	5
Advancement in wireless and mobile technologies increased device capabilities. More usable features.	1	2	3	4	5
The technology increases *efficiency and productivity.*	1	2	3	4	5
The technology increases *cost efficiency*.	1	2	3	4	5
The technology Increases *service and product quality*.	1	2	3	4	5

7. **How did your efficiency and productivity improve?**

Elimination of unavailability of staff. Can reach them anywhere, anytime. Increased availability.	1	2	3	4	5
Information being available to more people more frequently. Increased accessibility.	1	2	3	4	5
Availability of applications such as calendar, contacts, e-mail, etc.	1	2	3	4	5
Location (bound to office walls) and time restrictions (working hours) are limited or something of the past. Not limited to the office space or work hours.	1	2	3	4	5
Availability of business applications to sales people to do e.g. quotes and orders at the customer's site.	1	2	3	4	5

Field service personnel have information available in real time thus improving service delivery.	1	2	3	4	5
Improved customer experience through i.e. improved responsiveness through e-mail and/or cell phones.	1	2	3	4	5

8. How did product or service quality improve?

Product and service information readily accessible, i.e. price; features; location of shipment; to your customers.	1	2	3	4	5
Availability of your services such as balance enquiries, money transfers, online support, etc. increased through the use of wireless and mobile technologies.	1	2	3	4	5
Did your service delivery improve through the direct access anywhere, anytime to your business systems? E.g. Intranet, Internet, billing systems, SAP, etc.	1	2	3	4	5

9. How did the technology increase cost efficiency?

Were you able to eliminate redundant and /or expensive business activities? E.g. paper based manuals or documents, product and price lists, meetings, etc.	1	2	3	4	5
Shifting traditional work load activities performed by service providers, such as balance or product enquiries, electronic payments, etc. to the customer.	1	2	3	4	5
Increase cost effectiveness through wireless and mobile training solutions, e.g. virtual class rooms, access to interactive Web based training that can be done at home.	1	2	3	4	5

10. How did the technology impact your life *negatively?*

Please underline your choice

1= No impact 2= Little impact 3= Average impact 4= High impact 5= Major impact

Increased working hours due to accessibility of information, tasks and applications from home, or any other location outside the office.	1	2	3	4	5

Spending less time with your family and or friends. Less social interaction.	1	2	3	4	5
Leaving your house less often as most services such as banking and shopping can be performed at home.	1	2	3	4	5
Workload increased due to your increased availability outside office hours and walls.	1	2	3	4	5

Section D:

Please indicate if you agree with the following statements by answering yes or no through an X tick in the empty box.

11. **Do you have the need for availability and accessibility, through wireless and mobile technology, anywhere, anytime?**

Yes ☐ **No** ☐

12. **Wireless and mobile technology gives greater flexibility in communication as you can communicate anywhere, anytime at your own convenience with anybody.**

Yes ☐ **No** ☐

13. **Wireless and mobile technology eliminates geographical boundaries like a dedicated office. Your office can now be at home, on the road, etc.**

Yes ☐ **No** ☐

14. **Wireless and mobile technology improves the sharing of information.**

Yes ☐ **No** ☐

15. Electronic business (E-commerce) through Wireless and Mobile technology increased business effectiveness and competitiveness.

Yes ☐ No ☐

16. Wireless and mobile technology changed the way we shop through the availability of product and producer information like price and features.

Yes ☐ No ☐

17. Do you use your phone or laptop for banking activities?

Yes ☐ No ☐

18. Do you use wireless and mobile technology to do shopping on the Internet?

Yes ☐ No ☐

19. Do you see the benefit and belief that wireless and mobile technologies have benefits to the SA society?

Yes ☐ No ☐

Thank you for your assistance in completing this questionnaire. It is much appreciated.
Please remember to forward me your feedback as soon as possible.

Regards

Kobus Potgieter

ANNEXURE B

*OPSOMMENDE STATS SONDER OPDELING

```
EXAMINE
  VARIABLES=C6_Construct C7_Construct C8_Construct C9_Construct C10_Construct
  /PLOT NONE
  /STATISTICS DESCRIPTIVES
  /CINTERVAL 95
  /MISSING PAIRWISE
  /NOTOTAL.
```

Explore

Notes

Output Created		26-SEP-2007 18:28:37
Comments		
Input	Data	Q:\P\POTGIETER KOBUS\SELFOON.sav
	Active Dataset	DataSet1
	File Label	kobus
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	49
Missing Value Handling	Definition of Missing	User-defined missing values for dependent variables are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for the dependent variable or factor(s) being analyzed.
Syntax		EXAMINE VARIABLES=C6_Construct C7_Construct C8_Construct C9_Construct C10_Construct /PLOT NONE /STATISTICS DESCRIPTIVES /CINTERVAL 95 /MISSING PAIRWISE /NOTOTAL.
Resources	Elapsed Time	0:00:00.00
	Processor Time	0:00:00.00

[DataSet1] Q:\P\POTGIETER KOBUS\SELFOON.sav

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
C6_Construct	48	98.0%	1	2.0%	49	100.0%
C7_Construct	46	93.9%	3	6.1%	49	100.0%
C8_Construct	44	89.8%	5	10.2%	49	100.0%
C9_Construct	42	85.7%	7	14.3%	49	100.0%
C10_Construct	47	95.9%	2	4.1%	49	100.0%

Descriptives

			Statistic	Std. Error
C6_Construct	Mean		3.8855	.09122
	95% Confidence Interval for Mean	Lower Bound	3.7020	
		Upper Bound	4.0690	
	5% Trimmed Mean		3.9161	
	Median		4.0000	
	Variance		.399	
	Std. Deviation		.63200	
	Minimum		1.14	
	Maximum		5.00	
	Range		3.86	
	Interquartile Range		.59	
	Skewness		-1.512	.343
	Kurtosis		6.431	.674
C7_Construct	Mean		4.0563	.10384
	95% Confidence Interval for Mean	Lower Bound	3.8472	
		Upper Bound	4.2655	
	5% Trimmed Mean		4.1112	
	Median		4.0000	
	Variance		.496	
	Std. Deviation		.70429	
	Minimum		1.40	
	Maximum		5.00	
	Range		3.60	
	Interquartile Range		.88	
	Skewness		-1.161	.350
	Kurtosis		3.327	.688
C8_Construct	Mean		3.8030	.10868
	95% Confidence Interval for Mean	Lower Bound	3.5838	
		Upper Bound	4.0222	
	5% Trimmed Mean		3.8291	
	Median		4.0000	

	Variance		.520	
	Std. Deviation		.72092	
	Minimum		1.67	
	Maximum		5.00	
	Range		3.33	
	Interquartile Range		1.00	
	Skewness		-.450	.357
	Kurtosis		.554	.702
C9_Construct	Mean		3.3651	.15702
	95% Confidence Interval for Mean	Lower Bound	3.0480	
		Upper Bound	3.6822	
	5% Trimmed Mean		3.3898	
	Median		3.3333	
	Variance		1.036	
	Std. Deviation		1.01762	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		1.33	
	Skewness		-.181	.365
	Kurtosis		-.479	.717
C10_Construct	Mean		3.1915	.15808
	95% Confidence Interval for Mean	Lower Bound	2.8733	
		Upper Bound	3.5097	
	5% Trimmed Mean		3.2128	
	Median		3.2500	
	Variance		1.174	
	Std. Deviation		1.08374	
	Minimum		1.00	
	Maximum		5.00	
	Range		4.00	
	Interquartile Range		1.25	
	Skewness		-.227	.347
	Kurtosis		-.348	.681

ANNEXURE C

Hype Cycle for Wireless Hardware, Software and Services, 2006

ID Number: G00140973

11 July 2006

Phillip Redman, Ken Dulaney, Michael J. King, Carolina Milanesi, Stephanie Pittet, Eleana Liew, Monica Basso, William Clark, Leif-Olof Wallin, Katja Ruud, Jackie Fenn, Kobita Desai, Sandy Shen, Ronni J. Colville, Bern Ellio,t David Gootzit, Gene Phifer, Ray Valdes & Donald Feinberg

Quickly evolving applications and platforms for wireless, lead to a crowded *Trough of Disillusionment*. However, a number of technologies are starting their climb, developing into general business adoption by showing an ever-maturing capability.

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Analysis

1.0 What You Need to Know

As wireless and mobile networking standards continue to be implemented and mature, support for wireless networking, in the form of new hardware, software and services, continues to have activity. However, a slow evolution continues toward maturity and adoption.

2.0 The Hype Cycle

Two major themes in the mobile and wireless industry in 2006 — fixed-mobile convergence and the consumerisation of the enterprise — are well represented within the hardware, software and services Hype Cycle. Currently, the numerous emerging technologies are overcrowding the Peak of Inflated Expectations and the *Trough of Disillusionment* with a slowly maturing capability — not many came off the Hype Cycle chart from previous years. As the standards and service technology matures, we are finally seeing devices, mobile operating systems and applications starting to catch up. Microsoft has made significant strides, in the first half of this year alone, in maturing Windows Mobile and the .NET Application Framework. In the next year, Gartner predicts that Microsoft-based devices and application frameworks will challenge Research In Motion's (RIM's) successful architecture. The Peak of Inflated Expectations continues to exhibit multiple overhyped technologies. If 2005 overhyped voice over wireless local-area network (VoWLAN) and WiMAX, this year promises to overhype technologies and standards such as IMS, mobile TV and fixed mobile convergence. Though interesting, a lack of services has left a hole from earlier product announcements. Early mobile video broadcasts are finding some criticisms based on cost, poor quality and lack of content. And although fixed mobile http://www.gartner.com/DisplayDocument?doc_cd=140973&format=html (2 of 26) 12/02/2007 09:31:18 Hype Cycle for Wireless Hardware, Software and Services, 2006 convergence is spoken by all, it will be some years before the recent wave of mergers and acquisitions and the implementation of convergence architectures will be mature enough to provide more-strategic capabilities to support converged enterprise voice and data, mobile and fixed.

