FINDING SUCCESS IN MOBILE DATA: A BUSINESS MODEL FOR MTN

By

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To Whom It May Concern:

RE: Confidentiality Clause

Due to the strategic importance of this research it would be appreciated if the contents remain confidential and not be circulated for a period of five years.

Sincerely

N.R. Naidoo

Declaration

This research has not been previously accepted for any degree and is not being currently submitted in candidature for any degree.

Signed ....

Date ..24/08/2004.............................. 096947

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Abstract

The mobile data market in South Africa is predicted to be a significant revenue contributor for mobile telecommunication operators, such as MTN, over the next five years. In light of the declining revenue from the traditional voice services, most operators worldwide are turning to mobile data as the solution to this problem. However, there is widespread confusion on which is the correct business model to implement in order to maximise the gains from this new market. To add to the complexity, there is also no clear cut technology upgrade path. While it is well understood that the main driver for the mobile data market will be high data throughputs, the industry is still unsure on which is the best route for an operator to follow as it moves from a second generation (2G)to a third generation (3G) network.

This dissertation discusses the business model that MTN should implement in order to become the market leader for mobile data in South Africa. A literature survey on the latest market characteristics and forecast for the mobile data industry is presented. The recent developments on mobile data business models is also discussed. The technology upgrades, i.e. GPRS, EDGE and UMTS, available to a mobile telecommunication operator is described in detail. GPRS is the first stage in the evolution from a 2G to a 3G network and offers data rates of 40 Kb/s. EDGE improves on the GPRS technology with data speeds of 59.2 Kb/s per timeslot and utilise the same frequency, radio and switching equipment. UMTS is the final stage and is capable of delivering 2 Mb/s data rates. It operates on a different frequency spectrum, thus, requiring a new licence from the telecommunications regulator. In order to develop a new business model, MTN's current GPRS model is analysed. The poor success rate of this model can be attributed to the high prices being charged for the services and the lack of any "killer applications" to entice the users.

The business model focuses on the customer value of service, organisational, technical and pricing models. For the customer value of service, it is shown that MTN must offer cheaper prices for the services, higher data rates and more exciting applications. The pre-paid subscribers should also be allowed access to the mobile data network. The main changes to the organisational arrangement in MTN includes creating sub-departments in marketing, sales and network group to focus solely on mobile data. MTN must develop an integrated services approach and this can only be achieved by developing partnerships with all key players in the mobile data industry, such as content providers and application developers.

Due to the high costs, the technology arrangement section proposes that MTN first upgrade the network to be EDGE capable and later implement a UMTS network. The financial arrangement discusses the revenue, pricing and cost model. The revenue model proposes the development of an exciting and attractive mobile portal. New services and applications such as mobile gaming and gambling must be created for the personal consumers. For the corporate consumers, applications and services must be developed for customer relation management, supply chain management and workforce application. A hybrid pricing model must be adopted. A fixed, metered and value based pricing structure should be implemented to make the services more affordable and to gain the maximum revenues. Finally, the various elements that constitute the cost model is examined. The major contributing costs for the operator will be the network upgrade and subscriber acquisition.

Table of Contents

List of Figures

List of Tables

Chapter One – Introduction

1.1 Introduction

The revenue growth from traditional cell phone voice services is slowing throughout the world. This downward trend is also noticeable in the South African cellular market. The decline is occurring despite the increasing popularity of mobile phones and more dazzling portable multifunction "smart" phones with features such as cameras, e-mail and Internet connectivity. While the actual minutes of use are increasing, revenue growth from voice services are likely to decrease over the next several years as operators continue to cut the price of voice service. In order to create a sustainable competitive advantage, the mobile operators are forced to invest in novel revenue generating services. Due to the highly competitive business environment, companies like MTN, are constantly under pressure to develop services and products that are as mobile as their subscribers and fulfil their various needs. In this environment, mobile data services will become increasingly important to drive revenue growth.

The number of cellular subscriptions is forecasted to exceed 1 billion in 2004, compared with the 306 million that was forecast at the end of 1998. The demand for voice services has always been a key market driver. However, the demand for data services is fast emerging as an equally significant contributor. Approximately 50 percent of the current voice services subscribers are expected to use mobile data services by 2007, instead of the 25 percent as previously forecast. It is further predicted that within seven years, 18 percent of cellular revenues and 21 percent of PCS (Personal Communication Services) revenue will originate from mobile data services (Trillium, 2003). After many years of stasis, the telecommunications industry is undergoing revolutionary changes due to the impact of increased demand for data services on fixed and mobile networks. Up until recently, data traffic over mobile networks remained low, at around 2%, due to the bandwidth limitations of present mobile networks. However, new technologies are quickly emerging that will optimise the transport of data services and offer higher bandwidth in a mobile environment.

Success of mobile data has thus far been limited to specific areas such as Short Message Services (SMS). A number of important trends will ultimately position mobile data to be as significant as mobile voice. Computing itself is becoming ever more mobile with the prevalence of notebooks and Personal Digital Assistants (PDAs). Mobile telephones are also fast becoming powerful computing platforms. The Internet is becoming progressively more intertwined in the fabric of people's lifestyles, providing communications, information, service enhancements for memberships and subscriptions, community involvements and commerce. In this mix, mobile data is a powerful catalyst for the creation of new services and business opportunities for the mobile operators.

Since data throughput rates is the key driver of long-term mobile data network economics, most mobile telecommunication service operators are in the process of upgrading their existing Second Generation (2G) networks. There are several technology choices currently available for the progression from 2G to the Third Generation (3G) network. The path chosen to the 3G technology is expected to introduce significant competitive differentiation among mobile service operators in their ability to timely and effectively offer higher data services. The 3G technology decisions being made today will, in the coming years, determine which operator will be successful in the increasingly competitive mobile telecommunication marketplace. Network technology is the key to maximising operator revenues. Low cost, high performance solutions will enable operators to bring superior new features and services to the consumer, creating significant competitive and time-to-market advantages.

While the commercial success of a high bandwidth mobile data network will be linked to the subscriber acceptance of mobile data services, there is not yet any agreement on the right business model for these services. Many operators worldwide are struggling to decide on the right solution for mobile data and are finding it difficult to determine the optimal business case for generating revenue. The lack of any "killer applications" to entice the subscribers is also one of the reasons contributing to the poor uptake of the new services. There is widespread confusion on which is the best and most cost-effective technology upgrade to implement on the network in order to deliver faster data rates.

MTN is also placed in a similar predicament. In 2002, the company took the strategic decision to pursue an aggressive campaign to become the mobile data network of choice in South Africa. This was undertaken since the mobile data market in South Africa was forecasted to produce significant new revenues for cellular operators. MTN invested huge capital and resources to implement the new mobile data technology, General Packet Radio Services (GPRS), which offered higher data throughputs. However, the uptake of the new data services has not been as successful as anticipated. The GPRS business model is not generating any significant revenue for the operator. As the company progress with the costly network upgrades it has to implement a new business model to ensure that the costly investment pays off.

This dissertation describes the business model that MTN should implement in order to gain a huge share of the mobile data market. The business model considers the key aspects of customer value of service, organisational, technical and financial arrangements. The interdependency of each element in ensuring a successful business operation is examined. The financial arrangements section investigates the revenue, pricing and cost models to be employed. The most effective and cost efficient upgrade path for the network is explored in the technical arrangements section. The changes required to the organisational structure in order to deliver a high value proposition to the customer are also investigated. An analysis of the developments in mobile data technology, both worldwide and in South Africa, is also presented in this dissertation.

1.2 Background

1.2.1 Company Background

Mobile Telephone Networks (MTN) is one of three mobile cellular operators in South Africa. MTN was the second operator to provide mobile telecommunication services in 1994 and currently has approximately 6.3 million subscribers. The MTN Global System for Mobile Communication (GSM) network comprises over 4000 radio sites covering 19200 km of road and 900000 km^2 of land. The network provides cellular access to 94.5% of the South African population (www.MTN.co.za).

Vodacom, which began operating in 1993, is the largest operator in South Africa with 9.7 million subscribers (www.Vodacom.co.za). The third operator, Cell-C, which only began operating in 2001, has approximately 3 million subscribers (www.CELLC.co.za). The competition for subscribers in South Africa is fierce with all three networks continuously trying to churn subscribers by offering cheaper and more innovative services for the customers. It is estimated that by 2005 there could potentially be over 20 million cellular subscribers in South Africa (www.Cellular.co.za).

MTN has expanded into Africa and is presently operating GSM networks in Swaziland, Cameroon, Uganda, Rwanda and Nigeria. These networks contribute 36% towards MTN's revenue (www.MTN.co.za). MTN South Africa has the largest subscriber number in the MTN Group and provides all technical and financial support for the other 5 networks. However, it is estimated that the Nigerian network, which began operation in July 2002, will have the highest subscriber number by 2007. The technological decisions adopted by MTN South Africa are generally also implemented in the other African networks.

In order to effectively challenge the market leader, Vodacom, MTN has to always seek new and innovative ways of enticing subscribers to join their network. The major revenue stream for MTN is from voice calls while data calls, like SMS, Wireless Application Protocols (WAP) and High Speed Circuit Switched Data (HSCSD) have recently began generating sizeable revenues. With the appearance of the third operator, Cell-C, the market in South Africa, for voice generated revenue, is fast declining.

In order to differentiate itself from the other two networks and to create a sustainable competitive advantage, MTN took a strategic decision in 2002, to aggressively pursue the mobile data market in South Africa. MTN was the first network to launch GPRS in South Africa. GPRS allows for a much higher data rate transfer than conventional networks and is geared for carrying data where the subscriber is always attached to a data server and could easily browse the internet, read e-mails or even play on-line games. The upgrade to GPRS was an expensive investment for MTN since a huge part of the network had to be upgraded. However, to date the return on this investment has been very poor.

1.2.2 Business Models for Mobile Data

Although the concept of a business model is widely used and seen as important, there is no generally accepted definition of what constitutes a business model. Many authors have tried to identify the elements composing a business model. According to Amit and Zott (2001), a business model depicts the content, structure and governance of transactions designed so as to create value through the exploitation of business opportunities. The content refers to value in a general context, which implies any sort of flow that may influence revenues for a company such as mobile data services. The structure describes the relationships between actors that exchange content within the mobile operator's business model. Governance concerns the ability to control the structure and the distribution of content.

The mobile data business will be the combination of two value chains, the mobile telecommunication value chain and the electronic business value chain (Barnes, 2002). It is expected that this combination will lead to a wide variety of new possibilities. There are various conceptual illustrations of this model. Actors within the mobile data value network are in the infrastructure domain (network operators and service providers) and the content or end-services domain (content and portal providers, application providers and access providers).

When comparing different definitions of business models, it is possible to distinguish certain common elements such as (Faber et al, 2003):

- Service design – a description of the value that the value network offers to a specific target group of users, in particular in terms of a service offering
- Organisation design – a description of the configuration of actors that is needed to deliver a particular service, the roles that each plays and making it clear how the network creates value for the end-users.
- Technology design – a description of the fundamental organisation of a technical system, the technical architecture which is needed by the firms in the value network to deliver the service offering exhibited in the service design.
- Finance design – a description of how a value network intends to capture monetary value from a particular service offering and how risks, investments and revenues are divided over the different actors of a value network.

Designing business models is a complex undertaking due to the interrelatedness of the different blueprints. Various requirements (such as technical, user, organisational and financial) need to be accommodated and balanced (Faber et al, 2003). Design choices in one domain (e.g. technical domain) may affect those of the other domains (e.g. user domain). This interrelatedness of design choices complicates the design of viable business models for mobile services. For instance, what might make sense from a technical perspective may make no sense at all from a financial (e.g. too expensive) and user perspective (e.g. privacy concerns).

Besides the balancing of requirements, business developers also need to balance the interests of all the involved actors. This is not a straightforward task since actors may originate from different industries, each with their own peculiar business logic. The success of a business model is thus dependent on the commitment of all partners involved. The proposed business model for MTN will focus on customer value, the organisation, technical and financial arrangements needed to provide a high customer value of service. The development of the business model is highly dependent on the capabilities of the latest available technology, since this determines which services can be realistically delivered.

1.2.3 The Mobile Data Technology Roadmap

First generation (1G) mobile communication systems started in the early to mid 1980's, offering simple wireless voice services based on analogue technology. Digital second generation (2G) systems were developed in Europe, which was mainly based on the Global System (GSM) standard, and in the USA it was based on the Code Division Multiple Access (CDMA) standard. These systems provided better voice quality, higher capacity, global roaming capability as well as lower power consumption. 2G systems also offered support for simple non-voice services like Short Message Services (SMS). The low bit rate of 2G systems (9.6 kbps) could not meet subscriber demands for new and faster mobile data services (Wilberg, 2001). Figure 1.1 illustrates the development of mobile data and the associated services and data rates that can be offered.

In the late 1990s, wireless providers began planning the next generation of wireless services that would integrate voice communications with advanced data capabilities such as corporate LAN access and wireless video conferencing. This next generation of wireless services quickly became thought of as Third Generation (3G) services or Universal Mobile Telecommunication Systems (UMTS).

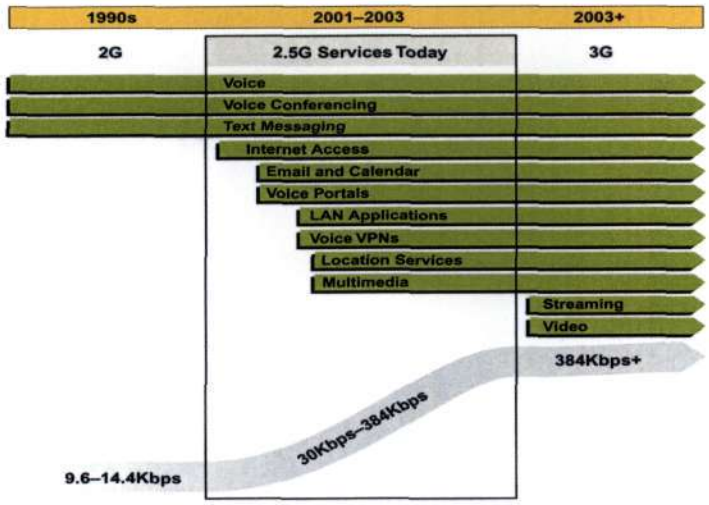


FIGURE 1.1: DEVELOPMENT OF MOBILE DATA TECHNOLOGIES

Adapted From: *Ellison, S. (2002). Next Generation Wireless Business Solutions are Here Today. London: International Data Corporation.*

The transition from 2G to 3G is extremely challenging from a technical perspective since it requires the development of radically new transmission technologies and is alarmingly expensive due to the vast capital outlay needed for new network infrastructure. The 3G system works on a different frequency band than the conventional GSM systems. Thus, the operator will have to acquire a new licence from the government in order to utilise the technology. The cost of this licence is extremely high, as was evident by the huge licence fees paid by operators in Europe. For these reasons it makes sense to move to 3G via intermediate 2.5G standards. In the evolution from 2G to 3G systems, different migration paths have been identified as shown in Figure 1.2. The GSM network operators, such as MTN, have tough choices to make regarding the best path to choose.

2.5G radio transmission technology is radically different from 2G technology because it uses packet switching instead of the traditional circuit switching technology. General Packet Radio Service (GPRS) is the 2.5G standard for the upgrade from GSM. GPRS overlays a packet-switched architecture onto the GSM circuit-switched architecture. It is a useful evolutionary step on the road to 3G since it provides mobile telecommunication operators the experience of operating packet networks and charging for packet data. Data transfer rates will reach 20 Kb/s per timeslot (Ericsson, 2002a). Due to the uncertainty regarding the technological development of 3G in 2001, MTN chose to implement GPRS and the service was commercially launched in July 2002. Therefore, going directly to 3G from GSM is not an option for MTN.

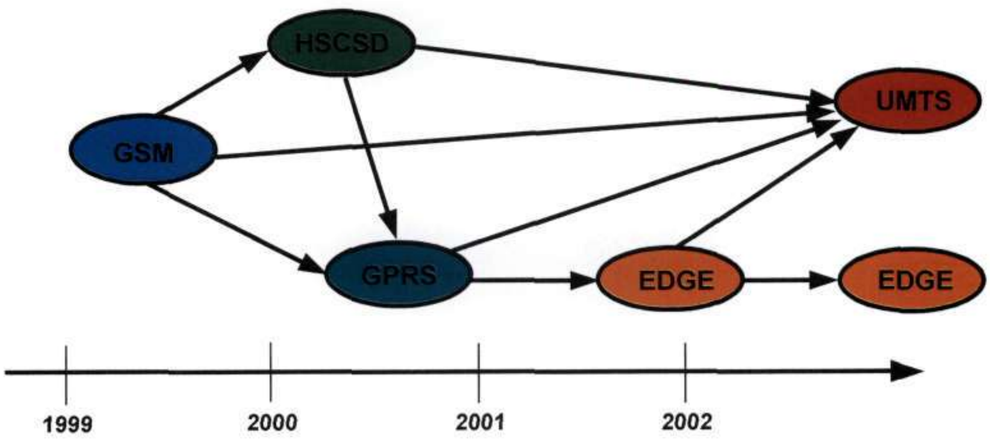


FIGURE 1.2: THE DIFFERENT UPGRADE PATHS TO 3G TECHNOLOGY

Adapted From: *Katsianis, D. (2003). The Economics of Next Generation Mobile Systems. University of Athens publication. Greece.*

Enhanced Data Rates for GSM Evolution (EDGE) provides the next stepping-stone beyond GPRS, offering 3G data rates for services within the GSM operators existing spectrum allocations. In technical terms, EDGE incorporates improvements to the GSM radio interface with a new modulation scheme delivering higher data rates, higher spectral efficiency, improved transmission performance and improved coverage. These improvements exploit the full benefits of the GPRS developments in the core network. In its Enhanced GPRS (EGPRS) mode, EDGE improves maximum data rates per time slot from 20 Kb/s to 59.2 Kb/s. It enables data rates up to 473.6 Kb/s, equal to the full mobility data rate that will be available from 3G (Ericsson, 2002a).

To ensure a smooth transition towards 3G, the IMT-2000 committee was set up by the International Telecommunication Union (ITU) to harmonise the different proposed 3G standards. Two 3G standards were adopted; wideband CDMA (W-CDMA, supported by GSM-centric countries) and cdma2000 (supported by current CDMA-centric countries). All 3G systems will support the following bit rates: up to 144 kbps in macro-cellular environments such as in moving vehicles, up to 384 kbps in micro-cellular environments like walking pedestrians and up to 2 Mbps in indoor environments such as in office buildings (Ericsson, 2001).

The best technological path to follow is the difficult strategic decision facing MTN. It could continue to market GPRS services until the South African government decides to allocate the 3G spectrum. The operator could then attempt to obtain a licence to operate a 3G network. However, due to the recent confusion surrounding spectrum allocations, it is very likely that the allocation of the 3G spectrum in South Africa will not materialise very soon. MTN's competitors might opt to follow the EDGE route in the interim, thus, gaining a competitive advantage over MTN. Another alternative is to implement the EDGE technology as soon as possible and decide at a later stage if an upgrade to 3G is warranted. Both scenarios must be carefully analysed, from a technological and economic perspective, before making a decision.

1.3 Motivation

Voice services has been the primary source of revenue for MTN but with the Internet continuing to influence an increasing proportion of subscriber's daily lives, it is inevitable that the demand for wireless data is going to ignite. Already, in those countries that have cellular-data services readily available, the number of subscribers taking advantage of mobile data has reached significant proportions. Unfortunately, to date the uptake for GPRS has been very poor for MTN. Despite the hype that surrounded the launch of the new technology, most customers were not eager to subscribe for the service. By March 2004 there were only 120 000 subscribers registered for this service and the data traffic being generated was very low. The reasons for the poor response can be attributed to the high price being charged for the feature and also there were not many exciting mobile data services introduced to entice the subscribers. There were no "killer applications" introduced with the new mobile data service. MTN did not have a clearly defined business model for mobile data.

MTN is now faced with the dilemma of deciding whether to invest in the new mobile data technologies that offer higher data speeds and the ability to offer more enticing mobile data applications or to continue marketing GPRS. Essentially, the operator is not sure if it should upgrade its network to be EDGE capable or if it should wait and upgrade to the 3G technology once the government starts issuing licenses for the frequency spectrum. There are also no clear pricing and revenue generation strategies for mobile data. The company has no convincing strategic plan on how to become the market leader for mobile data in South Africa. The decisions taken now will determine the success or failure of MTN's ambitions.

The motivation for this research is to provide guidance to MTN on the optimum business model to adopt. This will include investigating the best technology path to follow in order to achieve success in the mobile data market. Another motivation is to determine what revenue generating, pricing and cost strategies to pursue in order to create a sustainable competitive advantage.

1.4 Value of the Project

The mobile voice market in South Africa is fast becoming saturated following the introduction of the third GSM network provider, Cell-C. As the competition for subscribers intensifies, MTN cannot rely on only voice calls to be the major source of revenue. Established GSM network operators around the world have recognised that the next evolutionary path for operators is mobile data. They have already invested in upgrading their network to the latest available technology in order to gain a first mover advantage. However, due to the various options available, there is still a lot of confusion around which is the best and most cost-effective technological path to follow. Most operators are also still unsure on what is the best business model to implement since the economics of the mobile data business is still very new to most of them.

MTN took the strategic decision in 2002 to pursue the mobile data market and to become the mobile data network of choice in South Africa. Thus, the company was being proactive in seeking out alternative revenue streams while maximising the usage of its existing network. Unfortunately, the market leader, Vodacom, also realised the potential of the mobile data industry and soon followed MTN by upgrading its network to offer GPRS services to its subscribers. MTN must now devise a new strategy to counteract this threat.

This project will guide MTN in determining its mobile data strategy for the next 5 years. The results of this research project will ensure that MTN implements the correct technology and will be ahead of its competitors in terms of data speeds being offered to subscribers. The business model most applicable to the South African market is determined so as to enable MTN to obtain a sustainable competitive advantage. The successful strategies being employed by other operators around the world are analysed to ensure that MTN adopts the most feasible business strategies.

1.5 Problem Statement

In light of the latest technological developments and the current mobile data usage of its subscribers, what strategies and business model should MTN adopt in order to position itself as the market leader for mobile data in South Africa?

1.6 Objectives of the Study

The main aim of the research is to develop a business model for MTN to achieve success in the mobile data market. The model must establish the most cost effective way for MTN to upgrade its existing GSM network in order to offer the highest possible data throughput. Another objective is to determine the most profitable revenue generating strategies for MTN to employ. The optimal pricing and cost models to implement must also be determined in order to maximise profits and to become the mobile data network of choice in South Africa.

1.7 Methodology

A qualitative descriptive research methodology is employed for the project. A case study is utilised to examine the interplay of all the variables in a mobile data market. An extensive analysis of secondary data was undertaken on all relevant and current information regarding mobile data technology and business models. The secondary data source includes telecommunication conference proceedings, journals, equipment vendor publications and the Internet. An investigation into what business models other mobile operators around the world are employing was also carried out for the case study.

The case study first establishes what the current data usage is of MTN's GPRS service. This information was gathered from the MTN subscriber call records. The analysis identifies the GPRS service trends and growth patterns. The regions of the country that exhibit the highest mobile data usage is also identified since this will determine where the network should first be upgraded. The analysis also examines what mobile data applications, such as Internet browsing, e-mails or telemetry that the subscribers are currently using. Using this information, the most cost effective and feasible technology path for MTN to follow is determined. The other components of the business model, the customer value of service, organisational and financial arrangements, is formulated primarily from an evaluation of the mobile data market in South Africa as well as the current strategies being adopted by other operators internationally.

1.8 Limitations of the Project

One limitation was obtaining pricing information from GSM equipment vendors. Certain vendors did not want to reveal the costs of their equipment without an official request from the company. The technology path to be chosen is mainly determined by the cost of the new equipment and no cost comparison could be accomplished due to this limitation. However, MTN's current equipment supplier, Ericsson, did supply all equipment prices. Acquiring current and accurate information on the strategies of other operators was also a serious limitation. The only source of information available was from conference proceedings where the operators have presented their experiences with mobile data.

1.9 Structure of the Study

Chapter 2 examines the recent international developments in the mobile data industry. The subscriber number and potential revenue forecast is also investigated. A literature review on the recent development of mobile data business models is presented. The framework for the business model to be implemented is discussed in this chapter as well. A detailed description of the different components of the business model to be used for this case study is included.

Chapter 3 examines the three mobile data technologies most relevant to a GSM network. The characteristics, capabilities and network architecture of GPRS, EDGE and UMTS are investigated. A comparison of the data capabilities and the services that can be offered by each technology is presented. The different upgrade paths from a 2G to a 3G network is also examined in this chapter.

Chapter 4 first examines the developments of the mobile data market in South Africa. The forecasted demand for mobile data services in South Africa is presented. The mobile data strategy of MTN's competitors is also discussed. Using the proposed business model from Chapter 2, a detailed analysis of MTN's current GPRS model is carried out. The shortcomings of the model are highlighted.

Chapter 5 presents the recommend mobile data business model that MTN should implement. The different components of the model, i.e. the customer value of service, organisation, technical and financial arrangements are discussed in detail. The customer value of service section examines how MTN can improve the subscriber's perceived value of the service. Changes to the organisational structure at MTN are investigated. The technical arrangement element describes the network upgrade strategy while the financial arrangement section examines the various revenue, pricing and cost models.

1.10 Conclusion

Whilst preparing any business model requires making many assumptions, a mobile data business case is somewhat special in this respect. Typically, the services or products for which demand and revenue are being projected are known in advance and the business model is usually also well established. This, however, is not so for a mobile data business model. There is no clear indication of which services will be popular or what the demand will be for these services. Mobile operators throughout the world are experimenting with various business models in order to determine the most profitable solution.

The situation with MTN in South Africa is no different. A well thought out business model is urgently required to guide the operator in making the right decisions as it prepares to tackle the mobile data market. The company has tough strategic choices to make regarding the technology path to follow and the financial model to implement. With the right business model, MTN can overcome these challenges and capture the majority of the market. However, the first step in realising this will be to examine the recent international trends in mobile data business models as well as the forecast for revenue and subscriber numbers.

Chapter Two– Literature Review

2.1 Introduction

The mobile telecommunication industry is currently in an exciting phase that will radically change the industry, as it is known today. The development of new mobile data networks, such as General Packet Radio Service (GPRS), Enhanced Data for GSM Evolution (EDGE) and Universal Mobile Telecommunication System (UMTS) will spark the development of new mobile data services. Mobile services refers to all kinds of innovative services that combine technologies from the domains of telecommunication (e.g. mobile voice services), information technology (e.g. the Internet, Personal Digital Assistants) and consumer electronics (e.g. cameras). These new technologies, in combination with the convergence of these domains and the concepts of content and service providers, offer great opportunities for the mobile telecommunication operators. To exploit the opportunities, companies need to buy licenses, build networks and most importantly develop new services.

The commercial success of mobile data networks will be linked to the subscriber acceptance of mobile data services. However, many cellular operators are struggling to decide on the right business model to implement for these services. The introduction of GPRS has helped the operators and service providers to widen service offerings beyond traditional telecommunication services. As part of this new development, the operators and service providers have been forced to seek new partnerships and business models in order to offer a new generation of mobile data services. This has brought about enormous opportunities for network operators, as well as for other companies offering different types of services and applications.

Similar to other emerging industries, mobile business is characterized by a continuously changing and complex environment. This creates numerous uncertainties at the levels of technology, demand and strategy (Porter, 1980). At the technological level, uncertainties are typically caused by rapid technological development and the battle for establishing standards. These are normally in the beginning stages of the life cycle of an industry, which is born thanks to a technological innovation.

At the demand level, the consensus is that there is a huge potential for mobile business services. However, according to Camponovo (2003), the major role players in the industry are uncertain how to fully exploit these new possibilities brought about by technology, in order to create valuable services that the customers are willing to pay for. Strategic uncertainties are a common situation in emerging industries. The essential characteristic, from the viewpoint of formulating strategies, is the lack of established rules for the game. As a consequence, actors must experiment with a variety of strategic approaches and constantly reposition themselves in order to find the most favourable competitive position in the industry. Operators' mobile data business cases are highly complex and include many assumptions and estimates regarding usage levels, availability of technology and equipment, competitive environment, etc. Therefore, the mobile data business case might be affected by numerous factors, both internal and external to the operators (Northstream, 2001).

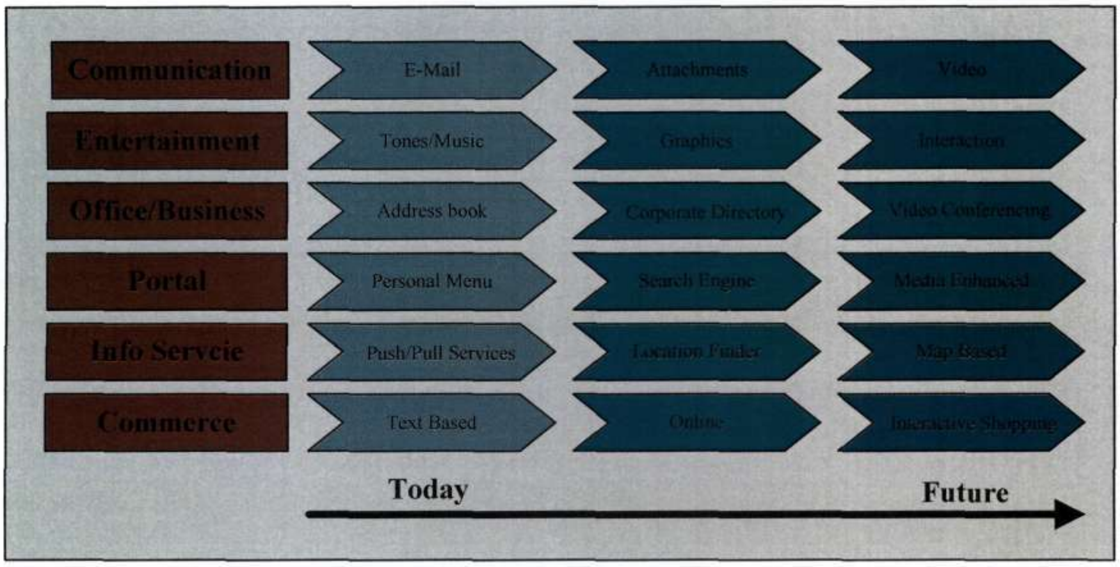
This chapter analyses the recent global developments in the mobile data industry. The current characteristics of the mobile data market, along with the revenue and subscriber number forecasts are presented. The current research on mobile data business models is examined. As a starting point, the definition of a business model is first considered. The proposed business model for this case study is then discussed in greater detail. The different components of the business model include the customer value of service, the organisational, financial and technical arrangements.

2.2 Market Analysis

2.2.1 Market Characteristics

The mobile data industry is a young and undeveloped market. The development of the telecommunication markets led to a multi-operator environment in most countries. The growing competition provoked declining tariffs and together with the advent of prepaid and mass-market penetration, pressure was put on the average revenue per user (ARPU). Industry analysts predict that mobile data services will reverse the ARPU trend and stimulate the willingness to pay (Northstream, 2001).

According to Siemens (2002), data services will continuously evolve in order to meet the lifestyle requirements of the users. For instance, basic voice and short message services will be complemented by advanced communication services. The convergence of mobile and internet technology allows users to send and receive emails, attachments and videos. Other service categories show similar evolution paths by adding value to the currently available applications as shown in Figure 2.1.



<u>FIGURE 2.1: MOBILE APPLICATION EVOLUTION</u>

<u>Adapted From:</u> *Siemens. (2002). Taking the Right Path Towards 3G – Radio Standards for Cellular Networks. Munich: Siemens AG.*

Users' spending directly relates to the perceived value of a service. Quality of Service (QoS) and easiness-to-use are crucial in order to assure a high level of user satisfaction. The latter makes it necessary to provide sufficient bandwidth. Advanced network technologies offer sufficiently high transmission speeds to fulfill the users' expectations. On the way to a multimedia-driven future, the available data rates will grow tremendously over the next few years (Siemens, 2002).

Whilst the technology argument is largely completed, there is still the challenge of building the revenue streams and creating a market demand for the Third Generation (3G) style applications. Ovum (2001), points out that the transition from using a mobile phone to having a complete life management tool will hinge on the availability of exciting new devices, supported by dynamic "must have" mobile services. New richer services are being introduced, changing the way in which the whole concept of mobile communications is being approached. The mobile Internet is gaining pace, with easier-to access services, which reflect individual lifestyle preferences and open minds to the potential of mobile data (Ovum, 2001). Building the market will revolve around communicating a lifestyle, service-oriented message, and not a technology one. The key to success involves a series of small yet progressive steps forward, building user confidence, delivering on expectations and driving demand for delivering the enhanced capacity and capabilities required for these new services. It is already clear that applications will evolve for sound economic reasons and not simply because they can be created from a technology perspective. Services must also be delivered with an appropriate and meaningful price tag since users demand to understand the tariff criteria and to retain a sense of control over what they pay for (GSACOM, 2001).

There are also clear indicators that users are willing to pay for 3G services. A NOP/Nokia (2001), study into 3G tariffs, the result of a year-long study, highlighted the strong interest amongst consumers for 3G services, and they are prepared to pay for them. The early adopters of 3G services indicated that they would be willing to pay more than 50% over and above their existing tariffs, provided they received the services they wanted. The 3G network also has a key role to play in response to the need for voice capacity in urban high-density areas such as in major metropolitan cities.

SMS has been an incredible and largely unexpected revenue success story. Equally significantly, it underlines the fact that user behaviour can and does change, given the right application driving the usage patterns. As the natural evolution of SMS, Multimedia Messaging Services (MMS) is the next important step towards delivering improved mobile Internet content and display capabilities to a mass audience. SMS has helped negate the decline in voice Average Revenue Per User (ARPU) levels. MMS offers significant new revenue generating capability and can lead the way towards 2.5 and 3G profitability (GSACOM, 2001).

From today's browsing style services, the move has to be towards a lifestyle view of service delivery that targets specific customer segments and delivers content directed at significant communities of interest. The quarterly mobile portal survey by GSACOM (2002), highlights the existing user experience and illustrates the importance of delivering user-friendly, customisable services, rather than promoting the traditional technology-focused message.

Service availability has to be complemented by clear, user-friendly billing, starting with GPRS. According to GSACOM (2001), there are many studies which support the business case for the mobile Internet. Industry forecasts for 2001 suggest that sales of mobile Internet terminals would more than triple to 200 million. Users want to be excited and amazed by what they can do with their lifestyle management tools such as new colour screens, imaging and media phones, gaming platforms, and Java-enabled applications. This will help to drive the demand for new content and services that users will be happy to pay for.

New services will drive the demand for network capacity, thus, giving operators access to additional revenue required to continue the investment in infrastructure. There is clear evidence that communication patterns are changing, as society becomes increasingly mobile. The success of SMS is a strong indicator of how mobile data can drive this change. Given the advent of new lifestyle packages and the clear evidence of user willingness to pay, this will be translated into a significant percentage increase in ARPU. In addition to this increase in ARPU, mobile data offers the potential of other revenue sources, such as portal service transactions, advertising and sponsorship. The business sector will also be an important revenue generator, based on building the market for m-Business applications, which are tailored to reflect the need for greater business mobility (GSACOM, 2001).

2.2.2 Forecasts

The mobile telecommunications industry encountered numerous challenges in 2001. The continued economic downturn prompted renewed concerns regarding the near-term commercial viability of mobile data services, including 3G. The UMTS Forum Reports No. 9 and No. 13, released in September 2000 and April 2001, studied 3G service-revenue opportunities and proposed a 3G-service framework that characterises the market opportunity from the user's perspective. UMTS Forum Report No. 17 (2001b), provided an update to the worldwide and regional forecasts of the previous reports, given changes in market conditions during the second and third quarter of 2001.

The forecast validation highlights the UMTS Forum position on several key aspects of 3G services:

- Complex services will take time to develop and services will be adopted slowly through 2005 in the developed countries.
- Many countries in the developing world will not adopt any 3G services until late in the decade.
- Issues involving handsets and 3G-service delivery are short-term and resolvable and will not affect the longer-term viability of 3G services.
- The demand for 3G mobile data services is real. Consumers and business users have consistently demonstrated strong interest in trying new services that combine mobility with content and personalisation.
- The challenge is to create compelling services that take advantage of the promise of 3G technology and provide a satisfactory end-user experience (UMTS Forum Report No. 18, 2002).

Figure 2.2 illustrates the worldwide demand for 3G services by revenue from 2001 to 2010.

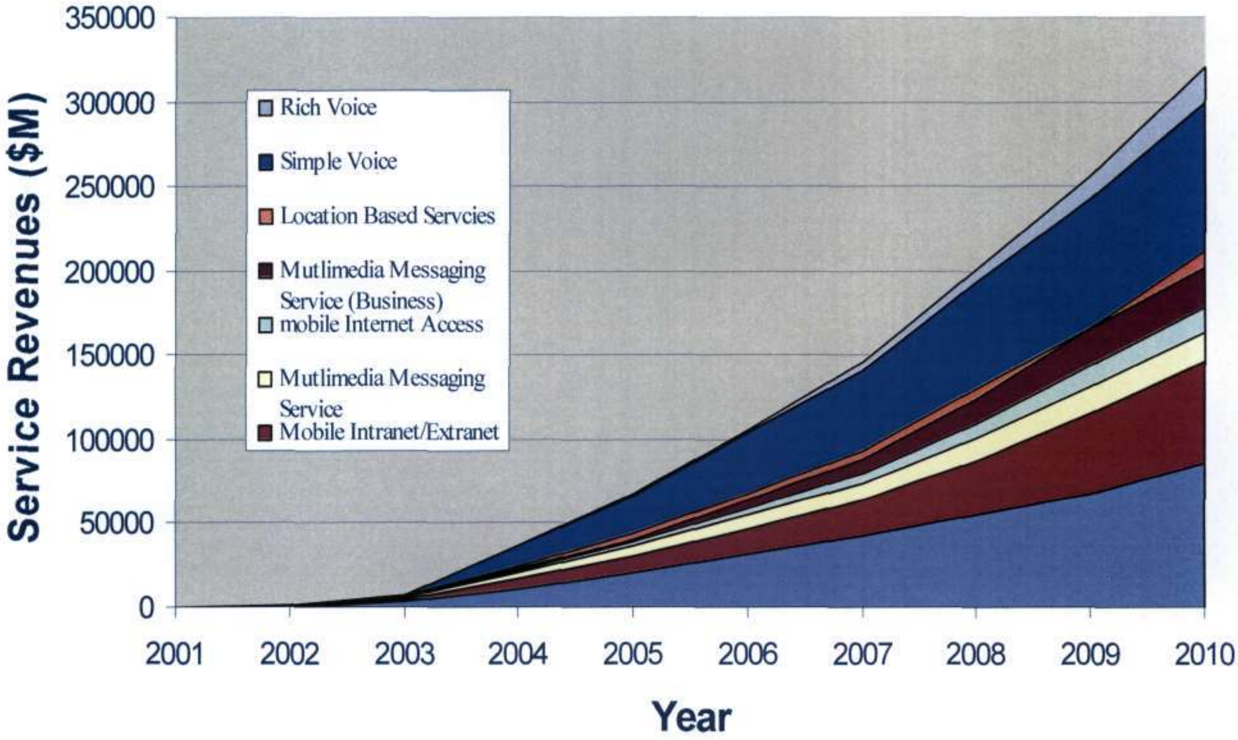


FIGURE 2.2: WORLDWIDE DEMAND FOR 3G SERVICES BY REVENUE

Adapted From: *UMTS Forum. (2001b). The UMTS Third Generation Market Study Update. London: UMTS Forum, Report No. 17.*

As detailed in the UMTS Forum Report No. 17 (2001b), negative market conditions in early 2001 had already reduced the short-term revenue forecast for 3G services by 17%, which is a total reduction of $10 billion by 2004. Through 2010, however, this represents less than a one per cent reduction in the overall service revenues predicted for 3G. Service revenue from 3G networks, therefore, still represent a substantial market opportunity of $320 billion in 2010, $233 billion of which will be generated by new mobile data services.

While growth has slowed in many countries in the developed world, the UMTS forecasts are consistent with worldwide mobile subscriber forecasts from other analysts (UMTS Forum Report No. 18, 2002). Figure 2.3 compares the UMTS Forum forecast assumption for worldwide mobile subscribers with a recent 2002 report from Morgan Stanley.

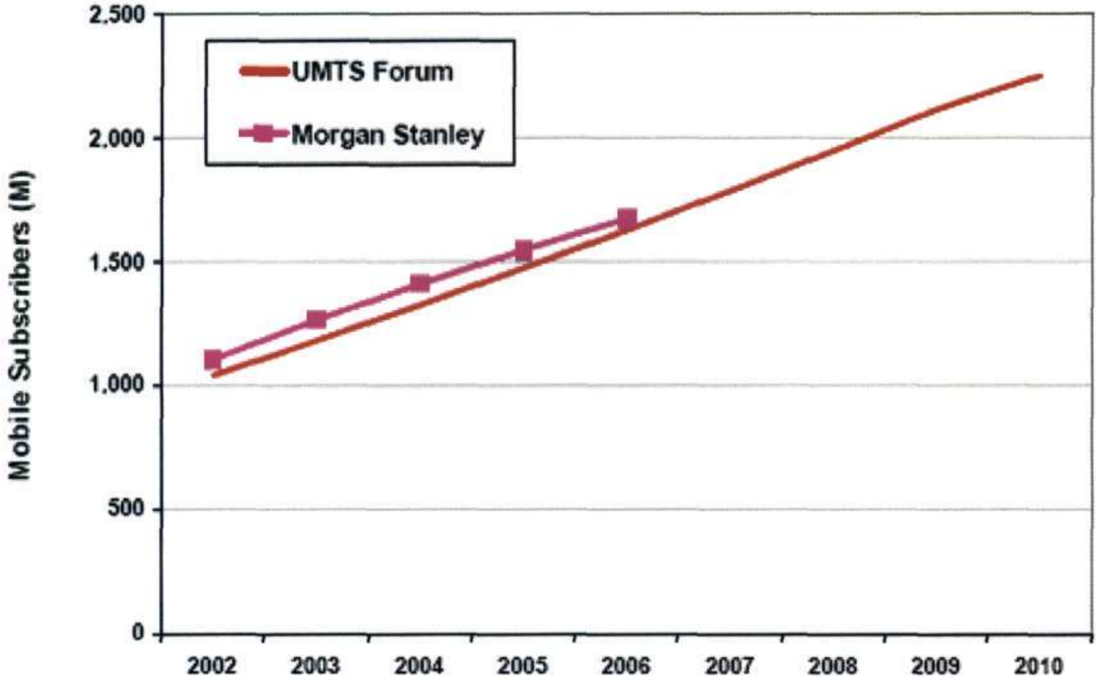


FIGURE 2.3: WORLDWIDE MOBILE SUBSCRIBER FORECAST COMPARISON

Adapted From: *UMTS Forum. (2002). Long Term Potential Remains High for 3G Mobile Data Services. London: UMTS Forum, Report No. 18.*

The slowing of subscriber growth also reflects reduced discretionary consumer income due to the economic downturn. The UMTS Forum forecast assumes mass market as opposed to premium pricing which is a conservative pricing model approach. In addition to mass-market pricing, the forecast assumes significant price declines throughout the forecast period. There is some evidence showing price increases may happen in conjunction with industry consolidation (UMTS Forum Report No. 18, 2002). Figure 2.4 depicts the forecasted worldwide subscriptions by selected services.

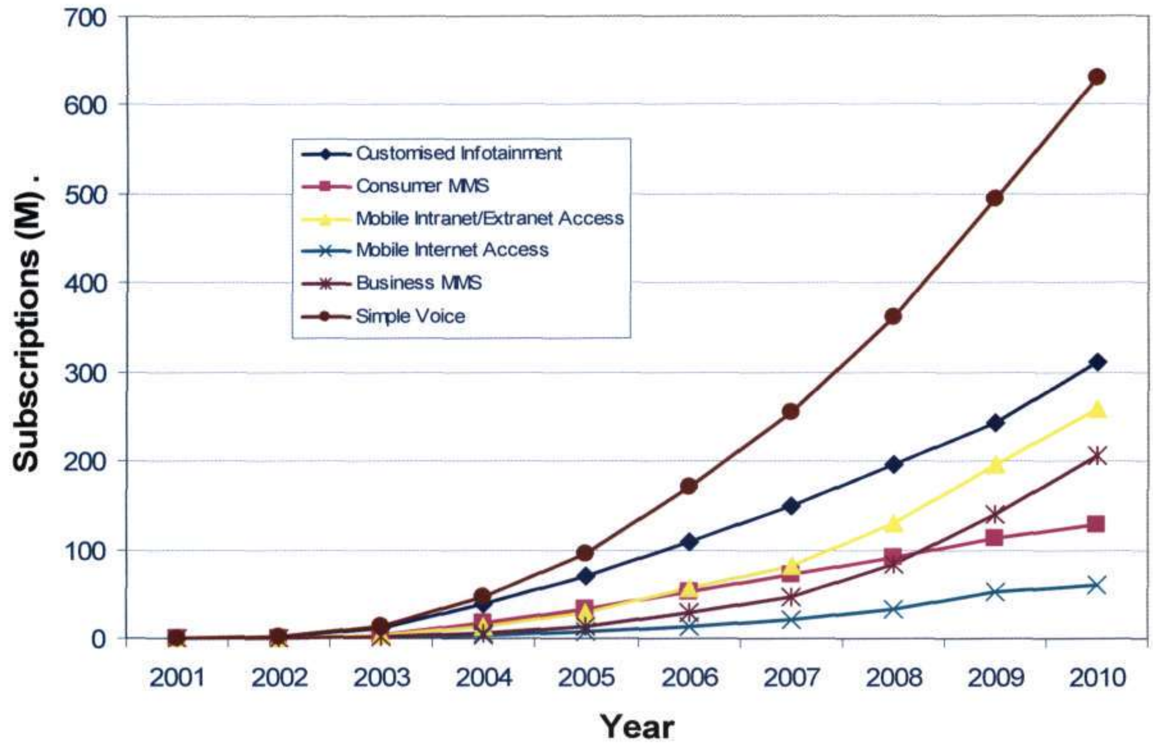


FIGURE 2.4: WORLDWIDE DEMAND FOR 3G SERVICES BY SUBSCRIPTIONS

Adapted From: *UMTS Forum. (2002). Long Term Potential Remains High for 3G Mobile Data Services. London: UMTS Forum, Report No. 18.*

Financial constraints of 3G licence holders, declining stock prices, and lack of 3G handsets have delayed 3G commercialisation in some countries, such as Germany, England and France. Due the lowering of stock prices, most companies have shifted from an equity-based strategy for raising capital to a debt-based strategy (UMTS Forum Report No. 18, 2002). Some analysts believe the market slowdown is helping incumbent operators to generate much needed cash from their 2G networks. A decline in market growth reduces customer-acquisition costs and increases the EBITDA margin. This factor is also bolstered by the industry's cost reduction and efficiency improvement efforts.

Cost reduction efforts include outsourcing, partnering and sharing networks. Combined, these factors do suggest that the capital needed to begin deploying 3G on schedule will be available, particularly for incumbent operators. It was originally assumed that commercial service of 3G would begin 12 to 24 months after the licence was awarded. Due to announcements by a number of global operators regarding handset shortages and other technical problems, the 3G-commercialisation dates for many countries have changed (UMTS Forum Report No. 18, 2002).

In general, Western European countries were originally assumed to begin offering 3G services in the 2001-2002 timeframe. This assumption, revised in the UMTS Forum Report No. 17 (2001b), to the 2002-2003 timeframe, is being validated by recent announcements. For example, Deutsche Telekom (Germany), Hutchison (UK) has launched 3G services in 2003. Belgium's three operators have communicated their desire to delay the rollout of 3G services until 2003. The US forecast, due to the lack of 3G spectrum, assumes a 2004 3G-commercialisation date. Commercialisation dates for developing countries will generally occur in 2007 or later (UMTS Forum Report No. 18, 2002).

The technical problems with the initial 3G handsets appear to be resolved. Demand versus availability tensions combined with ongoing debates regarding design and form factor will continue. In addition, issues are likely to occur as new services are introduced, but these have been considered in the forecast assumptions. As demand levels increase and manufacturers and mobile operators gain more confidence in the viability of services, handset production will increase (UMTS Forum Report No. 17, 2001b).

The revised assumptions in the UMTS Forum Report No. 17 (2001b), reflect these announced delays and industry concerns. The UMTS Forum market studies have consistently assumed that 3G adoption will be slow in the early years and will only be used by less than 30% of the worldwide mobile-subscriber base by 2010. Slow early adoption is to be expected for any new technology, especially one that requires new end user behaviour and the forging of new business relationships. Due to the 2001 economic climate, the August 2001 forecast in Report No. 17, modified the 3G-adoption curve used previously to be slower in the initial years. Figure 2.5 illustrates the assumed 3G adoption rates.

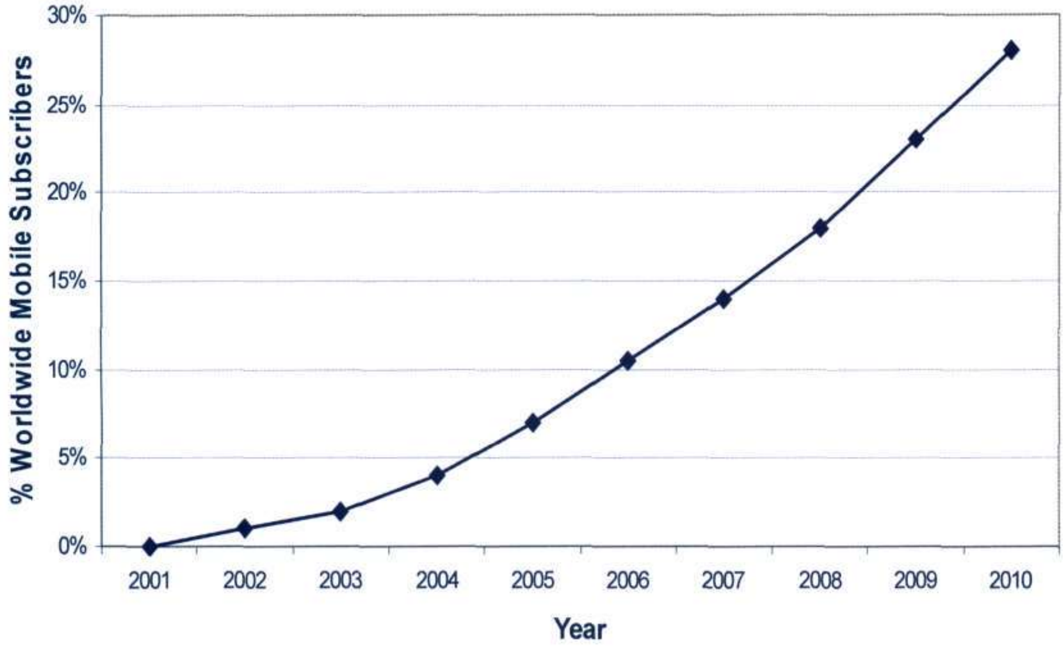


FIGURE 2.5: 3G ADOPTION RATES

Adapted From: *UMTS Forum. (2002). Long Term Potential Remains High for 3G Mobile Data Services. London: UMTS Forum, Report No. 18.*

The UMTS Forum Report (2001a) has significant delays built in, based on the additional years it will take for the complex service demand to materialise in any commercially significant manner. For example, the UMTS Forum forecast assumes that a robust version of 3G consumer mobile videophone service (which currently has an early implementation service in market trial with NTT DoCoMo's FOMA service and with Manx Telecom in the Isle of Man) will not be widely available until 2005. 3G Location-based Services, already available in less robust forms through Global Positioning Satellite and 2.5G networks, do not contribute revenue in the UMTS Forum forecast until 2003. These latter commercialization dates are meant to account for initial end-user resistance to adopting a new service and for other early hindrances to market adoption, network and handset availability and technology issues and more limited content choice (UMTS Forum Report No. 18, 2002).

With these fantastic predictions in mind and while looking at the success of the fixed Internet in the late nineties, mobile network operators started to invest massively in future infrastructure and licences. However, one important aspect has been ignored; due to high investments and maintenance costs for the mobile network infrastructure, network access cannot be offered at same low rates as in the fixed Internet to private customers. This leads to diminishing revenues for all parties in the value chain and vast "m-commerce scepticism". Only if all parties (mobile customers, network operators and service providers) can increase their profit significantly, the whole market potential might be realised. Therefore, existing mobile business models have to be reconsidered (Figge, 2003).

2.3 Definition of Business Model

In the 1970's the concept of a business model was used to describe and map business processes, information and communication patterns within a company for the purpose of building an IT-system. More recently, business models have been related to market structures and the place of individual companies within those structures. Sometimes the concept is used to describe co-ordination mechanism in economic processes, i.e. markets or hierarchies, or to discuss intermediation or dis-intermediation trends. In other studies, the implementation of a specific market model, for example the English auction, is discussed in terms of business models. Very often only one aspect is emphasized, for example the B2C-model for the retail sector. It is clear that the concept of a business model is widely used but hardly ever clearly defined (Faber, 2003).

As explained by Petrovic (2001), a business model describes the logic of a "business system" for creating value that lies behind the actual processes. It can be seen as a detailed conceptualisation of an enterprise's strategy at an abstract level, which serves as a base for the implementation of business processes (Camponovo, 2003). A commonly quoted definition by Timmers (1998) defines a business model as an architecture for the product, service, information flows, including a description of various business actors and their roles, a description of potential benefits for the various actors and a description of the sources of revenue.

2.4 Taxonomy of Business Models

There are numerous mobile data business models available today. In various taxonomies, a large number of business models are mentioned (Timmers, 1998, 1999; Rayport, 1999; Madehevan, 2000; Rappa, 2000; Turban, Lee, King & Chung, 2000; Afuah & Tucci, 2001; Deitel, Deitel & Steinbuhler, 2001; Deitel, Deitel & Nieto, 2001; Rayport & Jaworksi, 2001).

The basis for these classifications varies. Some classifications are based on developments in the area of technology, others on marketing concepts or product types. In some classifications, elements like value creation or strategy play a role. However, most classifications tend to be based on new opportunities offered by the Internet (Afuah & Tucci, 2001). Some classifications appear in a number of sources, sometimes in slightly modified or more detailed versions.

The business models as discussed in these taxonomies basically are versions of what Weill & Vitale (2001) call Atomic business models, to encompass Content Provider, Direct to Customer, Full Service Provider, Intermediary, Shared Infrastructure, Value Net Integrator, Virtual Community and Whole-of- Enterprise/Government models. In the view of Bouwman (2003), most taxonomies can be traced back to these eight basic models. Alt & Zimmerman (2001), suggest that there are a few common elements that turn up in definitions of business models:

- Mission: determining the overall vision, strategic objectives and value proposition but also the basic features of a product or service.
- Structure: this has to do with the actors and the role they play within a specific business environment (a value chain or web), the specific market segments, customers and products.
- Process: the concrete translation of the mission and the structure of the business model into more operational terms.
- Revenues: the investments needed in the medium and long term, cost structures and the revenues that are generated.

Afuah & Tucci (2001), see business models as a system of components (value, revenue sources, price, related activities, implementation, capabilities and sustainability), relationships and interrelated technology. Mahadevan (2000), emphasises value creation, revenues and logistics. As far as the buyer is concerned value creation means a reduction in searching and transaction costs. The seller can reduce costs associated with tracing customers, promotion and transaction costs, and benefit from a shorter turnover rate. The introduction of all sorts of intermediary parties on the Internet is assumed to increase the value stream for both the supply and the demand side.

Osterwalder (2002, also Osterwalder & Pigneur, 2002), is far more systematic in his approach to the concept of business models. Based on the questions of what a company has to offer, who it targets, how this can be realised and how much can be earned, he discusses four basic elements, i.e.:

- product innovation and the implicit value proposition,
- customer management, including the description of the target customer, channels, customer relations,
- infrastructure management, the capabilities and resources, value configuration, web or network, partnerships
- financial aspects, the revenue models, cost structure, and profit.

2.5 Framework for Mobile Data Business Model

When comparing different definitions of business models, it is possible to distinguish certain common elements such as (Faber, 2003):

- Service design – a description of the value that the value network offers to a specific target group of users, in particular in terms of a service offering
- Organisation design – a description of the configuration of actors that is needed to deliver a particular service, the roles that each plays and making it clear how the network creates value for the end-users.
- Technology design – a description of the fundamental organisation of a technical system, the technical architecture which is needed by the firms in the value network to deliver the service offering exhibited in the service design.
- Finance design – a description of how a value network intends to capture monetary value from a particular service offering and how risks, investments and revenues are divided over the different actors of a value network.

As depicted in Figure 2.6, the conceptual framework consists of four interrelated design domains: the service, organisation, technology and finance design.

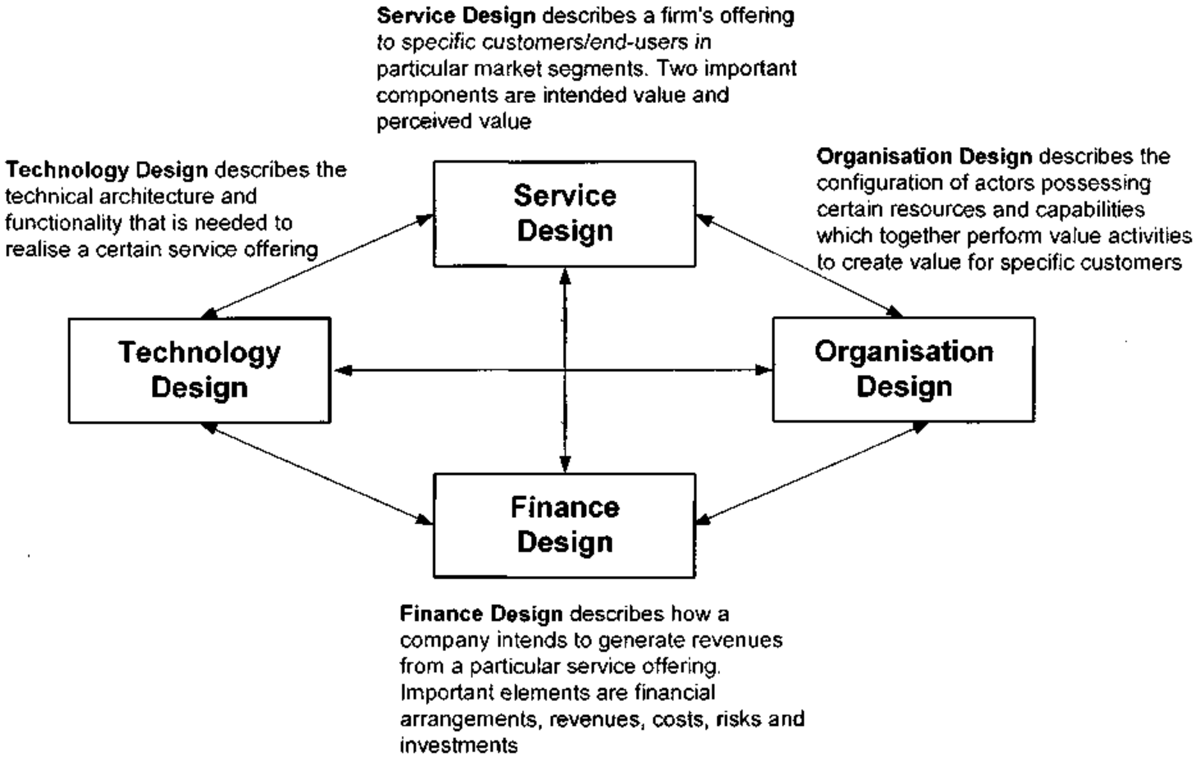


FIGURE 2.6: HIGH LEVEL CONCEPTUAL FRAMEWORK

Adapted From: *Faber, E., Ballon, P., Bouwman, H., Haaker, T., Rietkerk, O. & Steen, M. (2003). Designing Business Models for Mobile ICT Services. Proceedings of 16th BLED Electronic Commerce Conference, eTransformation. Slovenia.*

2.5.1 Service Design

According to Faber (2003), the central issue in Service Design is 'value' where a provider intends and delivers a certain value proposition and a customer or end-user expects and perceives a certain value proposition. Four related concepts are proposed: Intended value and Delivered value on the side of the provider and Expected value and Perceived value on the side of the customer or end-user. These concepts model the match or gaps between the different perspectives on 'value', which is similar to service quality (Parasuraman, Zeithaml & Berry, 1985). Another important issue in Service Design is the nature of the innovation, where Faber (2003), differentiates between two kinds of innovations: 'new version services' that take an existing service one step further (evolutionary) and 'way new services' that are new services that are in one or more aspects really new (revolutionary).

Intended value is the value that a provider intends to offer to customers or end-users with the service. This ambition is the starting point for the innovation, and is often equated with 'value proposition' but in many cases there are gaps between intended value and perceived value. Intended value is translated into functional requirements, like technical specifications (Technology Design) and into requirements for the value network (Organisation Design), such as roles that are necessary (Faber, 2003).

Delivered value is the value a provider actually delivers to customers or end-users with the service. Functional requirements are translated into technological functionalities (Technology Design), and these determine the delivered value. These translations are not straightforward, and there are often gaps and mismatches. Delivered value is also determined by non-technical value activities (Organisation Design) like help desk, support and physical distribution (Faber, 2003).

Expected value is the value a customer or end-user expects from the service. This is determined by the customer's or end user's previous experience with older versions of the service (in the case of a 'new version service') or with similar services (in the case of a 'way new service'). For previous versions, but also for similar services, one may describe the 'backward' and 'forward' technical compatibility services. Furthermore, expected value is determined by resources and capabilities (Organisation Design) such as branding, trust and reputation. It is also determined by financial arrangements (Finance Design) like paying for the device, paying per usage or paying flat fee, subsidized handsets or discounts.

Perceived value is the value a customer or end-user actually perceives when consuming or using the service. This perspective on value is the 'bottom line' – it is the customer or end user who evaluates the value of the innovation. Perceived value is like the sum of expected value and delivered value, including functional, emotional and process aspects. The higher the expected value, or the lower the delivered value, the lower is the perceived value (Faber, 2003).

2.5.2 Organisation Design

Faber (2003), describes the organisation design as the value network that is needed to realise a particular service offering. A value network consists of actors possessing certain resources and capabilities, which interact and together perform value activities to create value for customers and to realise their own strategies and goals. Actors can be more or less powerful in the value network, depending on their resources and capabilities. Hawkins (2002), identifies three basic types of partners in a value network: *structural* partners, who provide essential and non-substitutable (in-) tangible assets, *contributing* partners, who provide goods and/or services to meet specific network requirements, and *supporting* partners, who provide substitutable, generic goods and services to the network. Structural partners in principle are better positioned to exert control over the network than supporting partners.

The organisational issues revolve around the resources and capabilities which have to be made available. In their analysis of business models, Hedman & Kalling (2002) conclude that the bottom line is that economic value is determined by a firm's ability to trade and absorb ICT-resources, to align (and embed) them with other resources, to diffuse them in activities and manage the activities in a way that creates a proposition at uniquely low costs or with unique qualities in relation to the industry in which the company is operating.

2.5.3 Finance Design

A design for the financial arrangements between the different actors in the value network is given in the finance domain. It determines how the value network intends to capture monetary value. The result of the finance design is the set of arrangements between the actors in the value network in which the profit, investment, cost, risk and revenue sharing among the actors is arranged. The tariff and the tariff structure is the most visible part of the arrangements for the end-user. The structure of the value network, with an archetypical configuration of actors, will have a strong influence on the financial variables (Faber, 2003).

Revenues can come directly from the end-user but also other revenue sources may exist, such as advertisement or government subsidy. The investments and costs re closely related to the design choices made in the technology design. However, the question of who will supply investment capital is another important design variable in the finance domain. The costs may also be influenced by the coordination costs of the value network. The risks that may exist in the other domains come with financial consequences. For example, if the perceived customer value is much less than the assumed value, then this may have a negative impact on the revenues. The way the value network copes with the financial consequences of the various risks is part of the financial arrangements (Faber, 2003).

The evaluation and management of the financial arrangements over time are necessary. Typically, the arrangements and design variables are not static but change with time. Therefore, there are dynamic variables that may respond to changes in other variables, either in the finance domain or in the other domains. In addition, development of a new service goes through phases, which leads to changes in the financial arrangements with each phase. Scenarios for investments, costs and revenues may be used to capture future uncertainty (Faber, 2003).

2.5.4 Technology Design

According to Faber (2003), the most important technological design variables and some of their relevant characteristics are:

(a) The Technical Architecture describes the overall architecture of the components listed below. Important characteristics of the technical architecture are: Centralised vs. Distributed, Open vs. Closed and Interoperable vs. Non-interoperable.

(b) The Backbone Infrastructure refers to the long and medium range backbone network infrastructure. Important characteristics are: High vs. Very High Bandwidth and Future-proof vs. Non-future-proof.

(c) Access Networks refers to the first and second mile network infrastructure. Important characteristics are: Fixed vs. Wireless, High vs. Low Bandwidth, Universally available vs. Deployed in hotspots and Scalable vs. Non-scalable.

(d) Service Platforms refers to the middleware platforms enabling different functions, such as billing, customer data management, location information, etc. Important characteristics are: Centralised vs. Distributed, Personalised vs. Non-personalised, Secure vs. Non-secure, Legacy vs. New and Open vs. Closed.

(e) Devices refer to the end-user devices providing access to services. Important characteristics are: Multi-purpose vs. Single-purpose, 'Network Intelligent' vs. 'Dumb Interface', Storage facilities vs. No storage facilities and Embedded software vs. Open terminal.

(f) Applications refer to the user applications running on the technological system. Important characteristics are: Communication vs. Content, Always on vs. Time-critical, Personalised vs. Non-personalised and Secure vs. Non-secure.

(g) Data refers to the data streams transferred over networks. Important characteristics are: Bursty vs. Real-time and High volume vs. Low volume.

(h) Technical Functionality refers to the functionality offered by the technological system. Important characteristics are: Always on vs. Time-critical, Personalised vs. Non-personalised and Secure vs. Non-secure.

2.6 Mobile Data Business Model

Telecommunication operators, including mobile operators, have already proven that they do have the creativity and business skills to build very innovative business models. Yet they face significant obstacles in designing business models for packet data services due to the limitations of the data infrastructure, which must provide the necessary functions and information required to implement some of the more creative business models.

The approach for this thesis will focus on customer value, the organisation, technical and financial arrangements needed to provide a service which has customer value. The model proposed by Bouwman (2003), will be adopted for MTN. The starting point is the customer value of a product or service that an individual company has to offer. Strategies, and consequently business models, to a large extent determine the processes that lie at the basis of the business case; the concrete implementation of the business model in operational terms. To achieve that, a company has to make resources and capabilities available within the organisation and organise relevant (information) processes which will ensure the delivery of the product or services. This is enabled by technologies, most importantly by information and communication technology.

According to Bouwman (2003), information and communication technology, such as the Internet, is playing an increasingly important role not only in the organisational processes but also in delivering valuable products and services to the end customer as well. It is clear that in addition to these three elements, the financial aspects also plays a significant role. The components of the business model are shown in Figure 2.7.

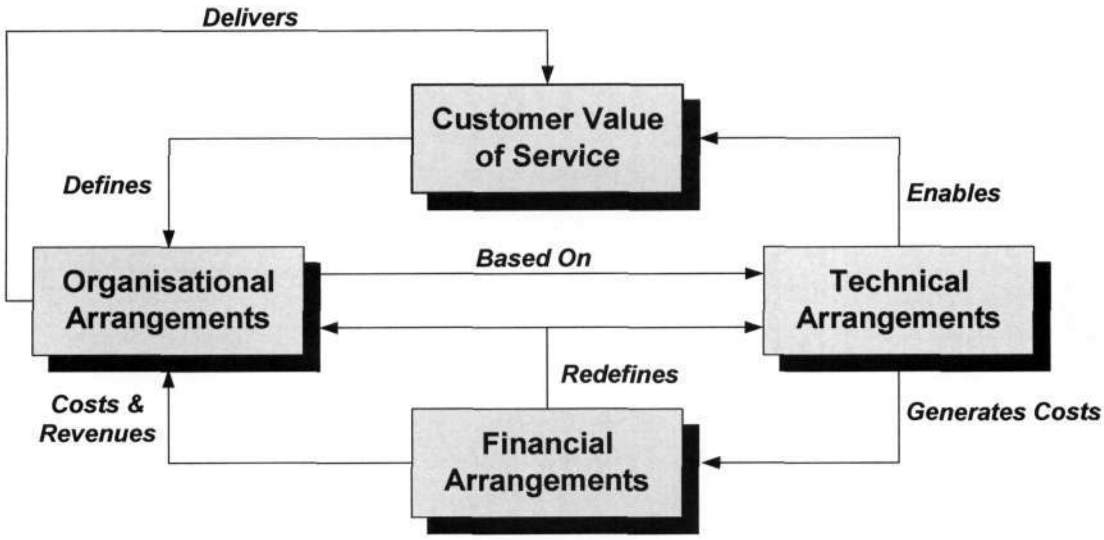


FIGURE 2.7: BUSINESS MODEL COMPONENTS

Adapted From: *Bouwman, H. (2003). Designing Metrics for Business Models Describing Mobile Services Delivered by Networked Organisations. Proceedings of 16th BLED Electronic Commerce Conference, eTransformation. Slovenia.*

2.6.1 Customer Value of Service

There is a long tradition of literature on customer value and basically it discusses what Ansoff's (1987) matrix, based on the dimensions of market and product newness, illustrates. Newness is quite a troublesome concept, whether it concerns products that are new to the world (Booz et al, 1982), major (Lovelock, 1984) or disruptive (Christensen, 1997) innovations. Customer value can be seen as a new innovative offer of a firm to its customers. Value is seen as part of an equation in which customers in target markets compare the perceived benefits and total costs or sacrifice of obtaining a product or service (Chen & Dubinsky, 2003). The value proposition of a firm must be considered better and deliver the desired satisfaction more effectively and efficiently than competitors. Customer experience is the key.

With the increasing importance of electronic networks, i.e. the Internet or mobile Internet, the channels that play a role in offering a product or service also become more important. Rayport & Sviokla (1994), therefore draw a distinction between:

- content: what companies are offering,
- context: how companies are offering it, and
- infrastructure: what enables the transaction to take place.

All three factors can play a role in defining the newness of the product or service. Both the product or service and the context can be new. Location-based mobile services represent a new product, whereas it may also be the mobile channel that constitutes the new element. Increasing connectivity is crucial. Furthermore, the intangible nature of the product or service as well as the increased role that customers play is becoming more important and increasingly reflects the service character of transactions through electronic networks (McNaughton, Osborne & Imire, 2002).