Figure 1. Hype Cycle for Wireless Hardware, Software and Services, 2006
Source: Gartner (July 2006)

3.0 The Priority Matrix

As advanced wireless networks are finally rolling out worldwide, the priority matrix for enterprises will be dominated by application opportunities for field sales and general enterprise users, such as wireless e-mail and CRM. There is nothing new here as far as the demand, but a continued drop in costs for devices, services and application development will drive growth. Even more challenging will be the support for procurement, deployment and management of these capabilities. That's where services, such as telecom expense management, are going, moving from managed services with limited capabilities to a full business process outsourcing strategy, what Gartner calls "Mobile Life Cycle Management." Many companies fall in this area and include a maturing capability to support enterprise telecom needs. New mobile devices will be the big news toward the end of 2006, and promised devices from last year are finally delivered. In the next year, significant price declines are predicted as a very competitive market appears, at last, for higher-end handhelds that support the high-speed networks.

Figure 2. Priority Matrix for Wireless Hardware, Software and Services, 2006

http://www.gartner.com/DisplayDocument?doc_cd=140973&format=html (3 of 26) 12/02/2007 09:31:18. Hype Cycle for Wireless Hardware, Software and Services, 2006

Source: Gartner (July 2006)

4.0 On the Rise

4.1 Cellular-WLAN Phones

Definition: Phones that support both cellular and Wi-Fi wireless LAN (WLAN) technologies. They are also called "cell-fi" phones. ***Position and Adoption Speed Justification:*** At present, few phones have these capabilities. Those that do tend to be expensive, are high-end models compatible with third generation cellular networks. Most devices of this type are aimed at business users. This will remain the case, but we will see some consumer cell phones support Wi-Fi, especially those with a focus on music and video.

User Advice: Organisations should realize that applications which make good use of the capabilities of cellular-WLAN phones will be limited for some time. What's more, the quality of voice-over-WLAN services probably won't be acceptable till 2007.

Business Impact: This kind of phone is good news for business users, because wireless voice-over-WLAN applications will, in time, lower their telecom costs.

But for operators of cellular networks, these phones could mean lower revenues.

Market Penetration: Less than 1 percent of target audience

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Maturity: Emerging

Sample Vendors: HTC; Nokia

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Carolina Milanesi

4.2 Embedded WWAN

Definition: Wireless wide-area network (WWAN) technology, typically wideband code division multiple access (WCDMA) — including general packet radio service (GPRS)/Enhanced Data Rates for Global Evolution (EDGE)/High-Speed Downlink Packet Access (HSDPA) or CDMA2000 evolution data only (EV-DO), which includes Revision 0, Revision A and 1x radio transmission technology (RTT) — is embedded into the laptop.

Position and Adoption Speed Justification: WWAN is undergoing rapid technology changes that each require new chipsets at the device end. Embedding technology that changes every six to 12 months into a device with a 30-to-36-month life span is premature.

User Advice: Hold off investing in laptops with embedded WWAN until the technology has stabilized and changes at a slower pace more aligned with laptop replacement cycles, or there is technology available to upgrade modules separately and easily. In the meantime, focus on using add-in PC cards.

Business Impact: WWAN technology affects mobile users with laptops. It may have sourcing implications because laptops with embedded WWAN may be subsidized by mobile operators.

Market Penetration: Less than 1 percent of target audience

Maturity: Embryonic

Sample Vendors: Dell; Fujitsu Siemens

Recommended Reading:

I "3G Wireless Notebooks Will Be a Futile Gold Rush"

l "Think Twice Before Buying Laptops With Built-In 3G Features"

Appears In Hype Cycle:

l "Hype Cycle for PC Technologies, 2006"

l "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Leif-Olof Wallin

4.3 Mobile Centrex

Definition: Mobile Centrex is a service using wireless phones that enable calling features, such as PBX. There are several forms of provision: IP PBX, with cellular or Wi-Fi dual-mode handsets, private base stations with cellular single-mode handsets, or mobile virtual private networks (VPNs).

Position and Adoption Speed Justification: The service is past its peak in Europe, maturing in Asia and is emerging elsewhere. As mobile penetration matures, mobile operators are looking to capture more of the total voice traffic. For the enterprise market, this involves pure displacement services, such as mobile Centrex.

User Advice: Users should carefully assess the requirements for voice services and look at parameters, such as need for mobility, current and expected use, features, and price. Mobile Centrex services are one option among a growing set of services aimed at rationalizing the mobile charges while maintaining PBX functionality.

Business Impact: This impacts the voice services and enterprise uses and provides an opportunity to eliminate duplication of voice services within one organisation. This can be a costly duplication illustrated by duplicate handsets, duplicate subscription, multiple numbers and management of multiple bills and providers. A mobile Centrex service also provides the opportunity to move the PBX off the premises and onto the network, which frees up employee resources that were used to manage the PBX. While several of these services are known to scale up to thousands of users, the primary target is expected to be the small and midsize enterprises, which have high requirements for mobility, for example, a consulting firm.

Market Penetration: One percent to 5 percent of target audience

Maturity: Adolescent

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Sample Vendors: Netcom; NTT DoCoMo; Pannon; TeliaSonera

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Katja Ruud

4.4 Wearable Computers

Definition: Wearable computers are light, compact body-mounted PCs, typically offering speech input and a head-mounted display or pocket-sized screen. Primary uses are mobile industrial inspection and maintenance.

Position and Adoption Speed Justification: Wearable computers remain a niche market for industrial "hands busy" applications such as warehousing. Within this niche, the technology is relatively well-established. Elements of the technology (particularly the head-mounted display and input techniques) must progress before they can have a broader impact. Aural rather than visual channels appear to be more acceptable for wearable devices, as indicated by the growth of ear-mounted attachments for cell phones.

User Advice: Focus wearable computing investigations on mobile users with a compelling need for hands-free interaction.

Business Impact: Mobile industrial inspection and maintenance, as well as customer check-in.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: Symbol Technologies; Xybernaut

Appears In Hype Cycle:

I "Hype Cycle for Human-Computer Interaction, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Jackie Fenn; Ken Dulaney

4.5 Fixed-Mobile Converged Voice Service

Definition: Service convergence is when an operator offers services that are integrated across stand-alone services, such as voice mail or a directory system that embraces voice over Internet Protocol (VoIP) and cellular subscripts. A fixed-mobile converged voice offering is a similarly integrated voice offering using one handset.

Position and Adoption Speed Justification: There are still very few commercial fixed-mobile converged voice services, but several more are in trial, and further service launches

are expected in the second half of 2006 and beyond. Current services have used Bluetooth to connect to the fixed network, and the range of handsets has been very limited. Next-generation services to be launched in 2006 will instead use Wi-Fi, and the range of available handsets will be larger.

User Advice: Users should carefully assess the potential return on using these services, including the cost of swapping out the established handsets. It is also likely that the established wireless LAN will need to be upgraded. Mobile operators may well provide location-based tariffs in response or larger buckets of minutes to counter a potential threat.

Business Impact: This impacts the voice services and enterprise uses and provides an opportunity to eliminate duplication of voice services within one organisation. Duplication can be costly as illustrated by duplicate handsets, duplicate subscriptions, duplicable numbers and management of multiple providers, including provisioning and billing. Fixed-mobile converged voice services are aimed at meeting the requirements for mobility and convenience in the form of one handset, one voice mail and one number, but they do so at a lower cost than relying on a pure cellular solution. The impact can therefore be high from a cost perspective and from a convenience perspective.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: BT Group; TeliaSonera

Appears In Hype Cycle:

I "Hype Cycle for Networking and Communications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Katja Ruud

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4.6 Mobile Sales Force Automation for Call Reporting

Definition: Use of wireless and mobile technology to meet service-level agreements, and follow up with prospects or current customers regarding sales or service issues.

Position and Adoption Speed Justification: Lower priority than other wireless initiatives using sales force automation (SFA) technology; most applicable to mature sales organizations and cultures.

User Advice: Avoid over- or under-investment; consider the maturity of the organisational sales force process, the value of improved accuracy and the ability to act on information.

Business Impact: Low to moderate — important for implementing customer-intimacy strategies.

Market Penetration: One percent to 5 percent of target audience

Maturity: Emerging

Appears In Hype Cycle:

I "Hype Cycle for CRM Sales, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: William Clark

5.0 At the Peak

5.1 Presence on Mobile

Definition: The concept of presence, which originated with PC-based instant messaging (IM) applications, is about how one can find out about the status of another person using a mobile device as the point of query. The mobile is also used to update one's personal presence status. Based on the Open Mobile Alliance Instant Messaging and Presence Service (OMA IMPS) specifications, presence status includes client device availability (my phone is switched on/off, I am in a call), user status (available, unavailable, in a meeting), location, client device capabilities (general packet radio service [GPRS], voice, text, Multimedia Messaging Service [MMS], Java, and so on) and searchable personal statuses, such as mood and hobbies. With a high degree of personal information available to the querying user, presence information should be made available only on a permission basis. Presence information is frequently closely tied to location awareness.