Customers contribute to and consume value. In most cases, due to all kinds of organisational, technical and operational problems, customer value, as defined in strategic plans, is not the value which will be ultimately delivered to the customer. Even if it is, it may not be the value that will be perceived by the customer. In many cases, the customer value as perceived by the end-user has little to do with the customer value that is envisaged in initial business models and greatly depends on the user's personal or consumption context (Chen & Dubinsky, 2003).

2.6.2 Organisational Arrangements

The arrival of 2.5G and 3G mobile services will dramatically change the business logic underpinning mobile communications; a logic that was built for traditional voice only services. The shift from circuit switched to IP-based networks, combined with the evolution of the radio and terminal sides, will move control of value propositions from the mobile access and core networks towards content and application creators distributed on the Internet. This will give rise to new players looking to take their share of emerging business opportunities (Ovum, 2001).

In the traditional mobile voice value chain the customer buys airtime from a network operator based on equipment purchased from a manufacturer. In some cases, an intermediary service provider and a retailer may add value to the chain. The focus of 2G is on selling airtime with a number of different pricing schemes. New mobile data technologies will offer increased opportunities to new players, particularly in the area of content services.

Content providers who own the content (through generating, sourcing or purchasing it) will provide original information such as news, financial information, music, etc. Content packagers combine different content sources and offer access to content through portals. Most packagers will not usually establish a direct billing relationship with consumers but rely on revenue from click-through, e-commerce, advertising, etc. Value added service providers on the other hand, establish this direct billing relationship and resale content or offer value-added telecommunications services (Bouwman, 2003).

According to Ovum (2001), the mobile data industry has not yet settled for a common and industry wide organisational constellation. There is no consensus within the industry regarding how business should be conducted. Even in the classification of the industry actors there is no common understanding. To be able to analyse the possible business models within the mobile data industry, a classification of the actors and their respective activities is needed. Furthermore, a language to communicate and visualize how the industry is organised and what streams it contains is also required. Prem, (2002) presents a useful and comprehensive model of this, which is illustrated in Figure 2.8.

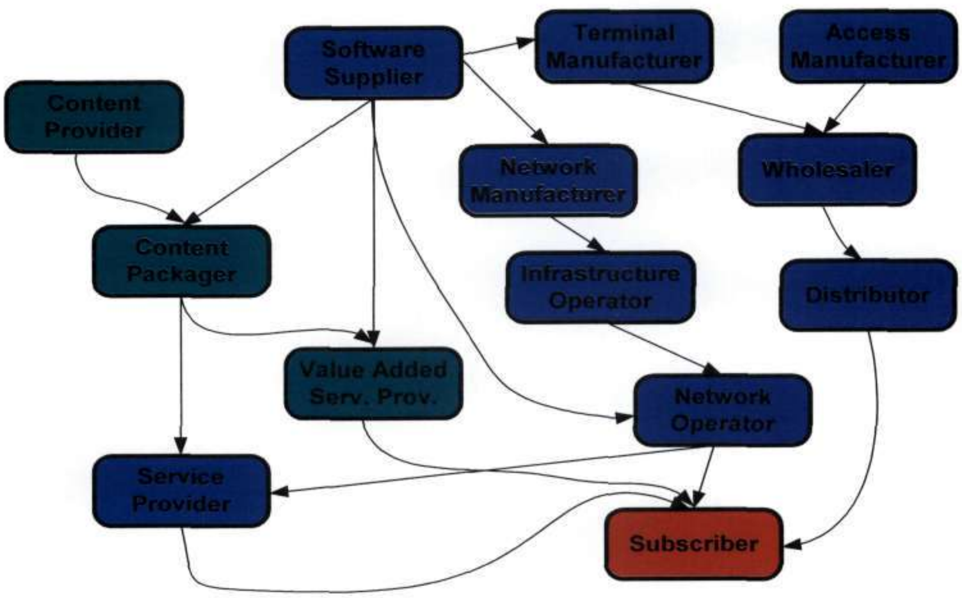


FIGURE 2.8: THE MOBILE DATA VALUE WEB

Adapted From: *Prem, E. (2002). Innovative Mobile Services and Revenue Models. [Online]. Available at http://www.eutema.com/downloads (Last accessed: April 2004).*

The new value chain reflects the convergence of telecommunications, IT and media companies. There seems to be a strong trend towards integrating as many value chain elements as possible into a company or holding. (Prem, 2002).

Bhargava (2002) lists the major entities or roles that are expected to emerge in the new value network or chain as:

- Mobile suppliers –manufacture and sell infrastructure for both voice and data networks, including the core and radio network equipment and terminals.
- Mobile network operators - own the infrastructure and licences required to operate a mobile network.
- Mobile service providers - provide mobile voice and data services to end-users by buying airtime from network operators and reselling it to end-users under their own brand name.
- Mobile virtual network operators (MVNOs) - these companies own network infrastructure and sell their services directly to customers using their brand name. They do not have a radio licence, and buy radio capacity from licensed network operators.

- Application service providers (ASP)- provide software-based application services to mobile network operators, service providers, MVNOs, and portals.
- Application developers - design and develop applications for the mobile world.
- Mobile portals - mobile portals offer an access point for mobile users to the mobile Internet. They offer access to content, links to other sites, applications, and services that can be accessed and operated from mobile terminals.
- Content aggregators- collect content from various sources and repack them in a user tailored offering that can be delivered to the mobile terminal.
- Content providers - produce content in a wide range of fields. Content can be in the form of textual information, game applications, banking services, specific database (e.g. airline ticketing), etc.
- Payment facilitators - provide payment facilitation services required for execution of online (mobile) transactions. This role can be performed by financial institutions such as banks and credit companies (e.g. Visa), or by companies providing only such services.
- Sponsors - sponsors most often pay part or the total cost of a service, making the service cheaper or free for the end user. Sponsors include sellers of products who are actively looking to promote their products through advertising in different types of media and by sponsoring services. Another type of sponsoring is subsidisation of devices, which is a common method to increase the number of subscribers or to attract new customers after the initial launch.
- End users - private and commercial users who buy mobile services from different types of players in the value web.

According to Ubacht (2001), most of the entities applying for a 3G licence have indicated their strong desire to assume the roles of the network operator, service provider and mobile portal. Other, more aggressive companies are also contemplating becoming payment facilitators and content providers. In figure 2.9 a simplification of the role models for the mobile data value chain are depicted.

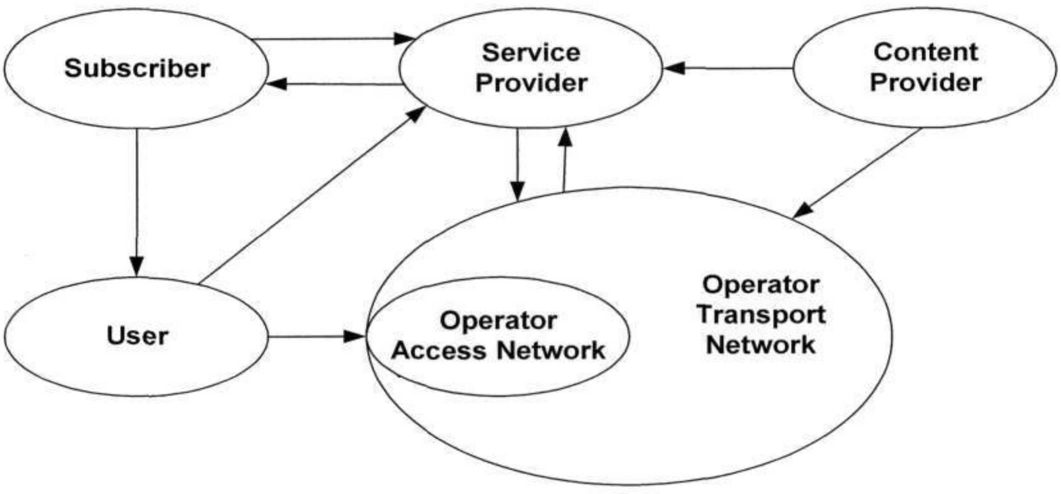


FIGURE 2.9: ROLE MODELS IN MOBILE DATA VALUE CHAIN

Adapted From: *Ubacht, J. (2001). UMTS: Question Marks for 2G Operators. Delft University of Technology Publication. Netherlands.*

The role of content providers and value added service providers will increase. An example of this can be seen in Japan where the mobile operator NTT DoCoMo has an alliance with about five hundred partners to offer news, information and entertainment within their service concept, i-mode. One player in the value chain can of course assume more roles. Looking at 2G operators the question of provisioning 'merely' transport services or positioning themselves as service/content providers is an important one. Their main strengths are direct access to the customers, access to customers' profiles and management of registration and billing of usage.

Both the revenues and costs of the entity will depend on the position/roles the entity assumes in this new and emerging value web. Thus, a correct business case can only be prepared once the entity's desired position is known.

2.6.3 Financial Arrangements

2.6.3.1 Revenue Models

The emphasis on different revenue sources in a network will shift for mobile data from the more traditional applications, such as voice, to revenue streams that nowadays form the basis for a number of internet-based businesses like advertising. However, according to many experts, voice will always remain the one "killer application" of mobile communication (Prem, 2002). Traditional revenue sources are subscription fee per time period, usage fee based on air time and service installation fee at activation time. From the network operator's perspective, activation fees are not so important, subscription fees are mainly used to recover handset subsidies and usage fees are decreasing. Innovative or newly emphasised revenue streams come from advertising and sponsoring revenues, sales revenues and service fees as well as transaction fees or commissions (Ubacht, 2001).

According to Prem (2002), the mobile network operator must fear being left somewhat aside in the new value chain. Considering Figure 2.8, it can clearly be seen that revenue flows mostly to new services and content rather than to the provider of the communication infrastructure. Of course, network operators are aware of the danger of turning into deliverers of bit streams rather than high quality and high price value added services. Operators will, thus, look to ensure their share of the revenue stream and indeed, they are in a good position to do so. The operator of a mobile network is in a position to hold key information about localisation, authentication and user preferences (Prem, 2002).

In addition to this, the mobile network operator holds an established billing relation with its customer. Operators will seek to optimally exploit information about user location and authentication in offering specifically tailored services. However, due to the complexity of many of the new services and the immature status of the underlying technology, co-operation with specialised partners is unavoidable (Prem, 2002). According to Ovum (2001), it is expected that the future of mobile revenue models will consist of complex co-operations among different technology and service partners. In these co-operations, operators will often try to retain as much of the valuable location and authentication information as possible or ask for high proportions of revenue to deliver this information to partners.

There are limits to this strategy since mobile data may develop in the direction of an open standard with IP driving the backbone. The key skill of mobile network operators in managing mobile data technology will no longer be crucial to the extent it was with 2G. Moreover, Prem (2002), highlights the fact that the valuable operator assets, location and authentication, can in principle be replaced by additional technological developments or simply by user input. There already exists mobile phones with built-in devices for exploiting location information. New mobile terminals may also be equipped with smart card readers to allow for secure identification and electronic signatures over the air interface. Both technologies will effectively undermine the mobile network operator's advantage.

A limited co-operation with content providers may backfire dramatically on network operators. Taking the widespread use of the internet as an example, its success is largely based on the incredible number of different actors providing all sorts of content, which is often on a free of charge basis. There is a real danger of undermining a similar development in the mobile use of content if network operators behave too restrictively. The very unsuccessful introduction of WAP technology based on GSM networks may be taken as an example. Reasons for the slow uptake are the poor content for many end users together with technological difficulties due to the slow data connection in GSM. It will be in the interest of mobile network providers to further the development of a large number of interesting services accessible through their networks (Prem, 2002).

There are increased complexities not only of the revenue streams, but also of other issues such as contractual aspects between all the involved actors or security and technology aspects related to billing. Success in meeting all these technological and business demands of innovative mobile services will thus only be possible through co-operation of many diverse players. Some of these will be completely new to the mobile arena. NEC (2001), rightly points out that mobile devices and networks are limited in terms of technology, interoperability and standardisation. This may indeed prove to be another important operator strength and suggest reasons for independent service providers to collaborate. Typical cooperation propositions from the operator side will include Hosting, Finance, Re-versioning, Information, Security and Billing.

With the advent of higher bandwidths for images, audio and video transmission, as well as, being "always-on" and new features such as cell broadcast, the creative industries will necessarily become new partners in mobile businesses. This includes advertising companies, new media agencies, cartoon designers etc. Media companies, however, will typically face a situation in which their idea is welcomed by an operator but arrangements for revenue sharing may turn out difficult and tedious (Prem, 2002).

The hardest skill to develop may indeed be the development of high-value features for the end-user. According to Prem (2002), operators have so far not proven to succeed in this domain. They will need to co-operate with fast moving, often small business-entrepreneurs who are in constant search and development of service value propositions. Ways of co-operation can take on many diverse forms, from linking third party services to an operator portal (where the service is hosted locally or remotely) to the subcontracting of developing a service branded by the operator. This effectively means that operators can choose between a low value "delivery" scenario and a high value "full service" scenario. In the former, the operator concentrates on voice communication, delivery through the network and a user interface. In the latter, the operator may add original content, portal presentation and a portal interface to cover a large number of steps in the value provision chain (NEC, 2001).

Similarly, different schemes for operator involvement in revenue collection are feasible. In a "low involvement" model, the operator collects orders from the end user and a transaction fee from the supplier of goods and services. The supplier delivers content to the user and also performs billing and collection directly. In a high involvement model, the operator is involved as a billing and collection intermediary with or without delivery of services to the user. It should be pointed out though that the actual billing process will be much more complex in mobile data. New types of content will become available, for which the end user will have to pay, e.g. videos or music files. Moreover, billing for prepaid subscribers will add to the complexity since this will require real-time data (possibly from third party services or content providers) to be integrated with the customer billing software (Prem, 2002).

2.6.3.2 Pricing Models

According to Cushnie and Hutchinson (2002), the pricing options in mobile data networks take on a wide variety and include the following bases for tariffs:

- Time
- Volume-based pricing (Mbyte)
- Value of transaction or content
- Service level agreement, e.g. guaranteed quality of service (minimum bandwidth)

In their choice of pricing scheme, operators will have to take into account a customer mindset that may be oriented to time-based tariffs of GSM and the capabilities of existing billing software. For transaction or volume-based pricing, clarity and transparency will be essential to the customer. First experiences with the GPRS based services point to the problem that customers will usually not know or understand file sizes of different media. Service level based tariffs with the option of charging for high-value content may turn out to be both understandable for customers and simple to maintain for operators (Cushnie & Hutchinson, 2002).

There are many charging models that have been proposed for the current and future Internet as well as those traditionally employed by the mobile and fixed line telephone networks. Most, if not all, of the Internet charging models are equally applicable for use in the mobile networks, especially with the introduction of 2G and 3G GSM systems. Cushnie and Hutchinson (2002), propose the following charging models and discuss how they can be adapted to the mobile network markets.

- **Metered Charging**

This pricing model is already in use with many Internet service providers (ISPs) and European mobile and fixed line telephone networks. The model involves charging the subscriber for the connection to the service provider on a monthly basis and then charging for metered usage of the service. The usage is usually measured in units of time and there is often a 'free' period of usage included with the monthly fee (Cushnie & Hutchinson, 2002).

- **Fixed Price Charging**

This pricing model is similar to that used by some US fixed line telephone networks for local call charging. The network service provider sets a fixed rental charge for the telephone connection and all local calls are then free of charge with metered charging used for long-distance calls (Cushnie & Hutchinson, 2002).

- **Packet Charging**

Packet Charging is specific to Packet Switching networks and involves the capturing and counting the number of packets exchanged in a session (Cai & Goodman, 1997). This is a proposed method of metering Internet traffic and being able to cross-charge between networks as well as ISP and mobile subscribers. This model requires the implementation of packet counting systems in the network and complex billing systems that can process the packet data on a subscriber and customer basis (Cushnie & Hutchinson, 2002).

- **Expected Capacity Charging**

This charging model allows the service provider to identify the amount of network capacity any subscriber receives under congested conditions and charge the subscriber an agreed price for that level of service. The subscribers are charged for their expected capacity and not the peak capacity rate of the network. Charging involves using a filter at the user network interface to tag excess traffic. This traffic is then preferentially rejected in the network in the case of network congestion but is not charged for. Charges are determined by the filter parameters (Cushnie & Hutchinson, 2002).

- **Edge Pricing**

This model charges for the usage at the 'edge' of the network scope for the subscriber, rather than along the expected path of the source and destination of the calling session. The networks in turn then cross-charge each other for the usage at the network 'edges'. Edge pricing refers to the capture of the local charging information. Once captured the information can be used for any kind of charging including metered, fixed or expected capacity. Past research has shown that much of the observed congestion on the Internet is at the edges of the individual networks which make up the Internet. The use of edge pricing may be effective as a policing method to monitor and alert the network operators to such congestion (Cushnie & Hutchinson, 2002).

- **Paris-Metro Charging**

This charging model introduces the concept of travel class, as used on public transport systems, to network traffic and relies on providing differentiated levels of service based on customer usage pricing only. The scheme assumes that subscribers will assign a preferred travel class with an associated cost for their different network traffic. The class assigned may be simplified to first and second class, as used on the Paris Metro system that inspired this charging model. The choice of class may be made dynamic and the subscriber may also use the throughput of the network to determine which class to use for their required traffic. The network may become self-regulating at periods of high usage.

When the network becomes congested and all the capacity in first class is filled, subscribers may downgrade to second class to improve their own network performance. This charging model may work well in GPRS and UMTS networks and allow subscribers to prioritise network traffic, for example, business emails may be considered more important that personal email so the cost penalty for first class may be considered appropriate for business email. An advantage of this charging model is the flexibility given to the network subscribers and also the control they have over the cost of their network traffic (Cushnie & Hutchinson, 2002).

- **Market Based Reservation Charging**

This charging model, usually attributed to Mackie-Mason, introduces the concept of a public auction of bandwidth or network resources. The network subscribers place monetary bids that will influence the quality of service they receive from their network-based applications. This model may be used in the mobile networks by having subscribers to the network maintaining a preferences profile that details the subscriber's bids for the various services used, for example email, voice, http, ftp and SMS. The network provider may then use the subscriber's preference profile when routing the network traffic (Cushnie & Hutchinson, 2002).

Table 2.1 compares the different charging models. The cost of implementation covers the infrastructure capital investment in new equipment and software to enable the use of the charging model.

Charging Model	Cost of Implementation	Network Overhead	Subscriber Overhead	Provision for Quality
Metered	High/Medium	Low	Low	No
Fixed Price	Medium/Low	Low	Low	No
Packet	High	High	Low	No
Expected Capacity	Medium/High	Low/Medium	Medium	Yes
Edge Pricing	Medium/Low	Low/Medium	Low	No
Paris Metro	Medium	High	Medium/High	Yes
Market Based	Medium/High	High	Medium/High	Yes

Table 2.1: Charging Model Comparison

Adapted From: *Cushnie, J. & Hutchison, D. (2002). Charging and Billing Models for GSM and Future Mobile Internet Services. Lancaster: Lancaster University Publication.*

The overhead on the network of the charging models includes, but is not limited to, the additional network traffic required to implement the model, and the addition of any new systems for data collection and processing over and above the standard GSM building blocks. Overhead to the subscribers include added complexity of tariffs and the maintenance of the subscriber's account to use the charging models efficiently and to avoid excessive charging by the mobile network provider.

The various GSM networks have the option to charge their subscribers using similar or different models for the new 2G and 3G GSM based Internet services. This is already the case with 1G GSM mobile networks, due to a variety of technical, commercial, geographical and political issues and concerns. In the mobile network market, it may make technical and commercial sense to adapt and combine some, or perhaps all, of the above charging models and additional ones into 'unified' flexible models, which will cover the more diversified requirements of mobile charging (Cushnie & Hutchinson, 2002). Figure 2.10 shows an example of how the various charging models may be combined for charging for GSM voice and Internet services.

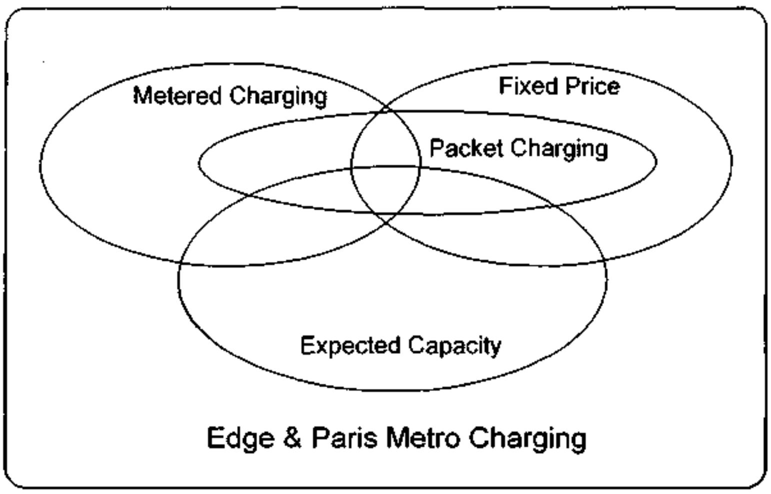


FIGURE 2.10: COMBINING CHARGING MODELS

Adapted From: *Cushnie, J. & Hutchison, D. (2002). Charging and Billing Models for GSM and Future Mobile Internet Services. Lancaster: Lancaster University Publication.*

A basic customer subscription may comprise a fixed price tariff that includes free mobile calls up to a fixed limit, plus Metered Charging for extra mobile calls. Packet Charging may be included for Web browsing and email using 2G or 3G GSM for the subscriber's account. Expected Capacity may also be included for 2G and 3G GSM data traffic as well as Edge Pricing and Paris Metro Charging for email and data traffic. Subscriber's requirements vary greatly from students to business users, from light domestic users to heavy personal users. By modifying and combining charging models tariffs can be developed for the major demographic groups of subscribers (Cushnie & Hutchinson, 2002).

The illustration above shows the overlap between the various pricing models and how the boundaries can be made flexible depending on the subscriber usage profiles. For example, the mobile network operator may use Packet Charging in both Fixed Price and Metered Charging tariffs for some subscribers but only use Packet Charging with a Fixed Price charging model for other subscriber groups or tariffs. Some subscribers may only want to use limited Internet services, for example only text email and no Web browsing. The tariffs for the subscriber may become complicated but may ultimately give the subscribers more control over the way they are charged for using the mobile voice and Internet services and the Quality of Service (QoS) they receive from the network (Cushnie & Hutchinson, 2002).

The network operators will also have the advantage of being able to charge the subscribers for different level of QoS for the different services and network provision. There will always be a trade-off between the complexity of the billing system to be implemented and the advantage the network provider will receive for having the systems in place. Fixed price charging schemes reduce the overhead of the charging and billing systems infrastructure, as they tend to provide the simplest charging scenarios. Usage based charging models provide incremental and harder to predict income for the network operators as well as requiring more infrastructure investment.

2.6.3.3 Cost Analysis

The background of a mobile data network operator is highly significant with regards to the potential success of the mobile data business case. Key factors that can differentiate the business cases of operators with different backgrounds include existing re-usable infrastructure, competence, subscriber base, organisation, and brand recognition. Both new and incumbent operators are subject to large capital expenditure, with some likely savings for incumbents. It will be very hard for a new operator to achieve profitability. Northstream (2001), have demonstrated that in the case where the new operator can obtain the same market share as an incumbent, will in the long run require an ARPU increase of 37% compared with the incumbent. In the case where this market share cannot be reached, the ARPU required becomes even higher. For a new operator with 15% market share by 2005, the required ARPU is 60% higher than for an incumbent with 20% market share.

A migration from the traditional operator role to a focus on network resource provisioning (bit-pipe operations) will reduce costs significantly. The mobile value chain is constantly changing. The 3G technology opens new opportunities for operators to establish themselves in traditional as well as new parts of the value chain. The position taken by an operator will have a large effect on the business case, affecting the capital expenditure (CAPEX), operational expenditure (OPEX), risk factor, revenues, and overall business success. Costs are reduced significantly when the operator becomes a bit-pipe provider. According to Northstream (2001), an operator operating as a bit-pipe operator will require ARPU levels 40% lower than those required by an operator that is also functioning as a service provider and a mobile portal. The revenues that are 'lost' by the bit-pipe operator will be transferred to service providers and Mobile Virtual Network Operators (MVNOs). There are no fixed rules dictating which position an operator should undertake. An analysis should be carried out on a case by case basis.

The dimensioning of the network and service platforms is based on a calculation derived from the traffic and sizing. CAPEX includes investments in intangibles like licence fees and various types of equipment. A detailed investigation of the OPEX should also be carried out. The CAPEX required for an entity holding a licence to operate a 3G network depends on where the operator wishes to be in the value chain. The assumption is that the operator will own the network, be the service provider and host a mobile portal. Bhargava (2002), lists the following major CAPEX items and its drivers:

- **Customer Care and Billing Systems**

Customer care and billing systems will play an increasingly important role in mobile data implementation. Good customer care and flexible billing systems will not only help operators understand user behaviour in order to provide subscribers with services and applications based on their usage pattern, but also generate new revenue streams. Flexible billing systems will create opportunities for sharing revenues with service and application providers. The main drivers for this part of the CAPEX are the number of subscribers and the complexity of services and charging methods.

- **Sales and Marketing Expenses**

The major components of the sales and marketing expenses are:

- Handset and accessories cost - operators in many markets subsidise the terminals purchased by their subscribers. Terminal subsidy accounts for a large part of the operator's OPEX. The level of subsidy depends on the competition within the market and the bargaining power of the operator. The main drivers of terminal subsidy are the number of gross adds (net adds plus churn), target user segments and the type and price of device.
- Advertising and promotion - these are costs that relate to the establishment of the brand name of the operator. Advertisement costs are usually high in the initial years and should come down (per gross add) as the operator becomes established in the market although the operator may have to sustain or even increase the advertising cost in highly competitive markets. The main driver of this cost is the number of gross adds and the level of competition.
- Commissions, retail location rent, direct sales force salaries/expenses, printing and materials etc - all of the above expenses tend to be high on a per gross add basis in the early years but should fall as the number of subscribers increases. The major drivers are the number of gross adds, the level of competition, availability of trained work force and the macro economic conditions of the market.

- **General and Administrative Expenses**

The main components of the G&A expenses are:

- Bad debt expense - this cost depends to a large extent on the credit standards imposed by the operator. It generally varies with the level of revenues. The main drivers for this cost are target segments, proportion of prepaid customers, the number of subscribers and the macro economic conditions. There is, obviously, no bad debt expense related to prepaid customers.

- Billing cost - these costs relate to the generation and delivery of bills to the post paid subscribers of a network. Prepaid customers, obviously, do not receive any bills. The main driver of this cost is the number of post-paid customers.
- Customer care expense - these costs relate to the salaries of the customer care staff and other expenses incurred in operating the customer care department/centre. The main driver of this cost is the number of subscribers.

- **Other General and Administrative Expenses**

A number of other expenses such as salaries, rent, and insurance are included in this category. These costs tend to be fixed and grow with inflation plus a margin.

- **Depreciation and Amortisation**

The level of depreciation in any year really depends on the level of capital expenditure and the choice of depreciation method. Due to the different types of equipment involved in a 3G network (including the equipment required for the mobile portal) the assets will be depreciated over varying lengths of time (ranging from a few years to 8–10 years). Amortisation expense results primarily from goodwill and licence cost.

- **Interest Cost**

The interest cost for a 3G network operator will depend primarily on the perceived risk of the project, security offered, competition within the financial community, debt to equity ratio (size of debt), type of debt and the level of interest rates in the market.

2.6.4 Technical Arrangements

The technology choices available to a mobile network operator are discussed in Chapter Three.

2.7 Conclusion

Mobile data has the potential to produce significant new revenues for cellular operators. The use of mobile data is expected to grow tenfold over the next five years. The UMTS forum predicts service revenue from 3G networks of $320 billion in 2010 of which $233 billion will be generated by new mobile data services. To profit from these opportunities, however, mobile operators will have to make critical choices over the next one to two years with respect to their mobile data strategies.

Developing a mobile data business model requires a deep understanding of technology and its commercial potential. A well thought out business model can help the mobile operator maintain realistic expectations of the business, evaluate new opportunities and challenges and make the right decisions in order to effectively handle those challenges and opportunities. This chapter has laid out the framework for the development of a mobile data business model. The key components of the business model include the customer value of service, organisational, financial and technical arrangements.

In order to provide superior customer service, the mobile operator will have to consider the content (what the company is offering), the context (how the company is offering it) and the infrastructure (what enables the transaction to take place). All three factors will play a major role in defining the newness of the product or service. The success of mobile data will not just come from the mere combination of the existing successful phenomena, namely mobility and the Internet. The real success will result from the creation of new service capabilities that genuinely fulfil a market need.

With the introduction of mobile data, the traditional mobile voice value chain is drastically changed. With the convergence of telecommunications, IT and media companies there are now new players in the industry. The mobile operator needs to decide which parts of the new value chain it wishes to own. The operator could be just the provider of the access network or it could also be a service and content provider of the mobile data network. Mobile operators must also establish constructive relationships and partnerships with everyone who brings value to mobile products and services. This includes the content providers, mobile handset manufacturers, application developers and system integrators. Through partnerships, the mobile operator can improve the customer experience and increase the financial rewards for the company by creating an integrated service environment.

With the development of new mobile technology, such as GPRS and UMTS, there is now a whole new source for mobile data revenue. Mobile operators will need to add value to content in order to derive more revenue than what is just available from selling network capacity and transport. In the new value chain, revenues flow mostly to new services and content rather than to the provider of the communication infrastructure. The creation of innovative service and product bundled offerings will enable the mobile operator to secure a superior competitive advantage. There are various pricing strategies available to the operator in order to charge the customers in the most effective manner. These include the metered, fixed price, packet, expected capacity, edge, Paris-metro and market based reservation charging.

The success of the business model is greatly affected by the cost of rolling out the new mobile data services and infrastructure. Each component of CAPEX and OPEX will have to be analysed. The major cost will be the deployment of the new technology on the network. Chapter Three discusses the various technological options available to network operators as they seek to upgrade their network.

Chapter Three –Technology Review

3.1 Introduction

As the volume of voice traffic per subscriber continues to grow and mobile penetration reaches its full potential, mobile operators must seek ways to stay competitive other than merely setting aggressive voice tariffs. Offering value-added services and interesting content is the key to increasing revenues and keeping ahead of the competition. Mobile data services make it possible to offer innovative, segmented services to different user groups to attract new subscribers and to reduce churn. Data users may also be the highest speech users, so capturing their business can also increase speech revenues.

With data constituting a rising percentage of total cellular traffic, it is essential that operators deploy data technologies that meet customer requirements for performance and is spectrally efficient, especially as data applications can demand significant network resources. Operators have a huge investment in spectrum and in their network, therefore, data services must leverage these investments. It is only a matter of time before most subscribers migrate to the new generation of mobile data networks. This presents tremendous opportunities and risks to operators as they choose the most commercially viable evolution path for migrating their customers (Rysavy, 2002).

Global System for Mobile Communication (GSM) is the leading mobile cellular standard worldwide. There are over 400 GSM networks in service today (GSACOM, 2001). Operators, like MTN, have built so-called Second-Generation (2G) mobile networks. The technology now enters a new phase with the exploitation of so-called Third Generation (3G) mobile networks. The 3G networks in Europe are commonly referred to as UMTS (Universal Mobile Telecommunications System). UMTS is part of the IMT-2000 project of the International Telecommunications Union (ITU).

Most 2G network operators are facing strategic and technical choices between continuing investments in their existing networks or waiting for 3G to hit the market. The choice for implementing 2G upgrades depends on (GSACOM, 2001):

- market demand for data services,

- the state of the GSM network,
- frequency capacity and financial resources of the network operator,
- the ambition of a network operator to offer value added services,
- whether or not a 2G operator obtains a 3G licence.

There are various paths that a GSM 2G operator, such as MTN, can follow as it upgrades its GSM network to achieve the highest possible data throughputs. It is vital that the operator fully understands the advantages and disadvantages of all new technologies. This chapter examines the three technologies most relevant to GSM based networks, namely GPRS, EDGE and UMTS. The network architecture required for all three technologies is discussed in detail. A comparison of the data capabilities and the services that can be offered is also undertaken. The different evolution paths to 3G technology is also explained in this chapter.

3.2 Technology Capabilities

The GSM migration from 2G to 3G technology incorporates constant enhancements in capability and efficiency. This progression enables an increasing number of applications, both due to performance and lower usage cost. 2G cellular data support is limited to basic data applications such as messaging, text based e-mail and download of ring tones. It lacks adequate connectivity for efficient Internet access. In assessing the potential applications of cellular data services, it is helpful to note the approximate throughput requirements for different applications (Rysavy, 2002). These are shown in Table 3.1 below.

Application	Throughput Requirements (Kb/s)
Micro browsing	8 to 16
Multimedia Messaging	8 to 32
Video Telephony	64 to 384
General Purpose Web Browsing	32 to 384
Enterprise Applications (e-mails, database access)	32 to 384
Video and Audio Streaming	32 to 384

Table 3.1: Data Throughput Requirements

Adapted From: *Rysavy, P. (2002). Data Capabilities for GSM Evolution to UMTS. [Online]. Available at http:// www.rysavy.com/articles (Last accessed: February 2004).*

Networks themselves set boundaries for services. A good service idea is constrained by the current or emerging technology. Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Enhanced Data rates for GSM Evolution (EDGE) and Universal Mobile Telecommunications System (UMTS) will be the basis for future mobile networks and thus, also a future service platform. GSM already has a large footprint all over the world and offers reliable but slow data connections. New technologies will bring quite extensive enhancements to the data rates and service opportunities (GSACOM, 2001).

According to Rysavy (2002), it should be noted that it is challenging to predict just what applications will drive the mobile data market and what their exact bandwidth requirements will be. The wide range of bandwidths suggested in Table 3.1 bears testimony to this. It is also not clear whether consumer applications will have greater bandwidth requirements than business applications, though this could well be the case if streaming entertainment becomes popular. Given this uncertainty, it is imperative that data services be flexible, has high spectral efficiency and supports a wide variety of applications. The data services in the GSM evolution to UMTS provides exactly this capability.

In order for MTN to formulate a mobile data strategy, it is imperative that all new network technologies are well understood. This includes the data throughputs that can be achieved as well as the upgrades required to the network. The next three sections examine the three technologies most applicable to MTN, i.e. GPRS, EDGE and 3G.

3.2.1 GPRS

GPRS gives a direct link between the worlds of the Internet and mobile communications. GPRS is different from current GSM data services since it is a packet-based IP connectivity solution supporting a wide range of enterprise and consumer applications. GPRS allows users to instantly access data, as they would use their office Local Area Network (LAN). The mobile user does not have to connect to the network each time he wants to transfer data; they can stay connected all day. GPRS enables instant, always connected applications. With throughput rates of up to 48 Kb/s (utilising coding schemes 1 & 2) using four time-slot devices, users have the same effective access speeds as a modem but with the convenience of being able to connect from anywhere (Rysavy, 2002). The technology enables users to be charged for the actual amount of data they transfer. This makes a completely new area of mobile data applications possible. GPRS is a significant development step toward 3G, which is why it is also classed as being "2.5G" technology. GPRS is now available worldwide in over 65 countries, with service from over 200 operators with a choice of over 85 handsets (Ericsson, 2002a).