Position and Adoption Speed Justification: To offer presence information via the mobile device, an "ecosystem" of mobile devices and application servers, as well as interoperability among both handsets and interworking with existing network infrastructure, is required. OMA, which is formed by mobile carriers, device makers, network suppliers, IT companies and content providers, has been working on a set of common features, functionality and specifications to create an interoperable solution. OMA compliant handsets and solutions have been finding their way in the market since March 2005. However, carriers have been grappling with the problem of how to offer a presence service, because the business case for presence is often unclear. Most subscribers may not be

willing to pay for presence information, but they may be willing to pay for an application that capitalizes on the use of presence, such as IM and mobile games. The cost associated with the network load required to support the service also outweighs the potential revenue that the carrier may recover for the service. Carriers also question whether the launch of presence will have a negative impact on the use of voice mail, text and voice calls.

User Advice: The business case for a presence service is not straightforward, but without presence information, offerings such as IM or push-to-talk over cellular (PoC) will not be complete. Carriers must justify a presence solution based on the business case of these applications. Carriers have to exercise caution in ensuring that the presence service offered can be easily interworked with future applications, as well as presence-capable handsets. A permission-based presence solution is a given.

Business Impact: Presence must be bundled with IM/mobile games or other mobile applications to provide added value to mobile subscribers. As with any other mobile data service, for presence to have an impact on an end consumer, it must be ubiquitous and workable, regardless of carrier, network or handset model and brand. For these reasons, presence will be consumer-driven feature rather than enterprise-driven.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: Motorola; Nokia; OZ Communications

Appears In Hype Cycle:

I "Hype Cycle for Consumer Mobile Applications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Eleana Liew

5.2 Mobile TV Broadcasting

Definition: The broadcasting of digital TV programs to cellular handsets using technologies such as Digital Video Broadcasting — Handheld (DVB-H) and Terrestrial Digital Multimedia Broadcasting (T-DMB).

Position and Adoption Speed Justification: Many trial projects were run in 2005, in countries such as Australia, Finland, France, Germany, Italy, Spain, the U.K. and the U.S.

We expect commercial services to launch in a few markets — Italy, Germany and the U.K. among them — in the second half of 2006, to add to those already operating in South Korea and Japan. The U.S. should see commercial services in 2007. The key hurdle for widespread launches of commercial DVB-H services is a lack of free spectrum. Mobile carriers may also struggle to define the right business model — and, even more fundamentally, to stimulate enough demand from consumers.

User Advice: Mobile carriers should:

- Forge strong relationships with content owners. They will only manage this if they are willing to give content owners a fair share of the profits.
- Acquire rights to use content.
- Learn from the success (or otherwise) of narrowcast services before investing in a broadcast network.

This will give them a better idea than the results of broadcasting trials of how much people are prepared to pay for mobile TV and of what types of program they prefer. If, having done this, carriers commit themselves to offering broadcast services, they should consider finding partners or buying capacity from wholesalers to minimize the infrastructure costs associated with building a network.

Business Impact: Mobile TV broadcasting will affect all areas of video production, rights management, syndication and advertising.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: DiBcom; LG; Nokia; Philips; Sagem; Samsung; Siemens; Texas Instruments

Recommended Reading:

I "How to Stimulate Interest in Mobile Video"

Appears In Hype Cycle:

I "Hype Cycle for Consumer Mobile Applications, 2006"

I "Hype Cycle for Consumer Technologies, 2006"

I "Hype Cycle for Media Industry Entertainment, 2006"

I "Hype Cycle for Telecommunications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

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5.3 Mobile Search

Definition: Capabilities that enable mobile phone users to find information and content online, whether through the search engine on their carrier's portal, a third-party search portal, or a client application preinstalled on the handset or subsequently downloaded. In addition, material can be requested by text message using the Short Message Service (SMS).

Position and Adoption Speed Justification: Google's popularity on the Internet has prompted many people to expect similar search capabilities on mobile phones at the touch of a button, wherever they are. As a result, mobile operator Vodafone has linked up with Google to make its search capabilities part of the Vodafone live! service, and Google and Yahoo have set up portals that support mobile search functions. In addition, several phone makers, such as Nokia and Motorola, are to put a Google icon on some of their handsets. There are, however, two short-term hindrances to widespread adoption of mobile search services:

- A lack of mobile content. Despite significant growth, the amount of mobile content available is still dwarfed by the mass of Internet material for PC users. Hence, searching from a mobile handset is more likely to yield irrelevant results and links to pages that cannot be viewed on the device in question.
- Poor usability. Internet search providers have mostly just scaled down their Internet search engines for the mobile environment. They generally haven't addressed issues such as how to input search queries easily, make content immediately available and categorize results on mobile handsets. Some specialist mobile search providers have done a better job, but they aren't as well known to mobile carriers. Consequently, their services have yet to be widely deployed.

User Advice: To succeed, mobile search services need the support of mobile carriers, specialist portal firms, content providers and mobile phone makers. The carriers, in particular, should ensure that:

- Information and content are available in formats suited to the small screens of mobile handsets.

- Search menus are short and yield relevant results with a minimum of clicks as part of user-friendly interfaces.
- Time-sensitive information is available and can be found, as some people want real-time updates on things like traffic congestion and stock market quotes.
- Search services are available on a wide range of mobile devices.
- They have good business relationships with mobile portals, content providers and handset makers.

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Business Impact: Mobile search capabilities will help to increase sales of content in the short term, and may generate advertising revenue for mobile carriers in the long term. They may also help to keep mobile subscribers loyal.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: Google; InfoSpace; MotionBridge; Yahoo

Appears In Hype Cycle:

I "Hype Cycle for Consumer Mobile Applications, 2006"

I "Hype Cycle for Telecommunications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Kobita Desai; Sandy Shen

5.4 Telecom Expense Management: Wireless

Definition: Moving from a managed services scenario to full business process outsourcing (BPO) offerings, telecom expense management (TEM) companies manage sourcing, provisioning, service management and billing of telecom capital through improved asset management, generally online.

Position and Adoption Speed Justification: Full-service offerings are maturing; fewer than 10 percent of TEM lines are full-service offerings, and these companies are generally smaller and lack financial viability. This is becoming a competitive market, with few differentiated offerings. There will be considerable consolidation in this industry in the next 18 to 24 months.

User Advice: Measure internal resources for telecom management as well as how mobility will fit into a holistic outsourcing strategy.

Business Impact: TEM reduces the costs of mobile devices and services and provides management where once there was none.

Market Penetration: One percent to 5 percent of target audience

Maturity: Emerging

Sample Vendors: BBR Wireless; ProfitLine, Rivermine; Traq; Vercuity

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Phillip Redman

5.5 Wireless Instant Messaging

Definition: The use of peer-to-peer instant messaging (IM) over a wireless network includes presence information and "buddy" lists. Wireless IM services may be offered by mobile operators through proprietary IM systems or through gateways that interconnect to the key Internet IM providers, such as AOL, Yahoo and MSN. Alternatively, mobile users may download IM clients on their enhanced mobile devices and use Internet IM services, regardless of the mobile operator's support.

Position and Adoption Speed Justification: Despite the growing hype in this area, wireless IM is still rather immature as a result of various issues on the technical and business side. Some standards are developing, such as the Wireless Village initiative with the Instant Messaging and Presence Services (IMPS) protocols as part of the Open Mobile Alliance

(OMA), or Jabber at the Internet side. However, the technology situation remains pretty fragmented at both the Internet and mobile side, with many different IM solutions. Most mobile operators have deployed a proprietary closed solution for wireless IM. They offer IM services to their customer base, with Short Message Service (SMS)-like tariffs, to balance the progressive adoption of Internet IM among consumers, which represents a potential disruption to their lucrative business on SMS. This approach doesn't match the expectations of mobile consumers that increasingly would like to extend on mobile devices their preferred Internet IM services, such as AOL and MSN, to be able to keep in touch with their family members, friends and other communities, and also when they are on the move. Key mobile operators, such as China Mobile, Telia Sonera, TMobile,

Telefonica, TIM and Vodafone, recently announced their intention to achieve interoperability among their proprietary IM solutions by following the IMPS approach — making service availability broader. However, consumers want Internet IM on their devices, and in the long run, mobile operators will need to support interaction with them. A few operators already take this approach, for example, Cingular with MSN and i-mode with MSN and Yahoo. One thing that is missing in the current wireless IM implementation is real-time presence information, including location, as well as effective integration of IM with other applications, such as wireless e-mail and SMS, to build a converging experience for end users.

User Advice: Carriers should abandon the closed proprietary approach and pursue real integration with established Internet IM systems, such as AOL and MSN, if they want to effectively face the growing competition and potential disruption it may bring to SMS business. Internet IM providers should make available carrier independent mobile interfaces to their IM services to enable their subscribers to access the service with mobile devices as well as computers. Enterprises may have difficulties deploying wireless

IM to their employees because of fragmentation, and in the short term they should consider wireless e-mail or SMS.

Business Impact: Mobile operators may see wireless IM as an opportunity to deliver a comprehensive offering around converging personal messaging, instead of as a threat.

Market Penetration: One percent to 5 percent of target audience

Maturity: Emerging

Sample Vendors: Comverse Technology; LogicaCMG; Openwave; OZ Communications

Recommended Reading:

- "Location and the Future of Interpersonal Messaging"
- "Mobile Carriers Should Embrace Internet-Based Instant Messaging Services"
- "Wide Array of Communications Overwhelms Users"

Appears In Hype Cycle:

- "Hype Cycle for Collaboration and Communication, 2006"
- "Hype Cycle for Consumer Mobile Applications, 2006"
- "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Monica Basso

5.6 Multichannel Application Gateways

Definition: Multichannel functionality architectures will be built into application platform suites to re-purpose mostly business-oriented content across disparate networks to multiple devices. However, multichannel application gateways (MAGs) will provide cross-application delivery and management options that will simplify the deployments.

Position and Adoption Speed Justification: MAGs have matured rapidly during the past 36 months, transforming from relatively simple application and content delivery engines into fully featured application design, deployment and management gateways, with best-of-breed products extending beyond mobile devices to browser-based and voice-based application interactions.

User Advice: Users investigating strategic solutions to support more than three disparate applications, three operating systems or longer-term deployment time frames should consider MAGs; otherwise, they should investigate more application-focused tactical solutions.

Business Impact: According to Gartner research, fewer than 20 percent of all enterprises invest strategically in MAGs, thus limiting the total potential market for these architecture-based solutions (and forcing smaller vendors to sell based on application functionality). However, this percentage is increasing year-over-year, so the market has
extensive growth potential in addition to significant amounts of M&A activities from the larger independent software vendors.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: IBM; Oracle; Sybase

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Michael King; Phillip Redman

5.7 Mobile Payment

Definition: Services that let people make payments from a mobile phone. They can, for example, settle bills, buy movie or parking tickets, use vending machines and shop on the Web.

Position and Adoption Speed Justification: SMS-based mobile payment technology is mature, but handicapped by poor usability and a lack of security. A solution based on smart cards is presently used only in Japan, but could be adopted in other countries where contactless infrastructure has been widely deployed. The biggest challenge is to persuade leading handset manufacturers to integrate smart cards into mobile phones.

User Advice: Mobile carriers should:

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Build an extensive network of merchants and banks that accept mobile payments. One way to do this is to work with third-party providers that have established processing relationships with banks and merchants for card- or Internet-based transactions. Carriers could then use those relationships to create a viable mobile payment system.

Address the usability of SMS-based interfaces. One option is to integrate the payment function into mobile handsets, so that users can send requests from the phone menu, rather than have to memorize short codes.

Business Impact: Mobile payment affects wireless data services. There is potential to support micropayments.

Market Penetration: One percent to 5 percent of target audience

Maturity: Emerging

Sample Vendors: Axalto; NEC Japan; NTT DoCoMo; UMPay

Appears In Hype Cycle:

I "Hype Cycle for Consumer Mobile Applications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Sandy Shen

5.8 Mobile Device Management

Definition: Mobile device management is software or services to manage mobile devices. Mobile devices include laptops, PDAs and smartphones. While laptops are often managed in similar methods to desktops, there are specific and unique mobile requirements for managing configuration (for example, inventory/discovery and deployment) and security. Mobile devices have user-controlled connectivity, bandwidth constraints, and application-specific needs, and may require extensive rigor for the security for both access and

configuration because of device ownership issues. As PDAs and smartphones increasingly get more processing and memory capabilities, in some cases rivaling the capabilities of a PC a couple of years ago, IT organisations need to start applying the same processes and methods to manage mobile devices as they do with desktop PCs.

Position and Adoption Speed Justification: Mobile systems management technology is maturing, but not widely adopted. Many different types of vendors are looking at providing software products for mobile device management. These include large systems vendors (for example, CA and IBM-Tivoli), PC life cycle configuration management vendors (for example, Altiris, Avocent, LANDesk, BMC, HP-Novadigm, Microsoft, Novell, and so on), as well as the consolidated market of dedicated mobile systems management vendors (for example, Sybase-iAnywhere, Nokia-Intellisync, Capricode and Insignia) and security-focused vendors (for example, Symantec, Credant,
SecureWave and Full Armor). In addition, mobile operators and remote access service providers are also marketing mobile device management as a service (for example, iPass). The large number of vendor categories claiming the device management space, as well as the massive consolidation tends to confuse buyers. In addition, midsize and large organisations tend to shy away from mobile-operator-provided management solutions they are perceived as a potential lock-in.

The products or services have been successful only among some large enterprises, and adoption has been slowed by the need to complement suite products with point solutions to get a workable end-to-end solution. The need for integration with mobile operators to provide over-the-air management of devices is another aspect that complicates the selection. The challenge remains for either a ubiquitous or more-critical mobile application to drive IT to better manage these devices as they do desktops, and until that happens, the vendor landscape will be driven by specific requirements, which leave the market with a diverse cross section to choose from. However, as occurred in the PC life cycle configuration management market, we expect the configuration management vendors to continue to enhance security functions, causing more consolidation across the vendor landscape.

User Advice: Large organisations need to start managing mobile devices the same way as they manage PCs, which may require that device ownership/purchase is separated from the mobile service subscription to improve manageability and control and to reduce support

cost by reducing the number of variations. In some cases (mobile-specific applications, specific bandwidth requirements, or a diverse PDA or smartphone environment) may require multiple solutions for management and security until systems management and PC life cycle configuration vendors enhance their solutions to meet the broad and diverse needs of mobile devices.

Business Impact: Mobile device management will become increasingly important to organisations as more mobile devices are being used in business-critical applications. Initially, benefits are most visible in sales force and workforce management deployments where improved device management can increase availability and productivity as well as decrease support cost.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Adolescent

Sample Vendors: Altiris; BMC-Marimba; Capricode; Computer Associates; HP-Novadigm; IBM Tivoli; LANDesk; Microsoft; Nokia; Novell; Sybase; Symantec

Recommended Reading:

I "Intellisync Deal Offers Nokia Enterprise Inroads"

I "Key Advice on How to Support PDAs and Smartphones in Business"

I "Mobile System Management Vendors Consolidate Across Configuration Markets"

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Leif-Olof Wallin; Ronni Colville

5.9 Mobile TV Streaming

Definition: The streaming of live TV from cellular networks to mobile handsets using narrowcasting or multicasting technology.

Position and Adoption Speed Justification: The streaming of live programs has grown in importance for mobile operators, now that many of those in developed markets have launched high-speed third-generation (3G) networks and are looking for a "killer application" to justify their investment. But use of these services remains very limited,

because of the comparatively small number of 3G handsets sold, off-putting prices and a lack of suitable content.

User Advice: Mobile carriers should:

- Offer the right content at the right price. Understand that, to start with, people may prefer to pay for individual programs to get a feel for what is available, but that, later, it will make sense to adopt a subscription model based on different content packages for different tastes.
- Welcome advertising to help pay for services, but, as with mobile TV broadcasting, take care that it doesn't annoy viewers.

Business Impact: If priced incorrectly, the cost of supplying mobile TV streaming services could exceed the revenue they generate for carriers. Streamed services are expensive to run, so carriers can only afford to offer them for free or as part of flat-rate bundles for limited periods. On the other hand, carriers need to attract users with eye-catching deals. It's a tricky balance to strike. If demand does grow, carriers should use streaming services for "premium" content in particular, and offer them alongside
broadcast programs.

Market Penetration: One percent to 5 percent of target audience

Maturity: Adolescent

Sample Vendors: MobiTV

Recommended Reading:

I "How to Stimulate Interest in Mobile Video"

Appears In Hype Cycle:

I "Hype Cycle for Consumer Mobile Applications, 2006"

I "Hype Cycle for Media Industry Entertainment, 2006"

I "Hype Cycle for Telecommunications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Carolina Milanesi

5.10 Unified Communications

Definition: Unified communications (UC) is the direct result of convergence in communication networks and applications. Differing forms of communication have historically

been developed, marketed and sold as individual applications. The convergence of all communications on IP networks and on open software platforms is allowing a new paradigm for UC and its impact on how individuals, groups and organisations communicate.

Gartner defines UC products (equipment, software and services) as those that enhance individual, workgroup, and organisational productivity by enabling and facilitating the control, management, integration, and use of multiple enterprise communication methods. UC products achieve this through convergence and integration of the communication channels (that is, media), networks, systems and business applications, as well as through consolidation of controls over them. UC products may be made up of a stand-alone product suite or from a portfolio of integrated applications and platforms.

UC products are used by employees for their own communications as well by enterprises to support workgroup and collaborative communications. These products also extend UC outside of the boundaries of a company to enhance communications between organisations and to support interactions among both very large public audiences and specific individuals.

Position and Adoption Speed Justification: UC solutions are now emerging onto the market. They represent a consolidation and convergence of capabilities that previously were available only separately. Key functional areas that are being combined include PBX, IP-PBX, softphones, voice mail, unified messaging, e-mail, desktop calendaring, audioconferencing, Web collaboration, videoconferencing, presence and instant messaging.

User Advice: Users should review the existing communication servers to see how they could offer more value by being integrated. They should also review business processes to see how these could benefit by being communication-enabled. Pilots can be undertaken to evaluate the solutions. A migration path should be developed so that as communications equipment is updated or acquired, it has a better chance of fitting into a broader portfolio.

Business Impact: UC improves the communications ability of individuals, groups and enterprises. This is typically reflected in speedier response to events and increased availability of accurate information.

Market Penetration: Less than 1 percent of target audience

Maturity: Embryonic

Sample Vendors: Alcatel; Cisco; IBM; Microsoft; Nortel; Siemens

Recommended Reading:

I "Achieving Agility Through Communication-Enabled Business Processes"

I "Magic Quadrant for Unified Communications, 2006"

Appears In Hype Cycle:

I "Hype Cycle for Collaboration and Communication, 2006"

I "Hype Cycle for Contact Center Infrastructure, 2006"

I "Hype Cycle for Enterprise Communications Applications, 2006"

I "Hype Cycle for High-Performance Workplace, 2006"

I "Hype Cycle for Networking and Communications, 2006"

I "Hype Cycle for Telecommunications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Bernard Elliot

6.0 Sliding Into the Trough

6.1 Wireless Audio/Video Streaming

Definition: Streaming of Internet audio and video content to mobile devices.