GPRS is the first GSM Phase 2+ service that requires major changes in the network infrastructure, bringing packet switching into a circuit-switched transmission mode GSM network. Standard GSM uses circuit-switched connections, i.e. each time a connection is required between two points, a link between the two points is established and the resources used are reserved for the use of that single call for the complete duration of the call. Data networks, such as the Internet and LANs, use packet-switched connections. With packet switching, the data to be transferred is divided into packets, which are then sent through the network and re-assembled at the receiving end. The digitised contents (text, images, tones, software etc.) are broken down into small data packages, compressed, and coded. These data packages are then sent to the recipient in "packaged" form more or less in the "gaps" arising in voice communication (Ericsson, 2002a).

GPRS upgrades GSM data services to be more compatible with other data networks, such as LANs, WANs and the Internet. The physical radio path used by the GPRS service is based on the same principles as the current GSM system. The same frequency domain is used, thus allowing the GPRS and circuit switch traffic to use the air interface simultaneously. To support GPRS, additional network elements are added to the current GSM network. These are the Serving GPRS Support Node (SGSN), Gateway GPRS Support Node (GGSN) and GPRS backbone (Trillium, 2000). An illustration of the network architecture is shown in Figure 3.1.

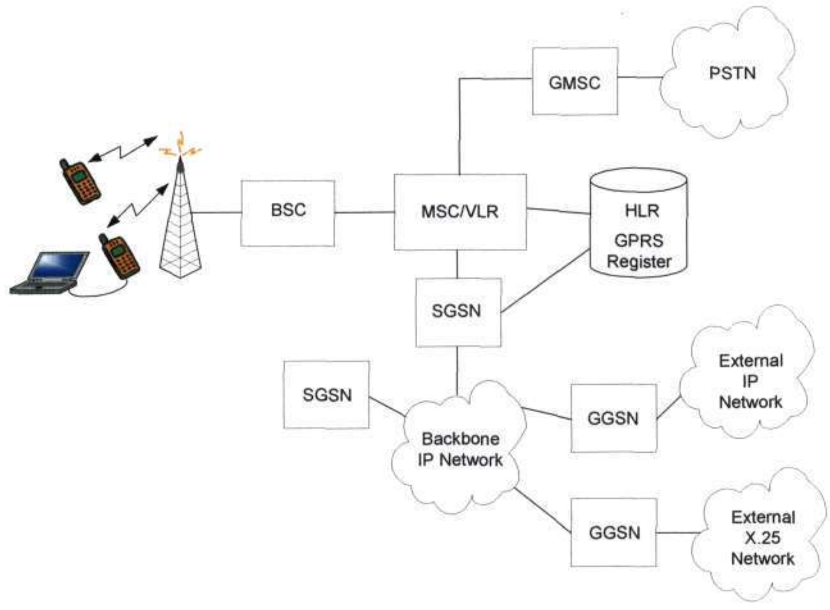


FIGURE 3.1: GSM/GPRS NETWORK ARCHITECTURE

Adapted From: *Third Generation (3G) Wireless White Paper. [Online]. Available at* *http://www.trillium.com/pages/white papers (Last accessed: March 2004).*

GPRS is essentially the addition of a packet-data infrastructure to GSM. The functions of the data elements are as follows:

1. The base station controller (BSC) directs packet data to the SGSN, which is an element that authenticates and tracks the location of mobile stations.

2. The SGSN performs the types of functions for data that the mobile switching centre (MSC) performs for voice. There is one SGSN for each serving area and it is often co-located with the MSC.
3. The SGSN forwards user data to the GGSN, which is a gateway to external networks. There is typically one GGSN per external network such as the Internet. The GGSN also manages IP addresses, assigning IP addresses dynamically to mobile stations for their data sessions (Rysavy, 2002).

In 2002, MTN had to purchase the new and expensive GPRS nodes (the SGSN and GGSN) in order to offer the new data service. There were also software upgrades required for the switching centres and the base stations. No hardware changes were needed for the base stations, any of the switching nodes or the Home Location Register (HLR).

With the GPRS standard, charging is no longer based on the length of transmission time instead the basis is the volume of data exchanged or the type of service. It means terminals can be "always on" and display arriving messages without delay. Depending on the coding, much faster data transmission rates can be achieved per timeslot with GPRS than the 9.6 Kb/s with GSM. In the GPRS standards there are four different channel coding schemes: CS-1 to CS-4. CS-1 offers the highest error correction, using half-rate convolutional coding and the lowest user data rate. CS-2 and CS-3 are punctured versions of the half rate code used in CS-1, while CS-4 achieves the highest data rate by providing no error correction to the user data. Table 3.2 shows the data rates for the different coding schemes (Ericsson, 2002a).

Channel Coding Scheme	Single Timeslot Data Rate
CS1	9.05
CS2	13.4
CS3	15.6
CS4	21.4

Table 3.2: Data Rates for GPRS

Adapted From: *Ericsson. (2002a). EDGE- Introduction of High Speed Data in GSM/GPRS Networks. Sweden: Ericsson AB.*

The rates shown above is for one channel, so a Mobile Station (MS) using all eight timeslots could achieve a theoretical data rate of 171.2 Kb/s with CS-4.

While GPRS is indeed an evolutionary technology, it has however demonstrated some limitations. According to Rysavy (2002), GPRS impacts on a network's existing cell capacity. There are only limited radio resources that can be deployed for different uses – use for one purpose precludes simultaneous use for another. For example, voice and GPRS calls both use the same network resources. The extent of the impact depends upon the number of timeslots, if any, that are reserved for the exclusive use of GPRS. In the radio link, GSM uses radio channels of 200 kHz width, divided in time into 8 time slots that repeat every 4.6 ms. The network can have multiple radio channels (referred to as transceivers) operating in each cell sector. The network assigns different functions to each time slot, such as circuit switched functions like voice calls or the packet broadcast control channel and packet data channels. The network can dynamically adjust capacity between voice and data functions and can also reserve a minimum amount of resources for each service (Ericsson, 2002a).

Ericsson (2002b), have demonstrated that achieving the theoretical maximum GPRS data transmission speed would require a single user taking over all 8 timeslots without error protection. Clearly, it is unlikely that a network operator will allow all timeslots to be used by a single GPRS user. The bandwidth available to a GPRS user will, therefore, be severely limited. The reality is that mobile networks are always likely to have lower data rates than fixed networks. Relatively high mobile data speeds may not be available to individual mobile users until EDGE or UMTS are introduced.

3.2.2 EDGE

EDGE is an enhancement to the GSM mobile cellular phone system. The name EDGE stands for Enhanced Data for GSM Evolution and it enables data to be sent over a GSM system at speeds of up to 384 Kb/s. In some instances EDGE systems may also be known as EGPRS, or Enhanced General Packet Radio Service systems. The objective of the new technology is to increase data transmission rates by a factor of three over GPRS, improve spectrum efficiency and to facilitate new applications for mobile use. With the introduction of EDGE in GSM phase 2+, existing services such as GPRS and high-speed circuit switched data (HSCSD) are enhanced by offering a new physical layer. The services themselves are not modified. EDGE is introduced within existing specifications and descriptions rather than by creating new ones (Ericsson, 2002b).

In addition to enhancing the throughput for each data user, EDGE also increases capacity. With EDGE, the same time slot can support more users. This decreases the number of radio resources required to support the same traffic, thus, freeing up capacity for more data or voice services. EDGE makes it easier for circuit-switched and packet-switched traffic to coexist while making more efficient use of the same radio resources. Therefore, in tightly planned networks with limited spectrum, EDGE may also be seen as a capacity booster for the data traffic (Nokia, 1999).

According to Rysavy (2002), EDGE leverages the knowledge gained through use of the existing GPRS standard to deliver significant technical improvements. Table 3.3 compares the basic technical data of GPRS and EDGE.

Feature	GPRS	EDGE
Modulation	GMSK	8PSK/GMSK
Symbol Rate	270 ksym/s	270 ksym/s
Modulation Bit Rate	270 kb/s	810 kb/s
Radio Data Rate per time slot	22.8 kb/s	69.2 kb/s
User Data Rate per time slot	20 kb/s (CS 4)	59.2 kb/s (MCS 9)
User Data Rate (8 time slots)	160 kb/s	473.6 kb/s

Table 3.3: Comparison of EDGE and GPRS Technical Data

Adapted From: *Rysavy, P. (2002). Data Capabilities for GSM Evolution to UMTS. [Online]. Available at http:// www.rysavy.com/articles (Last accessed: February 2004).*

Although GPRS and EDGE share the same symbol rate, the modulation bit rate differs. EDGE can transmit three times as many bits as GPRS during the same period of time. This is the main reason for the higher EDGE bit rates. One of the key elements of EDGE is the form of modulation that is used. GPRS, being essentially a packet switched version of GSM uses Gaussian minimum shift keying (GMSK), along with GSM itself. This form of modulation limits the data rate that can be transmitted over the air interface. EDGE uses a new modulation scheme called Octonary Phase Shift Keying (8- PSK). This is a form of phase shift keying where 8 phase states are used (Rysavy, 2002).

The advantage is that it can transmit high data rates, although it is not as immune to interference and noise. The network, therefore, switches to 8PSK to allow the high data transfer rates when signal strengths are sufficient to permit the data transfer with a sufficiently low Bit Error Rate. By using 8-PSK, it is possible to transfer data at 59.2 kb/s per channel rather than 9.6 Kb/s that is possible using GMSK. By allowing the use of multiple channels, the technology allows the transfer of data at rates up to 384 Kb/s. However, it should be remembered that these data transfer rates are only possible when the network is not highly loaded, as access to all the channels would not be allowed (Ericsson, 2002b).

For GPRS, four different coding schemes, designated CS1 through CS4, are defined. Each has different amounts of error-correcting coding that is optimised for different radio environments. For EGPRS, nine modulation coding schemes, designated MCS1 through MCS9, are introduced. These fulfill the same task as the GPRS coding schemes. The lower four EGPRS coding schemes (MSC1 to MSC4) use GMSK, whereas the upper five (MSC5 to MSC9) use 8PSK modulation (Ericsson, 2002b). Figure 3.2 shows both GPRS and EGPRS coding schemes, along with their maximum throughputs.

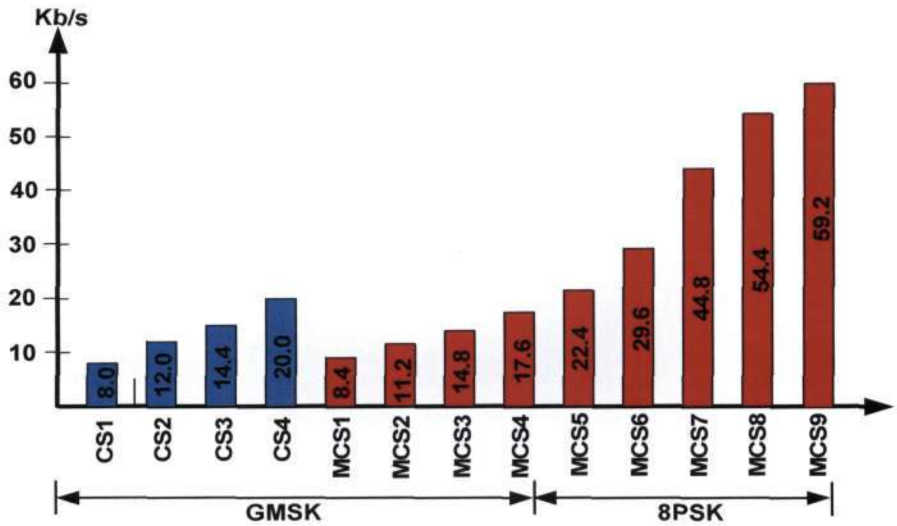


FIGURE 3.2: CODING SCHEMES FOR GPRS AND EGPRS

Adapted From: *Ericsson. (2002b). Giving Operators a New EDGE. Sweden: Ericsson AB.*

GPRS user throughput reaches saturation at a maximum of 20 Kb/s with CS4, whereas the EGPRS bit rate continues to increase as the radio quality increases, until throughput reaches saturation at 59.2 Kb/s. Both GPRS CS1 to CS4 and EGPRS MCS1 to MCS4 use GMSK modulation with slightly different throughput performances. This is due to differences in the header size (and payload size) of the EGPRS packets. This makes it possible to resegment EGPRS packets. A packet sent with a higher coding scheme (less error correction) that is not properly received, can be retransmitted with a lower coding scheme (more error correction) if the new radio environment requires it. This re-segmenting (retransmitting with another coding scheme) requires changes in the payload sizes of the radio blocks, which is why EGPRS and GPRS do not have the same performance for the GMSK modulated coding schemes. Re-segmentation is not possible with GPRS (Rysavy, 2002).

The increased bit rates put requirements on the GSM/GPRS network architecture. Figure 3.3 illustrates the nodes of the GPRS network that are affected with the introduction of EDGE. These are shaded red in the diagram.

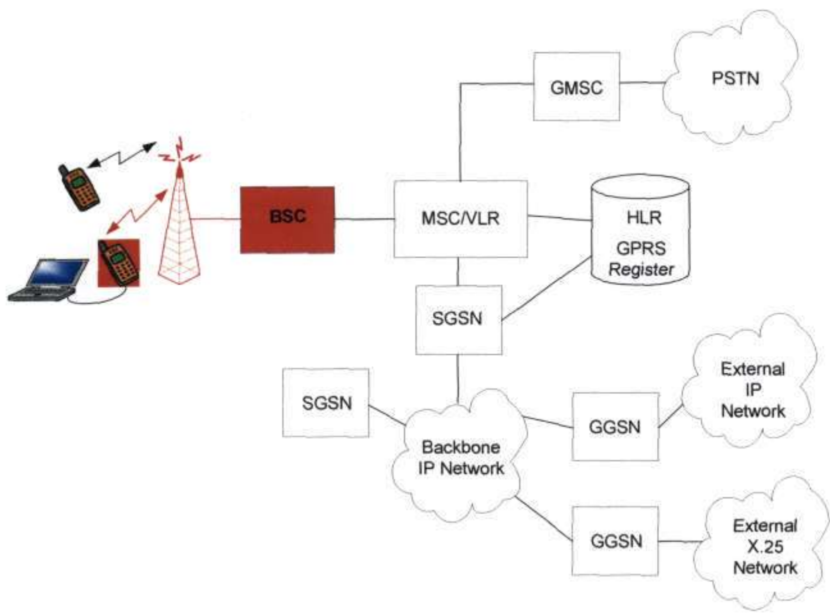


FIGURE 3.3: NODES AFFECTED BY THE INTRODUCTION OF EDGE

Adapted From: *Third Generation (3G) Wireless White Paper. [Online]. Available at http://www.trillium.com/pages/white papers (Last accessed: March 2004).*

According to Ericsson (2001), the impact of EGPRS on the existing GSM/GPRS network is limited to the base station system due to the minor differences between GPRS and EGPRS. The base station is affected by the new transceiver unit capable of handling EDGE modulation as well as new software that enables the new protocol for packets over the radio interface in both the base station and base station controller. An apparent bottleneck is the Abis interface (the air interface between the BSC and Base Station), which today supports up to 16 kb/s per traffic channel. With EDGE, the bit rate per traffic channel will approach 64 kb/s, which makes allocation of multiple Abis slots to one traffic channel necessary. The core network does not require any adaptations. Due to this simple upgrade, a network capable of EDGE can be deployed with limited investments and within a short time frame.

The ability of EDGE to utilise existing resources, infrastructure and spectrum, is seen as a major advantage of the technology and a key driver. By deploying EDGE to enhance a GPRS network, efficiencies can be demonstrated with the support of greater data capacity with the existing spectrum. These efficiencies will also have an effect on voice capacity, by freeing-up channels, which can be then used for voice traffic. EDGE is also an essential complementary stepping-stone en-route to UMTS and integrated cellular networks.

Rysavy (2002), demonstrated that by using EDGE to provide high-speed coverage outside the first stage of UMTS enabled areas, such as main metropolitan areas, would increase the adoption of 3G services and applications in the market. Going forward using EDGE to provide enhanced services in support of UMTS coverage, perhaps in areas of lower traffic density, will ensure EDGE as a must technology and gives a network operator who deploys EDGE a distinct advantage within the marketplace. Being able to deliver standardised applications and services, from whatever technology platform, with controlled Quality of Service (QoS) is a shared industry vision. A unified, enhanced Radio Access Network (RAN), supporting the different technologies is the key to this goal.

The need to reduce business risk and make the best use of existing resources is of paramount importance within today's business environment. GSM based networks have become the standard within the cellular landscape. According to Hughes (2002), EDGE is a GSM based technology that provides an enhancement for GPRS at little additional cost and is considered the best way in which to capitalize on existing resources. GPRS enabled applications and services will generally not require any additional investment to become EDGE compatible. The business benefits of deploying GSM based end-user devices, as opposed to other technologies is clear when economies of scale are taken into consideration.

Although the financial benefits of EDGE can be apportioned to individual network elements as outlined above, one of the main business drivers is that EDGE forms an essential part of the overall GSM evolution towards a seamless multi-radio GSM/GPRS/EDGE/UMTS network. As mentioned previously, GSM is the main standard for cellular communications worldwide and the business benefits of deploying an industry standard technology can be seen in nearly every aspect of a network deployment, from end-user devices, to applications to hardware (Siemens, 2002).

Operator driven studies have indicated that for a GSM operator to upgrade a GPRS capable network for EDGE working is approximately 7 - 15% of the total initial GSM investment. For a GSM operator there will always be a basic requirement to enhance their network infrastructure to improve service over time. This may include the introduction of a packet layer via GPRS and other enhancements, which will make best use of their existing infrastructure and investment. It is also worth considering that if new base stations are installed they will be delivered EDGE ready, especially if they are from a mainstream manufacturer. This program of improvements will, by definition, move the operator towards a network infrastructure, which can then be upgraded to EDGE at very little incremental cost (Rysavy, 2002).

MTN's GSM network is 10 years old with numerous outdated radio base station equipment still being used. For MTN to upgrade its GPRS network to EDGE will require a huge capital outlay in order to upgrade the base station to the latest EDGE capable equipment. Extra transmission and software costs will also be incurred.

3.2.3. Third Generation Technology

Telecommunication service providers and network operators are embracing the recently adopted global Third Generation (3G) wireless standards in order to address emerging user demands and to provide new services. The concept of 3G wireless technology represents a shift from voice-centric services to multimedia-oriented (voice, data, video, fax) services. In addition, heavy demand for remote access to personalised data is fueling development of applications, such as the Wireless Application Protocol (WAP) and multimedia management, to complement the 3G protocols. Complementary standards, such as Bluetooth, will enable interoperability between a mobile terminal (phone, PDA etc.) and other electronic devices, such as a laptop/desktop and peripherals, thereby, providing added convenience to the consumer and allowing for the synchronisation and uploading of information at all times. The 3G mobile devices and services will transform mobile communications into on-line and real-time connectivity. The 3G wireless technology will allow an individual to have immediate access to location-specific services which offer information on demand (Rysavy, 2002).

This mobile technology represents the convergence of various 2G wireless telecommunication systems into a single global system that includes both terrestrial and satellite components. One of the most important aspects of 3G wireless technology is its ability to unify existing cellular standards, such as Code Division Multiple Access (CDMA), GSM, and Time Division Multiple Access (TDMA), under one umbrella. To ensure a smooth transition towards 3G, the IMT-2000 was established by the International Telecommunication Union (ITU) to harmonise the different proposed 3G standards. To date, the ITU has decided on a single flexible standard with a choice of multiple access methods. CDMA is perceived to be the predominant air interface since it can support a higher bandwidth (Ericsson, 2001).

Two 3G standards, wideband CDMA (WCDMA) and cdma2000 have emerged as the most prominent contenders. WCDMA is supported by current GSM-centric countries while cdma2000 is supported by current CDMA-centric countries. WCDMA is also commonly known as Universal Mobile Telecommunication System (UMTS). W-CDMA will require bandwidth of between 5 MHz and 10 MHz, making it a suitable platform for higher capacity applications. Subscribers are likely to access 3G wireless services initially via dual band terminal devices. UMTS has garnered the overwhelming majority of new 3G spectrum licences, with most operators worldwide planning on deploying UMTS networks. The primary benefits of UMTS include high spectral efficiency, high user densities and support for high bandwidth data applications (Siemens, 2002)

According to Ericsson (2001), WCDMA data channels can support up to 2 Mb/s of data throughput. However, exact throughput depends on what size channels the operator chooses to make available and the number of users active in the network. Thus, users can expect throughputs of up to 384 Kb/s, which will satisfy almost any communications-oriented application. Operators can use a common core network that supports multiple radio access networks, including GSM, GPRS, EDGE and WCDMA. This common core network uses the same network elements as GPRS. This is called the UMTS Multi-radio network and gives the operators maximum flexibility in providing different services across their coverage areas. The network architecture for 3G is shown in Figure 3.4.

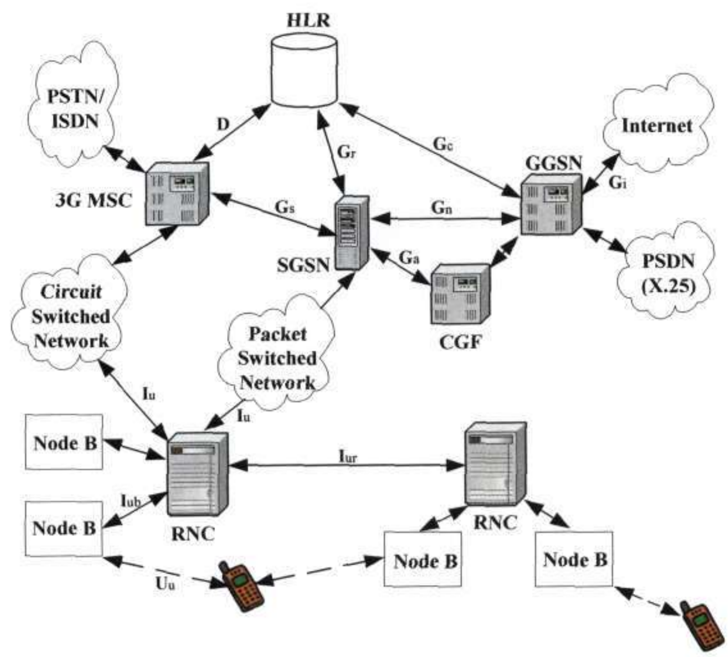


FIGURE 3.4: UMTS NETWORK ARCHITECTURE

Adapted From: *Third Generation (3G) Wireless White Paper. [Online]. Available at* http://www.trillium.com/pages/white papers *(Last accessed: March 2004).*

The 3G wireless networks consist of a Radio Access Network (RAN) and a core network. The core network consists of a packet-switched domain, which includes the 3G Serving GPRS Support Nodes (SGSN) and Gateway GPRS Support Nodes (GGSN), which provide the same functionality as in the GPRS system. The GGSN provides the connection to external Packet Data Network (PDN), such as the Internet backbone or an X.25 network. Both the SGSN and GGSN interface with the Home Location Register (HLR) to retrieve the mobile user's profiles to facilitate call completion. The circuit-switched domain includes the 3G Mobile Switching Centre (MSC) for switching of voice calls. Charging for services and access is done through the Charging Gateway Function (CGF), which is also part of the core network. The RAN functionality is independent from the core network functionality (Trillium, 2000).

The main purpose of the RAN is to provide a connection between the handset and the core network and to isolate all the radio issues from the core network. The advantage is one core network supporting multiple access technologies. The RAN consists of two types of nodes, the Radio Base Station (Node B) and the Radio Network Controller (RNC). The Node B handles the radio transmission and reception to and from the handset over the radio interface (Uu). It is controlled from the RNC via the Iub interface. The RNC is the node that controls all UMTS Radio Access Network functions. It connects the UMTS Radio Access Network to the core network via the Iu interface. There are two distinct roles for the RNC, to serve and to control. It provides the radio resource management, handover control and support for the connections to circuit-switched and packet-switched domains (Trillium, 2000).

WCDMA is spectrally more efficient than GSM but it is the wideband nature that provides the greatest advantage. The ability to translate the available frequency spectrum into high data rates. This results in flexibility to manage multiple traffic types, including voice, narrowband data and wideband data. WCDMA is actually a combination of a code-division multiple access and time-division multiple access. Packet data users can share the same codes and/or time slots as other users or the network can assign users dedicated channels and time slots. One enhancement over GPRS is that the control channels that normally carry signaling data can also carry small amounts of packet data, which reduces setup time for data communications (Rysavy, 2002).

To further expand the number of applications that can operate effectively, UMTS employs a sophisticated Quality of Service architecture for data that provides for four fundamental traffic classes, including (Rysavy, 2002):

1. Conversational – real-time interactive data with controlled bandwidth and minimum delay such as voice-over-IP or video conferencing.
2. Streaming – continuous data with controlled bandwidth and some delay such as music or video.
3. Interactive – back-and-forth data without bandwidth control and some delay, such as Web browsing.
4. Background – lower priority data that is non-real-time such as batch transfers.

3.3 Technology Comparison

3.3.1 Data Throughputs

Sections 3.2.1 to 3.2.3 described the workings of the various mobile data technologies. In Table 3.4, the peak network speed refers to the maximum specified throughput that the network technology can theoretically deliver and the average user throughput refers to the typical expected data rates that users will experience with these services.

Technology	Peak Network Speed	Average Expected User Throughputs (File Download of 256 Kb)
GPRS CS1 - 2	115 Kb/s	35 to 40 Kb/s
GPRS CS3 -4	160 Kb/s	30 to 60 Kb/s
EDGE	473 Kb/s	110 to 130 Kb/s
UMTS (3G)	2 Mbps	200 to 300 Kb/s

Table 3.4: Data Performance Comparison of Different Technologies

Adapted From: *Rysavy, P. (2002). Data Capabilities for GSM Evolution to UMTS. [Online]. Available at http:// www.rysavy.com/articles (Last accessed: February 2004).*

An important observation is the significant increase in performance going from GPRS to EDGE to UMTS. EDGE more than triples GPRS (CS1 – 2) speeds to yield average perceived throughputs of 110 to 130 Kb/s. There are further gains with UMTS. All 3G systems will support bit rates of up to 144 Kb/s in macro cellular environments such as in moving vehicles, up to 384 Kb/s in micro cellular environments like walking pedestrians and up to 2 Mb/s in indoor environments such as in office buildings (Ericsson, 2001).

3.3.2 Services Supported

Table 3.5 lists the range of service and applications categories, which users expect and the enabling technologies that will support them.

2G	2.5G	3G
Circuit Switched – GSM	Packet Services – GPRS	Multimedia – EDGE/UMTS
➢ voice	➢ interactive	➢ high interactivity
➢ simple message/SMS	➢ web browsing	➢ real time roadmaps
➢ event notification	➢ e-mail & attachments	➢ MMS
➢ fax	➢ file transfers	➢ audio streaming
	➢ transactions/e-commerce	➢ video streaming
	➢ instant messaging	➢ video telephony
	Weighted fair QoS	End-to end QoS

Table 3.5: Data Services by Different Technologies

Adapted From: *GSACOM. 2001. The Mainstream Evolution to 3G. London: GSACOM.*

GPRS introduces the packet core to GSM networks and has an important role to play in bringing to market evolved messaging services, transaction-based m-commerce applications, and speeding up e-mail and the Internet experience. However, the higher data throughput of 3G radio access technologies is absolutely necessary to achieve the fullest multimedia experience including all video components (UMTS Forum, 2001c).

UMTS, which represents new spectrum in the 2 GHz band in first deployments, will be critical in supporting significant numbers of users, especially in a mass market for 3G services. While GPRS will remain a good solution for e-mail, database access and information searches, tele-banking and financial services, EDGE will support the transmission of e-newspapers, images and sound files, tele-shopping and video telephony amongst many practical services. WCDMA will have advantages for services such as full-feature video conferencing (UMTS Forum, 2001c).

The service evolution roadmap starts with the introduction of packet-based services such as GPRS. According to the UMTS Forum (2002), services like e-mail, web access via WAP, for example, appear similar but work faster. Early marketing of GPRS by operators generally emphasises the speed element only but this is just the beginning. For example, messaging will evolve from today's basic 160 text characters to the Multimedia Messaging Service (MMS), featuring video and audio clips, annotated with personal notes, delivered and manipulated by phones incorporating colour screens, onboard cameras, imaging software, web browser and e-mail applications, to capture and communicate the location, immediacy, intimacy and emotion of the moment. MMS services are being launched progressively in several markets from 2002/3.

Services will evolve from what we have today to the 3G world. The user experience will evolve, e.g. pictures replace text, audio streaming adding richness, more use of colour, video streaming, faster interactivity, introduction of multi-sessions etc. In almost all cases, the 3G experience will have been first sampled in 2.5G. The Japanese experience of i-mode is now extended to Europe. In North America, AT&T Wireless Systems has launched mMode with features such as instant messaging, Find It for location specific services (weather, traffic, restaurants, shopping etc.). These and other service offerings throughout all regions will help give customers their first taste of 3G-like services, helping to build awareness. This is a necessary step for creating the 3G/UMTS services market (GSACOM, 2001).

3.3.3 Cost of Deployment

Bhargava (2002), demonstrated that operators deploying EDGE alongside WCDMA, to provide high-speed services from the first day of operation, can expect to spend 50% less on capital expenditure (CAPEX) by adopting this combined strategy, rather than building one nationwide WCDMA network. By using EDGE as a WCDMA complement, rapid introduction of 3G services can be achieved, covering more of the population. In short, using EDGE along-side WCDMA, time-to-market and time-to-revenue will be decreased. CAPEX savings can also be achieved for a GPRS operator upgrading to EDGE. By deploying EDGE, additional data capacity will be created with less Transceiver Units (TRU) within the RAN, eventually leading to less cell sites.

The following components, according to Bhargava (2002), must be considered when determining the cost of upgrading a network to offer the new mobile data services:

- **Licence Fees**

Licence fees, especially in the case of an auction can be the largest CAPEX item for the operator. The amount paid for the licence depends on the specific licensing method and the licence fee required by the regulator. The fees can be amortised over the licence period.

- **UMTS Radio Access Network (UTRAN)**

A significant part of the total expenditure goes into building the radio access network. The investments in the radio access network can be split into network equipment and civil works. The UTRAN is divided into two network elements, namely the node B and the radio network controller (RNC). Within the radio access network, investment in node Bs is the single largest investment item. The main drivers of this expenditure are required coverage and required capacity. Several node Bs are connected to one RNC, typically 100 to 300. The main drivers for the investment in RNCs are the number of node Bs and the volume of traffic generated by the node Bs.

Most of the expenditure for civil works is incurred in developing physical sites in rural areas. It is not to say that urban sites do not require civil works, it is simply a lower proportion of the total expenditure on civil works. The main driver is the number of sites.

- **UMTS Core Network**

For the purpose of analysing and estimating the CAPEX required for the core network, it is split into two parts, namely the circuit switched and packet switched nodes and the databases.

In a UMTS network, the traffic flow comprises a packet switched component and a circuit switched component. The main driver for dimensioning the capacity and number of circuit switched nodes is the busy hour call (including circuit switched data) minutes. The main drivers for dimensioning the packet switched nodes are the volume of packet data and the number of simultaneous connections.

Databases are used for managing and storing subscriber information. Typical databases include the Home Location Register (HLR), Visitor Location Register (VLR) and Authentication (AUC). These databases need to be dimensioned based mainly on the total number of subscribers.

- **Transmission Network**

These costs refer to the transmission of voice and data between the node Bs and the radio network controller (RNC), the transmission of voice and data from the RNCs to the core network nodes (MSC and SGSNs) and the transmission of voice and data between core network nodes. Fibre and microwave are commonly used for transmission. Parts of the transmission network that are not owned by the network operator are usually rented on a monthly basis. MTN currently leases all its transmission from Telkom.

The transmission network comprises access network transmission and core network transmission. An operator may or may not own the transmission network. However, many operators prefer to own the access network part of the transmission because of the control it provides them over network rollout. Microwave links are most often used for the access network transmission. One of the reasons for this is that it is often the fastest means of network rollout and capacity expansion. The main driver for the CAPEX in access network transmission is the number of radio network sites, traffic volume and the topology of the access network.

Compared with the access network transmission, core network transmission links are characterised by higher capacity demands and longer distances. Often fibre is used as a medium for core network transmission. Like the access network transmission, the operator has the choice of owning or leasing capacity. The main drivers for the CAPEX in this part of the transmission network are traffic volume and the distance between the core network nodes.

- **Service infrastructure**

The main items included in this category are the short message service centre (SMS-C), multimedia messaging server (MMS), WAP gateway, intelligent networks (IN), unified messaging platform (UM), mobile portal and voice mail system (VMS). The drivers for the service infrastructure are the number of subscribers and the choice of services offered.

- **Operation and Maintenance Systems (O & M)**

O & M systems are used to control and operate the network. Needless to say, the better the O & M system, the higher the flexibility for operating the network efficiently. To some extent, investing in a state of the art O&M system can help reduce operational expenditure on O&M. The main drivers for CAPEX are the size and complexity of the network.

- **Operating expenditure**

Like the capital expenditure, the operational expenditure for an entity holding a licence to operate a 3G network depends on where the entity wishes to be in the value chain. If the operator will operate the network, be the service provider and host a mobile portal then the operating expenditure can be split into the following categories: cost of service, sales and marketing and general and administrative.

The major components of cost of service are interconnection costs, which relate to what a 3G network operator has to pay to another network operator to complete a call on that network. The absolute value of this cost depends primarily on regulation and the level of competition in the market. Interconnection cost is charged on a per minute basis. Since interconnect can also be a source of revenues one often talks about net interconnect. Interconnect is a variable cost and its major drivers are call profile, that is, number of calls terminating in other networks, voice usage per subscriber and the number of subscribers.

Cost of providing long distance service relates to what a 3G network operator has to pay to a long distance operator. It is a variable cost and charged on a per minute basis. The absolute level of this cost depends on the volume the 3G operator can provide to the long distance carrier. Its major drivers are the volume of long distance calls, voice usage per subscriber and the number of subscribers.

Roaming costs occur when subscribers are roaming on another operator's network. There will be a cost for voice and for data services. Just like in the case of interconnect, roaming is also a source of revenues. It is a variable cost and its major drivers are user profile, that is, time spent roaming and usage while roaming, voice and data usage per subscriber and the number of subscribers.

The 3G technology is expected to bring new services and applications to the subscriber's mobile terminal through the operator's mobile portal. While some operators will attempt to develop some of the services and applications, most operators may opt to license these from the developers/providers. Licence fee is one of the many ways in which the developers may wish to charge the network operator/mobile portal provider for their services/products (revenue sharing is another approach that might be employed). The main drivers of this cost are the number and type of services and applications provided, bargaining power of the operator/mobile portal, the number of subscribers and in some cases the usage of the service (many licence fees are based on number of simultaneous users).

The absolute level of transmission cost depends upon the availability of transmission capacity, regulatory environment, competitive environment and topography of the coverage area. Its major driver is the number of sites and the area covered by the network operator, which in turn depends on the coverage required, the number of subscribers, the usage and usage profile per subscriber and the topology of the licensed area (distances, environment, etc).

The sites on which the equipment (radio access and switching) resides are often rented. The absolute value of these costs is determined by the availability of space and the macro economic conditions of the country. As the number of operators in each market increases, causing an increase in demand for cell sites, rental costs can be expected to increase. However, if the operators can agree to co-locate sites, these costs can be shared. The main driver of these costs are the number of cell sites which in turn depends on the coverage required, number of subscribers, usage and usage profile per subscriber.

The operation and maintenance costs relate to the expenses incurred in operating and maintaining not only the cell sites and network equipment but also the services and applications provided by a 3G operator. The main driver of these costs is the size and complexity of the network and services (or size of the CAPEX investment as a good approximation).