Position and Adoption Speed Justification: Streaming audio and video services continue to see slow adoption among consumers; interestingly, outside such markets as Korea and Japan, this has not deterred massive investment and partnerships by companies as wide-ranging as Qualcomm, MobiTV and Samsung. However, do not expect significant consumer adoption to occur until several key criteria are met:

- Availability of high-speed, third-generation networks
- Near-ubiquitous and unlimited pricing at reasonable levels (less than $15)
- Penetration of larger (more than 2.5-inch) screens and handsets at more than 30 percent
- Extended-life batteries offering more than two hours of connect and display time

The last of these criteria is likely to take the longest; hence, don't expect to see significant adoption in the next one to three years. Most of the investment has centered on a carrier-centric distribution model. The next wave of investments in streaming services will arise from the media companies positioning themselves to offer their owned properties across a variety of carriers. At this point, the struggle for "ownership" of the customer will surface again. Finally, consumers have not gotten involved in this battle, and we expect technologies such as the Slingbox and the media PC to enable end users to "take control" of their owned content and serve it up to any device on any network, regardless of carrier or device affiliation.

User Advice: Content is key to driving market uptake for audio and video streaming, and sticky content on the portal is a plus. Initially, many users will use carriers as their main access points for content. However, in the long term, carriers will lose control over content, because technologies and direct-to-consumer models will enable consumers to bypass the carrier conduit. Carriers should work with vendors to facilitate easy access to the service — integrate the streaming icon into the handset menu that directs users to their own or affiliated sites, and build interactivity into the service to bring users back.

Business Impact: Wireless data service.

Market Penetration: One percent to 5 percent of target audience

Maturity: Adolescent

Sample Vendors: Alcatel; Ericsson; Motorola; Nokia

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Michael King; Sandy Shen; Phillip Redman

6.2 Voice over Wireless LAN Phones

Definition: Voice over wireless LAN uses Wi-Fi only phones that work only on a wireless LAN.

Position and Adoption Speed Justification: Few models are available, plans for new devices have been scaled back and deployments have been late.

http://www.gartner.com/DisplayDocument?doc_cd=140973&format=html (13 of 26) 12/02/2007 09:31:18 Hype Cycle for Wireless Hardware, Software and Services, 2006

User Advice: Use Wi-Fi only phones or softphones instead of waiting for dual-mode phones in vertical industry (manufacturing, retail, healthcare) uses.

Business Impact: Voice over wireless LAN would be used by companies with a local need for mobile voice communications. This works well as a replacement for expensive private mobile radio systems and is primarily being adopted in the healthcare, retail, education and manufacturing industries.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: Most Wi-Fi vendors

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Phillip Redman

6.3 Location-Aware Services

Definition: Location-aware services are mobile services offered by carriers or service providers that exploit the user's geographical position detected through location technologies in the cellular network or in the mobile devices; for example, a find-a-friend service and child-locating service.

Position and Adoption Speed Justification: There are regional differences for the adoption of location-aware services. In Asia/Pacific, millions of subscribers in countries such as Japan and South Korea have adopted these services (such as J-Phone's J-Nav services or i-mode location services). In Europe, mobile operators have launched location services (such as Telefonica's Localizador de Persona) as well as service providers (such as Child Locate). In the United States, most efforts are made around emergency services, but there is little offering for commercial services. Major problems include the complex systems, a fragmented offering and no strong commitment from mobile operators.

User Advice: End-user organisations should consider potential benefits of location-aware applications but look to GPS-enabled devices with ad hoc applications rather than carrier-based services.

Business Impact: Location-aware services impact mobile marketing.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Adolescent

Sample Vendors: LocationNet; MapInfo; Mobilaris; Navtech; Tele Atlas; TomTom; Wayfinder; Webraska Mobile Technologies

Recommended Reading:

l "Advantages and Disadvantages in a Location-Aware Society"

l "Mobile Location Services for Governments"

l "Planning for Mobile Location Services in Government"

Appears In Hype Cycle:

l "Hype Cycle for Telecommunications, 2006"

l "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Monica Basso

6.4 Mobile Sales Force Automation for Opportunity Management

Definition: Tight integration of opportunity databases, using sales force automation (SFA) technology on smartphones or wireless PDAs. Enable schedules and tasks for marketing, inside sales, mobile sales and field forces to be automatically updated.

Position and Adoption Speed Justification: Despite much hype before the collapse of the technology bubble, particularly in pharmaceutical sales, most organisations still find it very difficult to tightly integrate back-end sales applications with calendaring functions on mobile devices. Adoption is also slowed by the challenges of providing a rich user experience on devices with limited screen size and inputting capability.

User Advice: Evaluate vendors on their road map for providing a software platform that unites the mobile e-mail, personal information manager (PIM) and opportunity management functions. View workgroups based on the need for collaboration and put processes in place to collaborate across workgroups to maximize customer intimacy.

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Business Impact: Can be very high in cases that require team selling or close collaboration across sales and marketing functions. But business impact is typically moderate, as most organisations have not yet reached this level of process efficiency. Opportunity management using mobile SFA requires an overarching business strategy to drive higher benefit levels that include shortened sales cycles and increased revenue per sale.

Market Penetration: One percent to 5 percent of target audience

Maturity: Emerging

Sample Vendors: Oracle; Salesforce.com; Saratoga Systems; SAP; Siebel Systems

Recommended Reading:

l "IT Must Factor Sales Culture Into Mobile SFA Device Selection"

l "Use Sales Force Role Requirements to Choose Mobile Devices and Connectivity"

Appears In Hype Cycle:

l "Hype Cycle for CRM Sales, 2006"

l "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: William Clark

6.5 Distributed Antenna System

Definition: A distributed antenna system uses passive (non-powered) or active (powered) networking equipment, such as antennas, fiber optics, coaxial cable and other technologies to extend radio frequency (RF) coverage (any technology) inside a building.

Position and Adoption Speed Justification: Distributed antenna technology is provided through wireless operators or third-party vendors and has low market penetration. However, awareness and technology capabilities are increasing.

User Advice: Assess the need for in-building wireless support and look first to see if your wireless vendor will pay or subsidize your system. Also see if it makes sense to piggyback wireless LAN onto this system.

Business Impact: A distributed antenna system could vastly improve in-building coverage for most wireless technologies and services and lower costs for support.

Market Penetration: Less than 1 percent of target audience

Maturity: Emerging

Sample Vendors: Andrew; Inner Wireless; LGC Wireless; Mobile Access Networks

Appears In Hype Cycle:

l "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Phillip Redman

6.6 Mobile Applications on Demand

Definition: Mobile applications on demand enable organisation to purchase stand-alone or incremental mobile solutions as services behind the firewall or as an offering hosted by a provider.

Position and Adoption Speed Justification: This technology is positioned post the Trough of Disillusionment as market players begin to scale business models. The adoption

rate will increase in enterprises that find advantage in trading operating expenses for capital expenses.

User Advice: Look at mobile software as a service and application service providers (ASPs) for tactical advantage, especially at a departmental level or when IT resources or capital budgets are too limited to address mobile project requirements. IT organisations and business units must assess the functional fit (although most mobile ASPs can provide limited tailoring) and ensure that there is adequate out-of-the-box configurability.

Business Impact: Mobile applications on demand can, in some instances, reduce the break-even payback time on mobile projects to less than two months by lessening capital expenditures on software, especially if mobile devices are also leased. ***Market Penetration:*** One percent to 5 percent of target audience

Maturity: Emerging

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Hype Cycle for Wireless Hardware, Software and Services, 2006

Sample Vendors: Gearworks; Salesforce.com; Xora

Appears In Hype Cycle:

I "Hype Cycle for Software as a Service, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: William Clark

6.7 Push-to-Talk Over Cellular

Definition: Push-to-talk over cellular (PoC) is a real-time, one-to-one and one-to-many mode of voice communication over a mobile device. Unlike conventional voice calls on mobile, which are over a circuit switch (CS), the voice burst on PoC is converted to packets and is carried via data channel. PoC users do not need to dial the other party's number to initiate a call. All that is required will be the push of a button upon selection of the party being called, and the voice burst would be sent across to the recipients. Similar to traditional walkie-talkie service, PoC is half duplex; only one party is able to speak at any time. Based on Open Mobile Alliance's (OMA's) PoC specifications, group advertising and instant personal alerts are also included.

Position and Adoption Speed Justification: Because PoC is a form of voice communication among two or more people, for an uptake of PoC, handset penetration is

critical. Rates of new handset take-up vary from operator to operator and from country to country and could take anywhere from several months to several years. In addition, because of the initial lack of standards and launch of a pre-standards solution, many carriers that have launched PoC solutions are unable to provide support for multiple brands of handsets and carrier interoperatability, limiting the range and the number of users that a subscriber can select from and talk to. Finally, because of the lack of quality of service and capacity on the established mobile data network, carriers have been faced with negative feedback on the PoC service they have launched. In response, carriers have toned down expectations for their service, and after their initial launch, they have been cautious about marketing it aggressively.

User Advice: Operators must acknowledge the limitations of the existing PoC solutions and review how they fit with their product portfolio and customer segmentation strategies. When competitive pressures exist, consider a phased launch. Each phase must target a different segment, with different tariffs and PoC value-added features for differentiation (see "Push-to-talk Overcoming Implementation Challenges in Asia/Pacific" and "Mobile Operators in Asia/Pacific Learn from Launch of Push-to-Talk"). Operators would also do well to ensure that their implementations are standards-based, so as to obtain the widest support for their handset. Carriers should also negotiate upgrades to future OMA PoC-compliant releases that allow for inter-operatability and sharing of presence information.

Business Impact: Enterprise uptake of PoC has been dismal, because most, if not all, carriers have been unable to guarantee quality of service. Because of latency and insufficient bandwidth, the experience for enterprise customers has been poor. Because of network limitations, PoC uptake is likely to be driven by end consumers rather than enterprise users.

Market Penetration: Less than 1 percent of target audience

Maturity: Adolescent

Sample Vendors: Ericsson; Motorola; Nokia

Recommended Reading:

I "Mobile Operators in Asia/Pacific Learn from Launch of Push-to-Talk"

I "Push-to-talk Overcoming Implementation Challenges in Asia/Pacific"

Appears In Hype Cycle:

I "Hype Cycle for Consumer Mobile Applications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Eleana Liew

6.8 SIP-Based Push to Talk

Definition: Session Initiation Protocol (SIP) supported instant messaging (IM) and voice over IP (VoIP), with additional voice and video messaging services to follow. Push-total (PTT) functionality has been the primary focus of these wireless VoIP sessions.

Position and Adoption Speed Justification: Faster networks with higher capacities enable SIP-based services. Better processors and more memory at the device layer enable the clients to run on a larger number of devices. However, limited user penetration (outside of Nextel) has reduced the carrier focus on PTT services, and few handset vendors have dedicated hardware to provide these services (dedicated PTT button on a handset).

User Advice: SIP-based messaging services are viable today, although not comparable to in-band service, such as Nextel's PTT. A longer-term push to IP services may be an alternative way to deliver voice, text and video messages (including IM).

Business Impact: Wireless voice application will benefit for the increased availability of these SIP-based services, although current "real world" examples of these are hard to find.

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Market Penetration: One percent to 5 percent of target audience

Maturity: Emerging

Sample Vendors: Kodiak Networks; Sonim; Winphoria Networks

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Michael King; Phillip Redman

6.9 Wireless Video Calling

Definition: Wireless video calling is the ability for users to conveniently make peer-to-peer video calls via Universal Mobile Telecornmunications System (UMTS) and CDMA2000 handsets equipped with video camera function.

Position and Adoption Speed Justification: Diffusion of devices is limited as a result of price, functionality and network support. The basic hygiene factors for the uptake of this

service are: 1) ubiquitous terminals; 2) attractively priced models; and 3) attractive service pricing.

User Advice: Likely adopters of video call are the end consumers, rather than enterprise users. Drivers include consumer-oriented third-generation (3G) handsets and marketing activities, from both carriers and handset manufacturers, targeting the end consumers. Apart from exploring simple, intuitive and attractively priced video call tariffs, carriers could capitalize on the video call platform to offer other value-added services that make use of both the video and interactive component of a video call.

Enterprise wide use of video call would be limited to niche segments and international video calling (mobile to mobile). Enterprises should check with their carriers to ensure that their carrier supports interoperator video calls. In addition, enterprises should review tariff rates for international video calls, because these are usually priced at a premium compared with international voice calls.

Business Impact: Wireless applications.

Market Penetration: One percent to 5 percent of target audience

Maturity: Adolescent

Sample Vendors: Ericsson; LG; NEC; Nokia; Panasonic; Samsung; Sony Ericsson

Appears In Hype Cycle:

I "Hype Cycle for Consumer Mobile Applications, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Eleana Liew

6.10 Mobile Sales Force Automation for Orders/Inventory

Definition: Use of wireless applications to improve timeliness, accuracy and currency of order and/or inventory information.

Position and Adoption Speed Justification: Lower wireless connectivity costs and cheaper devices are improving the return on investment of mobile order and inventory management. This is becoming more common among sales forces in industries with tight margins, where inventory carrying costs and stock-out situations are a major concern. Typically, wireless order/inventory management is difficult to implement, because of the amount of back-end integration required.

User Advice: This has the most impact on consumer package goods, retailers and merchandisers. IT must assess mobile business workflow carefully; noting particularly how

fast information can be passed between parties involved in a transaction, how frequently underlying IT systems can provide updates, and how quickly physical systems or partners can respond. By doing so, IT can determine the optimal set of order and inventory fields required in the application, which reduces the need for "big bang" integration, where large chunks of databases need to be replicated.

Business Impact: Very high — has a direct effect on customer satisfaction/fulfillment.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Adolescent

Sample Vendors: Apresta; Salesforce.com; Siebel Systems

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Appears In Hype Cycle:

I "Hype Cycle for CRM Sales, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: William Clark

6.11 Symbian OS for Enhanced Smartphones

Definition: Symbian OS is a software platform that's designed to be used on handheld devices, specifically smartphones and cellular PDAs. It competes with other platforms such as Microsoft Windows Mobile, Research in Motion OS, Palm OS and mobile Linux. Symbian's largest supporter is Nokia, and Sony Ericsson supports a minor product set.

Position and Adoption Speed Justification: Symbian is perfectly acceptable for basic smartphones, but to compete in higher-end deployments, it must improve its integration with back-end enterprise systems. This effort can take many years to complete; thus, we estimate five to 10 years until it reaches plateau.

User Advice: Symbian OS can be organisations' platform of choice when they deploy narrowly focused "appliance-like" devices, such as handhelds that only support voice mail, e-mail and personal information management. Organisations that have standardized on Symbian's development platform using the C or Java language can also consider this platform.

Business Impact: This technology enables the use of wireless devices in business.

Market Penetration: One percent to 5 percent of target audience

Maturity: Adolescent

Sample Vendors: Symbian

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Ken Dulaney

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6.12 Thin-Client Mobile Application Servers

Definition: Use of thin-client mobile application servers to provide online support (as opposed to multichannel access gateways [MAGs], which provide offline connectivity as well) to provide enterprise-specific content to employees, partners and customers. Content can be general or task-specific. Thin servers benefit from being based on business-to-consumer (B2C) servers that are already scaled to serve millions of users.

Position and Adoption Speed Justification: Long-standing trend that began with mobile access through browsers on a wide range of mobile devices to common information repositories such as corporate directories. Use is now expanding from B2C to business-to-employee (B2E) mobile applications to include travel, time and expense applications. Thin servers have traditionally lagged general adoption of wireless devices and wireless cards for laptops by about two to three years, but have now caught up and are ready to enter the mainstream. Overall adoption will remain relatively slow as a result of the time it takes to prepare workforces to change working patterns around core business processes based on mobile technology.

User Advice: IT departments need to assess thin-client mobile application servers as complements to their MAGs. Location-based services can be used to augment thinserver applications for tracking service-level agreements, for example.

Business Impact: Ability to reduce costs by extending general-purpose Web-based business applications to mobile devices. Impact is high due to ability to scale and manage these solutions for hundreds of thousands of users in an enterprise.

Market Penetration: One percent to 5 percent of target audience

Maturity: Early mainstream

Sample Vendors: IBM; Microsoft; Research in Motion; Volantis

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: William Clark

7.0 Climbing the Slope

7.1 Wi-Fi 'Hot Spots'

Definition: Wi-Fi "hot spots" use Wi-Fi wireless LAN technology to provide remote WAN connectivity at locations such as airports, hotels and shops.

Position and Adoption Speed Justification: Wi-Fi hot spots have low adoption by regular users, even as resold by cellular service providers. Fragmentation of coverage still reins in the market; however, continued integration into remote-access packages will drive some adoption in the next 24 months.

User Advice: Look for low-cost Wi-Fi service add-on to cellular data and remote access packages. Look to managed service providers to incorporate hot-spot services worldwide and incorporate this technology into global wireless data strategy.

Business Impact: Global wireless data technology is preferred because of ubiquity of coverage and standards, lower cost today than global data roaming over cellular.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Emerging

Sample Vendors: Boingo; SBC; T-Mobile; Wayport

Appears In Hype Cycle:

I "Hype Cycle for Transportation, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Phillip Redman

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7.2 Java 2 Micro Edition

Definition: Java 2 Micro Edition (J2ME) is a version of Java designed for use in small devices, such as mobile phones. J2ME is a part of related technologies that include definitions of profiles and configurations for mobile application developers.

Position and Adoption Speed Justification: J2ME has stalled in the Trough of Disillusionment. It is still fragmented and delayed. Developers are reporting instances of poor application performance and scalability compared with native applications.

User Advice: Use J2ME tactically for lightweight applications. Observe the impact of toolkit vendors, such as Tira Wireless, in bridging the fragmentation of implementations. Enterprises using developers trained in Java 2 Platform, Standard Edition (J2SE) or Java 2 Platform, Enterprise Edition (J2EE) need to allow extra time during initial projects for the learning curve for J2ME.

Business Impact: J2ME's impact on business is standardized. It's an operating-system-neutral application interface for wireless devices that promises widespread inclusion by handset vendors.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Adolescent

Sample Vendors: IBM; Sun Microsystems; Tira Wireless

Recommended Reading:

I "Guide to Choosing Architectures for B2C Mobile Applications"

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: William Clark

7.3 Location-Aware Applications

Definition: Location-aware applications are mobile enterprise applications that exploit the geographical position of a mobile worker or an asset, mainly through satellite [http://www.gartner.com/DisplayDocument?doc_cd=140973&format=html (19 of 26) 12/02/2007 09:31:18 Hype Cycle for Wireless Hardware, Software and Services, 2006] positioning technologies, such as GPS or through location technologies in the cellular network and mobile devices; for example, fleet management applications with mapping, navigation and routing functionalities, government inspections, and integration with geographic information system (GIS) applications.