3.4 Evolution Paths from 2G to 3G

The progression stages that operators will go through in evolving their networks are shown in Figure 3.5. The progression occurs in multiple phases where the first stage is the addition of GPRS. Next, the first phase of 3G capability using EDGE and UMTS radio access networks is introduced followed by evolved 3G capability through enhancements such as all IP networks (Katsianis, 2003).

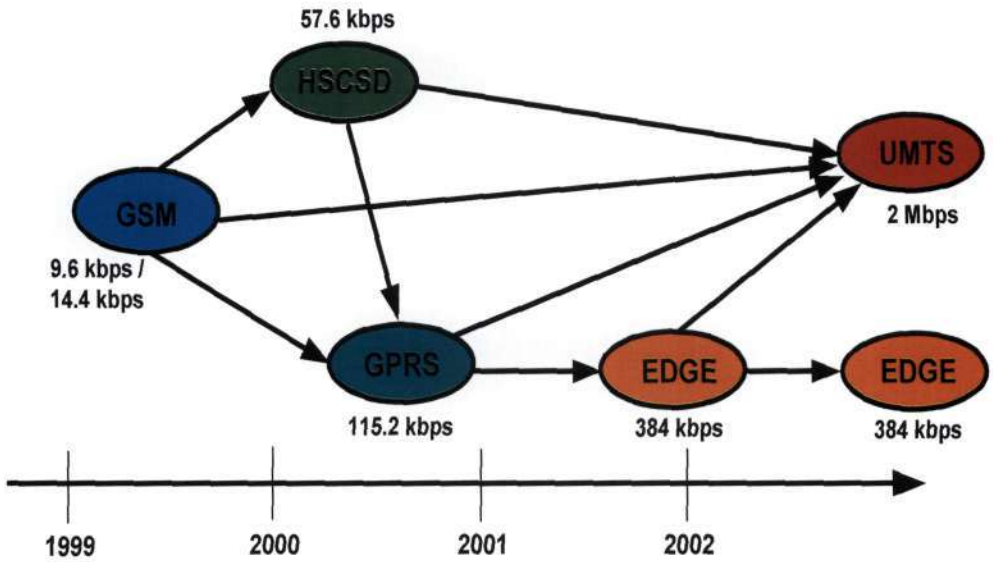


FIGURE 3.5: EVOLUTION OF CELLULAR TECHNOLOGIES

Adapted From: *Katsianis, D. (2003). The Economics of Next Generation Mobile Systems. University of Athens publication. Greece.*

Operators with existing GSM networks have enhanced their networks to support GPRS through the addition of the GPRS infrastructure as discussed in Section 3.2.1. This was achieved using existing cell sites, transceivers and interconnection infrastructures. Meanwhile operators deploying new GSM networks have deployed GSM and GPRS simultaneously.

The first major upgrade to GPRS is EDGE which is relatively straightforward for GSM operators. Though EDGE is a highly sophisticated radio technology, it uses the same radio channels and time slots as GSM and GPRS, so it does not require additional spectral resources. In fact by deploying EDGE, operators can use their existing spectrum more efficiently. For newer GSM/GPRS networks, EDGE is mostly a software upgrade to the radio base station and the switches since the transceivers are already EDGE capable. The same packet infrastructure supports both GPRS and EDGE. All networks will be able to take advantage of EDGE because the majority of terminals will support EDGE, facilitating a natural and smooth evolution (Rysavy, 2002).

According to Ericsson (2002a), in order to expand capability and capacity further, operators can deploy UMTS, which is a complementary technology for EDGE or an alternative one. Worldwide, GSM and new 3G operators are beginning UMTS deployments. Although UMTS involves a new radio access network, several factors will facilitate deployment. First is that most UMTS cells can be co-located with GSM cell sites. Second is that much of the GSM/GPRS core network can be utilised. While the SGSN needs to be upgraded, the mobile switching centre needs only a simple upgrade and the GGSN remains the same. Once deployed, operators will be able to minimise the costs of managing GSM and UMTS networks, as these networks share many of the same aspects, including:

- Packet data architecture
- Quality of Service architecture
- Mobility management
- Subscriber account management

Deployment of UMTS will occur in stages, beginning first with a portion of the coverage area having UMTS, progressing through continuous UMTS coverage and then reaching highly integrated, multi-radio operation (Rysavy, 2002). Table 3.6 shows this progression.

Deployment Stage	Characteristics
Initial UMTS Deployment	Only a portion of coverage area has UMTS GSM provides continuous coverage UMTS provides enhanced features and capacity relief for GSM
Enhanced inter-working of UMTS and GSM/EDGE	Continuous UMTS coverage Higher loading in UMTS Access network chosen based on service and load demands
Full Multi-radio network capability	Dense deployment of UMTS, including micro cells Integration of GERAN and UTRAN core equipment Seamless QoS integration Addition of new radio technologies

Table 3.6: Deployment Progression of UMTS

Adapted From: *Rysavy, P. (2002). Data Capabilities for GSM Evolution to UMTS. [Online]. Available at http:// www.rysavy.com/articles (Last accessed: February 2004).*

3.5 Conclusion

Building on GSM's global track record, the industry is moving towards 3G through a series of incremental steps to steadily reach profitability and to move into an important new mobile era. Success will be based on a stage-by-stage approach, moving from one success to the next, rather than announcing an explosion of intangible technology and concepts. This chapter has described the data capabilities in the GSM evolution to UMTS. This evolution occurs in successive stages, with each stage increasing data throughputs and spectral efficiency and adding new features such as QoS.

Rysavy (2002), has demonstrated that operators who will be deploying EDGE alongside WCDMA to provide high-speed services from the first day of operation can expect to spend 50% CAPEX by adopting this combined strategy, rather than building one nationwide WCDMA network. Using EDGE as a WCDMA complement, rapid introduction of 3G services can be achieved, covering more of the population. CAPEX savings can also be achieved for a GPRS operator upgrading to EDGE. By deploying EDGE, additional data capacity will be created with less transceiver units within the RAN, eventually leading to less cell sites and multimedia support. The migration and benefits of the evolution from GSM to UMTS is both practical and inevitable.

There are a number of major guiding principles en route to the mainstream evolution to 3G. GPRS and EDGE are important avenues towards realizing 3G. GPRS support for a wide range of business and consumer applications will drive demand for data services and will generate new revenue for operators. Beyond GPRS, EDGE provides a cost-effective 3G solution for operators to upgrade to an ITU approved 3G technology. EDGE provides operators with significantly higher data rates and improved efficiency. The risk of implementing EDGE into a network is minimal as it is an incremental investment that leverages the existing GPRS network.

As demand for data services grows, operators can deploy UMTS networks, which bring an entire new set of capabilities, particularly the support for high bandwidth applications. Whereas EDGE is extremely efficient for narrowband services, the WCDMA radio link is extremely efficient for wideband services. Combined with a comprehensive QoS framework and multimedia support, a network using both EDGE and WCDMA provides an optimal solution for a broad range of usages (Rysavy, 2002).

With the continued growth in mobile computing, powerful new handheld computing platforms, an increasing amount of mobile content, multimedia messaging, mobile commerce and location services, mobile data will inevitably become a huge industry. GPRS/EDGE/UMTS provides an optimum framework for realising this potential.

Chapter Four–Current Mobile Data Business Model

4.1 Introduction

Currently the mobile data arena in South Africa is characterised by a high uncertainty with respect to the rapid technology evolution, market development and regulatory environment. Uncertainties in service adoption rates, willingness to pay, future technology capabilities, cost levels, technology and market convergence introduce new and significant risk elements into telecommunications investment projects. Market response, pricing strategies, handling of uncertainty, strategic interaction between competitors and external effects influence the value chain and economics of telecommunication operator investment projects.

Mobile telecommunication operators worldwide are preparing to introduce new mobile data services in an attempt to arrest the declining ARPU being generated from the voice service. While a transition from a 2G to a 3G network is vital for an operator to remain competitive, it also represents a huge investment for the operator in a very uncertain and emerging market. Therefore, most operators, like MTN, have chosen to phase in the transition.

GPRS is the first major step that MTN undertook, in 2002, to offer mobile data in South Africa and was the first operator to offer this service. Since GPRS is the beginning stage of an emerging industry, valuable lessons can be learned from the business model and strategies that were implemented. In order to formulate a successful mobile data business model for MTN as it progresses from a 2.5G to a 3G network, it is essential that an analysis of the current GPRS business model be carried out.

The business model proposed in Chapter 2, Section 2.5 is used for the analysis of MTN's GPRS model. However, it is also important to understand the current mobile data business landscape in South Africa. Therefore, this chapter first examines the developments of the mobile data market, the forecasted demand for mobile data services and the strategies of other companies offering mobile data services in South Africa. Thereafter, a detailed analysis is carried out on MTN's GPRS business model. The shortcomings of the model are also discussed in this chapter.

4.2 South African Mobile Data Market

According to BMI Techknowledge Group (2003), most large organisations in South Africa are showing a strong interest in mobile data solutions and applications. The banking retail and private security sectors are rapidly adopting mobile solutions based on cellular networks. Applications based on SMS and WAP are already widely adopted and provides the bulk of revenue opportunities to date for all players in the mobile data value chain. This, according to BMI Techknowledge Group (2003), looks set to continue into the near future while GPRS struggles to establish a foothold in the mobile data market. Businesses are mostly using circuit switched data (CSD) and HSCSD for mobile dial-up connectivity for notebook PCs. Some are migrating to GPRS for this function, although this migration is limited by the perception that GPRS is generally more expensive.

BMI Techknowledge Group (2003), also forecast that the mass consumer adoption of GPRS will eventually happen but the rate of adoption will depend on "killer applications", starting with advanced messaging (beyond SMS) and certain new types of mobile entertainment. The adoption rate is also highly dependent on the pricing of these services. While GPRS handsets will become widely available and ultimately ubiquitous, the rate of growth in actual usage will depend heavily on how quickly cellular operators in South Africa introduce more aggressive pricing models. In addition, the success with which they forge meaningful partnerships with content providers and implement a billing platform for applications will drive the success of GPRS.

Table 4.1 illustrates the mobile data adoption on South African cellular networks based on a simplified BMI Techknowledge Group (2003) forecast model and IDC (2003) benchmark data from other countries.

Number of Users at Calendar Year End (million)	2001	2002	2003	2004	2005	2006	2007	CAGR 03-07
Total Mobile Subscribers	8.2	10.4	13.8	16.4	18.2	19.3	19.9	10%
SMS Users	3.0	5.6	8.3	10.4	11.7	12.6	13.2	12%
Scenario A								
Cellular Banking Users (excluding cell phone + PC combination)	0	0.03	0.05	0.08	0.09	0.11	0.14	31%
GPRS Internet Users (excluding cell phone + PC combination)	0	0.01	0.08	0.29	0.67	0.78	0.87	79%
Scenario B								
Cellular Banking Users (excluding cell phone + PC combination)	0	0.03	0.05	0.08	0.13	0.30	0.49	92%
GPRS Internet Users (excluding cell phone + PC combination)	0	0.01	0.08	0.34	0.67	1.03	1.43	103%

Table 4.1: Forecast of Cellular Mobile Data adoption in South Africa

Adapted From: *BMI Techknowledge Group. (2003). Future of Mobile Solutions and Applications in South Africa. South Africa: BMI Techknowledge Group.*

Scenario A assumes a status quo approach from network operators, in respect of driving GPRS forward, including least aggressive pricing. Scenario B assumes aggressive pricing in order to rapidly accelerate the growth in usage even at the expense of revenue growth.

In the short term, GPRS will enjoy some key niche markets. Mass market adoption, similar to that of SMS, will take place progressively from 2004 through to 2007 but only if driven by aggressive network service pricing and the availability of "killer applications" such as messaging. By the end of 2007, BMI Techknowledge Group (2003), forecast model predicts for Scenario A there will be 870,000 GPRS users in South Africa, i.e. 4.2% of the total cell phone user population. The model also predicts that the cell phone banking user population will be 140 000 users in 2007 which is an increase from the 2003 estimate of 50,000. This is much lower than the current population of traditional wired internet banking users, which was estimated at 1.2 million in 2003 and reaching 1.4 million by 2005.

Scenario B puts the forecasted GPRS users at a higher level of 1.4 million by 2007 or 7% of all cellular users. This is due to the assumption that messaging will continue to be the killer application on the GPRS based networks. The adoption rates will be similar to that of SMS, provided the cost of future GPRS enabled messaging services is at least comparative with that of SMS messaging today. Cellular banking is also predicted to be higher, at close to half a million users. The GPRS subscriber base must include a fair number of pre-paid subscribers if the 1.4 million forecasted users are to be achieved. Both scenarios assume there will be aggressive pricing and promotion of mobile data usage on GPRS capable handsets by the network operators and content providers. It also assumes that advanced messaging, especially internet e-mail, is a key part of the application mix.

For the immediate future, according to the BMI Techknowledge Group research (2003), there will continue to be a pent-up demand in South Africa for broadband internet connectivity to the home or small business. While Telkom is expected to promote and price its wireline ADSL services much more aggressively in future than it is today, it is also likely that wireless local loop (WLL) networks will be a key part of the future solution. This is particularly true for South Africa, due to the absence of cable networks. GPRS may be a partial solution but with the non-optimisation of the GSM networks for data, it is likely to be a less cost-effective platform.

Vodacom, MTN's main rival in the GSM cellular market, reported in September 2003 that close to 4.5% of its revenue was due to mobile data with the primary emphasis being on SMS. The company offers mobile data access via GPRS and circuit switched mediums. Vodacom has adopted the Japanese Market model as its strategic approach to servicing the South African market. Instead of providing Value Added Services themselves, the company opened up its network to partners that provide these services. Vodacom is a supplier to suppliers of wireless internet access and works in partnerships with other players to deliver wireless access. The company also runs a portal, www.vodacom.net that offers customer support and information as well as services (BMI Techknowledge Group, 2003).

The latest entrant to the mobile data market is Sentech with its broadband multimedia offering, MyWireless. Sentech's high-powered radio-based Internet connectivity does not rely on the terrestrial telephone network but works on a centrally managed IP technology. Using licensed radio frequency spectrum technology on a fully IP based network, MyWireless Internet offers all the benefits and services expected of an Internet connection, including web-browsing, FTP, instant messaging, and e-mail support (www.Sentech.co.za). Sentech does not have a licence to provide mobile voice services.

The portable broadband technology provides a telecommunication platform that is capable of supporting transmission speeds of up to 3 Mb/s to a portable wireless modem or PC card. MyWireless currently offers 3 packages differentiated by download speeds of 128 Kb/s, 256 Kb/s and 512 Kb/s. Sentech is initially using a high powered radio based network in the major metropolis of Johannesburg, Midrand, Pretoria, Durban and Cape Town. A fixed monthly charge is levied, depending on which data speed is chosen, and the user can send or receive as much data as they want. With the initial launch, the coverage is very limited but Sentech plans to eventually cover the whole country. Sentech maintains its own connections to the International Internet backbone so no additional ISP charges are levied. The Internet traffic is routed via the company's teleport in Honeydew to the base stations (www.Sentech.co.za).

4.3 MTN

MTN, like the other cellular operators in South Africa, will always attempt to exploit the potential of mobile data services as one key source of averting declining ARPUs. MTN's current mobile data offering includes SMS, MMS (MTNdataMESSAGE), CSD (MTNdataLink), HSCSD (MTNdataFAST) and GPRS (MTNdataLIVE and MTN CorporateMobility). MTNdataLINK has been available on the MTN network since shortly after the network was started and offer data speed of 9,6 Kb/s. HSCSD is offered with the MTNdataFAST service and the throughput speed is 14.4 Kb/s. The SMS and MMS messaging services are catered for with the MTNdataMESSAGE package.

To date, SMS has been the major contributor to data revenues. The mobile data services, including SMS, contributed R400 million or 4% towards the total revenue in 2003. A growing component of this SMS-related revenue is derived from bulk SMS packages sold by Service Providers to business customers for SMS broadcast applications (www.MTN.co.za).

MTN was the first cellular operator in South Africa to launch its GPRS network in February 2002 and as a result believes it has enjoyed a certain market advantage. Accentuating the "always-on" nature of this service, GPRS connectivity was marketed as the MTNdataLIVE package, to the South African market in May 2002. During the trial phase, approximately 30,000 business users tried GPRS enabled handsets (www.MTN.co.za). However, to date the revenue being generated from the GPRS service is far from the forecasted figures. The performance of the GPRS service has been very poor since its launch. At present there are only 120,000 active GPRS subscribers registered on the network (MTN statistics). The total cost for launching the GPRS service was R70 million. This cost includes the major upgrades to the network as well. According to the latest MTN statistics, the revenues being generated by this service is approximately R1 million per month.

Figure 4.1 depicts the amount of data traffic being generated by the GPRS service, on the MTN network, from October 2003 to March 2004.

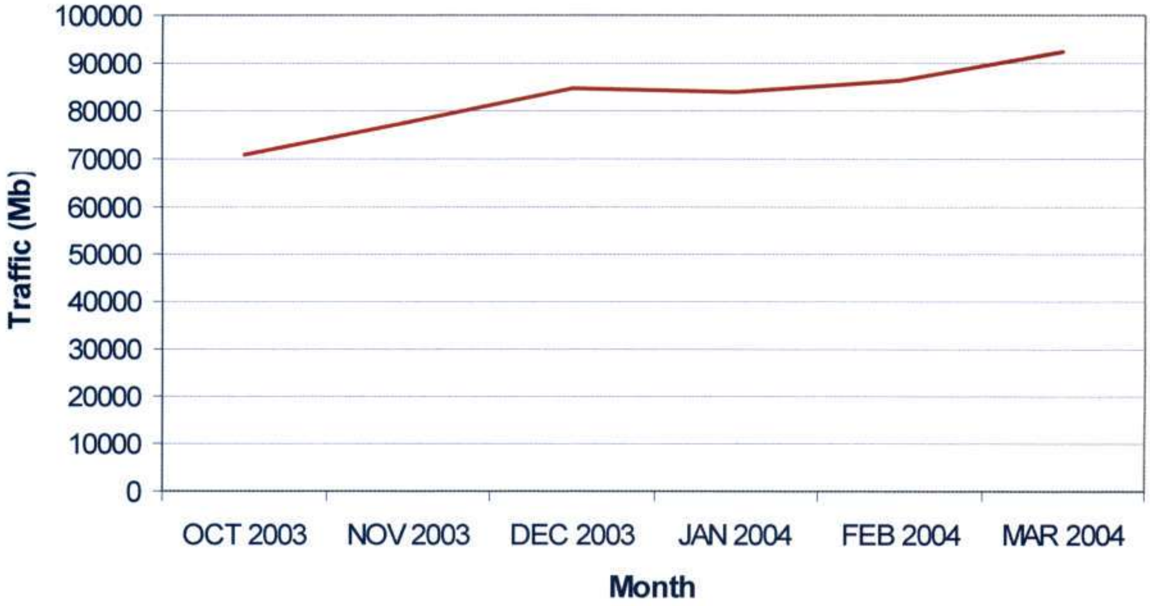


FIGURE 4.1: GPRS TRAFFIC ON MTN NETWORK

Adapted From: *MTN Internal GPRS Statistics, 2004*

The traffic has increased from 70 GB in October 2003 to 90 GB in March 2004. Although there is an increase in 20 GB of traffic in 6 months, the volume being generated is still not very significant.

4.4 GPRS Business Model

The business model depicted in Figure 2.7 will be used in the analysis of the current GPRS model being implemented by MTN. Figure 4.2 illustrates the main components of the business model. These include the Customer Value of Service, the Technical Arrangements, the Financial Arrangements and the Organisational Arrangements.

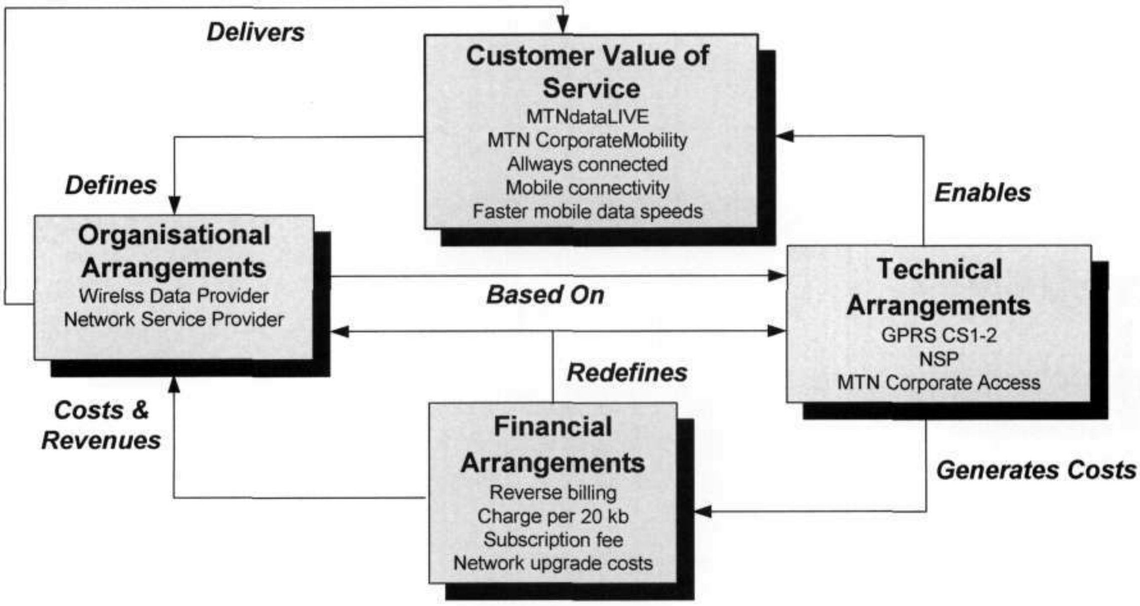


FIGURE 4.2: GPRS BUSINESS MODEL

Adapted From: *Bouwman, H. (2003). Designing Metrics for Business Models Describing Mobile Services Delivered by Networked Organisations. Proceedings of 16th BLED Electronic Commerce Conference, eTransformation. Slovenia.*

In order to effectively analyse the GPRS business model, an in-depth investigation of the current market offering was carried out. The internal processes, procedures and the technical upgrades to the network is also evaluated. The various revenue streams and the different pricing models are examined. Each component of the above business model is discussed in detail.

4.4.1 Customer Service Offering

MTN currently offers two GPRS packages, namely MTNdataLIVE and MTN Corporate Mobility. MTNdataLIVE was first introduced in May 2002 as MTN's implementation of the GPRS service. This package was created to allow post-paid subscribers to enjoy faster data throughputs than what was being offered by the circuit switched systems. The GPRS service is currently not available for pre-paid subscribers. The package is ideally suited to any low-volume applications which require the customer to be connected for long periods. Customers will be able to use MTNdataLIVE to:

- Connect to the Internet using a PC device (browsing the Internet, send and receive e-mails, download files and chat)
- Use the WAP browser function on the cell phone to connect to a WAP Portal such as MTNICE.
- E-mail (low volume)
- Utilise K-Java applications if their cell phone supports it
- Point of Sales devices
- Remote meters and control equipment

K-Java enables a cell phone to be customised to what the customer wants. The application is downloaded onto a cell phone via a link with a desktop computer or directly over the GSM network using any data connection. Many K-Java applications are interactive, thus requiring an ongoing connection. The current applications that are available are Chess, Space Trader, MTNAlerts (such as news, sport and stock exchange prices) and MTNMessaging. The GPRS service also allows for SMS to be sent or received over a GPRS connection. The tariffs for SMS remain the same but the speed of transmission is improved. There is very little difference in the user experience.

MTNdataLIVE is being sold as a fast technology capable of high data throughputs. The highest speed promised, with a cell phone capable of 4 timeslots for downloads and 1 timeslot for uploads, is approximately 52 kb/s download and 13 kb/s upload. MTNdataLIVE uses recognised and approved security encryption schemes in all the links between the various elements in the network. There is also additional security built-in on the customer profile on the network itself, limiting customers to only those areas where they are allowed. Over 97% of the MTN network is GPRS enabled with metropolitan coverage close to 100%. This provides ubiquitous data coverage for the customer.

MTN CorporateMobility was launched in 2003. It is a holistic approach to growing data revenues in the enterprise sector through a customer-focused, consistent and integrated offering. The package is a comprehensive Virtual Private Data Network (VPDN) service over GSM. The service is multi-bearer and a platform for future technical developments. New tariffs and a new billing method are introduced with this service. A VPDN gives the customer the experience of a private network (accessible only to the customer's users) even though it is actually implemented over MTN's shared (or public) network. The VPDN allows corporate customers to implement a range of solutions for their management, staff and assets. It provides a mobile extension so that their private networks (LAN or WAN) can be accessed wherever MTN has coverage. Figure 4.3 depicts the layout of the corporate mobility package.

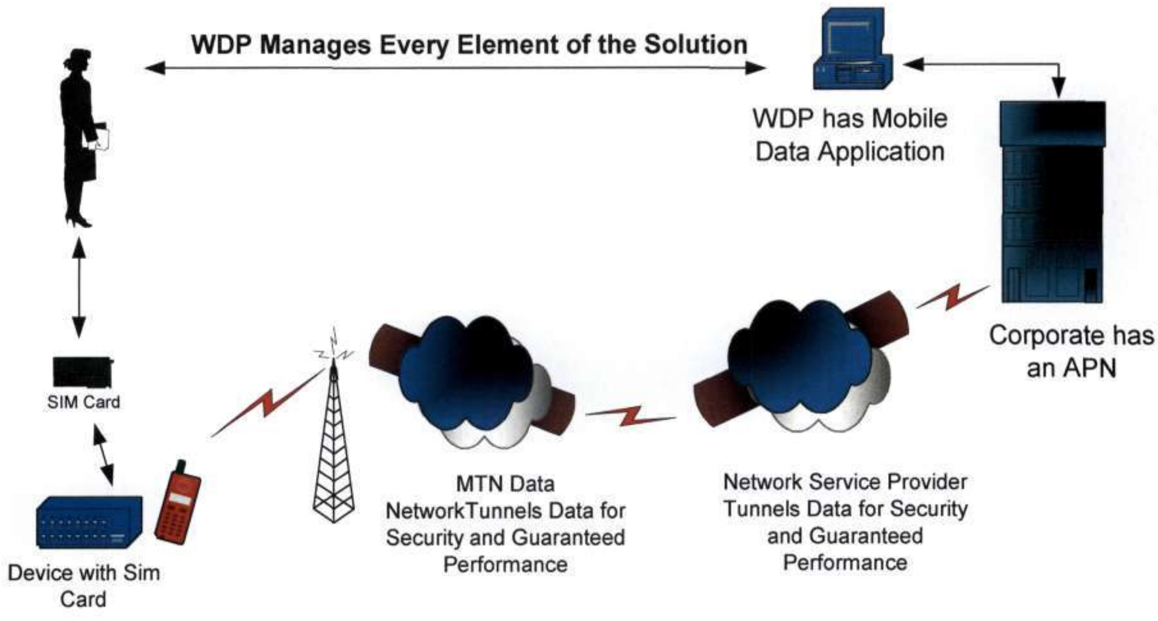


FIGURE 4.3: LAYOUT OF MTNCORPORATEMOBILITY ARCHITECTURE

The VPDN requires a fixed-line connection between MTN and the customer. MTN CorporateAccess is the mechanism introduced to improve the customer experience when establishing this fixed link. This involves a new entity called the Network Service Provider (NSP) to provide bulk connectivity to corporate customers. When accessing the VPDN via GPRS, the specific industry definition of this connection point is an APN (Access Point Name). If more bearer services become available, they will be activated under the VPDN. Each VPDN will be either forward or reverse billed. A single corporate may have more than one VPDN. For example, an insurance company could have one VPDN for their staff, which accesses normal corporate LAN information and another VPDN for their brokers, which accesses broker-specific information and customer records.

The CorporateMobility package is aimed at the following markets:

- Corporate enterprises – management, mobile professionals and telecommuters, sales force (providing access to corporate e-mails, intranets, databases, workflow and ERP systems), personal information management (synchronisation of calendars, contacts, task lists and expense lists) and dispatch.
- Telemetry – corporate asset control and tracking of office, plant and vehicles, video surveillance and point of sale transaction.

The benefits to the customer include:

- Corporate orientated/focused tariffs will offer savings as well as better user management through a reverse billing option
- A proliferation of new mobile applications
- A tailored retail channel that provides a better customer experience, which extends from pre-sales through to implementation and post sales.
- MTN and the NSP can together provide support, which is more proactive, technically equipped and tailored to the connectivity requirements of each customer.

4.4.2 Organisational Arrangements

For the MTNdataLIVE package there were no significant changes to the organisation. The current MTN Call Centre handles all queries and complaints related to GPRS. The normal sales channels were utilised to sell the product. There were no major marketing and promotional campaigns to promote the service. The only big campaign was when MTN allowed free use of the GPRS service for the first six months following the launch of the service. All the contents for the WAP portal (MTNICE) are being developed and maintained by third parties. MTN only provides connection to the Internet for its mass market GPRS subscribers.

There were various organisational changes that were implemented for the MTN CorporateMobility package. MTN chose to outsource most of the functions relating to corporate mobility. Essentially MTN has adopted a "connectivity model" where it is basically only the data transport provider. The provisioning of connectivity and enabling of services are delivered by third parties. The sales, connectivity and first line support are all handled by outsourced entities. MTN has no direct contact with the corporate customer. This allows MTN to focus on its core capabilities, i.e. maintaining the GPRS network and providing the required quality of service. It also allows MTN to avoid investments in service platforms and to minimise marketing and distribution spends for the new service by encouraging third parties to create and serve the market. MTN's main rival, Vodacom, also adopted a similar strategy for its GPRS service. In line with the current trend in the industry, Vodacom also does not provide any value added services but relies on partnerships with other companies to provide the services and applications.

Firstly, MTN introduced a new retail entity called the Wireless Data provider (WDP) specifically to offer mobile end-to-end solutions based on the package. The WDP has the pre-sales and post sales capacity as well as the end-to-end delivery capability to provide mobile data solutions including any relevant applications. They will also be exclusively involved in the reverse billing of data to the corporate customers. The WDP will be the interface to the customer and this includes first line commercial and technical support. No voice traffic will be handled by the WDP.

Any party, such as a solution or telemetry provider can apply to become a WDP, if they meet certain qualifying criteria. The National Key Account Manager (NKAM) in MTN Sales manages the WDP applications and supplies all the necessary information to the potential WDP. The basic criteria for a WDP are:

- General Criteria
    - Financial viability

- Basic technical and organisational capacity (sound management)
- Black economic empowerment component

- WDP Tailored Criteria
  - Strategic level commitment to growing the market in the longer term
  - Pre-Sales infrastructure
  - Project management capability and capacity
  - Post sales support and service – 24 X 7 call centre ability to resolve technical queries routinely

- Sales Targets
  - Certain minimum number of VPDNs will need to be established
  - Each VPDN will have to achieve a minimum monthly throughput
  - Total megabytes of traffic
  - Number of mobile numbers associated with or using the VPDNs

WDPs enter a synergistic relationship with MTN in which their existing business model is enhanced through a partnership with a GSM operator known to lead in the mobile data market. Reverse billing affords the WDP rapid access to customers regardless of legacy relationships with cellular service providers. The billing relationship also provides flexibility in the provision of core mobile bearers and associated services.

Another new entity created is the Network Service Provider (NSP) that provides bulk connectivity to corporate clients. MTN will sign up the NSPs. The national key account manager will also mange the NSP applications and supply all necessary information. The basic criteria to qualify for a NSP are:

- Be an existing first tier Internet Service Provider (ISP) or a major network infrastructure provider
- Have in-house skills in secure (VPN, Internet protocol security) services that have CISCO or equivalent certification
- Offer RADIUS (Remote Authentication Dial-In User Service), hosting and firewall services
- Have direct peering with other NSPs

- Have points of presence in Johannesburg, Durban and Cape Town
- Maintain a call centre 24 hours, seven days a week (24 X 7)

The NSP is responsible for:

- Connecting to the MTN Mobile Services Gateway Point (MSGP)
- Assisting customers and WDPs in configuring VPDNs
- Providing ancillary services to basic connectivity
- Providing first line support for connectivity 24 X 7

NSPs can add value to existing services through mobilisation. They can offer new services to enhance MTN CorporateAccess, such as managed connectivity, firewalls and security and hosting. NSPs are well positioned to become WDPs or to form strong alliances with WDPs.

Through these changes MTN hopes to provide their customers with a better experience, mobilise the industry to co-sell MTN products and nurture the development of new applications. The operator also hopes to attract existing players and to leverage their market position, customer base and marketing energies, as well as the existing infrastructure of these players to afford the customer a better pre-sales, implementation and post-sales experience. MTN will now manage fewer, higher-volume links and provide quality, focused technical and support services. MTN can also leverage the connectivity and commercial relationships that NSPs have with their existing customers. The MTN CorporateMobility platform is fundamental to the deployment of many other services such as bulk messaging. The reverse billing allows MTN to differentiate itself and to compete through the provision of bulk tariffs.

4.4.3 Financial Arrangements

For the financial arrangements, the revenue and the pricing models for the two GPRS packages will be analysed. MTN does not offer the GPRS service to pre-paid customers due to the complexity of the required billing system. The MTNdataLIVE package only provides access to the Internet. This package focuses mainly on the mass market. The only source of revenue is from the amount of data sent and received and subscription for the 2 and 15 MB packages (this is discussed in the pricing model). MTN also launched Multimedia Messaging Services (MMS) in 2003. The MMS message, as well as SMS, are transported over the GPRS platform. MTN does not have a mobile portal to provide any content for the subscribers to download or browse. To date MTN has not launched any "killer applications" that will spur on the mass adoption of GPRS. This is proving to be a major weakness in the GPRS service being offered by MTN.

The major revenue source was to be from the corporate enterprises through the Corporate Mobility package. MTN believes that the following corporate mobile data applications will contribute to the mobile data revenues:

- Personal Information Management (PIM) – the ability to access and synchronise e-mail, calendar and contact information whilst mobile
- Transport - fleet tracking and management
- Security (telemetry) – for both business and consumer applications
- Retail/Wholesale – logistics for sales order, delivery and despatch
- Public Services – such as Eskom Enerweb where customers report outages
- Government Applications – such as mobile voting for the elections and applications that would link into South Africa's eGovernment gateway project
- Competition applications
- Machine to machine applications – such as a soft drink manufacturer can do planned maintenance, logistics/telemetry and merchandising (link to ERP systems).

As is the case with the MTNdataLIVe package, MTN does not provide any portal or content for the corporate customers. The only source of revenue is from the monthly subscriptions and the charges for the amount of data sent and received. This is also a weakness in the GPRS service and is one of the major factors contributing to the poor success rate of this service.

MTN follows different pricing models for the two packages. For the MTNdataLIVE package, MTN adopted the metered charging model where the subscriber is charged for the connection on a monthly basis and is then billed for the volume of data used. A customer on the MTNdataLIVE packages will be charged in increments according to the amount of data consumed. The variations to this are the MTNdataLIVE 2 MB and MTNdataLIVE 15 MB services that require a monthly subscription fee and include free bundled data. Table 4.2

depicts the breakdown of the MTNdataLIVE package charges for the amount of data sent/received.

	Basic			2 MB			15 MB		
	MBs	Cost	R/20 Kb	MBs	Cost	R/20 Kb	MBs	Cost	R/20 Kb
Connection Fee		-			-			-	
Monthly Subscription		-			R50			R263	
Inclusive MBs	0			2			15		
Increment 1	0-1	R50	R0.98	2-5	R22.50	R0.44	15-50	R15.00	R0.29
2	1-2	R30	R0.59	5-15	R20.00	R0.39	50-100	R12.50	R0.24
3	2+	R25	R0.49	15+	R17.50	R0.34	100+	R10.00	R0.20

Table 4.2: MTNdataLIVE Pricing

Adapted From: *www.MTN.co.za (Last accessed: April 2004).*

Once a customer reaches the third increment, they will be charged for additional data at the same rate as depicted by the third increment. If a customer is on the basic package and uses 5 MB in one month then the cost will be R50 for the first MB, R30 for the second MB, R25 for the third, fourth and fifth MB. The total cost will be R155 at an average of R31/MB. Table 4.3 illustrates the breakdown of the charges for the amount of data sent/received once the customer has used up their inclusive bundle for the different packages.

	Basic		2 MB		15 MB	
Usage (MB)	Monthly Bill (R)	R/MB (R)	Monthly Bill (R)	R/MB (R)	Monthly Bill (R)	R/MB (R)
1	50	50	50	50	263	263
5	155	31	118	24	263	53
15	405	27	318	21	263	18
25	655	26	493	20	413	17
50	1,280	26	930	19	788	16
100	2,530	25	1,805	18	1,413	14

Table 4.3: Breakdown of R/MB

Adapted From: *www.MTN.co.za (Last accessed: April 2004).*

The metered charging pricing model is also adopted for the MTN CorporateMobility service but with some variations. For this package, corporate customers will be able to choose between reverse or forward billing per VPDN. Billing will be on a bearer service level (CSD/HSCSD and GPRS). All APNs applicable to MTN CorporateMobility are subscribed APNs, i.e. a customer needs to have the APN loaded onto their unique subscriber number (known as MSISDN) profile in order to access the APN. The corporate is charged for all VPDN related charges, as well as NSP-related charges. The data usage charges will be as per the corporate user's (A-number) price plan and the service provider will bill the corporate user as per regular forward billing practices.

A forward billed customer only benefits from the new MTN CorporateAccess mechanism and not the bulk tariffs. An example of where forward billing would be required is when a central agency is sponsoring basic connectivity and applications but satellite agencies (branch offices or provincial government departments) are paying for the actual usage. Reverse billing, involving the WDP, is where the Corporate (B-number) is charged for all data usage, as well as all VPDN and NSP related charges. A reversed billed customer not only benefits from the new MTN CorporateAccess mechanism, but also from the bulk data tariffs.

Tariffs for both forward and reverse billed VPDN's include VPDN related charges (setup and monthly charges), data usage charges and NSP-related charges.

➢ VPDN Related Charges:
- Setup Fees: There will be once off charges for setting up a VPDN and once off charges for configuring additional data bearers for use on that VPDN. These charges will be billed to the corporate regardless of whether forward or reverse billing is deployed.
- Monthly Charges: There is a monthly subscription for the VPDN (regardless of the number of data bearers) and this is paid for by the corporate, regardless of whether the VPDN is forward or reverse billed.

A monthly subscription fee will also be charged per MSISDN accessing an APN, over and above the 50 free MSISDNs subscriptions per APN.

➢ Data Usage Charges:

- On the forward billed model, the originating device (A-number) will be billed as per the existing published tariffs for the data bearer used, according to the A-number's price plan.
- On the reverse billed model the corporate (B-number) will pay for all usage associated with their VPDN.

➢ NSP Related Charges:

In addition to the above-mentioned MTN charges, the NSP can charge the customer (corporate) directly for the provision of NSP-supplied connectivity and associated services in both scenarios.

Table 4.4 depicts the setup and monthly charges for both the forward and reverse billing options on the MTN CorporateMobility Price Plan:

Item	Once off Setup Charge		Monthly Charge (Full month – not pro-rata)	
	Excl. Vat	**Incl. Vat**	**Excl. Vat**	**Incl. Vat**
VPDN Commissioning	R2 000	R2 280	N/A	
Each bearer service: MTNdataLINK/MTNdataFAST MTNdataLIVE	R1 000	R1 140		
MTN CorporateMobility Price Plan Subscription (regardless of the number of bearer services loaded, and includes 50 free MSISDN subscriptions per APN)	N/A		R1 000	R1 140
MSISDN Subscription (After the first 50 free MSISDN subscription per APN)			R8.77 / MSISDN	R10.00 / MSISDN

Table 4.4: Setup and Monthly Charges for Corporate Mobility

Adapted From: *www.MTN.co.za (Last accessed: April 2004).*

1. Each time a VPDN is commissioned, a once off charge will be levied by MTN to the CSP/WDP who will then charge the corporate.
2. Each time one of the bearer service products is loaded onto the MTN CorporateMobility Price Plan, a once off charge will be levied by MTN to the CSP / WDP who will then charge the corporate.
3. The MTN CorporateMobility Price Plan Subscription will be loaded onto the B number and will include the free subscription of 50 MSISDNs (A-numbers) to an APN.
4. If more than 50 MSISDNs are provisioned to an APN, an additional charge per MSISDN will be levied to the B-number.
5. MTN will charge subscription fees for A-numbers to have permission to an APN.
6. There will be no pro-rata charging for the charges listed in the tariffs section.
7. MTN will bill the CSP / WDP for the maximum number of unique corporate users (A-numbers) provisioned/subscribed to an APN during the billing period regardless of whether the corporate users have utilised the service/product or not. This will be applicable on the forward and reverse billing method. The A number will not be charged for being provisioned/subscribed to an APN.

If a corporate customer chooses reverse billing, then the corporate user (A-number) will not be charged for connecting to the corporate network or any other reverse billed destination but the corporate (B-number) will be billed by the WDP. Table 4.5 below depicts the bearer service usage charges for the reverse billing method on the CorporateMobility price plan.

Bearer Service	**Peak**		**Off Peak**	
	Excl. VAT	**Incl. VAT**	**Excl. VAT**	**Incl. VAT**
MTNdataLINK / MTNdataFAST Business (CSD/HSCSD)	R1.00 / min	R1.14 / min	R0.50 / min	R0.57 /min
Bearer Service	**Flat Rate (i.e. No Peak or Off Peak)**			
	Excl. VAT		**Incl. VAT**	
MTNdataLIVE Business (GPRS)	R0.17 / 20 KB		R0.19 / 20 KB	

Table 4.5: Reverse Billing Charges

Adapted From: *www.MTN.co.za (Last accessed: April 2004).*

1. When MTNdataLINK/MTNdataFAST Business is loaded on to the MTN CorporateMobility Price Plan, the above peak and off-peak charges will apply to the B-number.
2. CSD/HSCSD tariffs will be charged on the 60/30 billing increments (i.e. charged for the first minute in full and thereafter in 30-second increments).
3. If a device (A-number) is connected to an MTNdataLIVE (GPRS) session but does not send or receive any information within the 24 hour period from midnight to midnight, a minimum charge of 20 KB will be levied per day.
4. On the reverse bill method for MTNdataLIVE (GPRS), usage charges will be calculated per A-number per APN per 24 hour period (in 20 Kbyte units, rolled up at midnight of each day).
5. All usual billing rules will apply as per the MTNdataLIVE (GPRS), MTNdataLINK (CSD) and MTNdataFAST (HSCSD) rules.

By comparison Vodacom is offering the myMeg 0, 1, 5 and 10 packages. The breakdown of the various pricing is shown in Table 4.6.

Item	myMeg 0	myMeg 1	myMeg 5	myMeg 10
Connection fee	0	0	0	0
Monthly subscription	0	R35	R110	R200
Inclusive bundle (MB)	0	1	5	10
Out of bundle rates	R45/Mb	R20/Mb	R20/Mb	R15/Mb
Additional data usage	4.5c/Kb	2c/Kb	2c/Kb	1.5c/Kb

Table 4.6: Vodacom GPRS Pricing

Adapted From: *www.Vodacom.co.za (Last accessed: April 2004).*

The pricing model is similar to MTN's where the metered charging model is used. Vodacom also provides corporate APNs for its corporate customers. The cost of a direct-leased line to Vodacom is a R4,300.00 connection fee, a monthly APN rental of R300.00 and a maintenance fee of R830.00. There is also the 1st tier ISP connection for the corporate where the connection fee is R3,440.00, the monthly APN rental is R300.00 and the maintenance fee is R275.00. The pricing structure is very similar between the two mobile operators.

Sentech, however, has implemented the fixed price charging model where the subscriber only pays a monthly subscription fee and can send or receive as much data as they wish. The pricing plan is shown in Table 4.7.

Package	Data Rate	Monthly Subscription	Contract Period
MyWireless 128	128 kb/s shared	R649/month	24 Month Contract
MyWireless 256	256 kb/s shared	R849/month	24 Month Contract
MyWireless 512	512 kb/s shared	R1,449/month	24 Month Contract

Table 4.7: Sentech's Pricing Plan

Adapted From: *www.Sentech.co.za (Last accessed: April 2004).*

There is also a once-off upfront activation fee of R500.00. This model is much cheaper than what either MTN or Vodacom is offering and the guaranteed data rates are much higher than what MTN can currently offer. This is a serious threat for both mobile operators since a significant number of mobile data customers would surely be tempted to switch to Sentech. The high cost and low data speeds of GPRS will only serve to encourage current and new mobile data customers to enroll for the Sentech wireless data service. However, Sentech cannot provide any mobile voice services and this could prove to be a major stumbling block for the company.

The major cost driver was the upgrade of the GSM circuit switched network. It cost MTN R70 million rand to upgrade its network in order to deliver the GPRS service. No major marketing or advertising campaigns were undertaken for the launch of the service. Thus, no high costs were incurred. MTN also did not aggressively pursue new subscriber acquisitions, thereby, minimising this cost.

4.4.4 Technology Arrangements

In order to offer the GPRS service, MTN had to install new GPRS switching equipment at its switching centres in Randburg and Germiston. The switch software was also upgraded. No changes were required for the radio base stations. Packet Control Units (PCU) were installed in all Base Station Controllers (BSC). Currently, MTN is only offering Coding Schemes 1 and 2. This means that the maximum throughput that could theoretically be achieved is 107.2 Kb/s if all 8 timeslots were utilised. The current policy of MTN is to allocate network resources in favour of voice over GPRS. This means that all voice applications will take precedence over data when allocating network capacity. For the corporate mobility service various changes were also implemented.

MTN CorporateAccess is the connectivity mechanism between MTN, the NSP and the corporate. MTN CorporateAccess provides a cellular device with access to the corporate network (data only and not voice) using the VPDN. MTN CorporateAccess will be the technical foundation for future MTN business products that will also run over this connectivity. This enables new products to be brought to market faster by not having to reconnect the corporate to MTN each time a corporate desires to subscribe to a particular product/service.

MTN CorporateAccess involves the establishment of a VPDN through an existing or a new connection (Diginet link or equivalent) into MTN from the corporate via a NSP. The NSP will have a link into MTN and corporate clients will connect to an NSP, as shown in Figure 4.4. The NSP will be responsible for maintenance and support of the link and the provision of services and skills (such as configuration and security) related to this function. The NSP is either a First tier Internet Service Provider or major connectivity provider that has met certain criteria and has been approved by MTN to have NSP status.

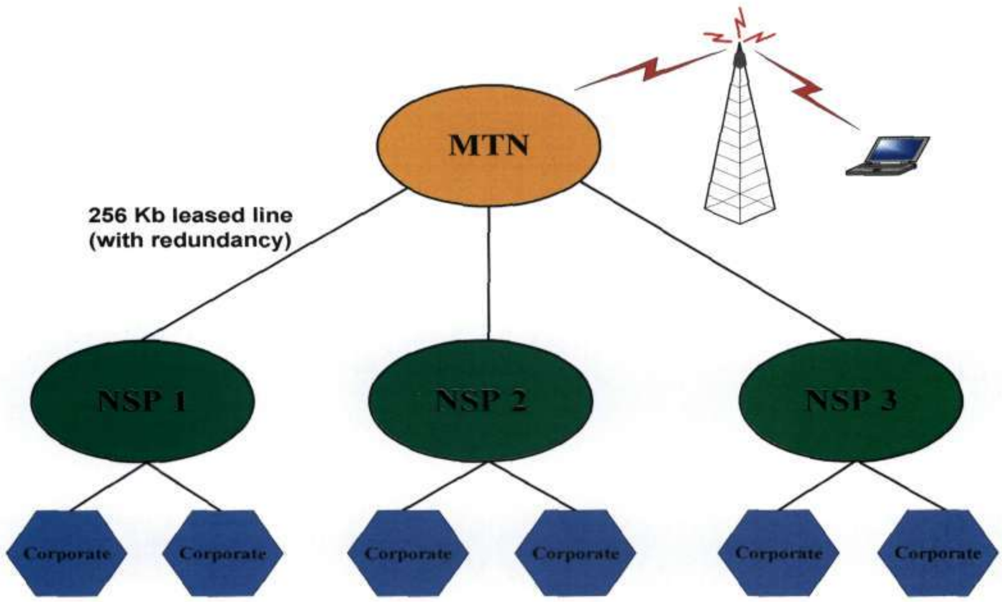


FIGURE 4.4: MSGP CONFIGURATION

MTN has created a platform specifically for connectivity to the Corporate through the NSPs. The platform is known as the MSGP (Mobile Services Gateway Point) and is designed to provide few, high quality connections to NSPs rather than dozens of direct connections to customers.

The benefits of the MSGP are as follows:

- Redundancy - each NSP connects to two different points at different geographical locations. Configurations on both sides are designed so that if one link fails, traffic can be routed through the other link.
- Link Status - MTN will be able to communicate the link status to the NSP.
- Future Proof Architecture - the MSGP is designed to accommodate new bearers with minimal reconfiguration.
- Traffic Management - the bandwidth can potentially be managed from the MSGP right through to the customer's premises.

The NSPs all connect into the MSGP and customers connect into the NSPs. This connection mechanism is known as MTN CorporateAccess. The NSP is contractually bound to provide two Diginet (or equivalent) links of minimum 256 kilobits per second capacity into the two connection points of the MSGP. MTN will not charge the NSP for connectivity. The NSP has the option of providing full redundancy by ensuring that under normal conditions both links are running at less than 50% capacity.

4.5 Analysis of the GPRS Business Model

As figure 4.1 illustrates, the huge anticipated GPRS usage on the network has not materialised to date despite the growing need for mobile data in South Africa. The average usage is approximately 90 GB per month which is far lower than what was anticipated by MTN. The reason for the poor uptake can be explained by the business model that was implemented.

The customer value of service is very limited. There are no obvious "killer applications" that was introduced with the service. While MTN allows the ordinary subscriber to connect to the Internet, it does not offer any content or value-added services. GPRS is also not offered to the pre-paid subscriber even though they make up 80% of MTN's subscriber base. There are also no clear incentives for the corporate subscribers to migrate to the GPRS service.

MTN only has 37 corporate clients that subscribe to the MTN CorporateMobility package. Appendix 1 lists the registered APNs and their GPRS usage in March 2004. The majority of the APNs did not generate any significant GPRS traffic.

The largest user, with approximately 7 MB, was the Internet APN which is provided by MTN for the MTNdataLive subscribers. This APN is used by both the normal subscribers and businesses that did not wish to subscribe to the CorporateMobility package and create their own APN. The next largest user was the delivery company, Sun Couriers, which utilise GPRS for its own internal tracking of all parcels that are being delivered. The information is fed via the GPRS network to their central collection point in Pretoria.

MTN.co.za is the internal APN for MTN staff. This allows the staff to dial into the MTN intranet and MTN servers from anywhere in South Africa. This is a free service to all MTN staff. The staff can read their e-mails, browse the Internet and even download information from the MTN servers. This APN generated 4 MB of traffic in March 2004. Actaris is a company that provides the pre-paid electricity vending machines to most local municipalities. The electricity subscribers can top up their electricity subscription through the vending machine that is supplied by Actaris. The company uses the GPRS network to update the accounts of the subscribers at their central office. This telemetry service is of a very short duration but the large number of subscribers making use of the service adds up to a large volume of traffic. The Actaris APN also generated 4 MB of traffic.

There has not been a great interest from most major enterprises to create their own APNs. It was anticipated that the major retail banks, such as Standard and ABSA Bank, would be the largest users of the mobile data network. However, these institutions were not enthusiastic to implement this service. The major obstacle was the price of the service. The banks are currently utilising the much cheaper SMS services that are being offered by MTN. The banks also did not envisage gaining any tangible benefits from the utilisation of the GPRS service. There is no unique or "killer application" available to convince the banks to sign up for the service. The current SMS facility that they employ fulfils their present needs. Only First National Bank (Fnbcoza) subscribe to the service but the usage is currently very low.

There were no major changes to the organisational arrangement in MTN. The operator chose not to directly interface with the corporate client but rather to be just a mobile data transport provider. There was no major marketing or sales drive from MTN to actively promote the new service. MTN only has 2 WDPs and NSPs signed up for the CorporateMobility package. In addition there are not many companies available that fulfil all the requirements for a WDP or NSP. The companies that have met the criteria were not keen to be a part of this business venture since they were not convinced that there was a profitable market for the service.

The current GPRS service is only capable of delivering Coding Schemes 1 and 2. Thus, the data throughputs are limited to a maximum download speed of 13.4 Kb/s per timeslot. The difference is that GPRS is packet switched based and allows the user to always be connected. The major advantage with the cellular based mobile data services is that it allows the users to be connected wherever there is cellular coverage. Over 97% of the MTN network is GPRS capable. Even though it is faster than circuit switched data, GPRS is still too slow for most common applications, such as on-line gaming and receiving e-mails with attachments. GPRS is most suited for low-volume traffic such as the Actaris telemetry application or the Sun Courier tracking service.

In order to obtain a competitive advantage over the other broadband providers in South Africa, such as Telkom, Vodacom and Sentech, MTN will need to provide much higher data throughputs. By having faster data throughputs, MTN will be able to provide much more attractive services. The broadband data connections being offered by Sentech is cheaper and offers higher data throughputs. MTN does not have any distinguishing application or service, besides the fact that mobile data can be offered anywhere and anytime.

The metered pricing model also discouraged many subscribers from trying the service. The customers perceive the cost of the GPRS service as being too high. The approach from Sentech, where a subscriber can send and receive an unlimited amount of data for a fixed monthly subscription is more appealing. The low revenue being generated can also be directly attributed to the fact that MTN does not provide any content for the subscribers. The current WAP portal, MTNICE, has very limited content and does not fully cater for all the needs of the subscriber.

BMI Techknowledge Group (2003), predicts that the total GPRS users in South Africa will grow to 1.4 million by 2007. Currently, there are 120 000 registered GPRS subscribers on the MTN network. If MTN is to capture at least 50% of the forecasted 1.4 million subscribers, then it's subscriber base will increase to 700 000. This will represent an increase of 580 000 subscribers over the next 3 years. The average growth rate per year will be 187% if MTN adds 194 000 subscribers per year over the next 3 years. This is a very attainable figure provided MTN pursues an alternative mobile data strategy and rectifies the deficiencies in the current business model.

4.6 Conclusion

The mobile data industry is in its infancy and operators are still experimenting with a variety of business models in order to conquer a sustainable and profitable position in this promising industry. Which business models will prove to be sustainable is yet to be seen. At present, network operators are exploring various ways to recoup the huge costs associated with deploying a mobile data network. By using business models inherited from GPRS networks, EDGE and UMTS networks would price itself out of reach of the general public. Also, the role of operators is undergoing change. If one thing at this point is clear, it is that extensive experimentation with different business models for future mobile data services will be necessary for these operators to survive.

While the mobile data market in South is still new, the forecast for the next 3 years is very encouraging. According to the forecast from BMI Techknowledge Group (2003), the number of GPRS users is expected to grow to 1.4 million by 2007. However, currently there are only 120 000 subscribers registered for the GPRS service on the MTN network. Major changes to MTN's business model are required if it is to become a major player in this market. The analysis carried out in this chapter of MTN's current GPRS business model has highlighted several areas where the company should reconsider it's strategy as it evolves to the next generation of mobile data networks.

From the analysis of MTN's offering for both the mass market and the corporate consumer it is clear that the operator must identify customer needs in order to provide "killer applications". The consumers do not perceive any tangible value from the current offering. There are no unique or exciting applications being offered by MTN to entice the users. Messaging over GPRS will continue to be the most popular application in the foreseeable future. MTN has to become more involved in the customer's data experience by delivering mobile data content. Mobile data service is dependent on the availability of quality content and genuinely useful services. The combination of quality content and useful services is the key to the widespread use of wireless networks. It is also very evident that the GPRS data speeds, while faster than the circuit switched speeds, is still too slow. MTN's competitors are offering much higher data throughputs. More exciting applications and contents are only possible if the network is upgraded to deliver higher data speeds.

Another major obstacle hindering the mass adoption of GPRS is the pricing model. Most consumers view the current pricing structure as being too expensive and this has prevented them from utilising the service. The metered charging model, which charges on the amount of data being sent or received, is inappropriate considering the current market climate. The correct charging of mobile data services is the one of the key factors that will encourage a favorable adoption rate of the services.

As MTN moves forward to the next generation of mobile data services, it has to take heed of the lessons learned from the business model implemented for GPRS. The shortcomings of the current model are rectified in the new model proposed in Chapter Five.

Chapter Five – Proposed Mobile Data Business Model

5.1 Introduction

The mobile telecommunications industry has reached a turning point in its development. Launching new mobile data services and supporting 3G networks has become the biggest financial investment for the industry in over a decade. For mobile operators like MTN, the new developments in mobile data presents an opportunity to deliver new data services to subscribers that could reverse the trend of declining Average Revenue Per User (ARPU) and increase profits for voice services. However, to create sustainable value from mobile data, the operator has to develop an attractive business model.

For MTN, the advent of 2.5 and 3G networks represents a shift from what was a voice-centric business model to one focused on providing multimedia data-oriented services. GPRS was a stepping stone for the company into the mobile data market in South Africa. Although, the service has not been very successful, the experience gained is invaluable for the development of a new business model as the company moves forward. In order to succeed with mobile data, it is vital that MTN implement a realistic and feasible business model.

The proposed business model also utilises the framework described in Chapter 2. However, as the operator progresses towards a 3G network there are major changes required to each component of the business model. Unlike the GPRS model, it is envisaged that the company will play a more active role in the services and applications being offered to the customer instead of being just a network provider. It is essential for the operator to adopt an integrated services approach. To achieve this, widespread changes are required with regards to the Customer Value of Service, Organisational, Technical and Financial Arrangements of the business model as depicted in Figure 5.1.

The customer value of service component examines how MTN can narrow the gap between the delivered and intended value proposition. It also describes how the company can exceed the expectations of the subscriber by offering more innovative mobile data services which benefits the consumer. The structure of the organisation will have to transform to effectively manage the changes to the value chain brought about by the introduction of the new mobile data technologies, services and applications. This transformation is elaborated on in the organisational arrangement section. The technical arrangement section describes the phased-in approach that MTN should implement in order to upgrade the network in the most cost effective manner, while still being able to offer competitive data speeds. The new services and application that the operator could potentially offer to both the mass-market and corporate subscribers is discussed in the financial arrangement section. The new hybrid pricing model, as well as the cost model, is also described in this section

5.2 Mobile Data Business Model

Figure 5.1 illustrates the elements of the proposed mobile data business model.

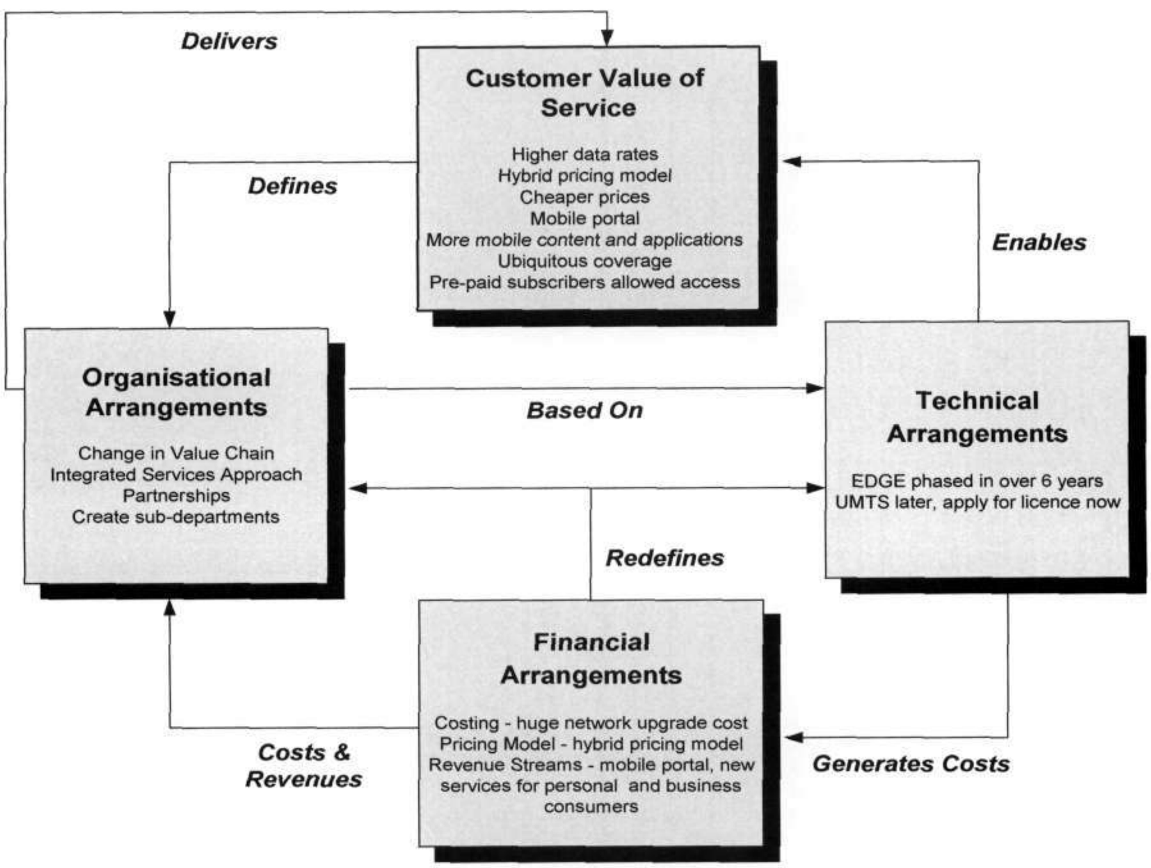


FIGURE 5.1: PROPOSED MOBILE DATA BUSINESS MODEL

Adapted From: *Bouwman, H. (2003). Designing Metrics for Business Models Describing Mobile Services Delivered by Networked Organisations. Proceedings of 16th BLED Electronic Commerce Conference, eTransformation. Slovenia.*

The Customer Value of Service defines the changes required by the Organisational Arrangements to be able to effectively deliver the intended value. These changes also form the basis on which the Technical Arrangements can enable the delivery of the value proposition to the customer. The major costs of the Financial Arrangements are due to the changes in the Technical Arrangements. Based on the costs and revenues, the Financial Arrangements redefines the transformation of the Organisational and Technical Arrangements. Each component of the business model is discussed in the following sections.

5.3 Customer Value of Service

The key issue with customer value is that there should be a very close tie in with MTN's intended and delivered value proposition. The operator must first develop various scenarios of the mobile data services which it intends to offer to customers and then examine if the company is capable of delivering those services. With the recent hype surrounding mobile data there are numerous exciting services being proposed as the next killer application but there are also various limitations which could prevent these services from being deployed on the network. These include the network technological upgrades required to deliver the high data speeds, handset availability to support the new services, the current penetration of these new handsets in the market, the organisation lacks the required skills to adequately fulfil the service requirements and the cost to deliver the service is not financially viable. These limitations have to be carefully considered by MTN when deciding which services to offer.

At present, customers do not expect much added value from the mobile data services since their perceived value of the WAP and GPRS services is very low (BMI Techknowledge Group, 2003). MTN now has a chance to exceed the expectations of the consumers and deliver a much higher perceived value. However, the services must fulfil all of the customer's requirements and the operator must deliver the desired satisfaction more effectively and efficiently than its competitors.

The capability to offer mobile data and voice services anywhere and anytime in South Africa is a major strategic advantage that MTN possess. The other data service providers, besides Vodacom and Cell-C, only deliver mobile data and not mobile voice services. MTN's current network offers ubiquitous coverage throughout the country. However, the key driver to delivering a higher customer value is faster mobile data rates. All new services will require much higher data throughputs than what the current GPRS network is delivering. The difference between the fixed line and mobile data throughputs should be negligible. The technology arrangement concerning the changes to the network is discussed in Section 5.5. It is recommended that MTN first phase in the evolutionary EDGE technology and later build a UMTS network. The data rates will improve significantly with both these network changes.

A major obstacle to the adoption of GPRS was the cost of the service. To overcome this barrier, it is proposed that a hybrid pricing model be introduced instead of just the metered charging model. With this scheme the various pricing models are combined to cater for the different types of users. Section 5.6, which discusses the Financial Arrangements of the business model, describes the new pricing scheme in detail. This will add value to the consumer since the prices will be lower and they will have a choice of choosing the package that best suits their needs and budget. Another important feature of the new pricing model is that it now includes charging for the value of the content being downloaded and is not based solely on the volume of data being consumed.

The lack of attractive mobile data content being offered by the operator is another major factor contributing to the poor success rate of the GPRS service. MTN will have to introduce a mobile portal with exciting and relevant content. The details regarding the mobile portal and content provisioning is outlined in the Financial Arrangement section. The service offering will be differentiated between the mass market and corporate users. The mass market will have the new MTN portal to connect to, while the corporate consumer will still have their own exclusive APN but can also connect to the portal. MTN will also open up the mobile data network to pre-paid consumers which will enhance their current mobile telecommunication experience. With these new mobile data service offerings, the company will endeavour to deliver the elusive "killer application" which is sorely needed for mobile data to succeed. These new Customer Value of Service now defines changes required to the Organisational Arrangements in MTN.

5.4 Organisational Arrangements

Major changes are required to the existing organisational structure to cater for the mobile data market and to ensure that the company delivers the customer value of service. The mobile data value chain is more sophisticated and complex than the voice counterpart. Figure 5.2 illustrates the changes in the value chain.

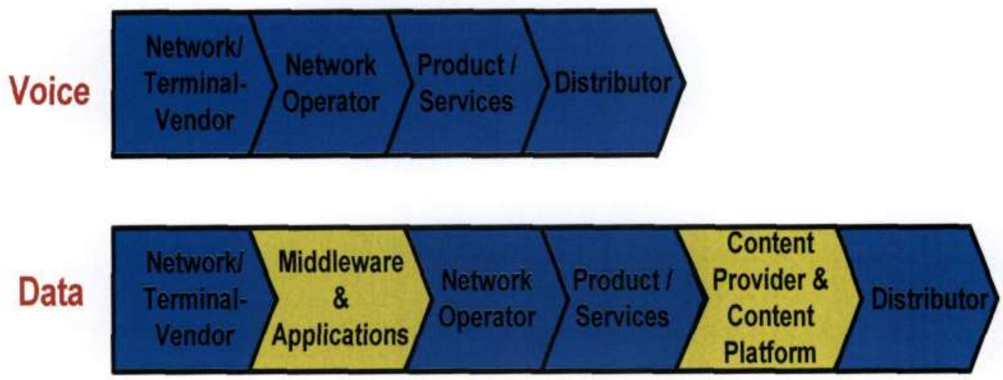


FIGURE 5.2: CHANGES IN THE VALUE CHAIN

In a second generation voice-centric world, the operator enjoys a vertically integrated value chain model in which it controls the services it produces and the distribution channels. In the current shift from voice to data services, many new players including content providers, content aggregators and application service providers are entering the value chain and need to be leveraged as part of the operator's strategy. These new entrants will also want their piece of the revenue pie. Through providing the mobile infrastructure and their own selected services, MTN can create an environment which encourages other companies to participate with additional revenue-generating services. In this environment, the operator's contribution to the value chain will vary from just transport and delivery of data to being a provider of sophisticated services to consumers and enterprises.

For the GPRS service, MTN introduced Wireless Data Providers (WDP) and Network Service Providers (NSP) to cater for the corporate market. This concept allows the operator to utilise the required data network skills and expertise of external companies. However, MTN is removed from the interface with the customer and is not in the front line anymore. As the operator moves to an integrated services approach, it will have to play a more active role than just a network provider. The company must form revenue-sharing partnerships with the WDPs and NSPs to be able to provide an integrated service to the corporate clients. The company must work closely with these new partners in fulfilling all the customers' needs. This will create more revenue opportunities for both parties since the corporate customers will have more confidence in the service. It will also encourage more companies to become WDPs. More applications and services, tailored for each corporate client's needs, must be developed. This can only be accomplished by forming partnerships with application developers and content providers. MTN will have an easier task of selling the mobile data service by offering advanced applications which improves the corporate client's business process.

The creation of a mobile portal is pivotal to the success of the mobile data services. MTN must ensure that all the required skills, to develop and maintain the portal, are either developed or acquired by the organisation. This also applies to all other key functional departments within the organisation, such as marketing, sales, network group and billing. The organisation is presently structured for mobile voice and radical changes are required to effectively create, market and sell the new mobile data services. It is proposed that new sub-departments be created within the functional units to specifically look after the mobile data services. With the changes in the value chain, it is imperative that these sub-departments are formed. Some of these units do exist for the GPRS service but they now need to be expanded to cater for the new applications and services to be offered.

The changes to the network will require new technologies and skills to be learned by the network engineers. The optimisation of the mobile data network is vastly different than that of the mobile voice network. To provide a reliable and quality network, MTN must create a sub-department within the network group to solely focus on the roll-out and management of the mobile data network. The marketing and sales department are also primarily geared for the promotion and sales of mobile voice applications and services. Mobile data provides a whole new set of challenges since it is a radically new service being offered. The consumers must be convinced of the benefits of mobile data. This requires a massive advertising and promotional campaign from MTN. A sub-department is, therefore, required to manage this task. The billing department will require changes to manage the new pricing model. The billing of pre-paid users is also an added complexity that must be effectively implemented and managed. The technical arrangements are based on the above changes to the organisational arrangements of the company.

5.5 Technical Arrangements

The technical arrangements are essential in enabling the customer value of service. Mobile services are price inelastic since increased usage does not sufficiently compensate for declines in retail prices. Mobile operators in South Africa have significantly cut effective per minute prices to increase usage and market share while in parallel spending heavily on network CAPEX. To combat similar value erosion in mobile data, MTN should move away from rolling out a substantial new mobile data network first and only then focus on which services to provide. Rather, the operator should add network capacity incrementally. For instance if transmission speed becomes a key user requirement to support the service experience in central urban areas, MTN should add capacity or infrastructure accordingly. The mobile operators in Europe have invested billions of Euros in 3G networks but the mobile industry now expects 80% of mobile data service revenue in the next three years to come from narrow-bandwidth services, such as messaging, and picture download, which can be comfortably provisioned on EDGE networks.

In order for MTN to capture a significant portion of the South African mobile data market, it needs to offer much higher data rates than what the current GPRS network is delivering. Sentech, one of MTN's competitors, is already offering data rates of 512 Kb/s. However, Sentech has limited coverage and cannot provide any mobile voice services. As shown in Figure 3.6, the different paths MTN can follow is to either immediately upgrade the network to be EDGE capable or apply for a UMTS licence from the telecommunications regulator (ICASA) and then roll-out a UMTS network. There are various advantages and disadvantages to pursuing either alternative. As discussed in Chapter 3, EDGE is a GSM based technology and is considered the best way to capitalise on existing GPRS resources. The current frequency spectrum can be utilised for this service, thus, MTN does not need to apply for a new licence from ICASA. Considering the huge amounts operators in Europe have paid for UMTS licences, this makes EDGE a much cheaper alternative. Even though UMTS will deliver much higher data rates, the cost to roll-out a new network will be very high.