Position and Adoption Speed Justification: An increasing number of organisations have deployed location-aware mobile business applications, mostly based on GPS enabled devices, to support queue business processes and activities, such as field force management, fleet management, logistics and good transportation. Mobile workers use either a PDA or "smartphone," connected via Bluetooth to an external GPS receiver, a GPS-enabled wireless device or a dedicated personal navigation device; however, they may also use laptops or "ruggedized" devices. Location-aware applications also include

messaging, especially in the government sector where operational efficiency can be achieved; for example, the nearest road crew can be dispatched to fix a water break without a delay in determining who is where.

The market is in an early adoption phase, and Europe is slightly ahead of the United States, thanks to the higher maturity of mobile networks, their availability and standardization. Some hype is ongoing around so-called "infomobility services" — for example, location services that enable people to move on streets and roads more easily. Modern countries, in which mobile penetration is extremely high and road traffic congestion is a serious issue, have some potential for adoption. However, these services are in their infancy, particularly when it comes to services for citizens. A number of pilot initiatives were launched in the last couple of years by local municipalities and public transportation companies — for example, a real-time service for public bus users providing the expected time of arrival, delays and coincidences. The limited availability and they lack of integration with other key services, such as mobile payments or booking, make such initiatives experimental and far from showing a real trend of adoption.

User Advice: User organisations with numerous groups of employees moving frequently outside a fixed location — either in a campus, on a national or international basis — should consider the possible benefits of deploying applications that can provide information or support based on the actual geographical location of a person or asset in real time.

Business Impact: Location-aware applications can be deployed in field force automation, fleet management, logistics and good transportation in sectors such as government, healthcare, utilities and transportation.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Adolescent

Sample Vendors: Aventeon; IBM; LogicaCMG; Webraska Mobile Technologies

Recommended Reading:

I "Advantages and Disadvantages in a Location-Aware Society"

I "Planning for Mobile Location Services in Government"

I "Tracking People, Products and Assets in Real Time"

Appears In Hype Cycle:

I "Hype Cycle for Emerging Technologies, 2006"

I "Hype Cycle for Government, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Monica Basso

7.4 Mobile Access to Portals

Definition: This technology provides access to portals by mobile devices.

Position and Adoption Speed Justification: Most portal products provide mobile access to portals, but the user experience is unacceptable for most of them.

User Advice: Explore situations where providing mobile access to the portal, like providing sales personnel access to systems with client data via mobile devices, will deliver business value.

Business Impact: It provides enhanced communications.

Market Penetration: Twenty percent to 50 percent of target audience

Maturity: Early mainstream

Sample Vendors: IBM; Oracle; Sybase

Appears In Hype Cycle:

I "Hype Cycle for Portal Ecosystems, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: David Gootzit; Gene Phifer; Ray Valdes

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7.5 Smartphone

Definition: A smartphone is a mobile terminal capable of voice and data calls. Although it's primarily voice-centric, it can run data applications without being connected to a network. Smartphones typically run market-based operating systems with a rich set of independently supplied applications.

Position and Adoption Speed Justification: Smartphones are only now being considered for enterprise applications. Wireless e-mail was the initial justification. Expansion into other areas will require more maturity in security and management areas (among others).

User Advice: Smartphones should be employed when enterprise applications have to be managed on mobile phone technology.

Business Impact: Anytime, anywhere computing.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Adolescent

Sample Vendors: Motorola; Nokia; Palm

Appears In Hype Cycle:

I "Hype Cycle for Emerging Technologies, 2006"

I "Hype Cycle for Human-Computer Interaction, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Ken Dulaney

7.6 Windows Mobile 5.0

Definition: The latest version of Windows 5.0 can be found on mobile devices, running a subset of Win32 application programming interfaces and applications. Windows Mobile 5.0 is based on the Windows CE 5.0 OS. Windows Mobile supports two classic handheld designs: the Predicted Postprocessed Accuracy (PPA) and smartphone form factors.

Position and Adoption Speed Justification: More original equipment manufacturers are emerging to support this platform, and it's rapidly becoming an enterprise standard for handheld devices. "Ruggedized" handhelds are primarily based on this platform.

User Advice: Windows Mobile makes the most sense for users who desire a single platform for business PDAs, smartphones and ruggedized handhelds from multiple vendors with strong development tools and back-end connectivity.

Business Impact: Mobile device application platform.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Early mainstream

Sample Vendors: Microsoft

Appears In Hype Cycle:

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Ken Dulaney

7.7 Mobile and Portable Device DBMS

Definition: A database management system (DBMS) engine designed for a small footprint used in devices — wired or wireless — that are occasionally connected to a system. Generally a subset of the larger parent DBMS (DB2, Oracle, SQL Server and Sybase) with fewer functions. Normally, these DBMSs include synchronization software used to synchronize the data during system connection.

Position and Adoption Speed Justification: The four major DBMS vendors (IBM, Microsoft, Oracle and Sybase) all offer a mobile DBMS option. These engines vary widely in functionality, maturity and manageability of the DBMS and associated applications, and in the R&D budget invested in them. As the market leader, Sybase iAnywhere solutions (including the DBMS, synchronization and development tools) have helped to drive this segment of the DBMS market toward maturity. One of the main drivers in this market is the increasing availability of wireless infrastructure worldwide, so the development and use of mobile applications is also increasing. In 2006, mobility and [http://www.gartner.com/DisplayDocument?doc_cd=140973&format=html (21 of 26) 12/02/2007 09:31:18 Hype Cycle for Wireless Hardware, Software and Services, 2006] mobile applications ranks in the top three technology issues identified by a Gartner survey described in "Executive Summary: Growing IT's Contribution: The 2006 CIO Agenda." These factors are causing an increasing need for these mobile, small-footprint DBMS engines.

User Advice: Choose your mobile DBMS based on the functions you need. Some of the synchronization software will function with many disparate database sources, but we still recommend a homogeneous environment. Analyze the necessary architecture for the application and choose the DBMS and tools based on this. Re-examine the available tools and DBMS functions regularly, as all the vendors are adding new functions and management tools. Keep a sharp eye on Microsoft. Although not the current leader, it is focusing on mobility and will quickly increase the functions and maturity of its product.

Business Impact: The main impact on business is the enablement of mobile applications and mobile devices. The more sophisticated the application, the more impact the DBMS and associated tools will have. Real choice and use of synchronization and DBMS functions will enable easy-to-use and easy-to-manage mobile applications. The impact of these applications on the business will vary, ranging from enabling remote working, reducing costs in many applications where data entry can be done once at the source and

using new portable devices that may increase the competitiveness of the organisation and its products.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Early mainstream

Sample Vendors: IBM; Microsoft; Oracle; Sybase

Recommended Reading:

I "Executive Summary: Growing IT's Contribution: The 2006 CIO Agenda"

Appears In Hype Cycle:

I "Hype Cycle for Data Management, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Donald Feinberg

7.8 Multimedia Messaging Service

Definition: The Multimedia Messaging Service (MMS) is a standard from the Third Generation Partnership Project (3GPP) that enables the transmission of messages containing still images, video, audio and text between mobile phones. In addition to person-to-person messaging, it can be used to distribute advertisements and multimedia content from businesses to consumers.

Position and Adoption Speed Justification: MMS has been available for about four years. It was first promoted as a picture-messaging service when camera phones appeared, but was plagued by interoperability problems, high prices and a lack of preconfigured handsets. The biggest problem, however, was a basic lack of interest among users.

The service is now widely available on packet data networks, and is well known. But though many of the early technical problems have been ameliorated, MMS is still little used.

Recently, MMS has been marketed as a more general-purpose service, and usage has begun to rise. The improvement is largely due not to growth in peer-to-peer messaging, but to greater use of MMS as a means of delivering content — logos, ring tones and such like — and as a way of updating blogs. Both of these flourishing applications avoid the remaining interoperability issues that can still thwart attempts to send picture messages to people on different networks.

User Advice: Businesses should explore ways in which MMS could improve their marketing in regions where packet data networks and compatible phones are widely available: Western Europe, North America and parts of Asia. MMS offers more creative possibilities than, say, plain-text messages, has more impact and can save time.

Property vendors, for example, could send both photos and written descriptions of houses straight to prospective buyers. Equally, policemen and ambulance crews could use it to get pictures of incidents back to base quickly.

The availability of phones with megapixel cameras is a basic requirement for the effective use of MMS in an organisational context.

Business Impact: Business-to-consumer applications — for mobile marketing, for example.

Business-to-business applications in areas such as field service and maintenance, healthcare and real estate.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Early mainstream

Sample Vendors: Comverse; LogicaCMG; Openwave

Appears In Hype Cycle:

I "Hype Cycle for High-Performance Workplace, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Stephanie Pittet

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8.0 Entering the Plateau

8.1 Wireless E-Mail

Definition: Wireless e-mail is the delivery of corporate e-mail to a variety of mobile devices, either from a dedicated gateway or directly from the e-mail server. The best method is push e-mail in which new e-mails are pushed down to the mobile device as soon as they are received on the e-mail server (or vice versa for e-mails sent from the mobile device). Alternative methods include time-based synchronization and manual pull. Such solutions support most common e-mail servers, including MSFT Exchange, Lotus Notes Domino and Novell Groupwise. Also IMAP and POP3 e-mail accounts are normally accessible. In all these cases, an offline e-mail client (native or not) is needed on the

devices. Alternatively, wireless e-mail may be accessed using a Web or WAP browser. These applications often also support the simultaneous synchronization of personal information management (PIM) data, such as calendar and contact manager.