Therefore, it is proposed that MTN should first phase in EDGE onto the network while at the same time apply for a UMTS licence. The UMTS network should only be rolled out if there is a significant demand for higher data rates or if the higher data throughputs are critically required for new service applications. All the current and proposed new services and applications can be easily enabled with the data rates an EDGE network will deliver. However, as far as future mobile data services are required, it is crucial for MTN to obtain a licence to provide UMTS services. From a strategic point of view it is imperative that MTN acquire a UMTS licence since it is most likely other mobile operators will definitely apply for one. There is also the threat that new operators will see this as an opportunity to break into the mobile telecommunication market and will apply for a licence.

There are various issues which MTN needs to consider when devising the EDGE roll-out strategy. The main driver is the cost of enabling this feature on the network. The EDGE roll-out strategy is considered in the following section.

5.5.1 EDGE Roll-Out Strategy and Costs

There are two different strategies MTN could adopt for the EDGE roll-out. The first approach would be to make the entire network EDGE compliant within a year. However, due to the cost and time implications this is not a very feasible route to follow. The overall costs will determine the rate at which MTN will upgrade the network. As will be shown, the CAPEX cost to upgrade the whole network is R728,505,255 and the total annual OPEX cost is R46,082,221.

Clearly it does not make financial sense for MTN to upgrade the whole network in one year. Therefore, the proposed strategy would be to phase in the EDGE service over 6 years. The major metro areas will be targeted first and should be EDGE compliant within the first two years. These regions currently display the highest GPRS usage on the MTN network. There is a clear indication from the GPRS services that the early adopters and high mobile data spenders emanate from the major metro areas in South Africa. The regions to be upgraded each year are shown in Table 5.1. These regions also track the current Sentech broadband services roll-out programme.

Year	Region
1	Central Cape Town, Durban Central, Johannesburg City Centre, Midrand, Randburg, Sandton North, Sandton South
2	Bloemfontein, Centurion, Germiston, Krugersdorp, Port Elizabeth, Durban North, Pretoria, Cape Town, Kempton Park
3	Durban South, Lowveldt, Belville, Eastern Cape North, East London, Johannesburg Eastern Suburbs, Johannesburg Southern Suburbs, Johannesburg Western Suburbs, Paarl, Pinetown, Pietermaritzburg, Richards Bay, Simons Town
4	Central Free State, Eastern Cape South, KwaZulu North, KwaZulu South, Limpopo East, Limpopo West, Mpumalanga North, North Coast, South Coast, Springs
5	Mpumalanga West, KwaZulu Midlands, Mpumalanga East, North Eastern Cape, Stellenbosch, Southrand, Northern Cape, Northern Free State, North West
6	North Western Cape, North West West, Southern Free State, South West Cape, N1 South, N2 East, N2 Transkei, N2 West, N3 South, N7 North

Table 5.1: Regions to be Upgraded Each Year

It is important to note that all the radio and switch equipment deployed on the MTN network is from a single vendor, Ericsson. Therefore, MTN is constrained to follow any equipment and software upgrades that Ericsson implements for the new features. The major costs to consider when upgrading a network to be EDGE capable are the transmission, software and radio base station (RBS) upgrade costs. Each major cost for the EDGE roll-out is considered below. The costing for the EDGE upgrade is based on the latest available prices from Ericsson.

5.5.1.1 Transmission

When using EDGE, each configured Basic Physical Channel (BPC) will generate two to three times the load on the Packet Control Unit (PCU) compared with a BPC configured for GPRS. Independent of the coding scheme used, an EDGE channel requires 64 Kb/s on the Abis interface (the link between the RBS and the Base Station Controller). The cost for MTN to upgrade its current 16 Kb/s transmission is shown in Table 5.2. Currently, MTN is bound by regulation to obtain all transmission from Telkom. The cost is calculated for upgrading the whole network, as well as for the selected regions that will be upgraded in the first year.

Item	Annual OPEX Cost	Capital Expenditure
Radio Network Impact (Abis Interface) Selected Region Year 1	R 3,009,268.23	R 8,465,906
Core Network Impact (Gb Interface) – conc. factor of 20%, Selected Region Year 1	R 2,295,492.62	R 2,386,329
Whole Radio Network Radio Impact (Abis)	R 34,376,491	R 67,721,211
Whole Core Network Impact (Gb interface) – conc. factor of 20%	R 8,884,865	R 9,236,452

Table 5.2: Transmission Upgrade Costs

The detailed breakdown of the costs is tabulated in Appendix 2. The 20% concentration factor for the core network (the Gb interface) refers to the fact that this link is currently under utilised and it is assumed that the increase in the load will only be 20%. MTN will save R31,367,222.77 on OPEX costs and R59,255,305 on CAPEX costs in the first year by phasing in the service.

5.5.1.2 Software Costs

In order to deploy EDGE commercially, the Base Station System (BSS) software needs to be upgraded to version R10. The BSS software is the main controlling software in the switches and all radio features are controlled by this software. The cost for the BSS software normally includes all basic functionality and radio features. All advanced radio features, such as EDGE, is an optional extra for which the operator is charged more if they choose to have these features activated on the network. Table 5.3 lists the software upgrade costs for the network. The basic EDGE feature is the only one required for providing EDGE support. All the other features are for enhanced and improved performance such as Quality of Service support.

Whole Network	Cost
Total BSS Software Upgrade Cost	R 29,482,716
Total Optional EDGE Features (Radio)	R 1,253,920,140
Total OSS Software Upgrade cost	R 12,216,696
Total Basic EDGE Feature cost	R 45,594,000
Selected Region – Year 1	
Total BSS Software Upgrade Cost	R 14,741,358
Total Optional EDGE Features (Radio)	R 221,565,060
Total OSS Software Upgrade cost	R 12,216,696
Total Basic EDGE Feature cost	R 8,268,000

Table 5.3: Software Upgrade Costs

Appendix 2 also includes the breakdown of the software costs. Ericsson charges $200 for each time slot that is activated for EDGE. The costing assumes that each cell will have 4 time slots activated for EDGE. Another assumption for the software pricing is that only the cost for the Basic EDGE support will be activated. MTN will certainly not activate all the optional features, as the cost is exorbitant. The BSS R10 upgrade cost has not been included, as this will be done as part of the normal network upgrade, irrespective of whether the EDGE feature is activated or not. Just the basic feature cost, will save MTN R 37,326,000.00 in the first year by phasing in EDGE.

5.5.1.3 Radio Base Station (RBS) Costs

Since the launch of the network, MTN has installed two series of Ericsson RBS equipment, the RBS200 and RBS2000 range. The RBS200 was the very first Ericsson product and does not support many of the new and advanced features. At present, there are 1428 radio sites equipped with the RBS200 equipment. All of these sites will have to be swapped out to the latest RBS cabinet, which is the RBS2206. The RBS2206 is the replacement to the popular RBS2202 and is the latest offering from Ericsson. This cabinet supports all the latest features including EDGE.

There are currently 2177 sites equipped with the RBS2202 equipment on the network. To be EDGE capable an upgrade to the RBS2000 series is required. A DXU-21 and EDGE capable transceiver unit (sTRU) must be installed or swapped out to a RBS2206 cabinet. The DXU-21 is a new Distribution Switch Unit that provides a system interface to the transmission link and connects individual time slots to certain transceivers. The DXU also extracts the synchronisation information from the transmission link and generates a timing reference for the RBS. The new BTS, the RBS2206, is EDGE ready but requires the EDGE capable double transceiver units (dTRUs). The dTRU has two TRUs combined into one unit. The cost of upgrading the RBSs for the whole network is shown in Table 5.4 below.

RBS Type	RBS Quantity	RBS Cost	Number of TRUs	TRU Cost	DXU-21 Cost
RBS200 swap out to RBS2206	1428	$18,564,000	4082	$17,697,511	0
RBS2202 requiring sTRU	2177	0	15046	$26,041,198	$7,915,572
RBS2206 with no EDGE dTRU	23	0	240	$299,149.50	0
RBS2302 swap out to RBS2308	479	$8,973,107	1190	$0.00	$0.00
RBS2102 requiring sTRU	26	$0.00	120	$232,944.00	$94,536
RBS2101 swap out to RBS2206	12	$224,796.00	24	$0.00	$0.00
Total	**4145**	**$27,761,903**	**20,702**	**$44,270,802.50**	**$8,010,108**

Table 5.4: Radio Base Station Upgrade Costs for Whole Network

There are currently 23 RBS2206 cabinets in the network that have the old version of dTRUs installed and these will have to be replaced with the EDGE capable dTRUs. The total RBS swap out cost is R600,321,101.25 if an exchange rate of R7.50 to the dollar is assumed.

The regions for year 1 will be upgraded in the next financial year. Due to the limited budget, it is proposed that there be two parts to the upgrade. All RBS2202 sites with a site TRU count of over 8 will be swapped out to the RBS2206. The sites with a TRU count of less than 6 will have an EDGE sTRU installed per cell and a DXU-21 per site. There are also 51 RBS200s in the selected regions for year 1 and year 2. These sites will also be swapped out to a RBS2206. The BTS cost for the selected regions for year 1 is shown in Table 5.5.

Item	Quantity	Total Cost
RBS2202 swap out to RBS2206	166	R70,062,790
sTRU	475	R14,982,450
DXU-21	227	R4,171,125
RBS200 swap out to RBS2206	51	R21,525,315

Table 5.5: RBS Upgrade Costs for Selected Regions of Year 1

The total cost for the first year is R110,741,680. The total network CAPEX and OPEX costs for the EDGE roll-out for both the whole network and the selected regions in year 1 is shown in Table 5.6.

Item	CAPEX Cost	OPEX Cost
Whole network	R728,505,255	R46,082,221
Selected Regions – Year 1	R 128,571,788	R5, 304,761

Table 5.6: Comparison of CAPEX and OPEX Costs

Purely from a cost perspective it makes sense for MTN to phase-in the EDGE upgrade to the network. MTN will save R599,933,467 in CAPEX costs and R40,777,460 in OPEX costs. Initially, the data speeds that EDGE delivers will not be required throughout the country, especially in the rural areas. MTN has the advantage of still being able to offer GPRS services throughout the country while it phases in the EDGE upgrades.

5.5.2 UMTS Costs

There are various costs associated with rolling out a UMTS network. Besides the high costs of the licence, new sites, radio equipment, switches and software are required. It is certainly not feasible for MTN to provide UMTS coverage throughout the country in the near future.

European operators are currently struggling to justify the UMTS roll-out since the take-up of the new service is very slow. The major obstacle is the shortage of mobile handsets and the lack of any killer applications. The costing for the roll-out of the UMTS network is included for comparison purposes and is based on the latest available prices from Ericsson.

For the UMTS costing it is assumed that the network will be phased in over three years. The total number of subscribers after the last phase is forecasted to be approximately 1,4 million (BMI Techknowledge Group, 2003). It is also assumed that only the Johannesburg, Cape Town and Durban regions will be covered in these three years. The cumulative areas for each clutter type to be covered in each of the three phases are shown in Table 5.7.

Clutter Type (Km^2)	Year 1	Year 2	Year 3
Dense Urban	232	544	862
Urban	381	885	1, 399
Suburban	523	1, 226	1, 944
Rural	370	861	1, 362
Roads	352	868	1, 403
Total	**1, 858**	**4, 384**	**6, 969**

Table 5.7: UMTS Coverage Area for the Three Years

Based on the given clutter requirements, the number of sites required each year is shown in Table 5.8. The site numbers are calculated using the radio propagation characteristics of UMTS and standard cellular site planning principles.

Year	Number of sites				
	Dense Urban	Urban	Sub-Urban	Rural	Road
1	75	53	43	15	20
2	261	183	134	50	70
3	602	422	343	103	161

Table 5.8: Number of UMTS Sites Required for Each Year

The total number of subscribers in each of the different types of area is listed in Table 5.9.

Subscribers/Clutter	Year 1	Year 2	Year 3
Dense Urban	70, 199	245, 157	566, 992
Urban	49,139	171, 610	396, 895
Suburban	35,100	110, 698	283, 496
Rural	8, 755	30, 645	63, 944
Roads	12, 285	42, 902	99, 224
Total	**175. 498**	**601, 011**	**1, 401, 551**

Table 5.9: UMTS Subscribers per Area Type for Each Year

Based on the number of sites and switches required, as well as the subscriber numbers, the total cost for the hardware and software for each year is shown in Table 5.10. The total breakdown of the cost is given in Appendix 2.

Year	Total Cost (USD)
1	17, 438, 576, 22
2	27, 827, 751, 32
3	56, 168, 776, 17

Table 5.10: Total Cost of UMTS Equipment for Each Year

The total cost over the three years is $101, 435, 103, 71. This excludes the cost of the licence, transmission, site acquisition, site rental and implementation. Since South Africa covers 1,219,912 Km^2 , this network will only cover 1% of the total area and approximately 22% of MTN's current 6.3 million subscribers. To provide UMTS coverage for all the subscribers throughout the country will cost significantly more than the EDGE roll-out. Therefore, the strategy of first phasing in EDGE and then only rolling out UMTS in areas where it is required, is more feasible. The huge network costs is an important element of the Financial Arrangements.

5.6 Financial Arrangement

As discussed in Chapter 2, the Financial Arrangements constitute the revenue model, the cost model and the pricing model. Each component is critical in ensuring MTN captures a significant share of the mobile data market. Each model is discussed in detail below.

5.6.1 Revenue Model

For the mobile data market, MTN could adopt a low-cost, low-risk, lower-growth connectivity revenue model with the objective of increasing the volume of data transmitted over the network. Here, the company will focus on growing data traffic but it will miss out on opportunities to capture value from the content carried over its network, as is happening with the GPRS revenue model. MTN should, however, adopt a higher-cost, higher-risk but higher-value integrated service revenue model. With this approach, the operator does not simply provide a connection but positions itself to directly influence and profit from the customer's total mobile experience.

MTN could continue to capture the basic value from owning the connection but the ability to grow is limited because it is always one step removed from the customer's experience. The company bears none of the risk involved in signing up more mobile data customers or for providing the innovations and quality that attracts customers. To earn the required return on past and future investments, MTN cannot continue to have a revenue model limited to running the network and providing connectivity while others are capturing the value created by the services running through the network.

In order to capture the maximum possible revenue from the market, MTN must transform its operations to become both a content packager and value-added service provider. A content packager, such as Yahoo, does not generate the content but delivers it to viewers through a portal or public interface to the outside world. A value-added service provider packages content for resale to end customers, provides value-added services such as format conversion and has a direct billing relationship with the customer. Both choices have lower costs and fewer barriers of entry since the major need is only for a portal. Both models can leverage

MTN's in-house IT skills and offer opportunities for attracting new revenue streams. Therefore, it is essential for MTN to develop an exciting and attractive mobile portal.

Mobile portals are characterised by a unique cost and revenue structure, which is mainly due to the nature of the business and services. To achieve a large customer database, a portal must specifically provide easy access, build and develop brand awareness of the portal and offer value-added, personalised services that customers want (Sigala, 2003). Early mobile data networks such as Japan's NTT DoCoMo i-mode service indicates that a rapid subscriber growth rate is catalysed by rapid service introduction more typical of "Internet time" than of more traditional voice service timelines. While wholesale emulation of i-mode is unlikely to assure success, MTN must consider i-mode's success formula in developing their own portal strategy. NTT DoCoMo's radical increase in data revenues came about through two key strategies (Funk, 2002):

1. Enabling value sharing with 3rd party developers and services through flexible accounting and smart billing
2. Accelerating service creation and deployment with service enabling building blocks

The development of a critical mass is dependent on the openness of a mobile portal. The access, content and services of mobile portals can be open or closed. A closed-access portal provides services only to customers whose mobile subscription comes from the same source. A portal that is closed on the side of content and services permits visitors to reach only selected services and not the Internet at large. Closed-access portals represent an effort by established mobile operators to lock their customers into subscribing to their mobile traffic services. Although this strategy may preserve business in the short term, it is flawed in the longer term because it limits the number of users the services can reach and so it does not help operators to compete against open-access players.

One of the first successful i-mode lessons points to a new business model where operators share the value of the content and applications on their network with third party developers and information providers. NTT DoCoMo provides a unified bill to subscribers that includes all of the charges for various content and services, while also managing the payment settlement to content providers. For this service, DoCoMo takes 9% of the total charges and pays back to the content provider the remaining 91% (Smith, 2001). NTT DoCoMo does not create most of the content and applications available via i-mode. Instead, DoCoMo has tapped a large, creative third party developer community and motivates them through value sharing to produce compelling applications and content for subscribers. MTN must adopt a similar revenue sharing deal with content providers and service application developers.

Interestingly enough, DoCoMo has continued to learn and adapt the i-mode official menu to reflect what is popular and generating revenue. Across the globe, DoCoMo has set up relationships with local wireless providers, handset manufacturers as well as Internet content providers with the desire to go mobile. Among the ways DoCoMo distinguishes itself from competing technologies is by promoting extensive application development. By January 2002, DoCoMo's "ten leading application partners" were America Online, Inc., Sun Microsystems, Microsoft Corporation, SAP AG, Sony Computer Entertainment, Inc. SEGA Corporation, Walt Disney Internet Group (Japan), Symbian, Ltd., 3Com Corporation, and Hewlett-Packard Company (Ratliff, 2000). These are some of the main companies MTN should consider forming partnerships with in order to create a successful portal

Pricing also plays a crucial role in attracting portal users. The cost of i-mode services in Japan has been set at low levels. There is a low subscription cost irrespective of frequency of access, as users also pay for data transferred (Smith, 2001). By contrast, European operators charge customers a fee each time they access a service plus for the time they stay online. Consequently, they have found it difficult to build a critical mass. Specifically, in designing its pricing strategy, DoCoMo exploited the capability to monitor usage more precisely, in order to un-bundle digital products/services and charge each individual only for the part that he/she uses, i.e. the so-called microproducts. Thus, the users pay a minimal amount each time they read a page of data, such as news and financial data. The user also pays larger amounts for purchases of items like air tickets. Overall, the DoCoMo's micro payment billing and collections services have enabled providers to sell cheap services to a great number of consumers, as opposed to expensive services to a few. In other words, the micro payment strategy has significantly contributed to the development of a critical customer base.

The i-mode model should be emulated by MTN for it's mobile portal creation. The key features, such as having an open portal, partnering with major content providers, revenue sharing agreements with the content aggregators and having a flexible billing system, are critical for the success of the portal. The portal should target two segments of the consumer market, i.e. the youth market (16 to 24 year age group) and the adult market. MTN should also ensure that access to the portal is easy, convenient and open to all subscribers, i.e. pre-paid, contract and corporate subscribers.

The company must also establish constructive relationships with everyone who brings value to all mobile data products and services. This includes the content providers, mobile handset manufacturers, application developers and system integrators. MTN does not have to manufacture devices or generate content themselves but the operator must increase its economic involvement and sphere of influence in this market to strengthen its control over revenue and profit. Only through partnerships can MTN create an integrated service environment which will improve the customer experience and increase the financial rewards for the company.

There are four fundamental capabilities that MTN possess which can, if leveraged properly, provide unique advantages to its mobile data revenue model:

- Who – MTN is able to authenticate and uniquely identify the individual and can get a message to them using either voice or data
- Where – through Location Based Services (LBS), MTN can identify the location of the subscriber
- What – MTN can determine where the subscriber goes on the web, whom they call and are in contact with and what devices they are using
- Transact – MTN has the unique ability to extract revenue from the subscribers in either a pre-paid or post-paid business relationship

All four of these capabilities can be useful to MTN as either information collection services or productivity enhancing mechanisms and should be treated as valued resources. This uniqueness should always generate some financial return to the operator. To be successful with mobile data, MTN must first create an architecture within their network that allows communication and interaction with thousands of content and service providers. There must be an environment where third parties can use the four fundamental network capabilities, knowing who, where, what and transact, to build rich content and services which may be of interest to mobile subscribers. Enlisting the support of third parties allows them to be adaptive enough to put out services faster than the competition and react to change in the market quickly. MTN must create unique offerings that will leverage the four network capabilities.

The industry is under pressure to introduce applications quickly, but there is still uncertainty as to which applications will be successful even though various studies were conducted over the last 3 years to determine the mobile data requirements of subscribers (UMTS Forum, 2002 & Durlacher, 2003). There are several key success factors for mobile data applications as identified above. However, there are also some obvious limitations consumer applications will face, such as a lack of bandwidth, limited device capabilities and availability of software enablers. The applications to be delivered by MTN will be different for the personal and corporate consumers. The framework of applications to be considered is detailed below for both groups of subscribers.

5.6.1.1 Personal Consumer Services

The market for consumer services is large and fragmented with numerous start-ups focusing their activities on specific consumer segments. Mobile messaging and mobile finance consumer services have already been introduced with GPRS and has experienced some success with end consumers. However, other more bandwidth intensive applications will require faster connection speeds, new devices and better micro-browsing capabilities. There are four major streams for consumer mobile applications, namely information, communication, entertainment and transaction (Durlacher, 2003). Table 5.11 lists the various types of applications MTN could potentially offer.

Type of Application		Examples
Mobile Information	Static Communication	▪ "Time Filler" such as celebrity stories and horoscopes
	Dynamic Communication	▪ News Alerts on share prices, sports and weather ▪ Location based information on events and traffic
Mobile Communication	Mobile Messaging	▪ Mobile Internet E-mail ▪ Instant messaging (e.g. Chat) ▪ Multimedia-Messaging such as pictures, animations, greeting cards and video messages
	Mobile Advertising	▪ Sponsored SMS/e-mail ▪ Permission-based advertising ▪ M-Coupon
	M-Emergency Services	▪ Child Tracking ▪ Health Monitoring
Mobile Entertainment	M-Gaming and Gambling	▪ Mobile betting and gambling ▪ Interactive and community games
	Mobile Video	▪ Short video clips of an event such as a goal in a soccer match
	Mobile Audio	▪ Downloading of music
Mobile Transaction	Mobile Tailing	▪ Shopping support systems ▪ M-Ticketing/M-Reservation ▪ Simple shopping services
	Mobile Finance	▪ M-Brokerage (with instant alerts) ▪ M-Banking (check and execute)
	Mobile Payment	▪ Simple micro-payment by phone bill and virtual clearing

Table 5.11: Proposed Mobile Consumer Services

Adapted From: *Durlacher (2003). UMTS Report: An Investment Perspective. London: Durlacher Research Limited.*

- **Mobile Information**

Digital distribution of content and information is growing rapidly. A great variety of information with a varying attached value can be delivered via a mobile device to the end-user. Examples of such services include sports news, weather information, share prices, and traffic updates. This content can be accompanied by various forms of sponsored advertisements. According to Durlacher (2003), mobile information can be segmented by content types and value chain constituents. Content can be differentiated in terms of static (e.g. reference catalogues) and dynamic or transactional content (e.g. news feeds or broker info).

Static content comprises dictionaries, Yellow Pages, map directories, city guides, search engines, phone books, and other forms of reference data that are seldom updated. Almost by definition, the mobile information channel cannot compete with the Internet in terms of information richness, volume, or multimedia characteristics. Distinguishing elements need to be sought in characteristics specific to the mobile delivery channel, such as location-specificity, personalization, and immediacy. The element of immediacy is incorporated in the dynamic content categories that include traffic information, event notifications, sports news, general news, stock quotes, transportation schedules, and other time-critical and frequently updated information.

Another important demarcation line is provided by location-specificity. Location based services have probably attracted most publicity recently because of the true innovation that lies in equipping information services with the geographical position of the user of the service. A number of novel services have recently been developed in this context, with many more to come soon. Examples include systems for

- Navigation, reservation, ordering
- Home, local, travel information
- Translation services depending on roaming or cell information
- End user assistance services, e.g. in emergency situations
- Monitoring person location, e.g. entertainment and leisure (such as find a nearby friend) or health-related monitoring or even prisoner tagging
- Third party tracking, fleet management, etc.

Location information can also trigger services when the mobile terminal enters a pre-defined area. Possible applications range from location-dependent advertising to contextual billing schemes. LBS is a typical case for new mobile services in which a number of specialised players need to cooperate for the realisation of high-quality services. Services that use geographical location of the mobile terminal lie at the very heart of a possible paradigm change in mobile computing (Prem, 2002).

- **Mobile Communication**

The communication services segment provides a number of revenue opportunities. Mobile messaging applications, including all person-to-person communication excluding voice telephony are generally regarded as the "killer applications" in the upcoming UMTS environment. This is supported by the huge success of SMS in the GSM world and by the success of internet messaging services such as e-mail and instant messaging. Experience from cellular services in Japan and Korea over existing (2G/2.5G) networks underscores the universal demand for picture messaging (still photos using embedded cameras), emails (with file attachments) and internet browsing (Funk, 2002).

As an advertising medium, the mobile phone complements other forms of advertising such as TV, direct mail, and web advertising. It also adds some unique characteristics that no other medium can effectively match. Existing advertising media are targeted at undifferentiated, mass audiences, and they rely predominantly on one-way mass communication. Since mobile advertising is able to efficiently identify the user, it could be tailored to highly selective customer groups. The ubiquitous mobile platform enables instant response from the recipient of advertisements, e.g. SMS-based advertising services. It offers also the possibility to combine user information with location data, a unique differentiating characteristic among advertising media.

Furthermore, the ability to offer a permission-based advertising option offers an effective way to increase the potential value of the advertising message to the consumer. These characteristics make the mobile phone a potentially lucrative advertising medium. As mobile advertising evolves towards mobile marketing, this channel will only increase in importance for traditional marketing functions such as brand building, promotion and direct response marketing.

Mobile emergency services already exist on GSM networks in the form of free SOS calls that connect end-customers to a help-desk operator. The emergence of positioning technologies and services will drive this application to a new level. The distress call functionality is regarded as a natural extension to the services of location-based systems. Personal tracking services designed specifically for children are also promising. Devices are already being created that constantly delivers details about a child's location, over the mobile network, to parents or a call-centre In the future, such devices may be built into personal items such as watches or jewellery. Mobile Health Monitoring is another service that is in trials now. International companies are currently testing a service for treating and monitoring patients at home. Specific portable equipment measures a patient's vital signals including the pulse, blood pressure or electrocardiogram, and sends the information over the GSM network to a central location in a hospital. In many cases such services may improve a patient's quality of life and bring increased confidence for the elderly and critically ill at home (Durlacher, 2003).

- **Mobile Entertainment**

Entertainment services, i.e. mobile games, gambling, icons, ringing tones, audio and video, will be key to unlocking the revenue opportunity in the B2C market. To date, revenues from mobile entertainment services are very limited. Mobile games are expected to become the number one service. The target demographic for mobile games will initially be the mass-market with casual users more likely to take to simple mobile games than the sort of complex games found on games consoles and PCs. To appeal to the mass market, games will need to be user-friendly, possess intuitive controls, have low learning curves, be relatively short in game play duration and provide instant gratification. Revenue models for simple games can include advertising, sponsorship, download and usage commissions.

Gambling represents another large category that will attract significant attention. The mobile platform allows users to place bets anytime, anywhere, even as the event of interest unfolds. Gamblers could place bets and receive information on changing odds as a football game advances, for example. The same scenario can be applied to most sporting events. However, real-time betting places great requirements for the ability of the mobile infrastructure to provide reliable and immediate service

Mobile devices provide another distribution channel for online music. Some degree of distribution of music content will be inevitable in the mobile internet world due to a variety of reasons. Music is an information product and a natural entertainment product. Major music labels view mobile music as another distribution channel which they will seek to exploit as they face increasing competition in both the online and offline worlds. There are three main possible delivery modes and thus, revenue sources for distribution of music via the mobile network (UMTS Forum, 2002):

- Downloading files (immediately in "trickle-and-store" mode)
- Streaming music (similar to wireline music streaming)
- Broadcasting music (live shows and programming)

Mobile video shares similar characteristics with mobile music. Currently, only the smallest forms of video entertainment, such as video clips, are routinely distributed over the fixed line internet. Mobile video will be a viable extension of this market, but it faces pressing technical constraints. As is the case with mobile audio, the three main distribution modes are downloads, video streaming, and video broadcast.

- **Mobile Transaction**

An interesting feature of mobile technology is the authentication of mobile terminals and the high degree to which terminals are operated by a specific person. While the uptake of e-commerce on the Internet has been relatively slow in South Africa, the use of mobile devices for purchases of goods and services offers new potential for further development. Important ranges of applications in this context are purchases at retailers or public access points where mobile phones are used as payment terminals. Successful applications in the area of ticketing for transport or events are another example in this context. Although mobile banking already exists on 2G networks, few have reached a mass-market status. It remains to be seen whether the improved technological qualities will change this situation.

M-Tailing refers to mobile transactions facilitated by or concluded with a mobile device. Mobile devices provide consumers with an additional channel for electronic ordering of products. The killer applications in the mobile retail domain will be those that resonate most with the key advantages of the mobile channel, namely location-specificity, personalisation, and immediacy. Based on these factors, the most likely killer applications in the m-(re)tailing domain will include m-auctions, m-promotions and other retail applications that are based on time-critical information and benefit from immediate response from the user. Mobile (re)tailing is best suited for impulse purchases and for situations in which instant product and price information is required (Durlacher, 2003). Examples of services amenable to the mobile platform include "in-store" price comparisons on CDs and appliances, movie ticket purchases, mobile auctions, and buying a CD after listening to a particular song. Shopping alerts and notifications of discounts and m-coupons complement such applications.

Traditional and online banks view mobile data as an additional distribution channel for their services. Some of the services are:

Mobile Banking

- Account balance and transaction history
- Funds transfer
- Bill payment
- News and other information

Mobile Brokerage

- Stock trades and quotes
- Alerts and notifications
- Portfolio Management

Mobile Insurance

- Insurance on demand (e.g. ordering travel insurance at the airport via a mobile device)
- Customer care and related information

A mobile payment system is defined as a method of payment that requires or enables the use of a mobile device to conduct financial transactions (Rayport, 2001). Mobile payment satisfies a number of key criteria necessary for the success of applications in the mobile internet world. Mobile payments enable immediate payment anytime and at any location. They provide direct access to personal accounts and profiles. Mobile payments are convenient in that they provide cashless capabilities and add functions similar to credit cards.

Mobile brokerage and banking have already experienced reasonable success and will become an increasingly user-friendly option for consumers.

5.6.1.2 Corporate Consumer Services

Mobile clients are still in a different environment from those in the wired Internet and a gateway is still required between the two worlds. Advanced IP network services such as tunneling, security, traffic management, application layer switching and address scalability are required. Since many of these capabilities have unique challenges in the mobile space, it creates an opportunity for MTN to build unique services that only it can offer, particularly to the corporate market.

In the case of corporate applications, the majority of applications that the subscriber would access would not be those provided by the mobile operator but those supported by the enterprise. The risk here is that if MTN offers nothing more than connectivity, the corporate subscriber will shop for the lowest price mobile data-pipe. The company will find itself competing on price only, unable to maintain margins or retain customers and will struggle to maintain a compelling business proposition. To provide compelling services for the corporate and to avoid being relegated to the role of an inexpensive bit-pipe, the operator should add services to their network that mitigate the concerns of the corporate and add value to the communications between the corporate and their in-house information systems.

The opportunity for MTN is to add value to their mobile data network in such a way that the corporate becomes a partner in the mobile information management. To do this, the company needs to directly address the needs of the corporate by creating an architecture that provides secure, reliable communications to the corporate IT system. These should be compatible with the corporate client's existing infrastructure, be relatively easy to implement, provide the coverage, ease of use of familiar applications, speed and throughput which will make any mobile implementation effective almost immediately. An architecture that supports an open model, combined with the following series of applications directed at the needs of the corporate, would be a start for the value-add necessary to win and retain corporate customers (Katsianis, 2003):

- Virtual Private Networks – created on-demand either end-to-end between the subscriber and the corporate or between the subscriber and applications within the network and between those applications and the corporate. This is similar to what is being done with the MTN CorporateMobility package through the NSPs.
- Instant Messaging - enabling secure communication between workgroup members and to provide critical presence information to the corporate.
- Location Based Services –allow for tracking and location sensitive applications to be created for corporate clients.
- Compression Services –permit client-server applications to work at their optimum capacity by compressing the data over the slowest link.
- Single Sign On – a capacity to simplify connection to both the general Internet and the corporate Intranet by using two-factor sign-on that leverages the phone capabilities to provide the highest possible authentication.
- Legacy Integration Tools – maximising the ability to provide up to 80% of the needed corporate functionality within the initial 20% of the project commencement, using tools that allow the corporate and their business automation consultants to create and manage the corporate connectivity in a secure environment.
- IP Filtering and Quality of Service - provide a method of securing transactions and portioning the MTN network so that corporate data traffic is routed in a secure fashion, segregated from any network data traffic.

Paramount in the marketing strategy of this corporate solution is the ability to provide phones/devices and services to a corporate as a unit instead of as individual subscribers.

In a very fragmented business application market, there are three major segments positioned to gain significantly from mobile technology (Durlacher, 2003):

- customer relationship management (CRM), comprised of applications that deal with partners, businesses and end customers,
- supply chain management (SCM), primarily dealing with business suppliers,
- workforce applications (mobile office) targeting the employees within the organisation.

CRM solutions are designed to enhance an organisation's customer-facing functions such as sales, service and marketing. They have the potential to increase revenues, customer satisfaction and profitability. The marketing function of CRM involves aggregating all interactions conducted by the end-customer from different channels into an integrated data repository used to generate promotional and marketing campaigns based on end-customers' preferences. Businesses will need to manage end customers' interactions conducted from mobile devices and incorporate the information into their customer profiles.

The sales function of CRM systems focuses on sales force automation to coordinate sales efforts and provide easy to use tools for representatives in the field. A wide range of solutions has been developed for mobile access to enterprise systems as mobility plays an increasing role in streamlining business processes and increasing customer loyalty. Popular applications could include contact details, appointments, order history and confirmation, special pricing, real-time availability of goods and resources and delivery confirmation. More advanced systems incorporate more detailed information on customers such as product and policy information. Service features available on mobile devices include accessing information regarding product problems, job details, and technical specifications. Significant value can be added to traditional service applications by mobilising these features.

The emergence of the Internet and the development of e-marketplaces and e-business hubs have had a dramatic influence on the supply-side function of enterprises across all industries, in which mobile data will be of assistance. Markets have enabled companies to purchase, fulfill and ship orders more efficiently. Mobile SCM connectivity and visibility-related applications that are most likely to benefit from mobile technology are mobile data collection, mobile alert generation and mobile-enabled integrated SCM applications.

Areas where mobile technology could add significant value to existing SCM systems are limited to intelligent alert generation, primary data collection, and gateways to enterprise messaging backbones. Positioning technologies are another important enabler for improving supply chain visibility. Intelligent alert generation systems will be an important complement to workforce messaging applications and would be focused on developing flexible business rules and managing multi-channel user communication.

Primary data collection is an important enterprise function that spans across the entire organisation. The quality and accuracy of primary information affects planning and forecast applications and inventory applications and enables transactions to be conducted in a faster, more controlled way. There are several areas where mobile technologies could contribute to better results. These include barcode scanning, location-stamping and machine-to-machine applications. M2M systems routinely retrieve a set of parameters from a given device such as a vending machine, a car engine etc. and sends them to a data collection device.