Position and Adoption Speed Justification: Moving toward deeper penetration in the enterprise, about 10 million to 12 million people use wireless e-mail in the enterprise, but we expect the number to double by the end of 2006 and reach at least 100 million by 2009. Enterprises depend increasingly on e-mail and have a growing number of mobile workers, which justifies the need for wireless e-mail deployment. Despite the fragmentation and lack of standards, products are now more flexible, providing support for more devices, including support, remote manageability and application extensions. Competition is also very tough, with a number of legal suits ongoing.

User Advice: Users need to evaluate different alternatives and choose the solution that best meets their requirements in terms of supported devices and e-mail servers, users and IT features. Usability, security and manageability are areas that should be carefully evaluated, along with cost.

Business Impact: As with any horizontal application, wireless e-mail does not allow an easy calculation of return on investment. Enterprises should rather focus on value of investment — looking for soft benefits such as increased personal productivity, responsiveness and better overall efficiency.

Market Penetration: Five percent to 20 percent of target audience

Maturity: Early mainstream

Sample Vendors: Extended Systems; Good Technology; Intellisync; Microsoft; Notify Technology; Research In Motion

Recommended Reading:

I "How to Justify and Contain Costs of Wireless E-Mail"

I "Magic Quadrant for Wireless E-Mail Software, 2H05"

I "Microsoft Direct Push for Wireless E-Mail: A Work in Progress"

Appears In Hype Cycle:

I "Hype Cycle for Collaboration and Communication, 2006"

I "Hype Cycle for Government, 2006"

I "Hype Cycle for Wireless Hardware, Software and Services, 2006"

Analysis By: Monica Basso

9.0 Off the Hype Cycle

Although there have been some significant developments in wireless hardware, software and services, only a couple have matured enough to go off the chart in the past year, including basic wireless e-mail and Binary Runtime Environment for Wireless (BREW).

9.1 Binary Runtime Environment for Wireless

Definition: Binary Runtime Environment for Wireless (BREW) is an application system designed by Qualcomm to support application development (AD), provisioning, marketing and billing of handheld wireless data applications, primarily for consumers.

Position and Adoption Speed Justification: Although BREW is mature in the narrowband code division multiple access (CDMA2000) marketplace as a programming language and an AD environment, and is used in a number of providers in Asia, South America and North America, it has not penetrated the Global System for Mobile Communications (GSM) and/or the wideband code division multiple access (WCDMA) carriers.

Most carriers are installing in-house application delivery and provisioning engines, lessening the need for outsourced solutions such as BREW; however, continued divergence

in the Java community spotlights BREW as one of the few write-once programming languages for mobile devices (CDMA devices). As Qualcomm becomes one of the leading WCDMA chipset vendors (all Qualcomm chipsets sold have BREW capabilities), the possibility of BREW appearing in WCDMA carrier environments becomes real, thereby dramatically increasing its reach and survivability.

User Advice: Due to its CDMA2000-only availability, few larger enterprise developers are focused on BREW.

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Business Impact: For content- and entertainment-based enterprises, BREW may provide an opportunity to reach a limited number for handset; however, it's unlikely that non-consumer-based applications will be delivered in BREW.

Market Penetration: Twenty percent to 50 percent of target audience

Maturity: Early mainstream

Sample Vendors: Qualcomm

Analysis By: Michael King; Phillip Redman

10.0 Appendices

10.1 Previous Iteration of the Hype Cycle

Figure 3. For Reference: Hype Cycle for Wireless Hardware, Software and Services, 2005
Source: Gartner (June 2005)

10.2 Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase Definition
Technology Trigger A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
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- *Peak of Inflated Expectations* During this phase of over enthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
- *Trough of Disillusionment* Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
- *Slope of Enlightenment* Focused experimentation and solid hard work by an increasingly diverse range of organisations lead to a true understanding of the technology's applicability, risks and benefits. Commercial, off-the-shelf methodologies and tools ease the development process.
- *Plateau of Productivity* The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their

second and third generations. The final height of the plateau varies according to whether the technology is broadly applicable or benefits only a niche market.

Approximately 20 percent of the technology's target audience has adopted or is adopting the technology as it enters the Plateau.

Years to Mainstream Adoption The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (June 2006)

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Table 2. Benefit Ratings

Benefit Rating Definition

- *Transformational* Enables new ways of doing business across industries that will result in major shifts in industry dynamics
- *High* Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
- *Moderate* Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
- *Low* Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (June 2006)

Table 3. Maturity Levels

Maturity Level Status Products/Vendors

Embryonic In labs None

Emerging Commercialization by vendors

Pilots and deployments by industry leaders

First generation

High price

Much customization

Adolescent Maturing technology capabilities and process understanding

Uptake beyond early adopters

Second generation

Less customization

Early mainstream Proven technology

Vendors, technology and adoption rapidly evolving

Third generation

More out of box

Methodologies

Mature mainstream Robust technology

Not much evolution in vendors or technology

Several dominant vendors

Legacy Not appropriate for new developments

Cost of migration constrains replacement

Maintenance revenue focus

Obsolete Rarely used Used/resale market only

Source: Gartner (June 2006)

Recommended Reading

"Understanding Gartner's Hype Cycles, 2006"

This research is part of a set of related research pieces. See Gartner's Hype Cycle Special Report for 2006 for an overview.

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ANNEXURE D

Global Competitiveness Index 2007-2008

Country/Economy	Rank	Score
United States	1	5.67
Switzerland	2	5.62
Denmark	3	5.55
Sweden	4	5.54
Germany	5	5.51
Finland	6	5.49
Singapore	7	5.45
Japan	8	5.43
United Kingdom	9	5.41
Netherlands	10	5.40
Korea, Rep.	11	5.40
Hong Kong SAR	12	5.37
Canada	13	5.34
Taiwan, China	14	5.25
Austria	15	5.23
Norway	16	5.20
Israel	17	5.20
France	18	5.18
Australia	19	5.17
Belgium	20	5.10
Malaysia	21	5.10
Ireland	22	5.03
Iceland	23	5.02
New Zealand	24	4.98
Luxembourg	25	4.88
Chile	26	4.77
Estonia	27	4.74
Thailand	28	4.70
Spain	29	4.66

Kuwait	30	4.66
Qatar	31	4.63
Tunisia	32	4.59
Czech Republic	33	4.58
China	34	4.57
Saudi Arabia	35	4.55
Puerto Rico	36	4.50
United Arab Emirates	37	4.50
Lithuania	38	4.49
Slovenia	39	4.48
Portugal	40	4.48
Slovak Republic	41	4.45
Oman	42	4.43
Bahrain	43	4.42
South Africa	**44**	**4.42**
Latvia	45	4.41
Italy	46	4.36
Hungary	47	4.35
India	48	4.33
Jordan	49	4.32
Barbados	50	4.32
Poland	51	4.28
Mexico	52	4.26
Turkey	53	4.25
Indonesia	54	4.24
Cyprus	55	4.23
Malta	56	4.21
Croatia	57	4.20
Russian Federation	58	4.19
Panama	59	4.18
Mauritius	60	4.16
Kazakhstan	61	4.14
Uzbekistan	62	4.13
Costa Rica	63	4.11
Morocco	64	4.08

Greece	65	4.08
Azerbaijan	66	4.07
El Salvador	67	4.05
Vietnam	68	4.04
Colombia	69	4.04
Sri Lanka	70	3.99
Philippines	71	3.99
Brazil	72	3.99
Ukraine	73	3.98
Romania	74	3.97
Uruguay	75	3.97
Botswana	76	3.96
Egypt	77	3.96
Jamaica	78	3.95
Bulgaria	79	3.93
Syria	80	3.91
Algeria	81	3.91
Montenegro	82	3.91
Honduras	83	3.89
Trinidad and Tobago	84	3.88
Argentina	85	3.87
Peru	86	3.87
Guatemala	87	3.86
Libya	88	3.85
Namibia	89	3.85
Georgia	90	3.83
Serbia	91	3.78
Pakistan	92	3.77
Armenia	93	3.76
Macedonia, FYR	94	3.73
Nigeria	95	3.69
Dominican Republic	96	3.65
Moldova	97	3.64
Venezuela	98	3.63
Kenya	99	3.61

Senegal	100	3.61
Mongolia	101	3.60
Gambia, The	102	3.59
Ecuador	103	3.57
Tanzania	104	3.56
Bolivia	105	3.55
Bosnia and Herzegovina	106	3.55
Bangladesh	107	3.55
Benin	108	3.49
Albania	109	3.48
Cambodia	110	3.48
Nicaragua	111	3.45
Burkina Faso	112	3.43
Suriname	113	3.40
Nepal	114	3.38
Mali	115	3.37
Cameroon	116	3.37
Tajikistan	117	3.37
Madagascar	118	3.36
Kyrgyz Republic	119	3.34
Uganda	120	3.33
Paraguay	121	3.30
Zambia	122	3.29
Ethiopia	123	3.28
Lesotho	124	3.27
Mauritania	125	3.26
Guyana	126	3.25
Timor-Leste	127	3.20
Mozambique	128	3.02
Zimbabwe	129	2.88
Burundi	130	2.84
Chad	131	2.78

Source: World Economic Forum

Global Competitiveness Index 2007-2008