Information collected from primary data sources has to be communicated to decision-makers and fed into respective enterprise systems. Alert generation applications can deliver timely and actionable alerts to corporate mobile employees. The key properties of such systems should include connectivity to enterprise systems, the ability to create flexible business rules that trigger messaging events, the ability to deliver information intelligently through a variety of channels and the interactivity features that allow the user to react to specific alerts in a predefined way (UMTS Forum, 2001c).

Mobile workforce applications facilitate communication of business processes to mobile employees through services such as planning, connectivity and collaboration. A number of novel services will specifically target business people and support office extension and tele-working environments. Increased mobility in daily operations is a global trend and not only generated by business travel. To the contrary, an increasing number of people are using tele-work to avoid daily trips between home and office and to better satisfy the demands of family and work. Flexibility in working times and working location also is an important company asset in the motivation of highly skilled employees.

Mobile data systems offer a technological basis for improving on today's existing tele-office support services. Increased group interaction, video telephony, phone and video conferencing for mobile users are just a few examples in this domain. New services to support mobile workers, to connect them to collaborators, information systems and head office will form an important revenue stream for specialised companies in this area.

5.6.2 Pricing Model

The experience gained from charging and billing for GPRS will prove valuable to MTN as it moves to offer advanced mobile data services. This move demands a fundamental shift in the manner in which mobile services and applications are billed and will require a revolutionary transition from MTN's perspective. In order for the operator to be able to offer these additional services to the customers, there is a requirement for the recovery of the infrastructure investment cost. Issues such as who supplies what to whom and the fragmented segmentation of next generation end-users will also mark a significant departure from the traditional mobile billing model. Billing systems that evolve to support mobile data services will have to cater for a wide range of events and services, including revenue sharing and the apportionment of revenues to third parties.

Charging may also be used to provide congestion control in under-provisioned and over-subscribed areas of the network. There are various proposed economic and technical models for charging and billing for Internet usage. Most of these are equally suitable for charging and billing of mobile data traffic, especially with 2.5G and 3G networks. The ability to bundle services will help to promote service personalisation by allowing customers to tailor packages and encourage experimentation. Initial experience with packet-based services shows three basic components to the billing model:

- a fixed monthly data services subscription
- a fixed service or content area subscription
- a variable data traffic fee.

One fundamental mistake of fixed Internet players was to concentrate on usage volumes in the mass market rather than on maximising the economic returns from the services provided (UMTS Forum, 2001c). MTN needs to avoid this pitfall and focus on capturing the value customers perceive in mobile data services. To do so, it needs to offer a mixture of value-based (e.g. R 1 per song) and volume-based (e.g. R 50 per MB transmitted or received) pricing to its customers. This will stimulate demand and enable MTN to maximise revenue from data services.

Different pricing schemes must be implemented for the mass market and corporate consumers. The mass market pricing model will have to cater for both the pre-paid and contract subscribers. Charging customers according to the number of packets sent or received may mean little to the personal consumer market and would only occasionally reflect the value of the services being accessed. The subscribers are only familiar with the time-based tariffs of GSM and do not know or understand the concept of packet charging. There is no correlation between customer perceived service value and the data volumes transmitted for the services. The price of a service should take into account the cost of providing the service, ability of subscribers to pay and finally, competitors' actions.

From a commercial viewpoint pre-paid makes sense for MTN, since it will receive payment from subscribers prior to the consumption of resources. This simplifies revenue collection but with the downside of increased complexity for the billing system when it comes to mobile data since the subscriber will have to be billed in real-time. In addition, the revenue from content downloaded from the portal, will have to be shared with the content providers. This implies that the system must be able to track and keep an accurate record of all transactions. Table 5.12 illustrates an example of the pricing scheme for pre-paid consumers.

Service	Tariff Scheme	Example
Access to MTN Portal	R10 each time the subscriber connects to the portal.	Allowed access to the portal anytime using any device
Content downloaded from the MTN portal	Subscriber is charged according to the value of the content	R3 for each ring tone or logo downloaded R2 for each news item downloaded
Internet Browsing	Charged per minute	R0.50 per minute of browsing
Mobile Data Application	Charged according to the value of the application	R1.00 for direction to nearest hospital from current position
SMS or MMS	Charged per message	R0.86 per SMS and R3.44 per MMS

Table 5.12: Example of Pricing Scheme for Pre-Paid Subscribers

The proposed pricing model for the pre-paid subscribers is a combination of metered, fixed and transaction charging. The pre-paid subscribers are allowed access to the MTN portal since this will be the only route to connect to the mobile data network. However, the customers will be charged a fixed rate for accessing the portal in order to prevent them from abusing the service and wasting valuable network resources which could lead to traffic congestion problems on the network. The consumer is charged for the value of any content downloaded from the portal.

From the portal, the subscriber will be allowed access to the Internet. The metered charging model will be used, where the customer is charged by the minute for this service. MTN should encourage the user to only use the official sites on the portal since it can gain revenue from any content purchased. Therefore, the subscriber will not be able to purchase any content from Internet sites which are not registered on the portal. The subscriber is charged for utilising any other mobile data applications offered outside of the portal. An example of this could be a location based direction finding service. The current tariffs for messaging will remain the same, i.e. the consumer will be charged per message (SMS or MMS) sent. The subscriber is not guaranteed any quality of service or data throughputs.

More options are available for the contract subscriber since MTN has more flexibility with the billing and to tie-in the customer, thus preventing any churn. Table 5.13 depicts the proposed pricing scheme. The pricing model for the contract subscriber is also a combination of metered, fixed and transaction charging. The subscriber is charged a fixed monthly subscription fee and the cost is different depending on which package is chosen.

The difference between the basic and premium Quality of Service (QoS) relates to the minimum data throughputs the consumer is guaranteed. The data throughputs will have to be realistic considering that MTN is phasing in the upgrades to the network. Initially, MTN could offer a basic minimum of 80 Kb/s and premium minimum of 128 Kb/s. These data speeds will improve once the EDGE upgrade is completed and when UMTS is introduced. With the premium QoS, the user is also guaranteed access to the network anytime, i.e. the subscriber is given a higher priority than any other subscriber is and will not experience any congestion problems during peak traffic times.

Service	Tariff Scheme	Example
Subscription	Depending on the QoS required and the bundled free data	R300 for basic QoS and 20 MB free per month R500 for premium QoS, 35 MB free per month and free access to e-mail
Access to MTN Portal	Free access to MTN portal	Allowed access to the portal anytime using any device
Content downloaded from the MTN portal	Subscriber is charged according to the value of the content	R25 for each music video downloaded R50 for each game downloaded
E-mail facility	Depending on subscription	For the basic subscription, the access to the e-mail box is R20 per month. Data transferred is charged at R0.50 per 20 Kb
Internet Browsing	Charged per MB sent or received	R0.50 per 20 Kb once free MBs are used
Mobile Data Application	Charged according to the value of the application	R1.00 for direction to nearest hospital from current position
SMS or MMS	Charged per message but given 100 free SMS and 5 free MMS per month	R0.80 per SMS and R2 per MMS

Table 5.13: Example of Pricing Scheme for Contract Subscribers

Access to the MTN portal is free but the subscriber is charged for any content downloaded. The subscriber will be allowed to customise the homepage of the portal to show only their preferences. The consumer will also have access to an e-mail server. There will be no charge to access the e-mail server for the premium subscriber but the basic package subscriber will be charged a monthly fee. The consumer is also given a certain amount of free MBs per month that could be utilised for surfing the Internet or sending and receiving e-mails. Unlike the pre-paid subscriber, the contract consumer is charged by the volume of data sent or received. The amount of data consumed can be easily reflected on the monthly statement that the subscriber will receive. The charging for messaging and using other mobile data applications remains the same as for the pre-paid subscriber.

A similar hybrid pricing model will be used for corporate customers. However, the major difference is that each corporate client will still have their own defined APN. An example of the pricing model for the corporate subscriber is shown in Table 5.14.

Service	Tariff Scheme	Example
Subscription	Monthly subscription with a guaranteed QoS.	R1000 per month and first 50 MSISDN subscriptions per APN are free. Each MSISDN is given 60 MB free per month
APN Creation	Charged per APN created	R2000 once of setup charge
Access to MTN Portal	Free access to MTN portal	Allowed access to the portal anytime using any device
Usage of MTN Application	Charged per volume of data consumed. The costs get cheaper as more data is consumed.	R0.30 per 20 Kb for telemetry usage
Content downloaded from the MTN portal	Corporate is charged per MSISDN according to the value of the content	R25 for each music video downloaded R50 for each game downloaded
Internet Browsing	Charged per MB sent or received if connected to site via the MTN portal.	R0.40 per 20 Kb
SMS or MMS	Each MSISDN will be charged per message but given 200 free SMS and 10 free MMS per month	R0.75 per SMS and R2 per MMS

Table 5.14: Example of Pricing Scheme for Corporate Customers

The corporate clients will be charged a once off fee for creating the APN. There will be a monthly subscription fee levied for access to the APN. The first 50 SIMS issued to the client will be provided free of charge to access the APN but thereafter each extra SIM will be billed for the service. All the other pricing models, defined for the contract subscribers, are also applicable for the corporate clients. The corporate subscriber will be charged on a sliding scale for the usage of any specific MTN corporate applications, i.e. the cost per MB gets cheaper as more data is transferred.

5.6.3 Cost Model

The cost to offer mobile data services can be broken down into business operations and network costs. The breakdown of the various costs is depicted in Figure 5.3.

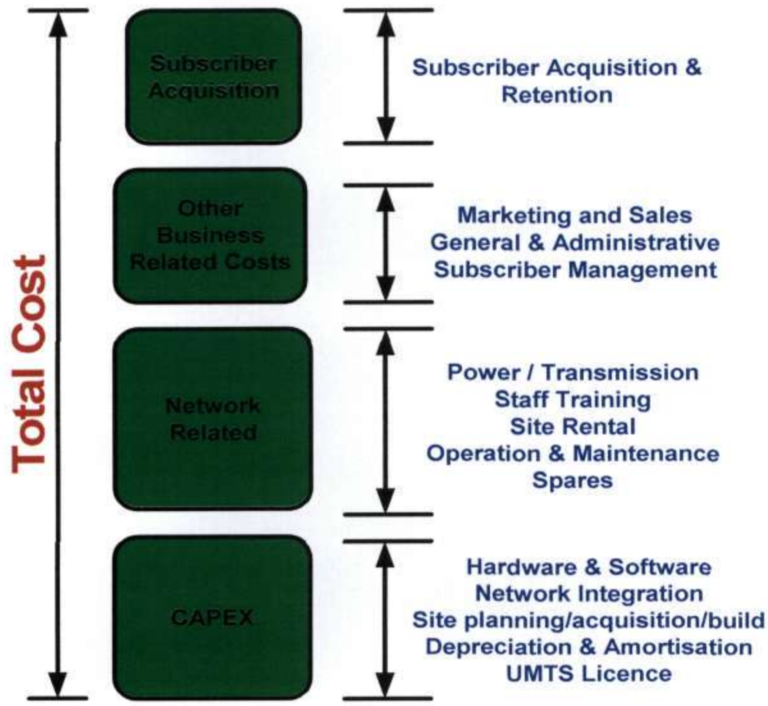


FIGURE 5.3: BREAKDOWN OF COSTS

The CAPEX cost refers to the upgrading of the network radio equipment and software to offer first EDGE and then UMTS services. As discussed in the Technology Arrangement section, this is a huge cost since MTN has a lot of old equipment which cannot support the new features. UMTS will also require a totally new network to be rolled out. MTN should adopt a phased in approach in order to minimise the network costs. This entails following a six year roll–out plan where EDGE is first deployed in the major urban areas and then in the surrounding suburban and rural areas. The operator will save R599,933,467 in CAPEX costs and R40,777,460 in OPEX costs in the first year by following this approach.

UMTS should only be deployed later provided there is a significant increase in subscriber demand for mobile data and if there are applications that warrant the investment for higher data rates. From a strategic perspective, MTN should still apply for a UMTS licence in the interim. At present, there is no indication from ICASA of what the costs and requirements will be for a 3G licence. If ICASA follows the same route as that of the European regulators, then the cost of the licence will be huge. Vodafone, the largest operator in the world, paid £6 billion for its UMTS licence in 2001. To provide coverage for 1,4 million subscribers it will cost MTN $101,435,103,71 just for the equipment and operating software.

As the network evolves, MTN will have to build more radio sites to cater for the increase in capacity. This will involve the planning, acquisition and building of the new sites. The integration of mobile data services into the network is also a huge added cost. New value added service platforms are required to cater for the various applications the operator wishes to deliver. Major costs will also be incurred in the development of the mobile portal and in securing partnerships for the integrated services.

The network related costs are incurred through the daily optimisation and management of the network. These include the power and transmission costs for the radio sites and network switches, which is very significant considering MTN has to lease all transmission from Telkom. In the Organisational Arrangements, it was proposed that a sub-department be created to manage the network. Thus, extra staff with the required skills and experience have to be employed. In addition, the current network engineers at MTN will require extensive training since they have only been working on the mobile voice network. The engineers and support staff will have to learn new technologies, radio and switch equipment and software as the network transforms to offer both voice and data. New operation and maintenance systems have to be installed for the supervision of the radio sites, network switches and the services and applications which will be provided by the operator.

MTN will have to take a more active role in educating the subscribers on the benefits of mobile data. This will incur a huge cost for sales and marketing. There should be a big drive to sell the new mobile data services and to create an awareness for the general public. Extra staff are also required since it is recommended that sub-departments be created to manage the marketing and sales of mobile data. The mobile portal will only be successful if it achieves a widely recognised brand. For this to occur, MTN has to actively advertise and promote the portal, especially to the mass-market subscribers.

Subscriber acquisition and retention is crucial to the success of the mobile data service. Customer retention costs include loyalty programs and associated reward costs, handset upgrade costs, customer communications costs, third party retention commissions and other customer retention costs. MTN will have to increase spend in this area but the customer retention costs are still significantly less than those associated with customer acquisition. The main driver for this cost is the handset subsidy. In order to be successful in mobile data, new handsets will have to be distributed to the subscribers since many of the older ones do not support GPRS and EDGE. UMTS will also require a totally new handset. These new handsets should be subsidised by MTN for the contract and corporate customers, thus, generating another huge cost for the company.

The current customer care program and call centre is chiefly geared towards handling mobile voice related problems. Major changes have to be implemented to cater for the mobile data services. The customer care and call centre staff will require intensive training and support tools to effectively assist the subscribers with problems. Since mobile data is a radically new service for the public, there will be numerous queries regarding the setting up of the mobile device for the service, connecting to the portal and billing related problems. To ensure the customer has an enriching mobile data experience, the customer care programme has to be efficient, since this will reduce churn and promote further usage of the service. It is vital that mobile data is offered for the pre-paid market, therefore, the billing platform also needs to be upgraded to cater for the billing system. Flexible billing systems will have to be introduced to create opportunities for sharing revenues with service and application providers.

5.6.4 Revenue Forecast

Today, MTN has a firm revenue base and a long-standing investment in the network infrastructure. The move to EDGE and UMTS will build on this foundation whilst providing the flexibility to grow the market for mobile data services. By enhancing GSM through GPRS and EDGE, to reflect increased demand for capacity in line with new services, this existing investment can be protected. At the same time, there needs to be a gradual investment in UMTS, which will be supported by the continuing and substantial revenue from 2G and 2.5G services.

As discussed in Chapter 4, the BMI Techknowledge Group (2003), forecast the number of mobile data subscribers in South Africa to increase to 1.4 million by 2007. If MTN acquires a minimum of 50% of these subscribers, then the subscriber base should increase from the current 120 000 to 700 000 by 2007. Table 5.15 depicts an estimated revenue forecast for MTN for the years 2005 to 2007 if EDGE is implemented. It is assumed that the subscriber base will increase by 200 000 each year. It is also assumed that 50% of these subscribers will be pre-paid, 25% will be corporate customers, 15% will be contract subscribers with the basic subscription and 10% will have the premium subscription.

Another assumption is that all related costs will increase by 10% each year. The network related costs is assumed to be R100,000,000.00 plus the network OPEX costs for the EDGE implementation. The network CAPEX costs is the value calculated in Section 5.5.1. The subscriber acquisition cost is estimated to be R1,000.00 per subscriber and this value will also increase by 10% each year. This cost, as well as the other business related costs, is similar to what MTN is currently spending for the voice services. The income values include the monthly subscription for the contract and corporate subscribers.

	2005	2006	2007
Subscriber Numbers			
Total No. of Subscribers	320 000	520 000	720 000
No. of Pre-Paid Subscribers (50%)	160 000	260 000	720 000
No. of Corporate Subscribers (25%)	80 000	130 000	180 000
No. of Basic Contract Subscribers (15%)	48 000	78 000	108 000
No. of Premium Contract Subscribers (10%)	32 000	52 000	72 000
Costs			
Network Capex	R128,571,788	R141,428,966	R155,571,863
Network Related	R105,304,761	R115,835,237	R127,418,760
Other Business Related	R100,000,000	R110,000,000	R121,000,000
Subscriber Acquisition	R200,000,000	R220,000,000	R242,000,000
Total Cost	**R533,876,549**	**R587,264,203**	**R645,990,623**
Income			
Pre-paid Subscribers Spending R50/month	R8,000,000	R13,000,000	R18,000,000
Corporate Subscribers Spending R3000/month	R240,000,000	R390,000,000	R540,000,000
Basic Contract Subscribers spending R450/month	R21,600,000	R35,100,000	R48,600,000
Premium Contract Subscribers spending R750/month	R24,000,000	R39,000,000	R54,000,000
Total Income	R293,600,000	R477,100,000	R660,600,000
Cash Flow	-R240,276,549	-R110,164,203	R14,609,376

Table 5.15: Estimated Revenue Forecast for EDGE

For the first two years the service will run at a loss but from the third year the company will start to realise a profit. This is due to the initial high network upgrade costs and the low subscriber numbers. MTN will have to rely on the revenues gained from the current voice services to fund the EDGE implementation for the first two years. The forecast does not take into account the brand and reputation that MTN will build for itself in the industry. This will prevent the current subscribers from churning and will also encourage customers from other networks to join MTN. The forecast also illustrates that the corporate customers will be the highest revenue contributors while the pre-paid subscribers will be the lowest. Therefore, the operator must ensure that this sector of the subscriber base is well catered for.

Even though there are many assumptions, this forecast does illustrate that there is a viable business opportunity for MTN in the mobile data market. MTN must aggressively pursue this market by upgrading the network and offering new and exciting applications for the subscribers.

5.7 Conclusion

As MTN advances towards 3G, it is imperative for the company to translate the positive experiences of GPRS into quantifiable results users can see, touch, feel and experience. The evolutionary path from GSM to EDGE through to UMTS offers the optimum balance between the technology and the business case. GPRS and EDGE are important avenues towards realising 3G and there is a clear evolutionary path to support the growing market. The operator must act now if the early revenue opportunities of the mobile data market are to be realised. Building user confidence in new services is an important source of interim revenue and supports the staged approach to achieving full 3G services. The emphasis now must rest firmly on creating a total lifestyle user experience that works, is compelling and is delivered when it is promised.

The heart of the mobile data offering is the data throughputs that the network can deliver. While UMTS will offer much faster data speeds, the cost to implement the technology is high. The current take-up of mobile data services in South Africa is very slow for various reasons, therefore, it is not advisable for MTN to invest immediately in a UMTS network. The operator must first upgrade it's network to deliver EDGE. However, this is also an expensive exercise since MTN has to swap out a lot of old radio equipment, lease more transmission capacity from Telkom and upgrade it's operating software. The EDGE functionality should be phased in over six years. The major metro areas must be upgraded in the first two years since most corporate clients reside in these regions. The experience from GPRS also indicated that the high GPRS users originate from these locations. From a strategic point of view, MTN must apply now for a UMTS licence from ICASA.

In order to gain maximum revenue from the mobile data market, MTN must adopt an integrated service approach instead of merely being a transport provider for mobile data. With the change in the value chain, the operator should ensure it is not losing out on valuable revenue. The company must form partnerships with all players who can contribute to the service offering. These include the content providers, service application developers and device manufacturers. The i-mode model must be followed where the operator encourages third parties to form partnerships through lucrative revenue sharing schemes. It is important to deliver the richer application experience to users now, as the company builds towards full 3G deployment. MTN must also develop an exciting and attractive portal for the new mobile data services. An open approach to the content of the portal is required where all third party partners can easily offer their content and services.

There are various proposed services and applications for both the mass-market and corporate consumers. It is crucial that the pre-paid subscriber is allowed access to the mobile data network. The applications for the personal consumer include mobile information, communication, entertainment and transaction. Mobile messaging is bound to be the most popular service given the current SMS usage and the recent penetration of mobile handsets equipped with digital cameras. However, mobile gaming and gambling will also prove to be highly popular. For the corporate clients, MTN should concentrate on developing applications which would assist the business user in customer relationship management, supply chain management and workforce applications. The applications introduced with the GPRS service, such as VPDN, should be expanded.

The pricing of mobile data services also plays an important role in attracting new users. It is recommended that MTN adopt a hybrid pricing value for the new services. The subscriber is billed for the value of the content and as well as for the amount of data consumed. Pre-paid subscribers are billed on a per-time basis for data usage since it is easier from a billing perspective and for the subscriber to understand. The contract subscribers have a choice of quality of service and will have to pay a fixed monthly subscription. The access to the MTN portal is free and free megabytes of data is included in the subscription. The customer also has access to an e-mail box on the portal. The corporate also has to pay a fixed monthly subscription and is guaranteed a certain quality of service. There is also a charge for the usage of any MTN applications developed for the client.

The cost model includes the CAPEX, network related, business related and subscriber acquisition costs. The major costs will be the upgrade to the network and subscriber acquisition. MTN should also undertake an expansive promotional exercise to educate the consumer on the benefits of mobile data and also to encourage users to subscribe to the services. Major organisational changes are also required. It is proposed that sub-departments be created in the key functional areas, such as network group, marketing, sales and billing to specifically look at the management, marketing and sales of mobile data. The company must also actively pursue partnerships with all external parties who can add value to the offering.

Preparing a mobile data business model requires a deep understanding of technology and its commercial potential. With this proposed business model, MTN is sure to be successful in it's new endeavors. There will be changes to the business model as the business landscape changes but the model proposed in this chapter will form a solid foundation from which the company can capture a major portion of the market. Success will be based on a stage by stage approach, moving from one success to the next, rather than announcing an explosion of intangible technology and concepts. However the time to act is now and to be the first to launch new services in the South African market.

Chapter 6 – Conclusion

The world of communications is evolving at an exciting pace, driven by successes such as GSM and global phenomena such as the Internet. Leading-edge technologies are empowering citizens to an extent hitherto reserved to the realm of science fiction. Meeting complex and growing user demands is the major and urgent challenge for the telecommunications industry. The markets for mobility and for fixed multimedia are already large and growing rapidly. Customers will want to combine mobility with multimedia, resulting in higher demand for bandwidth and creating a significant shift towards new data services. The next five years of innovation in the telecommunication industry will play an important part to enable a change in lifestyle and business, which has many personal and economic benefits.

Presently, the revenue being generated by voice services is declining and operators are turning their attention to mobile data to reverse this trend. Despite the poor current adoption rate of mobile data, it is forecasted that the number of mobile data subscribers in South Africa will reach 1.4 million by 2007. Worldwide, the revenue from mobile data is predicted to exceed $300 billion by 2010. However, to gain the major share of the lucrative market, it is imperative that mobile operators adopt the correct business model.

This dissertation has presented a new mobile data business model for MTN to implement in order to capitalise on the growing demand for mobile data in South Africa. The key elements of the proposed business model are the customer value of service, organisational, technical and financial arrangements. The customer value of service looks at the value proposition being delivered to the subscriber. The organisational issues refer to the resources and capabilities required to effectively deliver the value proposition. The changes required to the network to enable the new services are examined in the technical arrangements component, while the revenue, pricing and cost model is detailed in the financial arrangements element.

The main driver for mobile data is the data throughput that can be delivered by the network. Most mobile operators around the world are embracing the new technologies that can achieve much higher data speeds than what is currently being delivered. GPRS was the first packet based technology to be introduced on GSM networks and it offers data speeds of 20 Kb/s per timeslot. The next step in the evolution is EDGE where data rates of 59.2 Kb/s per timeslot can be achieved. The advantage with EDGE is that it uses the same radio and switch equipment as GPRS. The same GSM frequency spectrum is also utilised, therefore, no new licence is required.

UMTS or 3G is the final stage, at the moment, in the data technology evolution. It is based on the W-CDMA standard and offers speeds of up to 2 Mb/s. A new network, with different radio and switch equipment, will have to be built for this technology. UMTS operates on a different frequency spectrum, thus, a new licence from the telecommunications regulator is required. In Europe, 3G licences were sold at huge prices to the operators. There are various choices available for the evolution path from 2G to 3G. An operator can upgrade to EDGE from GPRS and then later apply for a 3G licence, which is the proposed route for MTN. Alternatively, the operator can persevere with GPRS and upgrade directly to 3G when required. However, the current GPRS services are very limited due to the low bandwidth and is contributing to the poor uptake of this service. Most of the proposed new applications require the higher throughputs offered by EDGE and ultimately UMTS. There is also the danger that the other operators in South Africa will upgrade their networks very soon and will gain a competitive advantage over MTN.

The business model implemented by MTN for the GPRS service was not very successful. By March 2004, the network was only carrying 90 GB of data. The main reasons for the failure were the lack of applications and the high cost of the service. There were no "killer applications" introduced with the service to entice the users. The operator does not have an exciting mobile portal with attractive content or any applications available for the subscribers. MTN is removed from the customer's experience since WDPs and NSPs were introduced to interface directly with the corporate clients. There were no major organisational changes made to promote and manage the GPRS service. The volume based charging model introduced for GPRS was too expensive and this also discouraged the customers from using the service. The short-comings of the GPRS business model were rectified in the proposed new model.

For the customer value of service in the proposed business model, it is recommended that MTN first develop various scenarios of the mobile data services which it intends to offer to customers and then examine if the company is capable of delivering those services. This is to ensure that the gap between the intended and delivered value proposition is narrowed. The hype around the services and applications that 3G could offer has raised the subscribers expectations. However, there are limitations to what can be offered. These obstacles include the implemented network technology, handset capabilities and availability and the required skills that the organisation possesses.

The main value proposition for the customers is the true mobility obtainable anywhere and anytime in South Africa for both data and voice services. It is imperative that MTN upgrades the network to offer higher data rates since it is crucial for the services to be offered and will provide a strategic advantage for the company. It is also recommended that the company adopts an integrated services approach, where it strives to become more involved in the services and applications offered to both the personal and corporate subscribers. MTN must form partnerships with key content providers and application developers for the creation of a mobile portal. It is proposed that a hybrid pricing model be implemented for the billing. A combination of fixed, metered and content based charging should be employed. This will enable cheaper services to be offered. Pre-paid subscribers must be allowed access to the mobile data network. These customers make up more than 80% of the current subscriber base and could be a significant contributor to the data revenues received.

In order to be competitive in the mobile data industry, MTN cannot afford to be just a data transport provider. In order to accommodate the changes in the value chain and to reap the full rewards from this market, the company has to undergo major organisational changes. Partnerships must be formed with all parties that can contribute to the service offering. The operator must form sub-departments in marketing, sales, network group and billing to focus solely on the promotion, sales and management of the mobile data services and network.

The higher data rates can only be achieved by upgrading the network from GPRS to either EDGE or UMTS. EDGE is easier, cheaper and quicker to implement since no new licence or switching equipment is required. Therefore, it is proposed that MTN first phase in the EDGE upgrade over 6 years. This will reduce the initial high costs required for the extra transmission, the new switching software and the radio base station equipment changes. By phasing in the new technology, MTN will save R599, 933,467 in CAPEX costs and R40, 777,460 in OPEX costs for the first year. However, MTN must still apply for a UMTS licence from the regulator. UMTS offers higher data speeds required for future services and applications. The 3G network can complement the EDGE technology in areas where the higher data rates are needed.

To capture the lion's share of the mobile data market, MTN must provide a mobile portal for the subscribers. The portal must adopt NTT DoCoMo's i-mode model, where an open approach for the provisioning of content is utilised. This encourages all third party partners to easily offer their services and applications on the portal. While messaging will still remain the main revenue generator for mobile data in the near future, there are various new services and applications that could be offered for both the personal and business subscribers. These can be segmented into mobile information, communication, entertainment and transaction for the personal consumer. It is forecasted that mobile gaming and gambling will be very popular and more applications must be created for this sector. Services must be developed in customer relationship management, supply chain management and workforce applications for the corporate consumers. The current GPRS applications should also be expanded.

MTN has to be creative with its pricing model in order to generate significant revenue from mobile data. The volume based charging used for the GPRS service proved to be a major obstacle in enticing users. The introduction of a hybrid pricing model is proposed for the new business model. The pre-paid subscribers will be charged a fixed rate each time the mobile portal is accessed. Thereafter, the charging will be time-based for any data consumed and the subscribers will be charged according to the value of any content downloaded. The contract subscribers will have a choice of packages to choose from based on the QoS desired. There will also be free data bundled with the subscription. These customers will be charged on the amount of data consumed since it can be easily reflected on their monthly bills. The contract customers will have free access to the mobile portal. The corporate clients will still have their own APN defined. There will also be a monthly subscription charged for the service and the corporate will billed for the volume of data consumed.

The main elements of the cost model are CAPEX, network related, business related costs and subscriber acquisition. The major cost is the CAPEX cost which refers to the network upgrade costs. By phasing in the upgrades, MTN will be able to reduce this cost quite significantly. The network related costs are incurred through the daily optimisation and management of the network. New staff will have to be hired to manage the mobile data network and the existing staff will have to undergo intensive training. MTN will also have to undertake a massive marketing campaign in order to promote the new services and also to educate the consumers on the benefits of mobile data. Another high cost will be the creation of the key sub-departments to market, sell and manage the mobile data services. Subscriber acquisition is also a significant contributor to the cost model. The company will have to subsidise the new handsets required to access the new mobile data technology. Intensive training and new support tools are required for the customer care and call centres to effectively handle all customer queries and problems.

Business models are generally volatile in nature and change quickly over time. Trying to predict the viability of mobile data services that have yet to be created is problematic in itself. Another complicating factor is that it is hard to account for difference between 'new-to-the–world' business models and business models that are versions of earlier, more or less successful business models originally applied in different settings, i.e. Internet models that are used in 3G services. The financial issues related to business models are also difficult to pin down as well. Firstly, the distinction between investments and exploitation plays an important role. In addition, traditional investment methods fail to take the intangible nature of services in account. Other complicating factors are the lack of financial data and the difficulty in comparing the data when they are available. It is hoped that the model presented in this dissertation will form the basis of MTN's new mobile data strategies and will lead to the company being highly successful in the market. However, new business models will continue to be created and it depends on innovative minds to discover models that can fully capitalise on the features of mobile technology.

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Appendix 1 – GPRS Corporate APN Traffic

APN	Traffic (Mb)
Abicoza	10.99
actariscoza	4025.82
actarismscoza	10.1
Arcaycoza	107.9
Astcoza	0.59
begetvpncoza	0.01
Cwizecoza	171.23
dataservecoza	38.91
exactmobilecom	0.04
figmentcoza	69.56
fischerconscom	1142.6
Fnbcoza	3.98
foschinicoza	30.97
infogrocoza	47.93
Internet	72276.15
Iscoza	245.16
istestapncoza	0.2
keytoolscoza	1.53
leafwirelesscom	6.75
libertycoza	202.84
Mtncoza	4415.02
Mtnnsnet	1.16
Mymtn	2977.73
nomadiscoza	26.22
osiairportscoza	0.04
primehomecoza	4.19
Rohligcoza	43.36
Rtcoza	0
sandboxmtnnsnet	33.62
Sasfincom	167.35
Sattcoza	4.54
Sitanscoza	14.6
smartsurvnet	176.45
Suncoza	6137.95
transportgovza	88.4
transwitchcoza	12.64
Xlinkcoza	0.01

Table A1: APNs and Traffic as of March 2004
Source: MTN Statistics

Appendix 2 – Cost Breakdown

A2.1 Transmission Cost

Item	Cost
E1 Installation Cost	R22,000.00
Average value of DXX equipment per link	R11,390.86
Additional DXX equipment	R24,000.00

Table A2.1: Transmission CAPEX Costs

Item	E1 Costs (R)		E1 Costs per Timeslot (R)	
	Cost per Annum	Cost per Month	Cost per Annum	Cost per Month
Telkom Lease of E1	35,879.95	2,990.00	1,196.00	99.67
Additional links to replace lost capacity	7,333.33	611.11	244.44	20.37
DXX depreciation	4,390.91	365.91	146.36	12.20
Additional DXX equipment to replace lost capacity	3,796.95	316.41	126.57	10.55
Additional DXX equipment at Site	8,000.00	666.67	266.67	22.22

Table A2.2: Transmission OPEX Costs

Item	Quantity
Total number of sites	4,145
Total number of sites with EDGE	198
Total number of links	7330
Avg number of links per site	1.762019231
Free timeslots per site	7.139423077
Total sites with < 7 TRXs	3156
Total sites with > 7 TRXs	989
Total sites with > 11 TRXs	248
Total sites with > 17 TRXs	45
Total sites with > 22 TRXs	6
Number of sites between 7 and 11 TRXs	741
Number of sites with between 17 and 22 TRXs	39
Additional Number of BTS E1 links required	780
Additional Number of DXX E1 links required - 20%	400

Table A2.3: Number of Transmission Links Required

A2.2 Software Cost

Software Item	Cost
BSS Upgrade to R10	$3,863,061
BSS Local Services	R 310,056
BSC GSDC Services	$26,627
OSS Upgrade to R10	$1,542,185
OSS Local Services	R 339,868
OSS GSDC Services	$41,392
Edge Support, SW License	
$893 per 5 kPDP	
Optional Radio Network Features	
EGPRS	$200 per TS activated
Streaming	$851 per 64 kbps
Quality of Service (QoS) and Scheduling	$893per 64 kbps
Network Assisted Cell Change	$48 per TS
GPRS/EGPRS End-user Performance	$43 per TS
Flexible Priority Handling of Packet Data Channels	$184 per 64 kbps

Table A2.4: Breakdown of Software Costs for EDGE

A2.3 UMTS Costs

Item	Year 1		Year 2		Year 3	
	QTY	Total Price (USD)	QTY	Total Price (USD)	QTY	Total Price (USD)
MSC Server HW	1	2 49 840,43	0	0	0	0
MSC Server Basic SW	2000	368 105.19	4900	901 857,71	8800	1 619 662,83
MSC Opt SW	2000	145 204,49	4900	355 751,01	8800	638 899,77
HLR basic SW	35	45 809,63	85	111 251,95	160	209 415,44
HLR Opt SW	35	46 902,19	85	113 905,31	160	214 409,99
AUC SW	140	73 149,03	340	177 647,65	640	334 395,58
FNR	35	22 718,00	85	55,172,29	160	103 853,71
Media Gateway HW & SW	3	1 290 804,73	0	0	0	0
GGSN HW	2	489 754,63	0	0	0	0
GGSN SW	1	199 500,00	0	0	0	0
SGSN HW	1	823 754,65	0	0	1	823 754,65
SGSN SW	4	346 500,00	6	126 000,00	11	514 500,00
RNC HW & SW	2	2 185 640,00	6	4 6868 148,74	8	8 782 397,00
Node B	206	7 187 996,01	492	17 174 793,15	933	32 584 144,63
UTRAN SW	882	1 704 098,01	2114	4 084 425,39	4024	7 774 705,66
Total Cost		**17 438 576,22**		**27 827 751,32**		**56 168 776,17**

Table A2.5: Breakdown of UMTS Costs